

The Influence of Innovative Leaders as Communication Development Agent in Leveraging Digital Technology Use Amongst Indonesian Teachers

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ABSTRACT

Teacher's digital technology use has become an enormous challenge in the school digital transformation program process. This study aims to analyze the emerging role of innovative leadership in influencing digital technology use and to test the relationship between innovative leadership, perceived usefulness, perceived ease of use, and digital technology use among teachers at the Sekolah Penggerak program in Indonesia. This study explores a modified technology acceptance model as the theoretical framework. Three hundred ninety-seven teachers participated in this research through a simple random sampling method. The study results show the significant role of innovative leadership in influencing teachers' digital technology use when mediated by perceived usefulness and perceived ease of use with a p-value of 0,000. Innovative leadership continuously has a significant direct effect on perceived usefulness, with a value of 0,000. It also shows positive effects on perceived ease of use with a value of 0,000. Moreover, data analysis shows that innovative leadership is perceived as sufficiently high, with a scale of 4,22 out of 5 points. Furthermore, being skilful at team building is perceived as a powerful indicator, contributing 4,25 out of 5 points. Not only team building, being visionary, skilful at relationship building, and confident at risk-taking is also statistically proven to be sufficient, with score results of 4,22, 4,21, and 4,21 for each indicator. Teachers' digital technology use also reached 3.82 out of a 5-point scale, which shows high results on the digital technology use variable index.

Keywords: Educational leadership, perceived usefulness, perceived ease of use, leveraging digital use

Article Info

Published: 2025/03/03

INTRODUCTION

Indonesia is one of many countries that encourages massive use of digital technology in many development sectors. Digital technology, comprehensively, has uncountable benefits for short and long-term development (Unesco, 2023). According to Gómez (Aparicio-Gómez et al., 2024), digital technology is also a beneficial driver for accomplishing the Sustainable Development Goals (SDGs) in various fields. In order to achieve the SDGs, it is essential to ensure that everyone has access to high-quality education. Furthermore, numerous studies have demonstrated that digital technology positively impacts education (Lindfors et al., 2021). Digital technology presents as a means of achieving high-quality education. In actuality, digital technology has previously changed the worldview of the school system. It serves not only as a source of information but also as a co-creator of information, mentor, and assessor. Undeniably, digital technology expands opportunities for skill training and facilitates access to high-quality information in the field of education (Haleem et al., 2022).

Amongst the many benefits of digital technology for education, it has become one of the most prominent challenges teachers must overcome today. The inquiry on the most proficient method to stay up with the fast improvement of digital technology innovation and how to coordinate it into learning has become a significant issue in training (Sato et al., 2024). Different endeavours have been made to expand the teachers' digital technology use (Luo et al., 2021). The Indonesia ministerial impact report showed that the gap in technology use among Indonesian teachers was still high despite the intensification of information and communication technology training, the distribution of digital device stimuli, and the launch of various digital learning resource platforms (Oliver Wyman, 2023). It is reported that 60 per cent of Indonesian teachers had difficulties integrating digital technology into teaching. This condition increases awareness of how, in the future, Indonesian students could compete in the global arena (Whitman & Whitman, 2020).

In an attempt to bridge the gap, innovative leadership is found to be one of the strong catalysts that can drive the transformation of education. It helps schools to shift from traditional to dynamic learning environments, fostering innovative culture and creativity. Innovative leadership prepares the school ecosystem to thrive in an increasingly complex digitalization world. Moreover, innovative leadership is bound for leaders to build strong partnerships with teachers, staff, parents, and the community. They understand that collaboration is essential for creating a supportive and enriching learning environment. By fostering a shared vision and empowering educators to innovate, these leaders create schools where teaching and learning are dynamic and engaging (Raman & Thannimalai, 2019).

Alluding to these circumstances and considering previous examinations, this analyse the effect of innovative leadership on teachers' digital technology use. This study uses the term digital technology with reference to the utilization of the digital teaching platform called *Merdeka Mengajar* platform (PMM), which was launched as an integrated platform for teaching and aimed to support teachers' pedagogical and professional tasks. PMM arose as a computerized drive to energize and conduct change in innovation reception for educators, work with showing errands, and give expansive admittance to free preparation (Oliver Wyman, 2023). Within the context of the technology acceptance framework, the primary goal of this study is to investigate how innovative leadership affects the use of the PMM digital platform. This study also tends to provide new statistical proof of how the perceived usefulness and perceived ease of use play a moderating role in innovative leadership and teachers' digital technology use within the school digital transformation context.

