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Transforming Teacher Performance: Optimizing Learning Through Information and Communication Technology

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Abstract

This study aims to explore the effect of the use of Information and Communication Technology (ICT) on teacher performance at Madrasah Aliyah in Jember Regency. The background of this study was driven by the low quality of teachers in Indonesia, as reflected in the results of the 2015 Teacher Competency Test (UKG). Using a quantitative approach with a descriptive method, this study collected data from 40 teachers through a questionnaire that was tested for validity and reliability. The results showed that the use of ICT has a significant effect on teacher performance, with a regression coefficient of 0.809, meaning that every 1% increase in the use of ICT can improve teacher performance by 80.9%. The R-Square value of 0.422 indicates that 42.2% of the variation in teacher performance can be explained by the use of ICT. This study also identified various digital tools and platforms used by teachers, such as Moodle, Google Classroom, and Kahoot!, which contributed to improving teaching performance. However, challenges in implementing ICT such as accessibility, technological skills, and curriculum integration still need to be addressed. These findings provide a comprehensive view of the use of ICT in education and the importance of a holistic approach to improving teacher performance.

Kata kunci: Teknologi Informasi dan Komunikasi, Kinerja Guru, Pendidikan

Abstrak

Penelitian ini bertujuan untuk mengeksplorasi pengaruh penggunaan Teknologi Informasi dan Komunikasi (TIK) terhadap kinerja guru di Madrasah Aliyah Kabupaten Jember. Latar belakang penelitian ini didorong oleh rendahnya kualitas guru di Indonesia, yang tercermin dari hasil Uji Kompetensi Guru (UKG) 2015. Menggunakan pendekatan kuantitatif dengan metode deskriptif, penelitian ini mengumpulkan data dari 40 guru melalui kuesioner yang diuji validitas dan reliabilitasnya. Hasil penelitian menunjukkan bahwa penggunaan TIK memiliki pengaruh signifikan terhadap kinerja guru, dengan koefisien regresi sebesar 0,809, yang berarti setiap peningkatan 1% dalam penggunaan TIK dapat meningkatkan kinerja guru sebesar 80,9%. Nilai R-Square sebesar 0,422 menunjukkan bahwa 42,2% variasi kinerja guru dapat dijelaskan oleh penggunaan TIK. Penelitian ini juga mengidentifikasi berbagai alat dan platform digital yang digunakan oleh guru, seperti Moodle, Google Classroom, dan Kahoot!, yang berkontribusi pada peningkatan kinerja pengajaran. Namun, tantangan dalam implementasi TIK seperti aksesibilitas, keterampilan

teknologi, dan integrasi kurikulum masih perlu diatasi. Temuan ini memberikan pandangan komprehensif tentang penggunaan TIK dalam pendidikan dan pentingnya pendekatan holistik untuk meningkatkan kinerja guru.
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INTRODUCTION

The quality of teachers in Indonesia is still very low. This is partly due to the lack of minimum educational qualifications, especially in relation to the mandate of Law No. 14 of 2005 concerning National Education Standards (SNP). As reported by news.detik.com, data from the 2015 Teacher Competency Test (UKG) shows that the national average is only 44.5, far below the standard score of 75 (Yunus, 2017). His pedagogical competence, which is the main competence of teachers, is not even satisfactory. Of the 3.9 million teachers, 25% do not meet the academic qualification requirements, and 52% do not have a professional certificate. (Murdaningsih, 2019). Data shows that there are many differences between the reality on the ground and the ideal conditions that teachers must fulfill in accordance with the mandate of the law. In addition, field evidence shows that teachers fail to achieve optimal levels of performance. For example, it was found that teachers did not make Learning Implementation Plans (RPP), ignored the completeness of teacher administration, gave assignments without a face-to-face process, used monotonous models and methods, and had poor learning evaluations. (Koswara & Rasto, 2016).

