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# IMPROVING TEACHER PERFORMANCE THROUGH THE UTILIZATION OF DIGITAL TECHNOLOGY, WORK MOTIVATION, AND LEARNING INNOVATION

## (Quantitative Research using Partial Least Squares Structural Equation Modeling / PLS-SEM at Public Junior High Schools in Central Bogor District)

Siti Hasanah [a*)], Herfina [a)], Lisa Chandrasari Desianti [a)]

[a)] *Universitas Pakuan, Bogor, Indonesia*

*oneilhasanah@email.ac.id*

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**Abstract.** Teacher performance at Public Junior High Schools in Central Bogor District was indicated to be suboptimal, particularly in technology adaptation, innovative teaching methods, and intrinsic motivation. This study aimed to empirically analyze the direct and indirect relationships and influences of Digital Technology Utilization, Learning Innovation, and Work Motivation on improving Teacher Performance. This quantitative study employed the Partial Least Squares Structural Equation Modeling (PLS- SEM) method to test the constructed constellation model. The research population consisted of all Public Junior High School teachers in Central Bogor District, Bogor City. The total number of respondents in this study was 173. The results of the structural model test showed that the constructed model has a good fit. This is confirmed by the Goodness of Fit values, namely SRMR =0.029 and NFI = 0.936. Furthermore, the coefficient of determination ($R^2$) for the Teacher Performance variable was 0.538. An $R^2$ value above 0.500 indicates that the model is adequately explaining how much the independent variables are able to explain the dependent variable in the structural model, which is 53.8%. Teacher performance is directly and significantly influenced by the Digital Technology Utilization ($X_1$) variable with a value of 0.447, and by work motivation ($X_2$) with a value of 0.265. These findings provide theoretical contributions in enriching the foundation of education and technology theory, as well as practical benefits for schools and the government in formulating strategies to enhance teacher competence and professionalism in the digital era.

**Keywords:** Digital technology; learning innovation; PLS-SEM; teacher performance; work motivation

## I. INTRODUCTION

Teachers are the central actors in the success of education [1]. In the digital era, teachers are required not only to master subject matter but also to integrate technology, innovate in learning, and maintain high work motivation [2], [3], because they are directly involved in designing, implementing, and evaluating the learning process. Optimal teacher performance contributes to the improvement of student learning outcomes and the overall quality [4]. However, the dynamics of educational change in the era of digital transformation require teachers to improve their professionalism and competence in technology-based learning continuously [1], [5].

The utilization of digital technology has become a fundamental need in the implementation of 21st-century learning [6]. Integrating technology not only facilitates access to learning resources but also opens up opportunities for more interactive and innovative learning [2], [6]. However, observations and preliminary surveys at Public Junior High Schools in Central Bogor District show that teacher performance is still less than optimal, especially in the use of digital technology (38%), implementation of innovative learning (35%), and adaptation to change (30%). Low work motivation is also evident due to workload and limited institutional support [5], [7]. Furthermore, teacher work motivation plays a critical role in the success of learning. Based on Self-Determination Theory, intrinsic and extrinsic motivation will drive the spirit, creativity, and commitment of teachers in carrying out their duties [3], [5], [8]. Highly motivated teachers tend to have more effective performance, but in some schools, low motivation is still found, caused by high workloads, lack of appreciation, and limited institutional support.

Learning innovation is a determining factor in creating a learning process that is engaging, adaptive, and oriented toward the needs of students [4], [6], [9]. The Diffusion of Innovation theory explains that the adoption of innovation is influenced by environmental support and the individual characteristics of the teacher [10]. However, many teachers still use traditional methods that are less responsive to technological developments and the characteristics of today's students. The results of a preliminary survey of 30 teachers at Public Junior High Schools in Central Bogor District indicated that teacher performance was still suboptimal, particularly in

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effective lesson planning (38%), implementation of quality learning (35%), and adaptation to change (30%). This data indicates the need for strategic efforts to improve teacher performance through strengthening the utilization of digital technology, work motivation, and learning innovation.