RESEARCH METHODS

The Variables

The independent variables in this research are the factors that influence teacher's digital technology use, especially in the school-level context, as follows:

X1- Innovative leadership

X2- Perceived usefulness

X3- Perceived ease of use

This study highlighted and analyzed relationships between variables and tested hypotheses. The dependent variable for this study is digital technology use (Y), with indicators as follows:

Y1.1 – Accessibility

Y1.2 – Use for learning

Y1.3 – Use for curriculum understanding

Y1.4 – Use for lesson planning

Y1.5 – Use for Evaluating

Y1.6 – Use for self-development

Y1.7 – Use for policy implementation

Research Framework

Based on the literature review, it is clear that innovative leadership offers a profound base for enhancing the use of digital technology. Mediated by two core attributes of TAM, the hypotheses built for this research are:

H1: Innovative leadership has a significant influence on perceived usefulness

H2: Innovative leadership has a significant influence on perceived ease of use

H3: Innovative leadership has a significant indirect effect towards digital technology use through the mediation of perceived usefulness

H4: Innovative leadership has a significant indirect effect towards digital technology use through the mediation of perceived ease of use.

Furthermore, in order to describe the research theoretical framework, please see Figure 1 as follows:

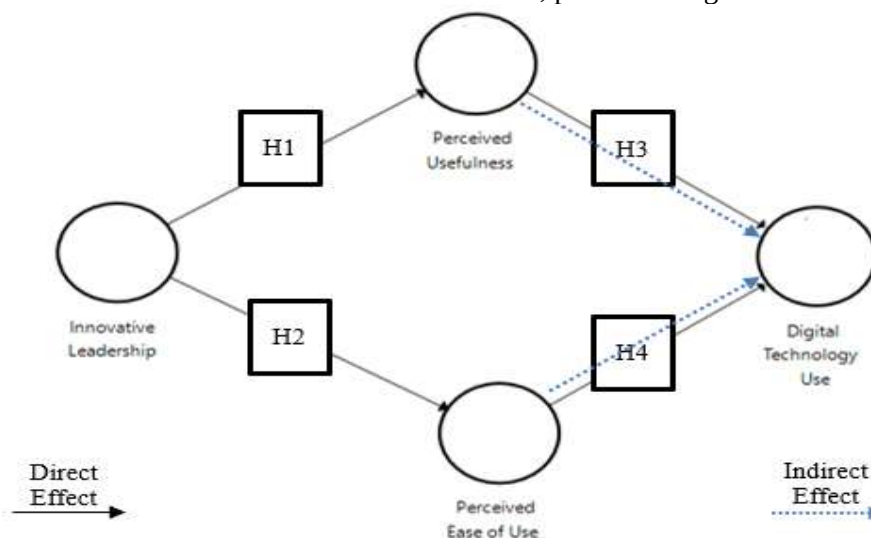


Figure 1. Theoretical Framework

Methods

The research employed a quantitative method by using surveys through questionnaires. Respondents were to complete the questionnaires, and the data collected were analyzed to see relationships between variables and to test hypotheses. The research locations were three regions surrounding Jakarta, commonly known as Indonesia's particular region. The data was analyzed using the *Partial Least Square-Structural Equation Model* through SmartPLS 3.0 to test the relationships between variables (Hair et al., 2022).

The research population is all teachers teaching at Sekolah Penggerak (Ministry of Education, Culture Research and Technology's school transformation program). 21 Schools actively involved in the program were selected using a simple random sampling method. These schools were located in three different regencies that surrounded Jakarta. These locations were selected since, first, these locations are the target of the Indonesian Sekolah Penggerak program batch 1 (2021-2022). Second, the schools involved in the Sekolah Penggerak Program commit to developing school digital transformation through the program. Thirdly, Sekolah Penggerak school leaders have been strengthened with sufficient knowledge and are involved in strengthening innovative programs at the school level. In the next stage, a simple random sampling was conducted in each school, gaining 397 respondents. Furthermore, in determining the unit analysis, this research referred to Slovin's formula (Tejada et al., 2012) as follows:

$$n = N / (1 + Ne^2)$$

Where:

n = number of samples

N = Large population

e = Margin error

So

$$n = 7000 / (1 + 7000 \times 0.052)$$

$$n = 378,378$$

$$n = 379 \text{ Teachers}$$

Based on the calculation of the Slovin formula, a minimum sample number of 379 people is needed so that this research has met the minimum sample number with a total sample of 397 teachers as a research analysis unit. Data collection was further analyzed using the *Partial Least Square-Structural Equation Model* through SmartPLS 3.0 to test the relationships between variables (Hair et al., 2022).