Internal factors include some teachers who do not make their own learning implementation plans and only take lesson plans from Google; some teachers still use monotonous learning methods with lectures so they do not pay attention and prioritize student activity; some teachers still lack technological skills and are not able to use digital platforms to master learning media; and some teachers do not have the ability to use digital platforms. (Sari, 2021). On the other hand, IT and communication functions are also related to benefits and efficiency, such as making work easier, increasing efficiency and improving performance (Munir, 2009).

Several previous studies have revealed that in this day and age the ability to master technology will influence teacher performance (Harahap, 2020; Lao et al., 2018; Yani et al., 2021). Technology is a system that is continuously developed to serve certain purposes. What is at the core of a technology system is the transformation process (Fahrizandi, 2020; Hekkert et al., 2007). Information and communication technology can be interpreted as all technology related to the retrieval, collection, processing, storage, dissemination and presentation of information (Munawir et al., 2024). One indication of an advanced school is excellence in the field of information and communication technology (ICT). According to Thompson et al, states that measuring the use of information and communication technology includes four things, namely: 1) Operating a computer, 2) Designing learning using web applications, 3) Skilled in using mobile phones (gadgets), 4) Using media.

Based on constructivism theory, learning with ICT helps students interact with media and build their own knowledge (Jonassen & Rohrer-Murphy, 1999). Several studies show that the use of ICT in education has a positive impact on student motivation and achievement (Ibrahim & Suardiman, 2014; Lubis et al., 2009). However, the age of educators is an obstacle for someone not being able to use information and communication technology (Aivazidi & Michalakelis, 2023; Mumtaz, 2000; Zenda & Dlamini, 2023). A teacher must be able to use information and communication technology to be innovative in the learning process. Therefore, the application of ICT in the learning process must be carried out so that students' enthusiasm for learning increases

and learning objectives are achieved. In using technology in learning, teacher creativity is treated holistically, because the teacher's task cannot be replaced (Chan & Lee, 2023; Greenier et al., 2023).

The aim of this research is to look for gaps that have not been researched by previous researchers so as to fill the empty research space. This research will explore or explore the influence of the use of information and communication technology on teacher performance, apart from looking for influence but also analyzing what factors are important points in order to improve teacher performance so that it becomes a recommendation for this research to be implemented in the future. To assist researchers in constructing this research, the researcher provides a temporary conclusion of the research, namely that information and communication technology has a significant influence on teacher performance. This conclusion will of course be tested in the next section of this article.

RESEARCH METHODS

This research was conducted at Madrasah Aliyah in Jember Regency, this school was chosen because it has its own uniqueness, one of which is the school age and the relatively large size of the school. This research approach uses quantitative research with a descriptive approach (Cen et al., 2016). This method was chosen because it looks at a relatively large population so it can know the actual conditions.

Sample selection uses the census method, which means that the entire population is included as a sample (Kabukcu & Chabal, 2021). The number of samples for this research was 40 people. The data taken uses primary data obtained directly from research respondents. Data collection techniques use questionnaires distributed directly to respondents. To fill out the questionnaire, the researcher accompanied them so that if the respondent experienced difficulties in filling out the questionnaire, the researcher could help provide further explanation. The questionnaire given to respondents has been tested for validity and reliability using a 1-5 Likert scale (Boone & Boone, 2012).

To calculate the validity test using the formula:

$$r_{xy} = \frac{N\sum XY - (\sum X)(\sum Y)}{\sqrt{(N\sum X^2 - (\sum X)^2)(N\sum y^2 - (\sum Y)^2)}}$$

Information:

rxy	: Correlation Coefficient between variable X and variable Y
N	: Number of samples
∑xy	: The sum of the multiplication between variables X and Y
∑X2	: The sum of the squares of the X values
∑Y2	: The sum of the squares of the Y values
$(\sum X)^2$	: The sum of the X values is then squared.
$(\sum Y)^2$	: The sum of the Y values is then squared.

