e-ISSN: 2985-4415
DOI: 10.57254/irma.v4i5.90

International Research of Multidisciplinary Analysis
IRMA JOURNAL
Vol. 4, No. 5, May 2026 hal. 510-520
Journal Page is available at http://irma.nindikayla.com/index.php/home

The Influence of Digital Leadership and Data Literacy on Managerial Effectiveness Through Work Motivation: A Study of Private Vocational School Principals in Jakarta

Ahmad Kosasih[1]*, Soewarto Hardhienata[2], Herfina[3]
[1]Universitas Indraprasta PGRI, Jakarta
[2, 3]Universitas Pakuan, Bogor, Indonesia
Email: aseng.kosasih@gmail.com

Abstract

The digital transformation of vocational education demands that school principals possess high levels of managerial effectiveness; however, the gap between expectations and reality remains a significant challenge. This study aims to examine the influence of digital leadership and data literacy on managerial effectiveness, both directly and indirectly, through work motivation. Employing a quantitative approach with a cross-sectional survey design, the study involved 206 teachers from 19 private vocational high schools (SMK PGRI) in Jakarta, Indonesia. Data were collected using a validated 5-point Likert scale questionnaire. Data analysis was conducted using Structural Equation Modeling-Partial Least Squares (SEM-PLS) with SmartPLS 4.0. The results show that: (1) digital leadership has a positive and significant direct effect on managerial effectiveness ($\beta = 0.291$; $p < 0.001$); (2) data literacy has a positive and significant direct effect on managerial effectiveness ($\beta = 0.174$; $p = 0.010$); and (3) work motivation significantly mediates the effects of digital leadership (indirect effect = 0.065; $p = 0.021$) and data literacy (indirect effect = 0.036; $p = 0.046$) on managerial effectiveness. These findings confirm that enhancing managerial effectiveness is optimally achieved through simultaneously strengthening digital competencies and work motivation.

Keywords: Digital Leadership, Data Literacy, Work Motivation, Managerial Effectiveness, Vocational Education, SEM-PLS

INTRODUCTION

Vocational education currently stands at a critical crossroads between the demands of digital transformation and the limitations of leadership capacity at the school level. UNESCO (2022) has positioned the transformation of Technical and Vocational Education and Training (TVET) as a global strategic agenda to support transitions toward more digital, inclusive, and sustainable economies. In Indonesia, government policies through the Merdeka Belajar (Freedom to Learn) initiative emphasize that vocational education must produce future talents relevant to the demands of the era (Kemendikbudristek, 2023). Within this context, school principals occupy a decisive role, as the quality of school transformation is ultimately shaped by their managerial effectiveness. Mergoni et al. (2026) demonstrate that principals' managerial practices are associated with school performance and various organizational processes that underpin educational quality. However, empirical reality indicates that the managerial effectiveness of principals at SMK PGRI in Jakarta remains suboptimal. A preliminary survey found that 63.4% of principals still need improvement in program development, 57% are lacking in directing teachers'

professional development, and 57% show insufficient responsiveness to teachers' innovative ideas. This phenomenon constitutes a critical issue that warrants urgent investigation.

Prior research has examined digital leadership as an important predictor of school effectiveness. AlAjmi (2022) found that principals' digital leadership influences teachers' technology integration in Kuwait during the COVID-19 pandemic. Berkovich and Hassan (2023) showed that principals' digital transformational leadership affects teacher commitment and school effectiveness. Navaridas-Nalda et al. (2020) affirmed that principal leadership is a strategic factor in schools' digital transformation. Simultaneously, data literacy has also gained attention as a key competency. Lee et al. (2024), in their systematic review of 56 studies, assert that principals' data literacy is a complex construct encompassing the ability to understand, interpret, use, and lead the use of data for school improvement. Doğan (2023), in a meta-analysis, found that data literacy education makes a high positive contribution to the knowledge and skills of data use among school administrators and teachers.

Nevertheless, these studies remain partial and have not integrated the mediating mechanisms that explain how digital competencies translate into effective managerial behavior. Specifically, there is a gap in understanding the role of work motivation as an intervening variable in the relationships between digital leadership, data literacy, and managerial effectiveness. Collie (2023) showed that autonomy-supportive leadership practices positively relate to teachers' work motivation, but similar research at the principal level remains limited. Wurster, Bez, and Merk (2023) demonstrated that a data use intervention enhances data literacy scores and self-efficacy, as well as positive motivational beliefs about data use, yet this has not been tested in the context of school leadership. Thus, the novelty of this study lies in integrating digital leadership, data literacy, and work motivation into a single, coherent explanatory model, which has rarely been undertaken in the context of vocational school principals in Indonesia.