Furthermore, having Sekolah Penggerak schools as a research location may lead to the application of innovative leadership at the school level, which serves as one independent variable to be analyzed for its influence on the use of digital technology in the school environment. Leadership practices in Sekolah Penggerak were selected because these school leaders have gone through some socializations and have developed a common perception of innovative

leadership practices at the school level. As for the target area, the target locations are Bogor, Bekasi, and Tangerang, which are Jakarta's buffer areas with strong urbanization characteristics.

This descriptive explanatory research aims to describe, evaluate and explain the relationship between research variables through hypothesis testing. It is supported by primary and secondary data. According to Cresswell (2018), quantitative research describes or explains a problem whose results can be generalized. This study uses statistical analysis and survey design, with a time horizon of once in one period (*cross-sectional studies*), conducted based on primary data using a questionnaire and supported by available secondary data.

This study also employed a 5-point scale to explain the results of descriptive analysis. The range used in this research is as follows (Table 1):

Table 1. Five points scale estimating the variable

Category	Range
Very High	4,2 - 5
High	3,4 - 4,2
Moderate	2,6 - 3,4
Low	1,8 - 2,6
Very Low	1 - 1,8

The questionnaires used for this study had undergone some validity and reliability tests for 30 teachers other than the research sample. The questionnaire set was rigorously discussed for suitability, accuracy, and relevance to the targeted sample. The test results obtained Cronbach Alpha value exceeded 0,7, which means all indicators have passed the ideal value (Hair et al., 2022).

RESULTS AND DISCUSSION

Respondent Characteristics

The respondents' characteristics show that out of 397 participants, 72% were female and 28% were male. Respondents were mostly at the age of ≤ 35 years old (42.9%), ages 36-45 years old (21.6%) and 35.4 % were at the age of ≥ 46 years old. Regarding educational background, most respondents had bachelor's degrees, making up 77.7% of the participants. While those with a master's degree comprised up to 23% of the participants. In the teaching experience part, we found out that 23,3% of respondents had less than five years of teaching experience, 24,5 % had 5-10 years of teaching experience, 29,4% had 11-20 years of teaching experience, and 22,7% had more than 20 years of teaching experience.

Assessment of Measurement and Structural Model

We used structural equation modelling (SEM) to analyze and test the relationships between variables. SEM is a group of multivariate factual investigation techniques that show complex underlying connections between estimated factors and inert builds. Convergent, construct, and discriminant validity were the three types of evaluation used to assess the measurement model's validity for latent constructs. The average variance extracted (AVE) was calculated to determine convergent validity. The fitness indices of the measurement model were used to assess construct validity (Hair et al., 2019a). Discriminant validity was criticized through the improvement of the Discriminant validity index. Composite reliability (CR) was utilized to determine the reliability of CRIS (Abraham et al., 2019). Multiple studies suggested these methods (Muhamad et al., 2024), which offered more robust measures for determining validity and reliability. Indicators and path coefficients between constructs comprise the measurement model depicted in Figure 2.

Figure 2 shows that all indicators accurately and significantly evaluate their respective latent variables. As per the guideline, the external stacking values should surpass 0.7 (Hair et al., 2022). Consequently, the external stacking, from 0.815 to 0.961 with a p -value < 0.000 , shows that the focalized legitimacy has been reached or marker dependability exists. Each inert factor of this study is substantial. As a result, the study has retained all reflective indicators.

The inner model consistency is assessed utilizing composite reliability and Cronbach's alpha values. The satisfactory incentive for composite reliability ought to surpass 0.70 (Hair et al., 2019b). In this review, each factor's composite unwavering quality incentive surpasses 0,70. Meanwhile, convergent validity is established when the indicators share significant variance, indicating convergence on a particular construct. The extracted average variance (AVE) can be used to assess this. The AVE value must exceed 0.5 (Hair et al., 2019) to demonstrate convergent validity. As can be seen in Table 2, all AVE values of sufficient outer loadings have exceeded 0.5, indicating that convergent validity was fulfilled.