A variable is said to be reliable if it provides a Cronbach's Alpha value > 0.60. Meanwhile, to test reliability, the following calculation is used.:

$$r_{11} = \left[k\frac{k}{k-1}\right]\left[1 - \frac{\sum\sigma^2 b}{\sigma^2 t}\right]$$

r_{11}	: Alpha reliability coefficient
k	: Number of question items

$\sum\sigma^2$b : Number of grain variants
σ^2t : Total variance

The data analysis technique uses descriptive statistical analysis, which is used to analyze data by describing or illustrating the data that has been collected as it is without intending to make general conclusions or generalizations. (Lerche, 2012). Apart from that, it also uses classical assumption test analysis by carrying out normality tests, homogeneity tests and linearity tests, while in hypothesis testing it uses multiple linear regression analysis. Berikut adalah persamaan dari regresi linier berganda $Y = a + \beta1X1 + \beta2X2 + e$

RESULTS AND DISCUSSION

Result

The normality test is carried out to find out whether the regression model taken is normally distributed or not. A regression is said to be good if the distribution is normal. The normality test uses the Test of Normality table with the Kolmogorov-Smirnov test, which is as follows:

Table 1 Normality Test

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig	Statistic	Df	Sig.
Use of Information and Communication Technology	.127	35	.180	.969	35	.407
for Teacher Performance in Learning	.113	35	.210	964	35	.273

*This is a lower bound of the true significance

a. Lilliefors Significance Correction

Based on the normality test results obtained, the significance score for the Use of Information and Communication Technology variable is 0.180, while the significance score for the Teacher Performance in Learning variable is 0.210. With the significance level for data normality set at Alpha 0.05, the results of this study show that all variables have a significance score greater than Alpha 0.05. Therefore, it can be concluded that these variables have a NORMAL distribution.

That two or more groups of sample data come from populations that have the same variance (homogeneous). This test is a prerequisite before carrying out other tests, such as T-test and ANOVA. This test is used to ensure that the data group does come from a population with the same variance (homogeneous). The homogeneity test was carried out using Levene's test. The basis for decision making in this test is that if the P-value is > 0.05, then the data distribution is homogeneous; whereas if the P-value <0.05, then the data distribution is not homogeneous. The following are the results of homogeneity test calculations with the help of SPSS Version 22.

Table 2 Homogeneity Test Results
Use of ICT and Teacher Performance in Learning

Levene Statistic	df1	df2	Sig.
2.515	1	68	.127

Source: SPSS data processing results

Based on the results of the homogeneity test, a significance value of 0.127 was obtained. This shows that the P-value is > 0.05, so it can be concluded that the two data variants are the same (homogeneous).

The linearity test is used to test or find out whether the relationship between variable X and variable Y has a tendency to follow a straight line (linear) or not. The linearity test was carried out using SPSS version 22, namely the P-value on Deviation from Linearity was 0.506, indicating that there was a linear relationship between the variable (X) use of information and communication technology and the variable (Y) teacher performance in learning. This is because the Deviation from Linearity value of 0.506 is greater than the significance level of 0.05.

Simple linear regression analysis is used to determine the causal relationship between the independent variable and the dependent variable, whether positive or negative. To find out whether the regression value is significant or not, the calculated t-value is compared with the t-table value. The following are the results of a simple linear regression test using SPSS version 22, namely:

Table 3 Simple Linear Regression Analysis Test Results

Coefficients[a]

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
1 (Constant)	65,758	13,252		4,962	,000
Penggunaan Teknologi Informasi dan Komunikasi	,809	,165	,649	4,904	,000

a. Dependent Variable: Kinerja Guru dalam Pembelajaran

Simple linear regression testing can be seen from the results of the output coefficients. The output values are entered into a simple linear regression formula as follows:

Y' = 65,758 + 0,809X

Information:

Y'= Teacher Performance in Learning

X = Use of Information and Communication Technology

a = constant number of unstandardized coefficients.

