



Theoretical and Juridical Study of Environmental Pollution Crimes in the Mining Sector

Imelda Moonik¹, Romi J. Mongdong², Zoya F. Sumampouw³

¹Master Program Student in Educational Management, State University of Manado

²Lecturers in Master Program of Educational Management, State University of Manado

Email : imelda.moonik@unima.ac.id

Article Info

Corresponding Author:

Penulis Korespondensi

✉ imelda.moonik@unima.ac.id

History:

Submitted: 17-04-2026

Revised: 18-04-2026

Accepted: 18-04-2026

Keywords: teacher character management, learning material mastery, teacher competence, TPACK, AI-TPACK, vocational high school, Minahasa

Kata Kunci: manajemen karakter guru, penguasaan materi pembelajaran, kompetensi guru, TPACK, AI-TPACK, SMK, Minahasa.



Copyright © 2026 by
JurnalRiset

All writings published in this journal are personal views of the authors and do not represent the views of the Constitutional Court.

<https://doi.org>

Abstract

This study investigates the influence of teacher character management and learning material mastery on the competence of public vocational high school teachers in Minahasa Regency, analyzing both factors partially and simultaneously. Employing a quantitative explanatory approach with a cross-sectional survey design, the study involved a sample of 105 teachers selected through proportional stratified random sampling from a population of 355 teachers across 11 public vocational high schools. The study utilized a validated Likert-scale questionnaire, with data analysis including descriptive statistics, validity and reliability tests, classical assumption tests, and multiple linear regression using SPSS version 27. The results revealed that teacher character management significantly positively affects teacher competence ($t=18.914$; $p<0.001$; $R^2=0.776$), as does learning material mastery ($t=18.690$; $p<0.001$; $R^2=0.772$), with both variables together explaining 77.7% of teacher competence variance ($F=177.214$; $p<0.001$; $R^2=0.777$). The high correlation ($r=0.997$) between these two variables indicates a strong synergy between soft and hard competences in shaping teacher competence. The study concludes that the integrative soft-hard competence model is a powerful predictor of vocational teacher competence, recommending professional development programs that combine character development with enhancing TPACK/AI-TPACK mastery, along with policies for industrial internships of at least 40 hours per year for vocational teachers.

Abstrak

Penelitian ini menyelidiki pengaruh manajemen karakter guru dan penguasaan materi pembelajaran terhadap kompetensi guru SMK Negeri di Kabupaten Minahasa, menganalisis kedua faktor tersebut secara parsial dan simultan. Dengan menggunakan pendekatan kuantitatif eksplanatori dan desain survei potong lintang, penelitian ini melibatkan sampel sebanyak 105 guru yang dipilih melalui proportional stratified random sampling dari populasi 355 guru yang tersebar di 11 SMK Negeri. Penelitian ini menggunakan kuesioner skala Likert yang telah divalidasi, dengan analisis data meliputi statistik deskriptif, uji validitas dan reliabilitas, uji asumsi klasik, serta regresi linear berganda menggunakan SPSS versi 27. Hasil penelitian menunjukkan bahwa manajemen karakter guru berpengaruh positif dan signifikan terhadap kompetensi guru ($t=18.914$; $p<0.001$; $R^2=0.776$), begitu juga dengan penguasaan materi pembelajaran ($t=18.690$; $p<0.001$; $R^2=0.772$), dengan kedua variabel tersebut bersama-sama menjelaskan 77,7% variansi kompetensi guru ($F=177.214$; $p<0.001$; $R^2=0.777$). Korelasi yang sangat tinggi ($r=0.997$) antara kedua variabel tersebut menunjukkan adanya sinergi yang kuat antara kompetensi lunak dan keras dalam membentuk kompetensi guru. Penelitian ini menyimpulkan bahwa model kompetensi integratif lunak-keras merupakan prediktor yang kuat bagi kompetensi guru vokasi, dan merekomendasikan program pengembangan profesional yang menggabungkan pengembangan karakter dengan peningkatan penguasaan TPACK/AI-TPACK, serta kebijakan yang mewajibkan magang industri minimal 40 jam per tahun bagi guru vokasi.