Table 2 Assessment of construct validity and reliability

Items	Cronbach's Alpha	Rho A	Composite Reliability	Average Variance Extracted (AVE)
Digital Technology Use	0,962	0,965	0,969	0,816
Innovative Leadership	0,958	0,964	0,969	0,888
Perceived Ease of Use	0,957	0,958	0,967	0,855
Perceived Usefulness	0,971	0,973	0,976	0,873

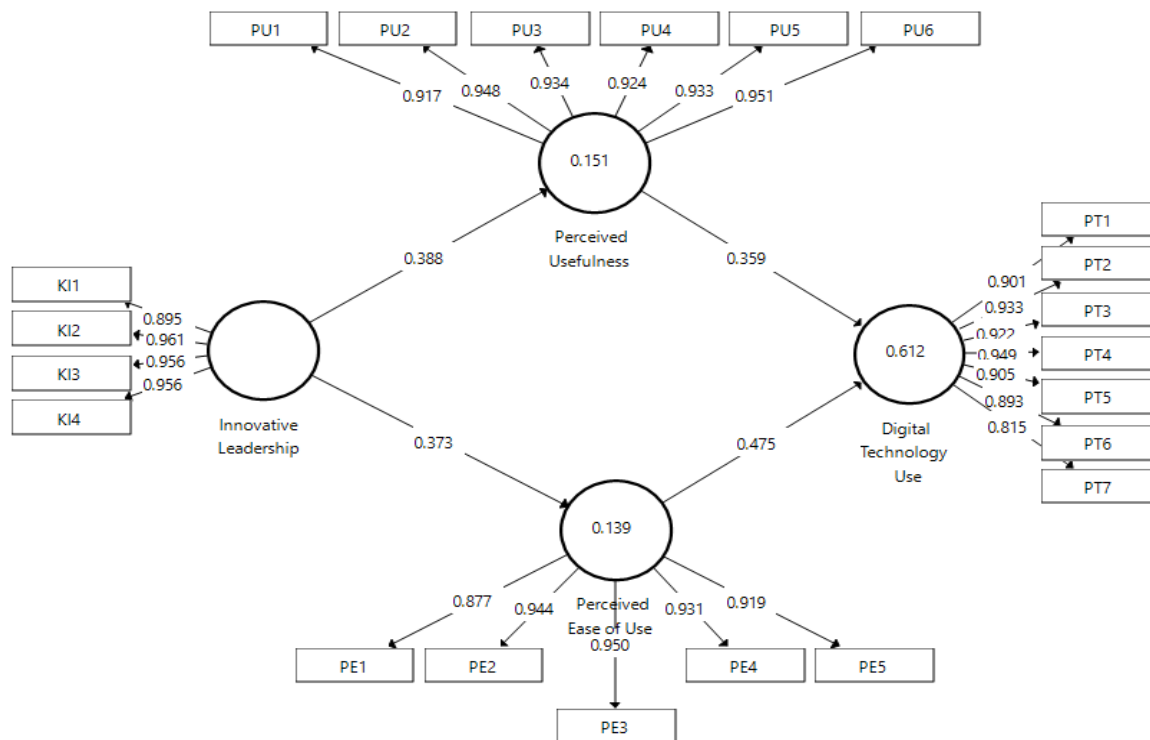


Figure 2. Structural Equation Model

Next, as presented in Table 3 below, this paper presents the path coefficients, standard deviations, absolute T values, and significance values. The significance of the coefficients was determined through bootstrapping, taking into account a 5% level of significance and the p-values of <0.05, indicating the relationship significance between the latent variables. Path coefficients were presented to evaluate the strength of these significant relationships. The results can be seen as follows (Table 3):

Table 3. Analysis of Direct Effects and Indirect Effects

Items	Standard Deviation (STDEV)	T Statistics (O/STDEV)	P Values
Direct Effects			
Innovative Leadership -> Perceived Ease of Use	0,063	5,956	0,000
Innovative Leadership -> Perceived Usefulness	0,058	6,649	0,000
Perceived Ease of Use -> Digital Technology Use	0,062	7,637	0,000
Perceived Usefulness -> Digital Technology Use	0,067	5,332	0,000
Indirect Effects			

Innovative Leadership -> Perceived Ease of Use -> Digital Technology Use	0,035	4,985	0,000
Innovative Leadership -> Perceived Usefulness -> Digital Technology Use	0,035	3,985	0,000