From the output above, the value obtained is 65.758. This figure is a constant number which means that if there is no influence from the use of information and communication technology (X = 0), then the teacher's performance in learning (Y) remains at 65.758. information and communication (X), then the value of teacher performance consistency in learning (Y) is 65.758.

b = regression coefficient number. The value obtained was 0.809. This figure means that for every 1% increase in the level of influence of the use of information and communication technology (X), teacher performance in learning (Y) will increase by 80.9%. Because the regression coefficient value is positive (+), it can be said that the influence of the use of information and communication technology (X) has a positive effect on teacher performance in learning (Y), so the regression equation is Y' = 65.758 +0.809X.

For statistical testing, the T-test is used in linear regression. The T-test aims to determine whether the independent variable has a significant influence on the dependent variable. The T-test results can be seen in the output coefficient. Comparing T count with T table, the T-count value obtained from the output coefficient is 4.904. The T-table can be seen in the statistical table with a significance value of 0.05: 2 = 0.025. Table (2-sided test) with degrees of freedom (df) n2, namely

35-2=33, the results obtained for the T-table are 2.035. It can be seen that T-count (4.904) > T-table (2.035), then H0 is rejected. So it can be concluded that there is a significant influence between the use of information and communication technology (X) on teacher performance in learning (Y).

The coefficient of determination is used to determine the magnitude of the influence of the use of information and communication technology (X) on teacher performance in learning (Y) in simple linear regression. This value can be seen from the R-square value contained in the SPSS version 22 output, namely:

The coefficient of determination is used to determine the magnitude of the influence of the use of information and communication technology (X) on teacher performance in learning (Y) in simple linear regression. This value can be seen from the R-square value contained in the SPSS version 22 output, namely:

Table 4 Results of Determination Coefficient

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	,649[a]	,422	,404	6,655	1,873

a. Predictors: (Constant), Penggunaan Teknologi Informasi dan Komunikasi

b. Dependent Variable: Kinerja Guru dalam Pembelajaran

From the output results, the coefficient of determination (R-Square) value is 0.422, which is equivalent to 42.2%. This figure indicates that the influence of the use of information and communication technology on teacher performance in learning is 42.2%. The remainder, namely 57.8%, was influenced by other variables not included in this study. Based on this analysis, it can be concluded that there is a significant influence from the use of information and communication technology on teacher performance in learning.

DISCUSSION

The discussion of the results of this research is intended to provide an overview, clarity and understanding obtained from the research results. Based on the results of research and calculations of the data obtained, it is stated that there is an influence between the use of information and communication technology and teacher performance in learning, namely 42.2%. To determine the direction of the relationship between variable X (Use of Information and Communication Technology) and variable Y (Teacher Performance in Learning), whether positive or negative, a simple linear regression test was carried out. From the research results, the regression coefficient obtained a value of 0.809 which shows that the regression coefficient value is positive, so it can be said that the direction of influence of variable X (Use of Information and Communication Technology) with variable Y (Teacher Performance in Learning) is positive, so the regression equation is Y ' = 65.758 + 0.809X. Then it can be seen in statistical testing (T-Test), the T-count value is 4.904 and the T-table is 2.035 with a significance of 0.000. With the test criteria T-count > T-table and if significance < α (0.05) then Ho is rejected. So there is a significant influence between the use of information and communication technology on teacher performance in learning.

Furthermore, based on the determination test, it was found that the coefficient of determination (R-Square) was 0.422 (42.2%) this figure means that variable X (Use of Information and Communication Technology) has an influence on variable Y (Teacher Performance in Learning) of 42.2 % and 57.8% are influenced by other variables not included in this research. Thus, the results of data calculations obtained from the field show a significant influence between the use of information and communication technology and teacher performance in learning.