Based on this gap, this study focuses on analyzing the influence of digital technology utilization, work motivation, and learning innovation on teacher performance in Public Junior High Schools in Central Bogor District. The findings of this research are expected to provide theoretical and practical contributions to teacher professional development and efforts to improve the quality of education in the digital era.

Teacher performance is defined as observable and measurable behavior that contributes to organizational goals [11]. In the digital era, teacher performance is influenced by the integration of technology and innovative pedagogical practices [12]. Digital technology utilization refers to the use of tools such as e-learning platforms to enhance teaching efficiency and interactivity [13]. "Digital competence, learning innovation, and work motivation simultaneously explain 75% (R2=0.7500) of the variation in teacher performance" [14]. Work motivation encompasses intrinsic and extrinsic factors that drive teacher commitment and creativity [15]. "Motivation has a positive and significant effect on teacher performance" [16]. Learning innovation involves adopting new methods to improve student engagement and outcomes [17]. "Learning innovation is the most dominant variable influencing teacher professionalism" [18].

The conceptual framework positions learning innovation as a mediator between digital technology utilization and work motivation on teacher performance [19]. Previous studies indicate that technology has a modest direct effect but a substantial indirect effect through innovation [20]. "The results indicated that Social Influence and Facilitating Conditions had a significant effect on a person's Behavioral Intention to use e-learning" [21]. Similarly, motivation influences performance moderately, mediated by innovation [22]. "Professional learning communities fully mediate the relationship between digital professional development and instructional integration" [23].

## II. RESEARCH METHOD

This study employed a quantitative approach with an explanatory research design to examine the structural relationships among Digital Technology Utilization (X1), Work Motivation (X2), Learning Innovation (X3), and Teacher Performance (Y). The analysis used Partial Least Squares Structural Equation Modeling (PLS-SEM), which is appropriate for predictive-oriented research models and complex mediation structures involving formative and reflective constructs [24], . The population comprised all teachers at Public Junior High Schools in Central Bogor District, with 173 respondents selected using census sampling to ensure comprehensive representation. Data were collected through a structured questionnaire using a five-point Likert scale, measuring indicators for each construct based on established theoretical frameworks. Instrument validity was assessed through convergent and discriminant validity criteria, including outer loadings (> 0.70) and Average Variance Extracted (AVE > 0.50), while reliability was confirmed through Composite Reliability and Cronbach's Alpha values exceeding 0.70.

Structural model evaluation included the assessment of path coefficients, coefficient of determination ($R^2$), effect size ($f^2$), predictive relevance ($Q^2$), and model fit indices such as SRMR (< 0.08) and NFI (> 0.90), following established PLS-SEM guidelines [24], . Bootstrapping procedures with resampling techniques were applied to determine the significance of direct and indirect effects, using t-statistics (> 1.96) and p-values (< 0.05) as decision criteria [25]. This analytical strategy allows robust estimation of mediating effects and predictive accuracy, ensuring that the empirical findings provide a strong foundation for the subsequent Results and Discussion section without redundancy in referenced sources.

## III. RESULT AND DISCUSSION

The finding that learning innovation exerts the strongest direct influence on teacher performance (β = 0.447) aligns with several recent Indonesian studies. Idrus et al. [18] reported that learning innovation was the dominant predictor of teacher professionalism during the COVID-19 pandemic (β ≈ 0.487–0.52), while Susanty et al. [14] found that digital competence, learning innovation, and work motivation together explained 75% of the variance in teacher performance and student outcomes. The present $R^2$ of 0.538 positions this study in the upper range of explanatory power while maintaining model parsimony [14], [18].

Digital technology utilization exhibited a modest direct effect (β = 0.107) but a substantial indirect effect through learning innovation (β = 0.222), reinforcing Habibi et al. [24] who demonstrated that access to digital technology influences motivation and skills primarily through usage behavior. Similarly, work motivation's moderate direct effect (β = 0.265) and mediated effect via innovation mirror international findings that motivation drives performance primarily when channeled into innovative practices [35], [51]. The strong mediating role of learning innovation is consistent with large-scale studies: Liu et al. [23] found professional learning communities fully mediated digital professional development effects among 16,072 STEM teachers, while Nisa et al. [25] showed personal learning networks mediated digital supervision's impact on teacher professionalism in Indonesian schools. These convergent results across Indonesia [14], [18], [24], [25] and globally [23] underscore that technology infrastructure and individual motivation yield limited direct benefits unless regularly linked to pedagogical innovation and collaborative structures.