Innovative leadership has significantly influenced the perceived usefulness with a *p-value* of 0.000 (value must be < 0.05). These findings supported the previous study results, highlighting innovative leadership's significant influence on perceived usefulness by technology adopters (Horst et al., 2007). Likewise, the influence of innovative leadership on perceived ease of use is also accepted with a *p-value* of 0.000 (< 0.05). It predicts the influence of innovative leadership on the perceived ease of use. It corroborates the previous study results that show innovative leadership's significant influence on perceived ease of use. According to previous results, perceived usefulness significantly affects digital technology use. It is indicated by the value $0.000 < 0.05$. Furthermore, perceived ease of use is also proven to significantly affect digital technology use with a value of 0.000, or < 0.05 . It reinforces Moorhouse's statement about the importance of technology usefulness and ease of use in using the latest learning technology by teachers (Moorhouse et al., 2021).

Regarding the results and previous discussion on direct and indirect effects analysis, the researchers found out that all proposed hypotheses are accepted, as shown in Table 4 below:

Table 4. Hypotheses Results

Hypotheses	P Value	Results
H1: Innovative leadership has a significant influence on perceived usefulness	0,000	Accepted
H2: Innovative leadership has a significant influence on perceived ease of use	0,000	Accepted
H3: Innovative leadership has a significant indirect effect towards digital technology use through the mediation of perceived usefulness	0,000	Accepted
H4: Innovative leadership has a significant indirect effect towards digital technology use through the mediation of perceived ease of use	0,000	Accepted

Based on data analysis, all hypotheses are accepted with a value of 0,000, corroborating the significant influence within the proposed model. Furthermore, based on data analysis, perceived usefulness has significantly mediated innovative leadership towards digital technology use with a value of $0.000 < 0.05$. It implies how important it is for school leaders to communicate the benefits of using technology to teachers. This action can motivate teachers to integrate digital technology into their teaching and enhance their performance (Agarwal & Prasad, 1997). Even more, when school leaders introduce the technology, it enhances teachers' technology use (Kulophas & Kim, 2020). These results were strengthened by the descriptive analysis showing that 93 per cent of respondents strongly agreed that their leader's clear vision about integrating digital technology in the classroom motivated them to use technology when teaching. Not only that, but 89 per cent of the respondents also agreed that the capability of Indonesian school leaders to communicate the vision and build commitment within the school team members to use technology in the classroom significantly impacted the teacher's use of technology in the classroom. Besides being visionary and skilful at team build, the teachers agreed that maintaining good relationships and managing risk efficiently were strongly needed to arouse the teachers' willingness to adopt innovation and digital technology brought by the school leaders. The results showed that 41 per cent of teachers strongly agreed that the leader's capability as a relationship builder influenced their willingness to commit to integrating new technology in teaching. In addition, 52 per cent of respondents agreed that a leader who was brave enough to make decisions, learn more, and mitigate risk well in adopting new technology motivated them to try to keep up with new technology. High indexes on each innovative leadership indicator (visionary, team builder, relationship builder, and risk taker) statistically supported the significant role of innovative leadership in teachers' use of new technology (*Merdeka mengajar* digital platform). The descriptive analysis of innovative leadership also shows that all indicators of innovative leadership have an enormously high contribution, with 4,22 points from the five maximum scores. Furthermore, when looking at the results of each of the four dimensions of innovative leadership, team building skill is seen as a strong indicator, contributing 4,25 out of 5 maximum score, which shows an intense high. Not only is a great team builder, visionary, skilful at relationship building, and risk taker are also statistically proven as strong innovative leadership indicators with score results of 4,22, 4,21 and 4,21 each.

Moreover, in line with previous study results, perceived ease of use is proven to have a significant mediating effect on innovative leadership towards teachers' digital technology use (value $0.000 < 0.05$). This result supports previous research, which suggested that the perceived ease of using technology significantly mediated innovative

leadership towards adopting new technology (Baba et al., 2023). The findings also emphasized the importance of providing enough technical support for teachers to enhance the use of technology introduced by their school leaders. Given some statistical proof, innovative leadership supports and emphasizes communicating the benefits of technology and providing teachers with access, technical support and ICT integration training (Kuo & Lee, 2011). It also highlights that a previous study showed that the perceived ease of using technology affects the willingness to use it (Peng & Yan, 2022).