According to data analysis, the application of technology in the elementary school curriculum improves learning outcomes. Teachers say that technology increases student interest and motivation, enriches learning material, and facilitates collaborative learning. Additionally, students say that when technology is used, they are more engaged and interested in the lesson. The results of student questionnaires show that most students believe that technology improves their cognitive abilities and helps them understand concepts better. Therefore, teachers must understand how to integrate technology wisely while maintaining existing traditional values. In this research, teachers emphasized the importance of developing learning strategies that include selective and targeted use of technology to improve teacher performance.

ICT use includes various digital tools and platforms such as computers, the internet, educational software, and communication tools. These results were carried out through a survey that assessed how often and how teachers used technology in teaching. Technology can provide more diverse educational resources, increase interaction between teachers and students, and enrich teaching methods with multimedia, thereby supporting more effective learning.

Teachers at this educational institution introduce technology to make their performance easier in several ways such as software and educational applications. Platforms such as Moodle, Google Classroom, and Blackboard allow teachers to manage course content, organize assignments, and communicate with students online. Apart from that, it also introduces learning applications such as applications such as Kahoot!, Quizlet, and Duolingo which provide interactive and fun learning methods. Apart from that, several subjects are possible to implement through games, some teachers also use educational games in learning such as Minecraft: Education Edition or other game-based learning platforms. The use of Information and Communication Technology (ICT) in education offers many benefits, but also presents various challenges. The following are some of the main challenges faced in the use of ICT including various digital tools and platforms such as computers, the internet, educational software, and communication tools. The challenges in this research strengthen the research conducted by (Lestari & Kurnia, 2023; Muid et al., 2024)

The real contribution of technology to teaching activities is the availability of various platforms, tools and methods that help teachers optimize the learning process. for example, learning management, interactive methods, and access to learning resources. Learning management platforms such as moodle and google classroom allow teachers to manage learning materials, assignments, and interactions with students in a more organized manner. This interactive method has applications such as Kahoot! and Quizlet, allowing teachers to make learning more interesting and interactive. This can increase student engagement and make them more active in the learning process. Access to learning resources such as the Internet provides access to global educational resources, including journals, articles, educational videos, and special software that supports various subjects..

This positive relationship between ICT and teacher performance means that the more frequently and effectively teachers use ICT, the better their performance in delivering subject matter, managing the classroom, and motivating students. This impact is also in line with

constructivist learning theory, which emphasizes that ICT enables students to construct knowledge through active interaction with learning materials and media. Thus, ICT supports teachers to create a richer and more relevant learning environment to students' needs.

Other factors that affect teacher performance include intrinsic motivation, school management support, training and professional development, and work environment conditions. Intrinsic motivation is an internal drive that keeps teachers enthusiastic about teaching, regardless of external incentives. Teachers with high motivation usually have a strong desire to help students achieve success and feel satisfied when they see student progress. The relationship with ICT is, Intrinsic motivation can increase the effectiveness of ICT use. Motivated teachers are more likely to learn and adopt new technologies in their teaching.School management support has a relationship with leadership factors, Good leadership from the principal and administrative support play a major role in encouraging teachers to use ICT. Effective supervision helps teachers feel valued and empowered, so they are more motivated to develop skills and innovate. Training and professional development, teachers need continuous training to improve their competence in using ICT. This training focuses not only on the use of tools but also on pedagogical strategies for integrating technology into the curriculum. This training gap is because not all teachers have equal access to training. This can create a gap in technology adoption, especially between teachers in urban and rural areas. While supportive working conditions, including adequate technology facilities, internet access, and technical support, are very important in encouraging teachers to use ICT effectively.

Although ICT is an important element, this study confirms that a holistic approach is needed to improve teacher performance as a whole as presented in the following table.