Based on the theoretical framework outlined above, this study aims to examine: (1) the direct effect of digital leadership on managerial effectiveness; (2) the direct effect of data literacy on managerial effectiveness; (3) the direct effect of work motivation on managerial effectiveness; (4) the effect of digital leadership on work motivation; (5) the effect of data literacy on work motivation; (6) the indirect effect of digital leadership on managerial effectiveness through work motivation; and (7) the indirect effect of data literacy on managerial effectiveness through work motivation. The core argument to be tested is that improving managerial effectiveness is insufficient through merely enhancing digital competencies; it must be accompanied by increased work motivation as the psychological energy that drives principals to actualize those competencies in daily managerial behavior. Accordingly, the proposed hypotheses are that digital leadership and data literacy positively influence managerial effectiveness, both directly and indirectly, through work motivation.

METHOD

This study employed a quantitative approach with a cross-sectional survey design. The research was conducted from October 2025 to June 2026 across 19 private vocational high schools (SMK PGRI) located throughout the Special Capital Region of Jakarta (Central Jakarta, North Jakarta, West Jakarta, South Jakarta, and East

Jakarta). The selection of this location was based on the characteristics of SMK PGRI as private schools facing specific challenges in resource management and the demand for relevance to the industrial world.

Population and Sample

The study population comprised all teachers from the 19 SMK PGRI schools in Jakarta, totaling 421 individuals. The sample size was determined using the Taro Yamane formula with a 5% margin of error, yielding a minimum required sample of 206 respondents. The sampling technique employed was proportional random sampling to ensure representation from each school. This sample size exceeds the minimum recommended for SEM-PLS analysis, which is ten times the largest number of indicators in a single construct (Hair et al., 2021).

Research Instruments

Data were collected using a 5-point Likert scale questionnaire (1 = never to 5 = always). The instruments were developed based on an in-depth literature review and were piloted on 30 respondents outside the sample. Table 1 presents a summary of the instruments used.

Table 1. Summary of Research Instruments

Variable	Operational Definition	Number of Dimensions	Number of Items	Source
Digital Leadership (X1)	The principal's ability to lead, direct, and manage technology-based change	6	40	AlAjmi (2022); Berkovich & Hassan (2023)
Data Literacy (X2)	The principal's ability to understand, interpret, use, and lead the use of data	6	40	Lee et al. (2024); Doğan (2023)
Work Motivation (X3)	Internal and external forces that drive principals to choose and direct their actions	6	40	Collie (2023); Ryan & Deci (2017)
Managerial Effectiveness	The principal's ability to perform	7	40	Daulay et al. (2024);

 e-ISSN: 2985-4415
DOI: 10.57254/irma.v4i5.90

Variable	Operational Definition	Number of Dimensions	Number of Items	Source
(Y)	management functions optimally			Mergoni et al. (2026)

Validity and Reliability

Instrument validity was tested using Pearson Product Moment correlation, with the criterion r-calculated > r-table (0.361; n = 30; α = 0.05). Reliability was tested using Cronbach's Alpha, with the criterion coefficient > 0.70. The pilot test results indicated that all instruments were valid and reliable, with Cronbach's alpha values ranging from 0.892 to 0.958.

Data Analysis Techniques

Data analysis was conducted in two stages. The first stage employed Structural Equation Modeling-Partial Least Squares (SEM-PLS) using SmartPLS 4.0 to test the measurement model (outer model) and the structural model (inner model). The outer model evaluation included tests of convergent validity (loading factor > 0.70, AVE > 0.50), discriminant validity (Fornell-Larcker criterion), and composite reliability (CR > 0.70). The inner model evaluation included multicollinearity testing (VIF), coefficients of determination (R^2), effect sizes (f^2), predictive relevance (Q^2), and goodness-of-fit (SRMR). Hypothesis testing was conducted using bootstrapping (5,000 subsamples) at a significance level of 5% (t-table = 1.96). The second stage employed the SITOREM method (Hardhienata, 2017) to optimize the findings by identifying priority indicators for improvement based on the criteria of Cost, Benefit, Urgency, and Importance.