Finally, the results showed that the model proposed in this study escalated the use of the *merdeka mengajar* digital platform in school. The descriptive analysis of teachers' use of the digital platform reached 3.82 out of 5 scale scores, meaning a high category in the digital technology use an index that ranged from 1-5 (high score range 3,4 - 4,2 points). Furthermore, 21 per cent of respondents admitted that the *Merdeka Mengajar* platform has very high accessibility, and 54 per cent agreed that its high accessibility helped them to use it frequently. Twenty-one per cent of respondents admit that they accessed the digital platform moderately. In terms of *Merdeka Mengajar* platform usage, 72 per cent of respondents agreed that using the platform helped them with their pedagogical tasks, 78 per cent agreed that the platform also helped them understand the new curriculum better, and 57 per cent agreed that the platform helped them understand the latest policy (*merdeka belajar* policy) in Indonesia education system.

CONCLUSION

This study has produced statistical evidence on the emerging role of innovative leadership of school leaders in leveraging and enhancing teacher's digital technology use. It answers the objectives statements in several points: first, in this model, innovative leadership is proven to have significant direct effects on perceived usefulness and ease of use. Second, perceived usefulness and ease of use have significant mediating effects on innovative leadership and their influence on teachers' use of the digital technology (platform *merdeka mengajar*). It strengthens many studies that have proven these two core attributes of TAM are still powerfully relevant to be used as antecedents of digital technology acceptance in this school digital transformation context. The process of school leaders communicating the benefits of the platform has also proved to be significantly impactful in motivating teachers' actual use of the digital platform. More importantly, teachers found that leaders using the promoted technology and providing access and technical support helped them confidently integrate the platform in classrooms. In conclusion, innovative leadership has significantly impacted teachers' use of digital technology at the school level.

As recommendations, looking at the significance of innovative leadership in supporting teachers' actual use of digital technology at the school level, there is an emerging situation of spreading more attention to innovative leadership training for school leaders in Indonesia. Currently, the focus is more likely to be on teachers' ICT training rather than improving school leaders' innovative leadership. This result may initiate comprehensive discourse and action on sustaining new reinforcement in improving digital technology adoption in schools due to the profound role of innovative leadership in the school digital transformation era.

ACKNOWLEDGMENTS

The authors would like to express their gratitude to Professor Aida Vitayala S. Hubeis for her unlimited support during the research data collecting and analysis. May She forever be remembered for her tremendous works in promoting gender equality for woman in community development programs.

DISCLOSURE

The authors report no conflicts of interest in this work.

REFERENCES

- Abiddin, N. Z., Ibrahim, I., & Aziz, S. A. A. (2022). Advocating Digital Literacy: Community-Based Strategies and Approaches. *Academic Journal of Interdisciplinary Studies*, 11(1), 198–211. <https://doi.org/10.36941/ajis-2022-0018>
- Abraham, S., Mir, B. A., Suhara, H., Mohamed, F. A., & Sato, M. (2019). Structural equation modeling and confirmatory factor analysis of social media use and education. *International Journal of Educational Technology in Higher Education*, 16(1). <https://doi.org/10.1186/s41239-019-0157-y>
- Agarwal, R., & Prasad, J. (1997). The role of innovation characteristics and perceived voluntariness in the acceptance of information technologies. *Decision Sciences*, 28(3), 557–582. <https://doi.org/10.1111/j.1540-5915.1997.tb01322.x>
- Akour, I., Alshurideh, M., Al Kurdi, B., Al Ali, A., & Salloum, S. (2021). Using machine learning algorithms to predict people's intention to use mobile learning platforms during the COVID-19 pandemic: Machine learning