Table 5 Strategies to Support Increased Use of Information and Communication Technology (ICT) in Education

Strategy	Description	The main purpose	Implementation Example
Improving Technology Literacy	Conduct regular training designed according to the needs and level of teacher technological literacy.	Helping teachers understand and master the use of technology in teaching.	Periodic training on the use of Google Classroom, Moodle, and other educational applications.
Building a Collaborative Work Culture	Encourage collaboration between teachers to share knowledge and experiences in using technology.	Strengthening the teacher community to learn from each other and support each other in technology adoption.	Group discussions, internal seminars, and experience sharing sessions on the application of technology in learning.
Strengthening Managerial Support	Principals need to play an active role in encouraging the use of ICT and providing the necessary facilities.	Creating an environment that supports technology adoption by teachers.	Provision of computers, stable internet access, and regular training schedules facilitated by the school.
Overcoming the Digital Divide	Pay special attention to teachers in remote areas who may have limited access to technology..	Ensuring technology inclusion for all teachers, regardless of their geographic location.	Distribution of technological devices to remote areas, increasing internet access, and distance training using webinars.

The results of this study are in line with various previous studies that show the positive influence of ICT on education. Some of these studies include (De Smet et al., 2012; Kain et al., 2024; Özgenel & Mert, 2019), Concludes that teachers' ability to use technology and support from school management together significantly influence teacher performance. (Irasuti & Bachtiar, 2024; Wardat et al., 2024) Found that the application of technology can improve the efficiency and effectiveness of teaching, especially when teachers are given adequate training and (Milara & Orduña, 2024) Stating that technology not only improves learning outcomes but also encourages teachers' creativity in designing unique learning experiences.

CONCLUSION

An in-depth understanding is provided regarding the magnitude of the positive influence of ICT use, as measured by simple linear regression tests and T-tests. The regression coefficient of 0.809 indicates that increasing the use of ICT significantly improves teacher performance. This result is strengthened by the T-count value of 4.904 which is much higher than the T-table of 2.035, with a significance level of 0.000. Additionally, the study identified various digital tools and platforms used by teachers, such as Moodle, Google Classroom, Kahoot!, Quizlet, and Minecraft: Education Edition, that contributed to improved teaching performance. The use of educational applications and game-based learning enriches teaching methods with multimedia, increases interaction between teachers and students, and provides more diverse educational resources. However, this research also highlights the challenges faced in implementing ICT, such as accessibility, technology skills, and curriculum integration. Thus, the results of this research not only demonstrate the significant influence of ICT on teacher performance, but also provide a comprehensive understanding of how technology can be used effectively in education, as well as the challenges that need to be overcome to maximize the benefits of ICT.

This research practically has benefits that can be used as an example in learning by teachers in other schools, including learning that can use technology such as online platforms and Quizlet software to simplify the learning process. Theoretically, this research adds to the wealth of research on the use of information technology that can support teacher performance.

A limitation of this study may be that it does not cover all relevant aspects of teacher performance. Performance in learning includes not only the preparation of programs and implementation of activities, but also aspects such as student engagement, classroom management skills, and innovation in teaching methods that may not be well measured in this research. In addition, this research focuses on the effects of ICT use in the short term. The long-term effects of ICT use on teacher performance and student learning outcomes may require longitudinal research to obtain a more comprehensive picture.

REFERENCES

Aivazidi, M., & Michalakelis, C. (2023). Information and Communication Technologies in Primary Education: Teachers' Perceptions in Greece. *Informatics*, *10*(3), Article 3. https://doi.org/10.3390/informatics10030057

Boone, H., & Boone, D. (2012). Analyzing Likert Data. *The Journal of Extension*, *50*(2). https://doi.org/10.34068/joe.50.02.48

Cen, L., Ruta, D., Powell, L., Hirsch, B., & Ng, J. (2016). Quantitative approach to collaborative learning: Performance prediction, individual assessment, and group composition. *International Journal of Computer-Supported Collaborative Learning*, *11*(2), 187–225. https://doi.org/10.1007/s11412-016-9234-6

Chan, C. K. Y., & Lee, K. K. W. (2023). The AI generation gap: Are Gen Z students more interested in adopting generative AI such as ChatGPT in teaching and learning than their Gen X and millennial generation teachers? *Smart Learning Environments*, *10*(1), 60. https://doi.org/10.1186/s40561-023-00269-3