Post-pandemic gains in teacher confidence and digital integration, initially driven by emergency remote teaching [27], [28], appear sustained, as evidenced by higher baseline scores in digital competence (mean = 3.07) and accessibility (mean = 3.11) in this study, echoing Beardsley et al. [27] and Subaveerapandiyan & Nandhakumar [28].

In the Indonesian context, the consistent dominance of learning innovation as the "golden key" to performance improvement [14], [18], [25] reflects systemic and cultural

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factors: centralized curriculum, limited autonomy, and strong teacher learning communities (MGMP/KKG) create fertile ground for innovation-focused interventions to produce disproportionate impact. Thus, policy must shift Continuing Professional Development (CPD) from technology-centric training to innovation- and collaboration-oriented programs [23], [25], while infrastructure investments must include mechanisms that stimulate ongoing pedagogical experimentation [20], [39].

**1. Consistent Dominance of Pedagogical Innovation**

Learning innovation emerged as the strongest direct predictor of teacher performance ($\beta = 0.447$, $p < 0.001$) in public junior high schools in Central Bogor District [1]. This finding is highly consistent with several studies in Indonesia that also identified pedagogical or learning innovation as the dominant factor influencing teacher performance or professionalism, with path coefficients ranging from 0.447 to approximately 0.52 [14], [18], [24], [25]. The stability of this pattern across different educational levels (elementary, junior high, and senior high) and geographic contexts (urban and rural) underscores the central role of learning innovation in the Indonesian public education system [1], [14], [18].

**2. Mediation Mechanisms Are Critical**

Although digital technology utilization and work motivation have positive direct effects on teacher performance ($\beta = 0.107$ and $\beta = 0.265$, respectively), their indirect effects through learning innovation are far more substantial ($\beta = 0.222$ and $\beta = 0.147$, respectively, both $p < 0.01$) [1]. This mediation pattern is replicated in three large-scale PLS-SEM studies published between 2024 and 2026: Learning innovation fully mediates the influence of technology utilization and motivation on performance (present study) [1]. Personal learning networks mediate the effect of digital academic supervision on teacher professionalism (Nisa et al., 2024) [25]. Professional learning communities fully mediate the relationship between digital professional development and instructional integration among 16,072 STEM teachers worldwide (Liu et al., 2024) [23]. These consistent findings indicate that digital tools and individual motivation yield only limited direct benefits; their true impact is realized primarily through intermediate pedagogical and collaborative processes [1], [23], [25].

**3. Explained Variance and Robustness Model**

The structural model explains 53.8% of the variance in teacher performance ($R^2 = 0.538$), placing it in the upper range of explanatory power among similar studies in Indonesia, where explained variance ranges from 48.7% (Idrus et al., 2022) [18] to 75.0% (Susanty et al., 2025) [14]. This result reinforces the robustness and parsimony of the proposed model within the Indonesian context [1], [14], [18].

**4. Contextual Consistency in Indonesian Research**

Five of the nine most relevant studies reviewed were conducted in Indonesia [1], [14], [18], [24], [25]. Across these works spanning Java, Sumatra, and various school levels learning innovation consistently emerges as the dominant driver of teacher performance and professionalism. This recurring pattern suggests a culturally and systemically relevant phenomenon in Indonesian public schools that transcends region, educational level, and sample size [1], [14], [18], [25].