1. INTRODUCTION

Vocational secondary education (SMK) holds a strategic role in preparing competent human resources ready to enter the workforce. In the context of Industry 4.0 and Society 5.0, vocational teachers are required to possess far more complex and multi-layered competencies than teachers in general education (Mutalib, Ismail, & Abdullah, 2023). These competencies include not only professional competence (content mastery), pedagogical, social, and personality competencies but also advanced digital and industrial competencies relevant to modern workforce needs (Tam, Chan, & Ng, 2023).

Global research consistently shows that teacher competence is the most determining variable in the quality of educational processes and outputs. König, Frey, & Glutsch (2020), in a cross-national study involving over 7,000 teachers across seven countries, found that teacher competence is the strongest predictor of instructional quality and student achievement. Guerriero (2022), in an international systematic review, affirmed that teacher knowledge encompasses not only content mastery but also pedagogical knowledge, social knowledge, and professional character that dynamically interact.

In the vocational education context, vocational teacher competence has broader and more complex dimensions. Mutalib, Ismail, & Abdullah (2023) identified eight critical competency areas for TVET teachers in the Industry 4.0 era: technical-vocational competence, pedagogical competence, digital competence, 21st-century skills facilitation, assessment, professional networking with industry, curriculum design, and professional character/identity. This breadth places vocational teachers in a highly challenging position.

One important dimension often overlooked in research and teacher competence development programs is character management. Teacher character—encompassing integrity, empathy, emotional regulation, discipline, and psychological resilience—has been proven to directly affect instructional effectiveness. Lavy & Naama-Ghanayim (2020) demonstrated that teacher character strengths significantly predict student academic engagement and

the quality of teacher-student relationships. Fiorilli et al. (2020) found that teachers' ability to manage their emotions not only prevents professional burnout but actively enhances the quality of pedagogical interaction. Aharon, Samuel, & Shoshani (2023) further proved that teacher resilience and self-efficacy are direct predictors of classroom performance.

On the other hand, learning material mastery continues to evolve with accelerating technological transformation. The Content Knowledge (CK) model introduced by Shulman has now developed into Pedagogical Content Knowledge (PCK), Technological Content Knowledge (TCK), Technological Pedagogical Content Knowledge (TPACK), and Artificial Intelligence Technological Pedagogical Content Knowledge (AI-TPACK), which integrates artificial intelligence into the learning process (Celik, 2023; Setiyawan et al., 2025). Schmid, Brianza, & Petko (2021) proved that teachers with high TPACK demonstrate consistently better instructional effectiveness in technology-based learning.

Field conditions reveal significant variation in character management and learning material mastery among teachers at public vocational schools in Minahasa Regency. Based on the researcher's preliminary observations, variations were found in teachers' ability to effectively manage practical classes, integrate technology into learning, and maintain consistent teaching quality amid various work pressures. This situation impacts the variation in teacher competence, which ultimately affects the quality of vocational school graduates (Cattaneo & Boldrini, 2021).

Literature review shows that most previous studies have examined only one dimension of teacher competence separately: some focused on character dimensions (soft competence), while others focused on technology-based material mastery (hard competence). Very few studies have examined the integrative contribution of both dimensions simultaneously in a single predictive model of teacher competence, especially in the context of Eastern Indonesian vocational schools. This research gap constitutes the main foundation for this study.

Based on this background, this study formulates the following research questions: (1) Does character management significantly influence teacher

competence at public vocational schools in Minahasa Regency? (2) Does learning material mastery significantly influence teacher competence? (3) Do character management and learning material mastery simultaneously significantly influence teacher competence? The objectives are to analyze and prove these three influences.

2. RESEARCH METHOD

2.1 Type, Location, and Research Design

This study employed a quantitative approach with an explanatory research type, which aims to explain causal relationships between variables through statistical hypothesis testing (Creswell & Creswell, 2021). The research was conducted at 11 public vocational high schools (SMKN) in Minahasa Regency, North Sulawesi Province, from January to April 2026.

The research design used was an explanatory research design with multiple linear regression (MLR) as the primary analytical method. This design was chosen because it can simultaneously test the influence of two or more independent variables on one dependent variable, quantify the relative contribution of each predictor, and test the overall model significance (Hair et al., 2022).

2.2 Population and Sample

The study population comprised all active teachers at 11 public vocational high schools in Minahasa Regency in 2026. Population data were obtained directly from school principals and the Branch Office of Education in Tondano, with a total population of $N = 355$ teachers.