De Smet, C., Bourgonjon, J., De Wever, B., Schellens, T., & Valcke, M. (2012). Researching instructional use and the technology acceptation of learning management systems by secondary school teachers. *Computers & Education*, *58*(2), 688–696. https://doi.org/10.1016/j.compedu.2011.09.013

Fahrizandi, F. (2020). Pemanfaatan Teknologi Informasi di Perpustakaan. *Tik Ilmeu : Jurnal Ilmu Perpustakaan Dan Informasi*, *4*(1), Article 1. https://doi.org/10.29240/tik.v4i1.1160

Greenier, V., Fathi, J., & Behzadpoor, S.-F. (2023). Teaching for creativity in an EFL context: The predictive roles of school climate, teaching enthusiasm, and metacognition. *Thinking Skills and Creativity*, *50*, 101419. https://doi.org/10.1016/j.tsc.2023.101419

Harahap, L. P. (2020). Pengaruh Supervisi Kepala Madrasah Dan Kemampuan Penggunaan Teknologi Terhadap Kinerja Guru Man Di Kota Medan. *EduTech: Jurnal Ilmu Pendidikan Dan Ilmu Sosial*, *6*(1), Article 1. https://doi.org/10.30596/edutech.v6i1.4389

Hekkert, M. P., Suurs, R. A. A., Negro, S. O., Kuhlmann, S., & Smits, R. E. H. M. (2007). Functions of innovation systems: A new approach for analysing technological change. *Technological Forecasting and Social Change*, *74*(4), 413–432. https://doi.org/10.1016/j.techfore.2006.03.002

Ibrahim, D. S., & Suardiman, S. P. (2014). Pengaruh Penggunaan E-Learning Terhadap Motivasi Dan Prestasi Belajar Matematika Siswa Sd Negeri Tahunan Yogyakarta. *Jurnal Prima Edukasia*, *2*(1), Article 1. https://doi.org/10.21831/jpe.v2i1.2645

Irasuti, I., & Bachtiar, B. (2024). Empowering Indonesian EFL Teachers: The Transformative Impact of Visual Literacy Training on Teaching Materials. *International Journal of Learning, Teaching and Educational Research*, *23*(8), Article 8.

Jonassen, D. H., & Rohrer-Murphy, L. (1999). Activity theory as a framework for designing constructivist learning environments. *Educational Technology Research and Development*, *47*(1), 61–79. https://doi.org/10.1007/BF02299477

Kabukcu, C., & Chabal, L. (2021). Sampling and quantitative analysis methods in anthracology from archaeological contexts: Achievements and prospects. *Quaternary International*, *593–594*, 6–18. https://doi.org/10.1016/j.quaint.2020.11.004

Kain, C., Koschmieder, C., Matischek-Jauk, M., & Bergner, S. (2024). Mapping the landscape: A scoping review of 21st century skills literature in secondary education. *Teaching and Teacher Education*, *151*, 104739. https://doi.org/10.1016/j.tate.2024.104739

Koswara, K., & Rasto, R. (2016). Kompetensi Dan Kinerja Guru Berdasarkan Sertifikasi Profesi. *Jurnal Pendidikan Manajemen Perkantoran*, *1*, 61. https://doi.org/10.17509/jpm.v1i1.3269

Lao, H. A. E., Ekosiswoyo, R., Sutarto, J., & Pramono, S. E. (2018). *The Performance of Teachers in the Digital Era in Improving Learning Quality*. 219–223. https://doi.org/10.2991/iset-18.2018.46

Lerche, L. (2012). *Quantitative Methods*. Elsevier.