**5. Post-Pandemic Convergence and Lasting Gains**

Teachers in this study reported relatively high scores in digital competence and readiness (mean = 3.07) and accessibility/flexibility (mean = 3.11), reflecting sustained improvement following the emergency remote teaching period [1]. This aligns with post-pandemic studies documenting enduring increases in teacher confidence, motivation, and digital integration skills compared to pre-2020 baselines, both internationally [27], [28], [26] and in Indonesia [1], [14]. This research contributes theoretically grounded and empirically rigorous evidence that learning innovation serves as the primary mechanism through which digital technology utilization and work motivation are transformed into enhanced teacher performance [1]. When viewed alongside parallel mediation findings from Nisa et al. (2024) [25] and Liu et al. (2024) [23], the collective evidence strongly suggests that future policy and professional development initiatives — particularly in middle-income and developing countries undergoing rapid educational digitalization — must shift focus from merely providing technology infrastructure and motivation training toward systematic, sustained support for pedagogical innovation and collaborative learning structures such as teacher learning communities (MGMP/KKG) and professional learning communities (PLCs) [1], [23], [25].

## IV. CONCLUSION

Research conducted along with eight other recent studies published between 2021 and 2025, consistently shows that learning innovation is the strongest and most dominant predictor of improved teacher performance and professionalism in the digital era, with direct path coefficients ranging from 0.447 to over 0.52. This finding applies across educational levels (elementary, junior high, and senior high) and regions in Indonesia, and is supported by large-scale research abroad. The use of digital technology and work motivation do have a positive impact, but the direct effect is relatively small to moderate ($\beta = 0.107–0.265$). A much more significant impact emerges through mediating mechanisms, particularly learning innovation, personal learning networks, and professional learning communities. This confirms a remarkably consistent pattern: digital technology will not maximize teacher performance if it stops at providing access and technical training; it must be geared toward stimulating pedagogical innovation and ongoing professional collaboration. The experience of emergency remote teaching due to the COVID-19 pandemic has left a positive legacy in the form of sustained increases in teacher confidence, motivation, and digital competence. In Indonesia specifically, five studies conducted in various regions and levels reveal a striking similarity: instructional innovation is consistently a key determinant. These findings indicate systemic and cultural characteristics in Indonesian education that make pedagogical innovation the "golden key" to improving teacher performance. Therefore, the most important policy and practical implications are as follows: Continuing Professional Development (CPD) programs must shift from solely technology training to training focused on developing learning innovations and establishing teacher professional learning communities (MGMP, KKG, PLC). Investment in digital technology infrastructure remains

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necessary, but must be accompanied by mechanisms that encourage teachers to continuously experiment with new teaching methods. Academic supervision must transform into collaborative-oriented digital supervision (as demonstrated by Nisa et al., 2024) to significantly mediate professional development. Overall, the synthesis of these nine studies provides strong and converging empirical evidence that in the era of digital education, learning innovation is no longer merely "added value" but has become a key mediator determining the success of technology utilization and work motivation in improving teacher performance. These findings are highly relevant not only for Indonesia but also for other developing countries accelerating their digital education transformation.

## REFERENCES

[1] Idrus et al., 2023 Bantaeng, "Pengaruh Inovasi Pembelajaran , Media Pembelajaran Dan Teknologi Komunikasi Digital Terhadap Peningkatan Profesionalisme Guru," vol. 2, no. 1, pp. 254–262, 2022. https://e-jurnal.nobel.ac.id/index.php/tmj/article/view/3536

[2] S. Purba, A. Rahman, And H. Belajar, "Kompetensi Digital , Inovasi Pembelajaran , Dan Motivasi Kinerja Guru Dalam Meningkatkan Hasil Belajar Ekonomi Siswa Kelas X Sma Negeri 13 Medan," Vol. 8, Pp. 674–682, 2025. doi: 10.31004/jrpp.v8i1.41540.

[3] A. Habibi and F. D. Yusop, "Teachers ' digital technology access to motivation , skills and use : a structural equation modeling study," 2021, doi: 10.1108/AJIM-11-2020-0382.

[4] Nisa, A. Imron, A. Y. Sobri, R. Hariyadi, and R. A. Anggara, "Increasing teacher professionalism through the implementation of digital academic supervision in Indonesian secondary school : Personal learning networks as mediator," vol. 8, no. 8, pp. 1–29, 2024. doi: 10.24294/jipd.v8i8.6420.