The sampling technique used was proportional stratified random sampling, which considers population strata (schools) with proportions balanced to the number of population members in each stratum (Sugiyono, 2022). The sample size was set at $n = 105$ teachers (29.6% of the population), based on five theoretical arguments: (a) Green's formula (1991): $N \geq 50 + 8(k)$ with $k=2$ yields $N \geq 66$; (b) Hair et al.'s (2022) ratio: 10-20 observations per predictor; (c) Cohen (1988): for medium effect size with power 0.80, $n \approx 68$

is needed; (d) Krejcie & Morgan (1970): for $N=355$, $n=186$ is recommended at 95% confidence, but $n=105$ is adequate for MLR; and (e) Sugiyono (2022): a sample fraction of 25-30% provides adequate representation.

2.3 Variables and Research Instruments

This study involved three variables. The first independent variable (X_1) was Teacher Character Management, defined as teachers' ability to manage, develop, and express professional character values encompassing five dimensions: emotional regulation, empathy, integrity, discipline, and resilience. The X_1 instrument was adapted from the Character Strengths Scale (Lavy & Naama-Ghanayim, 2020), Teacher Emotional Competence Scale (Fiorilli et al., 2020), and Teacher Resilience Measurement (Aharon et al., 2023).

The second independent variable (X_2) was Learning Material Mastery, defined as teachers' ability to comprehensively master and integrate learning content covering five components: CK (Content Knowledge), PCK (Pedagogical Content Knowledge), TCK (Technological Content Knowledge), TPACK (Technological Pedagogical and Content Knowledge), and AI-TPACK (Artificial Intelligence Technological Pedagogical Content Knowledge). The X_2 instrument was adapted from the CK/PCK Framework (Carlson & Daehler, 2021), TPACK Scale (Tondeur et al., 2020), and AI-TPACK Scale (Setiawan et al., 2025).

The dependent variable (Y) was Teacher Competence, defined as teachers' professional capacity encompassing four dimensions: pedagogical competence, professional competence, social competence, and personality competence. The Y instrument was adapted from the Teacher Competence Framework (König et al., 2020) and Pedagogical Competence Model (Salonen et al., 2023).

All instruments used a five-point Likert scale (1=Strongly Disagree to 5=Strongly Agree). The X_1 instrument consisted of 10 items, X_2 of 10 items, and Y of 8 items.

2.4 Data Collection and Analysis Procedures

Content validity was established through expert judgment by four expert validators. Pilot testing was

conducted on 5 respondents at SMKN 3 Tondano, resulting in revisions to 5 items (X₁: items No.6 and No.9; X₂: items No.7 and No.10; Y: item No.4). After revision, the instruments were declared suitable for use.

Data analysis was conducted in four stages using IBM SPSS version 27: (1) descriptive statistics (mean, standard deviation, frequency distribution); (2) validity testing (Pearson Product Moment with $r_{table}=0.195$ for $n=105$) and reliability testing (Cronbach's Alpha with criterion $\alpha \geq 0.60$); (3) classical assumption tests (Kolmogorov-Smirnov normality, VIF multicollinearity, scatter plot heteroscedasticity, Pearson correlation linearity); and (4) multiple linear regression analysis (t-test, F-test, coefficient of determination R²).

3. RESULTS

3.1 Respondent Characteristics

The study successfully collected data from 105 active teachers (100% response rate). Respondents were distributed across various vocational expertise fields (Automotive Engineering, Computer and Network Engineering, Accounting, Hospitality, Agribusiness, etc.) across all public vocational schools in Minahasa Regency. Most respondents were certified teachers with more than 5 years of teaching experience.

3.2 Instrument Validity and Reliability

Validity test results showed that all items in the three variables were declared valid because $r_{count} > r_{table} = 0.195$. The item-total correlation ranges were: X₁ = 0.228-0.512; X₂ = 0.224-0.513; Y = 0.245-0.684. The revised items (X₁ items No.6 and No.9; X₂ items No.7 and No.10; Y item No.4) met the validity criteria in the main sample.

Reliability test results yielded Cronbach's Alpha values: X₁ = 0.701; X₂ = 0.695; Y = 0.776. All values exceeded the standard $\alpha \geq 0.60$, indicating adequate internal consistency (Tavakol & Dennick, 2011).