RESULTS AND DISCUSSION

Evaluation of the Measurement Model (*Outer Model*)

The evaluation of the *outer model* showed that all indicators had loading factors > 0.70 (range: 0.768–0.936), Composite Reliability (CR) values > 0.90 (range: 0.851–0.966), and Average Variance Extracted (AVE) values > 0.50 (range: 0.555–0.834). The Fornell-Larcker Criterion values indicated that the square root of AVE for each construct was higher than its correlations with other constructs, thus discriminant validity was established. Accordingly, the measurement model was declared valid and reliable.

Evaluation of the Structural Model (*Inner Model*)

The evaluation of the structural model produced an SRMR value of 0.034 (< 0.08), indicating good model fit. The R-square for managerial effectiveness (Y) was 0.888, meaning that the independent variables explained 88.8% of the variance in managerial effectiveness, with the remaining 11.2% explained by other factors outside the model. The R-square for work motivation (X5) was 0.830 (83.0%). The Q^2_predict values for both endogenous variables were positive (0.878 for Y and

e-ISSN: 2985-4415
DOI: 10.57254/irma.v4i5.90

0.825 for X5), indicating good *predictive relevance*. The VIF values for all constructs were below 3.3, indicating no multicollinearity issues.

Direct Effect Hypothesis Testing

Table 2. Direct Effect Hypothesis Testing Results

Hypothesis	Path	β	T-Statistic	P-Value	Conclusion
H1	Digital Leadership → Managerial Effectiveness	0.291	4.035	0.000	Significant
H2	Data Literacy → Managerial Effectiveness	0.174	2.567	0.010	Significant
H3	Work Motivation → Managerial Effectiveness	0.169	2.676	0.007	Significant
H4	Digital Leadership → Work Motivation	0.384	5.207	0.000	Significant
H5	Data Literacy → Work Motivation	0.213	2.987	0.003	Significant

As shown in Table 2, all direct effect hypotheses (H1–H5) were **accepted**. Digital leadership had the largest effect on work motivation (β = 0.384), followed by data literacy on work motivation (β = 0.213), digital leadership on managerial effectiveness (β = 0.291), data literacy on managerial effectiveness (β = 0.174), and work motivation on managerial effectiveness (β = 0.169).

Indirect Effect (Mediation) Hypothesis Testing

Table 3. Indirect Effect (Mediation) Hypothesis Testing Results

Hypothesis	Mediation Path	Indirect Effect	T-Statistic	P-Value	Conclusion
H6	Digital Leadership → Work Motivation → Managerial Effectiveness	0.065	2.313	0.021	Mediation significant
H7	Data Literacy →	0.036	1.992	0.046	Mediation

Hypothesis	Mediation Path	Indirect Effect	T-Statistic	P-Value	Conclusion
	Work Motivation → Managerial Effectiveness				significant

The mediation test results (Table 3) demonstrate that work motivation significantly mediates the effect of digital leadership on managerial effectiveness (indirect effect = 0.065; p = 0.021) and also mediates the effect of data literacy on managerial effectiveness (indirect effect = 0.036; p = 0.046). Thus, hypotheses H6 and H7 were accepted. The mediation is *partial*, as the direct effects remained significant after the inclusion of the mediator.

.

DISCUSSION

Direct Effect of Digital Leadership on Managerial Effectiveness

The findings of this study confirm that digital leadership has a significant direct effect on the managerial effectiveness of vocational school principals (β = 0.291; p < 0.001). This result aligns with the meta-analysis conducted by Okunlola (2025), which reported a strong combined effect between digital leadership and school effectiveness, with a pooled effect size of r = 0.672 (p < 0.001) based on 11 empirical studies across six countries. The findings also reinforce AlAjmi's (2022) research showing that principals' digital leadership influences teachers' technology integration, as well as Berkovich and Hassan's (2023) study finding that principals' digital transformational leadership impacts teacher commitment and school effectiveness.

In the context of vocational school principals, digital leadership entails not merely technical proficiency with technology but also the ability to articulate a vision for digital transformation, engage in effective digital communication, foster digital innovation, and demonstrate digital resilience (Hidayat & Patras, 2024). Principals with a strong digital orientation tend to be more adaptive in responding to change, more effective in coordinating resources, and more accurate in decision-making. Navaridas-Nalda et al. (2020) affirmed that principal leadership is a strategic factor in schools' digital transformation. Without adequate digital leadership, schools struggle to adapt to the rapidly changing demands of the Industry 4.0 era (Ridho et al., 2024). Ofita, Komariah, and Abubakar (2024), in their study assessing the digital leadership of junior high school principals, identified that principal support, teacher literacy enhancement, and the formation of innovation teams are crucial factors for effective digital leadership.