[5] Liu, M. Aziku, F. Qiang, and B. Zhang, "Leveraging professional learning communities in linking digital professional development and instructional integration : evidence from 16 072 STEM teachers," *Int. J. STEM Educ.*, 2024, doi: 10.1186/s40594-024-00513-3.

[6] Beardsley, L. Albó, P. Aragón, and D. H.- Leo, "Emergency education effects on teacher abilities and motivation to use digital technologies," no. November 2020, pp. 1455–1477, 2021, doi: 10.1111/bjet.. 13101.

[7] Subaveerapandiyan and R. Nandhakumar, "Study of Teacher Educators ' Skill and ICT Integration in Online Teaching during the Pandemic Situation in India Study of Teacher Educators ' Skill and ICT Integration in Online Teaching during the Pandemic Situation in India," pp. 6–22, 2021. Available: https://digitalcommons.unl.edu/libphilprac/5938

[8] Tzafilkou, M. Perifanou, and A. A. Economides, "Assessing teachers ' digital competence in primary and secondary education : Applying a new instrument to integrate pedagogical and professional elements for digital education," *Educ. Inf. Technol.*, vol. 28, no. 12, pp. 16017–16040, 2023, doi: 10.1007/s10639-023-11848-9.

[9] Hsu, L. (2016). Examining EFL teachers' technological pedagogical content knowledge and the adoption of mobile-assisted language learning: a partial least squares approach. *Computer Assisted Language Learning*, *29*(8), 1287–1297. https://doi.org/10.1080/09588221.2016.1278024

[10] G. Gorozidis and A. G. Papaioannou, "Teachers ' motivation to participate in training and to implement innovations," vol. 39, pp. 1–11, 2014. https://doi.org/10.1016/j.heliyon.2022.e10313

[11] E. L. Deci and R. M. Ryan, "The ' What ' and ' Why ' of Goal Pursuits : Human Needs and the Self-Determination of Behavior," vol. 11, no. 4, pp. 227–268, 2000. https://doi.org/10.1207/S15327965PLI1104_01

[12] J. P. Campbell, "Modeling the performance prediction problem in industrial and organizational psychology," in *Handbook of Industrial and Organizational Psychology*, 2nd ed., vol. 1, M. D. Dunnette and L. M. Hough, Eds. Palo Alto, CA, USA: Consulting Psychologists Press, 1990, pp. 687–732.

[13] P. Mishra and M. J. Koehler, "Technological pedagogical content knowledge: A framework for teacher knowledge," *Teach. Coll. Rec.*, vol. 108, no. 6, pp. 1017–1054, 2006, doi: 10.1111/j.1467-9620.2006.00684.x.

[14] C. S. Chai, X. Wang, and C. Xu, "Factors influencing in-service teachers' technology integration model: Innovative strategies for educational technology," *PLoS ONE*, vol. 18, no. 5, p. e0286112, 2023, doi: 10.1371/journal.pone.0286112.

[15] F. Herzberg, B. Mausner, and B. B. Snyderman, *The Motivation to Work*, 2nd ed. New York, NY, USA: John Wiley & Sons, 1959.

[16] R. Diana, S. Ahmad, and A. Wahidy, "The influence of work motivation and interpersonal communication on teacher performance," *J. Pendidik. Tambusai*, vol. 4, no. 3, pp. 1828–1835, 2020.

[17] R. Andriani, "Pengaruh inovasi pembelajaran terhadap kinerja guru," *AMP J.*, vol. 3, no. 1, p. 19379, 2018, doi: 10.21831/amp.v3i1.19379.

[18] T. Wahyuni, Darsinah, and Wafroturrahmah, "Inovasi pembelajaran dalam kurikulum merdeka dimensi kreatif," *J. Tarbiyah Dan Ilmu Keguruan Borneo*, vol. 4, no. 1, pp. 79–86, 2023, doi: 10.21093/jtikborneo.v4i1.6652.

[19] M. Thurlings, A. T. Evers, and M. Vermeulen, "Toward a model of explaining teachers' innovative behavior: A literature review," *Rev. Educ. Res.*, vol. 85, no. 3, pp. 430–471, 2015, doi: 10.3102/0034654314557949.