- approach. *JMIR Medical Education*, 7(1). <https://doi.org/10.2196/24032>
- Aparicio-Gómez, O. Y., Ortiz, O. L. O., & von Feigenblatt, O. F. (2024). Building a sustainable future: The role of digital resources in achieving the Sustainable Development Goals (SDGs). *Revista Lusofona de Educacao*, 61(61), 125–139. <https://doi.org/10.24140/issn.1645-7250.rle61.08>
- Baba, M. A., Haq, Z. ul, Dawood, M., & Aashish, K. (2023). FinTech Adoption of Financial Services Industry: Exploring the Impact of Creative and Innovative Leadership. *Journal of Risk and Financial Management*, 16(10). <https://doi.org/10.3390/jrfm16100453>
- Bai, B., Wang, J., & Chai, C.-S. (2021). Understanding Hong Kong primary school English teachers' continuance intention to teach with ICT. *Computer Assisted Language Learning*, 34(4), 528–551. <https://doi.org/10.1080/09588221.2019.1627459>
- Falloon, G. (2020). From digital literacy to digital competence: the teacher digital competency (TDC) framework. *Educational Technology Research and Development*, 68(5), 2449–2472. <https://doi.org/10.1007/s11423-020-09767-4>
- Granić, A., & Marangunić, N. (2019). Technology acceptance model in educational context: A systematic literature review. *British Journal of Educational Technology*, 50(5), 2572–2593. <https://doi.org/10.1111/bjet.12864>
- Hair, J. F., Hult, G. T., Ringle, C. M., & Sarstedt, M. (2022). A Primer on Partial Least Squares Structural Equation Modeling (PLS-SEM) Third Edition. In Leah Fargotstein (Ed.), *Sage Publications* (Third Edit). SAGE Publications Inc.
- Hair, J. F., Risher, J. J., Sarstedt, M., & Ringle, C. M. (2019a). When to use and how to report the results of PLS-SEM. *European Business Review*, 31(1), 2–24.
- Hair, J. F., Risher, J. J., Sarstedt, M., & Ringle, C. M. (2019b). When to use and how to report the results of PLS-SEM. *European Business Review*, 31(1), 2–24. <https://doi.org/10.1108/EBR-11-2018-0203>
- Haleem, A., Javaid, M., Qadri, M. A., & Suman, R. (2022). Understanding the role of digital technologies in education: A review. *Sustainable Operations and Computers*, 3(February), 275–285. <https://doi.org/10.1016/j.susoc.2022.05.004>
- Hofer, M. & Harris, J. (2011). Tpack : an Emerging Research and Development Tool for. *The Turkish Online Journal of Educational Technology*, 10(4), 370–377.
- Holzmann, P., Schwarz, E. J., & Audretsch, D. B. (2020). Understanding the determinants of novel technology adoption among teachers: the case of 3D printing. *Journal of Technology Transfer*, 45(1), 259–275. <https://doi.org/10.1007/s10961-018-9693-1>
- Horst, M., Kuttschreuter, M., & Gutteling, J. M. (2007). Perceived usefulness, personal experiences, risk perception and trust as determinants of adoption of e-government services in The Netherlands. *Computers in Human Behavior*, 23(4), 1838–1852. <https://doi.org/10.1016/j.chb.2005.11.003>
- Kaewsang-on, R., AL-Takhayneh, S. K., Jam, F. A., Chang, B. L., Pradana, M., & Mahmood, S. (2022). A three wave longitudinal study of school innovation climate and entrepreneurship teachers' acceptance to technology: Moderating role of knowledge sharing and knowledge hiding. *Frontiers in Psychology*, 13(October), 1–15. <https://doi.org/10.3389/fpsyg.2022.1028219>
- Kulophas, D., & Kim, M. (2020). How “Thailand 4.0” principals applied leadership and technology towards teacher learning: Three case studies. *Kasetsart Journal of Social Sciences*, 41(3), 614–619. <https://doi.org/10.34044/j.kjss.2020.41.3.25>
- Kuo, R. Z., & Lee, G. G. (2011). Knowledge management system adoption: Exploring the effects of empowering leadership, task-technology fit and compatibility. *Behaviour and Information Technology*, 30(1), 113–129. <https://doi.org/10.1080/0144929X.2010.516018>
- Lindfors, M., Pettersson, F., & Olofsson, A. D. (2021). Conditions for professional digital competence: the teacher educators' view. *Education Inquiry*, 12(4), 390–409. <https://doi.org/10.1080/20004508.2021.1890936>
- Luo, Z., Brown, C., & O'Steen, B. (2021). Factors contributing to teachers' acceptance intention of gamified learning tools in secondary schools: An exploratory study. *Education and Information Technologies*, 26(5), 6337–6363. <https://doi.org/10.1007/s10639-021-10622-z>
- Mamula, T., Perić, N., & Vujić, N. (2019). The contribution of innovative leadership style as an answer to global and business changes. *Quality - Access to Success*, 20(170), 9–14.
- Matias, J., & Timosan, J. Q. (2021). Examining teachers' use of Learning Information Systems (LIS) of the basic education schools in the Philippines using structural equation modeling. *International Journal of Enterprise Information Systems*, 17(1), 69–84. <https://doi.org/10.4018/IJEIS.2021010104>
- Miguel-Revilla, D., Martínez-Ferreira, J. M., & Sánchez-Agustí, M. (2020). Assessing the digital competence of educators in social studies: An analysis in initial teacher training using the TPACK-21 model. *Australasian Journal of Educational Technology*, 36(2), 1–12. <https://doi.org/10.14742/ajet.5281>