3.3 Descriptive Statistics

Table 1. Descriptive Statistics of Research Variables (n=105)

Statistic	X ₁ (Character Management)	X ₂ (Material Mastery)	Y (Teacher Competence)
Mean (Total Score)	39.56	39.58	31.82
Mean per Item	3.956	3.958	3.977
Standard Deviation	3.68	3.65	3.76
Category	High	High	High

The mean score per item for all three variables fell into the High category (range 3.41-4.20). The differences between means were very small (difference <0.03), indicating a balanced profile between character, material mastery, and teacher competence. Frequency distribution showed that 61% of respondents were in the High category for X₁ and X₂, and 54% in the High category for Y. No respondents fell into the Very Low category for any variable.

3.4 Classical Assumption Tests

Table 2. Summary of Classical Assumption Test Results

Assumpti on Test	Statisti c	Result	Concl usion
K-S Normality (X ₁)	D=0.125	p=0.069	Assumed
K-S Normality (X ₂)	D=0.122	p=0.078	Assumed
K-S Normality (Y)	D=0.100	p=0.230	Assumed
Residual Normality (S-W)	W=0.981	p=0.134	Assumed
Multicollin earity (VIF)	VIF=141.30	r(X ₁ ,X ₂) =0.997	Not Assumed *
Linearity r(X ₁ ,Y)	r=0.881	p<0.001	Assumed
Linearity r(X ₂ ,Y)	r=0.879	p<0.001	Assumed
Heterosced asticity	Scatter Plot	Random pattern	Assumed

*Note: High multicollinearity between X₁ and X₂ (r=0.997; VIF=141.30) was addressed by conducting simple regression for testing H₁ and H₂ partially,

following the recommendations of Hair et al. (2022) and Kline (2023). The simultaneous F-test (H₃) using multiple regression is unaffected by multicollinearity and remains valid.

3.5 Hypothesis Testing

Hypothesis 1 (H₁): Influence of Character Management (X₁) on Teacher Competence (Y)

Simple regression results: $Y = -3.798 + 0.900X_1$; $t = 18.914$; $p < 0.001$; $R^2 = 0.776$. Thus, H₁ is **accepted**. Each one-unit increase in character management score is predicted to increase teacher competence score by 0.900 units. Character management explains 77.6% of the variance in teacher competence.

Hypothesis 2 (H₂): Influence of Learning Material Mastery (X₂) on Teacher Competence (Y)

Simple regression results: $Y = -3.953 + 0.904X_2$; $t = 18.690$; $p < 0.001$; $R^2 = 0.772$. Thus, H₂ is **accepted**. Each one-unit increase in material mastery score increases teacher competence score by 0.904 units. Material mastery explains 77.2% of the variance in teacher competence.

Hypothesis 3 (H₃): Simultaneous Influence of X₁ and X₂ on Y

Multiple linear regression results: $Y = -3.844 + 0.792X_1 + 0.110X_2$; $R = 0.881$; $R^2 = 0.777$; Adjusted $R^2 = 0.772$; $F = 177.214$; $p = 0.000$. Thus, H₃ is **accepted**. The combination of character management and learning material mastery simultaneously explains 77.7% of the variance in teacher competence at public vocational schools in Minahasa Regency.

Table 3. Summary of Hypothesis Testing

Hypothesis	Statement	Method	Statistic	p-value	Decision
H ₁	$X_1 \rightarrow Y$	Simple Regression	t=18.914	0.000	Accepted
H ₂	$X_2 \rightarrow Y$	Simple Regression	t=18.690	0.000	Accepted
H ₃	$X_1 + X_2 \rightarrow Y$	Multiple Regression	F=177.214	0.000	Accepted

4. DISCUSSION

4.1 Influence of Teacher Character Management on Teacher Competence

The finding that teacher character management significantly influences teacher competence ($R^2=0.776$) confirms theoretical predictions from several international studies. Lavy & Naama-Ghanayim (2020) found that teacher character strengths—particularly compassion, honesty, and wisdom—significantly predict the quality of teacher-student relationships and academic engagement. The convergence of these findings indicates that the relationship between character and teacher competence is universal, also applying in the context of Eastern Indonesian vocational education.

Fiorilli et al. (2020) provided a mechanistic explanation that strong teacher emotional regulation acts as a "protective buffer" preventing professional burnout. In the Minahasa Regency vocational school context, where teachers face dual demands between academic workload, industrial practice supervision, and institutional administration, emotional regulation capacity becomes crucial. Aharon, Samuel, & Shoshani (2023) added that resilience is the strongest predictor of classroom performance ($\beta=0.41$; $p<0.001$)—stronger than teaching experience and formal education level.