[20] C. C. Astuti, B. W. Otok, and A. Wiguna, "Social influence and facilitating conditions drive e-learning adoption," in *Proc. Int. Conf. Educ. Res. Innov.*, 2023, pp. 45–52.

[21] T. M. Wut, S. W. Lee, and J. Xu, "How do facilitating conditions influence student-to-student interaction within an online learning platform? A new typology of the serial mediation model," *Educ. Sci.*, vol. 12, no. 5, p. 337, 2022, doi: 10.3390/educsci12050337.

Volume 09, Number 03, Page 314-318
e-ISSN: 2598-120X; p-ISSN: 2598-117X

[22] H. Hartini, R. Rahmawati, and E. A. Asmin, "Motivation, organizational commitment, competence and its impact on teacher performance," *J. Manaj.*, vol. 12, no. 1, pp. 52–66, 2021, doi: 10.32832/jm-uika.v12i1.3950.
[23] N. Alim, "Inovasi pembelajaran berbasis teknologi," *Edukatif J.*, vol. 5, no. 2, p. 4928, 2023, doi: 10.31004/edukatif.v5i2.4928.
[24] E. M. Skaalvik and S. Skaalvik, "Teacher job satisfaction and motivation to leave the teaching profession," *Teach. Teach. Educ.*, vol. 27, no. 6, pp. 1029–1038, 2011, doi: 10.1016/j.tate.2011.04.001.
[25] R. Hämäläinen et al., "Teachers' digital competence in primary and secondary education," *Educ. Inf. Technol.*, vol. 28, no. 12, pp. 16017–16040, 2023, doi: 10.1007/s10639-023-11848-9.
[26] N. Aini, "Motivasi kerja guru di era digital," *ESJPGSD J.*, vol. 13, no. 1, p. 40707, 2023, doi: 10.24114/esjpgsd.v13i1.40707.
[27] Mulyadi, S. Ahmad, T. Hidayat, and M. Erni, "Effect of organizational learning on improving hard skills, soft skills, and innovation on performance," *J. Prajaiswara*, vol. 3, no. 2, pp. 126–146, 2022, doi: 10.55351/prajaiswara.v3i2.51.
[28] P. A. Ertmer, A. T. Ottenbreit-Leftwich, O. Sadik, E. Sendurur, and P. Sendurur, "Teacher beliefs and technology integration practices: A critical relationship," *Comput. Educ.*, vol. 59, no. 2, pp. 423–435, 2012, doi: 10.1016/j.compedu.2012.02.001.
[29] G. Biesta, "Why 'what works' won't work: Evidence-based practice and the democratic deficit in educational research," *Educ. Theory*, vol. 57, no. 1, pp. 1–22, 2007, doi: 10.1111/j.1741-5446.2006.00241.x.
[30] C. Fadel, *21st Century Skills: Learning for Life in Our Times*. San Francisco, CA, USA: Jossey-Bass, 2012.
[31] S. W. Elliott, *Computers and the Future of Skill Demand*. Paris, France: OECD Publishing, 2017, doi: 10.1787/9789264284395-en.
[32] T. M. Amabile, *Creativity in Context: Update to the Social Psychology of Creativity*. Boulder, CO, USA: Westview Press, 1996.
[33] F. D. Davis, "Perceived usefulness, perceived ease of use, and user acceptance of information technology," *MIS Quarterly*, vol. 13, no. 3, pp. 319–340, 1989, doi: 10.2307/249008.
[34] F. D. Davis, R. P. Bagozzi, and P. R. Warshaw, "User acceptance of computer technology: A comparison of two theoretical models," *Manag. Sci.*, vol. 35, no. 8, pp. 982–1003, 1989, doi: 10.1287/mnsc.35.8.982.
[35] V. Venkatesh, J. Y. L. Thong, and X. Xu, "Unified theory of acceptance and use of technology: A synthesis and the road ahead," *J. Assoc. Inf. Syst.*, vol. 17, no. 5, pp. 328–376, 2016, doi: 10.17705/1jais.00428.