Direct Effect of Data Literacy on Managerial Effectiveness

This study demonstrates that data literacy significantly influences managerial effectiveness (β = 0.174; p = 0.010). Although the coefficient is smaller than that of digital leadership, the finding remains statistically significant and carries important implications for principal professional development. Lee et al. (2024), in their systematic review of 56 empirical studies, assert that principal data literacy is a complex construct comprising 63 specific indicators organized into seven dimensions. A key finding from their review is that principal data literacy fundamentally differs from teacher data

e-ISSN: 2985-4415
DOI: 10.57254/irma.v4i5.90

literacy—while teachers focus more on the creation, collection, and analysis of classroom data, principals play a larger role in leading the school community through data.

Doğan (2023), in a meta-analysis of eight studies published between 2006 and 2021, found that data literacy education makes a high positive contribution to the knowledge and skills of data use among school administrators and teachers, with an overall effect size of 2.16 (high effect category). Filderman et al. (2022) also showed that data literacy training for K-12 educators influences teacher outcomes, particularly regarding the use of data for instructional decision-making. These findings confirm that data literacy is not an innate ability but a competency that can and must be strengthened through targeted professional development interventions. Data-literate principals are better able to develop relevant programs, monitor implementation objectively, and evaluate outcomes accurately.

Direct Effect of Work Motivation on Managerial Effectiveness

The direct effect of work motivation on managerial effectiveness ($\beta = 0.169$; $p = 0.007$) confirms that psychological energy is a key determinant of managerial performance. This finding aligns with Daulay, Haidir, and Firmansyah (2024), who involved 144 school principals and found that achievement motivation has a direct and significant effect on leadership effectiveness, with a path coefficient of 0.189. Collie (2023) showed that autonomy-supportive leadership practices positively relate to self-determined work motivation, which in turn predicts extra-role behaviors, intentions to stay or leave, and positive and negative work affect.

From the perspective of Self-Determination Theory (Ryan & Deci, 2017), intrinsic motivation grows when three basic psychological needs—autonomy, competence, and relatedness—are satisfied. Motivated principals demonstrate greater persistence, initiative, and commitment, as well as a better capacity to overcome challenges and work pressures. Maria et al. (2024), in a study of 474 secondary school teachers in Indonesia, demonstrated the importance of motivation and professional development in determining teacher performance. This finding reinforces the argument that interventions to improve managerial effectiveness must focus not only on technical skills (hard skills) but also on motivational aspects (soft skills) that are psychological in nature.

Effect of Digital Leadership on Work Motivation

The relationship between digital leadership and work motivation ($\beta = 0.384$; $p < 0.001$) represents the strongest path in this study's model. This finding aligns with Lahumuddin, Hamid, and Qamaruddin (2024), who used PLS-SEM on 309 respondents and found that digital leadership has a direct, positive, and significant effect on self-motivation, with a significance level of $p = 0.000$. Principals who possess a clear digital vision, communicate effectively using digital tools, and foster innovation in their schools tend to have higher work motivation because they perceive their work as meaningful and as presenting positive challenges.

Berkovich and Hassan (2023) also found that digital transformational leadership affects teacher commitment, which is conceptually close to work motivation.

Theoretically, this finding is supported by Self-Determination Theory (Ryan & Deci, 2017), which posits that an environment supporting autonomy and competence enhances intrinsic motivation. Digital leadership creates an environment in which principals feel supported to adopt new technologies, thereby enhancing their sense of competence and autonomy, which in turn drives higher work motivation.

Effect of Data Literacy on Work Motivation

Data literacy was found to have a significant effect on work motivation (β = 0.213; p = 0.003). Wurster, Bez, and Merk (2023), in a randomized controlled trial with pre-service teachers, demonstrated that a brief data-use intervention produced strong positive effects on data literacy scores and self-efficacy, and participants reported generally positive motivational beliefs about data use. Principals who are able to read, understand, analyze, and use data feel more confident in making decisions, are more assured that their decisions are evidence-based, and consequently experience increased work motivation.

Doğan (2023) also showed that data literacy education makes a high positive contribution to knowledge and skills in data use, which in turn enhances educators' professional self-confidence. This finding confirms that technical competence in data processing not only benefits decision quality but also builds self-confidence and internal drive to act. In other words, when principals feel competent in using data, they become more motivated to lead based on evidence.