- Moorhouse, B. L., Li, Y., & Walsh, S. (2021). E-Classroom Interactional Competencies: Mediating and Assisting Language Learning During Synchronous Online Lessons. *RELC Journal*. <https://doi.org/10.1177/0033688220985274>
- Muhamad, M. Q. B., Doddanavar, I. A., & Chowdhury, S. (2024). Determining youths' computational thinking skills using confirmatory factor analysis. *International Journal of Evaluation and Research in Education (IJERE)*, 13(4), 2060. <https://doi.org/10.11591/ijere.v13i4.28513>
- OliverWyman. (2023). Peran Teknologi dalam Transformasi Pendidikan di Indonesia. *Kemdikbud*, 4(2), 1–7.
- Pagaura, A. R. (2020). Innovative leadership attributes of school administrators in the Philippines: Implications for educational management. *Interdisciplinary Research Review*, 15(2), 1–7. <https://ph02.tci-thaijo.org/index.php/jtir/article/view/192352>
- Peng, M. Y. P., & Yan, X. (2022). Exploring the Influence of Determinants on Behavior Intention to Use of Multiple Media Kiosks Through Technology Readiness and Acceptance Model. *Frontiers in Psychology*, 13(March), 1–11. <https://doi.org/10.3389/fpsyg.2022.852394>
- Qaisar, R., Lajane, H., Lamiri, A., Bouzoubaa, H., Abidi, O., & Khyati, A. (2020). The Perceived Usefulness of Digital Simulators in the Acquisition of Professional Competencies by Undergraduate Nursing Students. *International Journal of Emerging Technologies in Learning*, 15(22), 258–265. <https://doi.org/10.3991/ijet.v15i22.17023>
- Raman, A., & Thannimalai, R. (2019). Importance of Technology Leadership for Technology Integration: Gender and Professional Development Perspective. *SAGE Open*, 9(4). <https://doi.org/10.1177/2158244019893707>
- Ripki, A. J. H., Murni, S., Wahyudi, M., Suryadi, S., Burmansah, B., Wulandari, A., & Cletus, S. (2020). How does transformational leadership on school leaders impact on teacher creativity in vocational high schools? *Universal Journal of Educational Research*, 8(10), 4642–4650. <https://doi.org/10.13189/ujer.2020.081033>
- Sato, S. N., Condes Moreno, E., Rubio-Zarapuz, A., Dalamitros, A. A., Yañez-Sepulveda, R., Tornero-Aguilera, J. F., & Clemente-Suárez, V. J. (2024). Navigating the New Normal: Adapting Online and Distance Learning in the Post-Pandemic Era. *Education Sciences*, 14(1). <https://doi.org/10.3390/educsci14010019>
- Tarrés, M. A., & Macau, C. M. (2021). Leadership styles and teacher involvement in secondary school, a (self) biographic approach. *Profesorado*, 25(3), 197–218. <https://doi.org/10.30827/PROFESORADO.V25I3.9309>
- Tejada, J. J., Raymond, J., & Punzalan, B. (2012). On the Misuse of Slovin's Formula. *The Philippine Statistician*, 61(1), 8.
- Tejedor, S., Cervi, L., Pérez-Escoda, A., & Jumbo, F. T. (2020). Digital literacy and higher education during COVID-19 lockdown: Spain, Italy, and Ecuador. *Publications*, 8(4), 1–17. <https://doi.org/10.3390/publications8040048>
- Tongrugjun, N., Chullasap, N., & Atiwithayaporn, J. (2023). Factors and Indicators of Innovative Leadership of Private School Administrators in the Digital Era on the East Coast Southern Sub-Region of Thailand. *Migration Letters*, 20, 383–395.
- Unesco. (2019). The ICT Competency Framework for Teachers Harnessing OER Project Digital Skills Development for Teachers. In *policy brief*.
- Unesco. (2023). *Global Education Monitoring Report 2023. Technology in Education: A Tool on Whose Terms?* (Issue 114). <https://doi.org/10.47413/vidya.v2i2.197>
- Whitman, W., & Whitman, W. (2020). Preface. COmmunication is RObust when NAtions Come Together: The Importance of Collaboration during a Global Crisis. *Journal of Education, Innovation, and Communication, June Special Issue*, 9–15. https://doi.org/10.34097/jecom_sp_june2020_0