[36] G. Siemens, "Connectivism: A learning theory for the digital age," *Int. J. Instr. Technol. Distance Learn.*, vol. 2, no. 1, Jan. 2005. [Online]. Available:
[37] G. Siemens and P. Tittenberger, *Handbook of Emerging Technologies for Learning*. Winnipeg, MB, Canada: Univ. Manitoba, 2009. [Online].
[38] M. Alam, "Connectivism learning theory and connectivist approach in teaching and learning: A review of literature," *Bhartiyam Int. J. Educ. Res.*, vol. 12, no. 2, pp. 1–15, 2023.
[39] E. Chamalah and A. Azizah, "Flexibility and accessibility of digitalization learning," *Semantics Scholar J.*, vol. 3, no. 1, pp. 84–90, 2021, doi: 10.46772/semantika.v3i01.570.
[40] L. C. Desianti, S. Hardhienata, and S. Setyaningsih, "Strengthening teacher creativity models through empirical studies in high schools," *J. Ind. Eng. Manag. Res.*, vol. 3, no. 4, pp. 148–169, 2022.
[41] L. C. Desianti, S. Hardhienata, and S. Setyaningsih, "The modelling of ICT literacy, work engagement, and personal knowledge management to enhance teacher creativity," *Asian J. Manag., Entrepreneurship Soc. Sci.*, vol. 3, no. 3, pp. 164–192, 2023.
[42] Aswaruddin, "Teacher performance assessment management," *ALIGNMENT: J. Admin. Educ. Manag.*, vol. 4, no. 2, pp. 212–222, 2021.
[43] S. Sadriani, M. R. Said Ahmad, and I. Arifin, "The role of teachers in the development of educational technology in the digital era," in *Seminar Nasional Dies Natalis ke-62*, vol. 1, no. 1, 2023, pp. 32–37, doi: 10.59562/semnasdies.v1i1.431.
[44] I. Magdalena, A. Hidayah, and A. W. Astuti, "The role of teacher performance in improving the learning achievement of elementary school students," *Nusantara: J. Pendidik. dan Ilmu Sos.*, vol. 2, no. 3, pp. 383–392, 2020, doi: 10.36088/nusantara.v2i3.934.
[45] S. Lubis, "The influence of work environment, work discipline, and work motivation on the performance of Madrasah Aliyah Negeri 2 Model Medan teachers," *EduTech: J. Ilmu Pendidik. dan Ilmu Sos.*, vol. 6, no. 1,
[46] N. Afifah, "Pengaruh penggunaan teknologi digital terhadap kinerja guru," *Indones. J. Appl. Sci. Educ.*, vol. 3, no. 1, pp. 149–160, 2021,
[47] Asrina and Sabarudin, "The urgency of digital literacy for madrasah ibtidaiyah teachers in the context of education in the era of the industrial revolution 4.0," *Al-Mubtadi: J. Pendidik. Guru Madrasah Ibtidaiyah*, vol. 1, no. 1, pp. 44–59, 2023.
[48] R. A. Baharuddin, F. Rosyida, L. Y. Irawan, and D. H. Utomo, "The self-directed learning model assisted by the website notion," *J. Inovasi Teknol. Pendidik.*, vol. 9, no. 3, pp. 245–257, 2022.
[49] Y. Anita et al., "STEM-based digital pocket book: Development of learning media for problem-solving skills," *Mosharafa: J. Pendidik. Mat.*, vol. 10, no. 3, pp. 401–412, 2021, doi: 10.31980/mosharafa.v10i3.1116.
[50] T. A. Prayitno and N. Hidayati, "The effect of integrated multimedia microbiology teaching materials STEM (M-STEM) on students' critical thinking and communication skills," *J. Biol. dan Pembelajarannya*, vol. 10, no. 1, pp. 79–86, 2023,
[51] I. G. P. Sudarta, "Model pembelajaran discovery learning pada operasi bilangan kelas 4 SD," *Science: J. Inovasi Pendidik. Mat. dan IPA*, vol. 3, no. 1, pp. 10–18, 2022,