The Mediating Role of Work Motivation

The most significant finding of this study is the role of work motivation as a mediator, significantly mediating the effects of digital leadership (indirect effect = 0.065; p = 0.021) and data literacy (indirect effect = 0.036; p = 0.046) on managerial effectiveness. This finding indicates that merely enhancing digital competencies is insufficient; it must be accompanied by strengthening the internal drive to act.

Theoretically, this finding is consistent with Self-Determination Theory (Ryan & Deci, 2017), which states that intrinsic motivation grows when individuals feel competent, autonomous, and socially connected. Principals who feel competent in digital leadership and data literacy experience increased self-efficacy, which in turn drives higher work motivation. Collie (2023) showed that autonomy-supportive leadership practices positively relate to more self-determined work motivation. Maria et al. (2024) also demonstrated that motivation serves as an important mediator in determining teacher performance in Indonesia.

This mediation finding carries strong practical implications. Principal development programs should not focus solely on technical training about digital technology or data analysis; they must also include strategies to enhance work motivation, such as setting meaningful goals, providing constructive feedback, creating a supportive work environment, and recognizing achievements. In other words, a holistic and integrative approach is required to optimize managerial effectiveness.

SITOREM Analysis and Practical Implications

The results of the SITOREM analysis identified priority indicators for improvement: (1) utilization of technology for coordination and decision-making; (2) ability to interpret and analyze data; (3) fairness; and (4) humility. Indicators to be maintained include: (1) vision for digital transformation; (2) digital innovation; (3) use of data for decision-making; and (4) religious devotion. These findings provide concrete practical guidance for the design of principal training programs, particularly in the context of vocational education in Indonesia, which is characterized by strong socio-religious values (Zaharuddin et al., 2024).

CONCLUSION

This study demonstrates that digital leadership and data literacy have positive and significant effects on the managerial effectiveness of SMK PGRI principals in Jakarta, both directly and indirectly, through work motivation. These findings confirm that improving managerial effectiveness is optimally achieved through simultaneously strengthening digital competencies (digital leadership and data literacy) and work motivation as the psychological mechanism that translates competencies into effective managerial behavior.

Limitations of the Study

This study has several limitations. First, the cross-sectional design does not allow for strong causal inferences. Second, the use of perceptual data from teachers regarding principals' managerial effectiveness may introduce bias. Third, the research context is limited to SMK PGRI schools in Jakarta, so generalization to other schools or regions should be made cautiously. Fourth, this study did not examine contextual variables such as organizational culture and policy support that might moderate the observed relationships.

Recommendations for Future Research

Future studies are advised to employ longitudinal designs to test causality, integrate objective performance data (such as school accreditation scores or graduate employment rates), expand the sample scope to include various school types and regions, and test moderation models with contextual variables such as organizational support or school culture.

Practical Implications

Principal development programs should integrate three main components: (1) digital leadership training covering digital transformation vision, digital communication, digital innovation, and digital resilience; (2) data literacy training covering data understanding, data analysis, and data use for evidence-based decision-making; and (3) sustained work motivation enhancement strategies through meaningful goal setting, constructive feedback, and the creation of a supportive work environment.

REFERENCES

e-ISSN: 2985-4415
DOI: 10.57254/irma.v4i5.90

AlAjmi, M. K. (2022). The impact of digital leadership on teachers' technology integration during the COVID-19 pandemic in Kuwait. *International Journal of Educational Research, 112*, 101928. https://doi.org/10.1016/j.ijer.2022.101928

Berkovich, I., & Hassan, T. (2023). Principals' digital transformational leadership, teachers' commitment, and school effectiveness. *Journal of Educational Administration*. https://doi.org/10.1080/20004508.2023.2173705

Collie, R. J. (2023). Teachers' work motivation: Examining perceived leadership practices and salient outcomes. *Teaching and Teacher Education, 135*, 104348. https://doi.org/10.1016/j.tate.2023.104348

Daulay, B., Haidir, H., & Firmansyah, F. (2024). The influence of managerial competence and achievement motivation on the leadership effectiveness of high school principals. *Jurnal Cakrawala Pendidikan, 43*(2). https://doi.org/10.21831/cp.v43i2.61912

Doğan, E. (2023). A meta-analysis study on data literacy education for school administrators and teachers. *Journal of Theoretical Educational Sciences, 16*(1), 199-217. https://doi.org/10.30831/akukeg.1134207