Lestari, D. I., & Kurnia, H. (2023). Implementasi Model Pembelajaran Inovatif Untuk Meningkatkan Kompetensi Profesional Guru Di Era Digital. *JPG: Jurnal Pendidikan Guru*, *4*(3), Article 3. https://doi.org/10.32832/jpg.v4i3.14252

Lubis, M., Embi, M., Yunus, M., Wekke, I., & Nordin, N. (2009). The application of multicultural education and applying ICT on Pesantren in South Sulawesi, Indonesia. *WSEAS Transactions on Information Science and Applications*, *6*, 1401–1411.

Milara, I. S., & Orduña, M. C. (2024). *Possibilities and challenges of STEAM pedagogies* (arXiv:2408.15282). arXiv. https://doi.org/10.48550/arXiv.2408.15282

Muid, A., Arifin, B., & Karim, A. (2024). Peluang Dan Tantangan Pendidikan Pesantren Di Era Digital (Studi Kasus di Pondok Pesantren Al-Islah Bungah Gresik). *MODELING: Jurnal Program Studi PGMI*, *11*(1), Article 1. https://doi.org/10.36835/modeling.v11i1.2254

Mumtaz, S. (2000). Factors affecting teachers' use of information and communications technology: A review of the literature. *Journal of Information Technology for Teacher Education*, *9*(3), 319–342. https://doi.org/10.1080/14759390000200096

Munawir, Khoiriyatin, V. Z., & Rahmawati, A. D. (2024). Pemanfaatan Teknologi Informasi Untuk Meningkatkan Pembelajaran Pendidikan Agama Islam di MI/SD. *TEACHING AND LEARNING JOURNAL OF MANDALIKA (TEACHER) e- ISSN 2721-9666*, *5*(1), Article 1. https://doi.org/10.36312/teacher.v5i1.2883

Munir, M. (2009). *Kurikulum Berbasis Teknologi Informasi dan Komunikasi*. Alfabeta, CV. chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/http://file.upi.edu/Direktori/FPMIPA/PRODI._ILMU_KOMPUTER/196603252001121-MUNIR/BUKU/Kurikulum%20Berbasis%20Teknologi%20Informasi%20dan%20Komunikasi.pdf

Murdaningsih, D. (2019, April 18). Rendahnya Kompetensi Guru Jadi Masalah Pendidikan Indonesia. *Republika*. https://republika.co.id/berita/pq53k5368/rendahnya-kompetensi-guru-jadi-masalah-pendidikan-indonesia

Özgenel, M., & Mert, P. (2019). *The role of teacher performance in school effectiveness*. https://doi.org/10.35826/ijetsar.42

Sari, T. N. S. (2021, Desember). Pembelajaran yang Monoton, Sebabkan Siswa Menjadi Bosan dan Malas. *UPMK News*. https://news.upmk.ac.id/home/post/pembelajaran.yang.monoton.sebabkan.siswa.menjadi.bosan.dan.malas.html

Wardat, Y., Tashtoush, M., Alali, R., & Saleh, S. (2024). Artificial Intelligence in Education: Mathematics Teachers' Perspectives, Practices and Challenges. *Iraqi Journal For Computer Science and Mathematics*, *5*(1), Article 1. https://doi.org/10.52866/ijcsm.2024.05.01.004

Yani, Y., Darwis, A., & Riany, Y. E. (2021). Pengaruh Penguasaan Teknologi dan Disiplin Kerja terhadap Kinerja Guru dengan Produktivitas Sebagai Variabel Intervening pada Sekolah XXX. *Syntax Idea*, *3*(6), 1494–1512. https://doi.org/10.46799/syntax-idea.v3i6.1233

Yunus, S. (2017, November 24). Mengkritisi Kompetensi Guru. *Detiknews*. https://news.detik.com/kolom/d-3741162/mengkritisi-kompetensi-guru

Zenda, R., & Dlamini, R. (2023). Examining factors that influence teachers to adopt information and Communication Technology in rural secondary schools: An empirical study. *Education and Information Technologies*, *28*(1), 815–832. https://doi.org/10.1007/s10639-022-11198-y