Filderman, M. J., Toste, J. R., Didion, L., & Peng, P. (2022). Data literacy training for K-12 teachers: A meta-analysis of the effects on teacher outcomes. *Remedial and Special Education, 43*(5), 328-343. https://doi.org/10.1177/07419325211054208

Hair, J. F., Hult, G. T. M., Ringle, C. M., Sarstedt, M., Danks, N. P., & Ray, S. (2021). *Partial least squares structural equation modeling (PLS-SEM) using R: A workbook*. Springer. https://doi.org/10.1007/978-3-030-80519-7

Hardhienata, S. (2017). The development of scientific identification theory to conduct operation research in education management. *IOP Conference Series: Materials Science and Engineering, 166*, 012007. https://doi.org/10.1088/1757-899X/166/1/012007

Hidayat, R., & Patras, Y. E. (2024). Digital leadership of school principals in Indonesia: Strategic interventions needed. *Pedagogia: Jurnal Ilmiah Pendidikan, 16*(1), 32-42. https://doi.org/10.55215/pedagogia.v16i1.10209

Kemendikbudristek. (2023). *Transformasi pendidikan vokasi siapkan talenta masa depan di berbagai bidang*. Kementerian Pendidikan, Kebudayaan, Riset, dan Teknologi Republik Indonesia.

Lahumuddin, M. Y. P., Hamid, R. S., & Qamaruddin, M. Y. (2024). The effects of e-performance and digital leadership on self-motivation and employee performance in MSMEs. *Jurnal Manajemen Teknologi, 23*(2), 119-134. https://doi.org/10.12695/jmt.2024.23.2.3

Lee, J., Alonzo, D., Beswick, K., Oo, C. Z., Anson, D. W. J., & Abril, J. M. V. (2024). Data literacy of principals in K–12 school contexts: A systematic review. *Educational Research Review, 45*, 100649. https://doi.org/10.1016/j.edurev.2024.100649

Maria, U., Husni, S., Thoharudin, M., Wardani, S. F., & Kholifah, N. (2024). Examining the role of family sociology, managerial support, and working conditions in determining teacher performance in Indonesia: The mediating role of motivation and professional development. *Frontiers in Education, 9*, 1413525. https://doi.org/10.3389/feduc.2024.1413525

Mergoni, A., Camanho, A., Soncin, M., Agasisti, T., & De Witte, K. (2026). The influence

e-ISSN: 2985-4415
DOI: 10.57254/irma.v4i5.90

of school principals' management on school efficiency: Evidence from Italian schools. *European Journal of Operational Research, 329*(1), 260-272. https://doi.org/10.1016/j.ejor.2025.06.020

Navaridas-Nalda, F., Clavel-San Emeterio, M., Fernández-Ortiz, R., & Arias-Oliva, M. (2020). The strategic influence of school principal leadership in the digital transformation of schools. *Computers in Human Behavior, 112*, 106481. https://doi.org/10.1016/j.chb.2020.106481

Ofita, C., Komariah, A., & Abubakar, A. (2024). Assessing digital leadership of junior high school principals. *Journal of Educational Management and Instruction, 4*(1), 127-139. https://doi.org/10.22515/jemin.v4i1.9502

Okunlola, J. O. (2025). Digital leadership: Shaping school effectiveness in the digital era - A meta-analysis. *Educational Technology Quarterly, 2025*(3), 253-265. https://doi.org/10.55056/etq.972

Ridho, M. R., Wiyono, B. B., & Mustiningsih. (2024). Digital leadership of school principals to improve the quality of learning in the industrial revolution era 4.0. *Insania, 29*(1). https://doi.org/10.24090/insania.v29i1.9566

Ryan, R. M., & Deci, E. L. (2017). *Self-determination theory: Basic psychological needs in motivation, development, and wellness*. Guilford Press. https://doi.org/10.1521/978.14625/28806

UNESCO. (2022). *Transforming technical and vocational education and training for successful and just transitions: UNESCO strategy 2022-2029*. UNESCO.

Wurster, S., Bez, S., & Merk, S. (2023). Does learning how to use data mean being motivated to use it? Effects of a data use intervention on data literacy and motivational beliefs of pre-service teachers. *Learning and Instruction, 88*, 101806. https://doi.org/10.1016/j.learninstruc.2023.101801

Zaharuddin, Auliya, N. N., & Despiana, D. (2024). Religiosity and career commitment on work performance among teachers. *Psikis: Jurnal Psikologi Islami, 10*(2), 201-210. https://doi.org/10.19109/psikis.v10i2.24251