The integrity dimension of character management has particular relevance in the vocational school context. Sappa & Aprea (2020) found that TVET teachers with high integrity gain greater trust from students and create a more responsible workplace learning culture. In vocational practice learning where occupational safety is paramount, teacher integrity becomes a prerequisite for a safe and quality learning environment.

4.2 Influence of Learning Material Mastery on Teacher Competence

The finding that material mastery significantly influences teacher competence ($R^2=0.772$) strengthens Carlson & Daehler's (2021) argument that strong Content Knowledge is an absolute prerequisite for teaching effectiveness. Teachers with deep CK can provide accurate explanations, choose relevant analogies, identify student misconceptions, and answer unexpected questions.

Gess-Newsome (2022) affirmed that PCK distinguishes teachers who "know the material" from teachers who "can teach the material effectively." Koh & Chai (2021) proved that TPACK significantly predicts constructivist learning design ($\beta=0.52$; $p<0.001$). Schmid, Brianza, & Petko (2021) found that TCK develops more slowly, implying the need for specific training based on vocational expertise areas.

Regarding AI-TPACK, items in the instrument showed relatively lower item-total correlations ($r=0.231$ -

0.413), indicating greater variability in this dimension. Setiyawan et al. (2025) affirmed that AI-TPACK requires specific training programs because it involves understanding AI algorithms, AI systemic limitations and biases, and pedagogical strategies for utilizing AI as an authentic learning tool.

4.3 Simultaneous Influence and Multicollinearity Phenomenon

The very high correlation between X_1 and X_2 ($r=0.997$; $VIF=141.30$) has a rich substantive explanation. König, Frey, & Glutsch (2020) argued that the best teacher competence emerges when affective (character), cognitive (knowledge), and technical (pedagogy-technology) aspects develop together. Two mechanisms explain this synergy: (1) teachers with strong character (discipline, integrity) tend to be more proactive in updating their material mastery; (2) teachers with deep material mastery develop stronger professional identity and higher instructional self-efficacy, which promotes character development.

Mutalib, Ismail, & Abdullah (2023) confirmed that professional character and knowledge-skill mastery are two foundations supporting the other six competency areas. The $R^2=0.777$ value indicates that the integrative soft-hard competence model explains 77.7% of the variance in teacher competence. The remaining 22.3% is explained by other factors such as intrinsic work motivation, principal leadership quality, organizational culture, learning facilities, industrial experience, and demographic characteristics (Salonen et al., 2023).

5. CONCLUSION AND RECOMMENDATIONS

5.1 Conclusion

Based on the research results and discussion, it can be concluded that:

1. **Teacher character management has a significant positive effect on teacher competence** at public vocational schools in Minahasa Regency ($t=18.914$; $p<0.001$; $R^2=0.776$). Each one-unit increase in

character management score increases teacher competence by 0.900 units.

2. **Learning material mastery has a significant positive effect on teacher competence** ($t=18.690$; $p<0.001$; $R^2=0.772$). Each one-unit increase in material mastery score increases teacher competence by 0.904 units.
3. **Simultaneously, character management and material mastery have a highly significant effect on teacher competence** ($F=177.214$; $p<0.001$; $R^2=0.777$). The combination of both variables explains 77.7% of the variance in teacher competence at public vocational schools in Minahasa Regency.

All three research hypotheses (H_1 , H_2 , H_3) were accepted. These findings confirm that improving vocational teacher competence requires simultaneous strengthening of soft competence (emotional regulation, empathy, integrity, discipline, resilience) and hard competence (CK-PCK-TCK-TPACK-AI-TPACK) as two mutually reinforcing pillars in a holistic and integrated vocational teacher professionalism model.

5.2 Recommendations

For School Principals and SMKN Management: (1) Design sustainable teacher character development programs through coaching, emotional regulation workshops, and peer learning; (2) Develop integrated TPACK/AI-TPACK training programs based on specific vocational contexts; (3) Implement a data-based academic supervision system that provides constructive and measurable feedback.

For the Minahasa Regency Education Office: (1) Formulate vocational teacher professional development policies that synergistically integrate character development and material mastery; (2) Mandate industrial internship programs for teachers of at least 40 hours per year; (3) Organize AI-TPACK training in collaboration with leading technology institutions; (4) Develop a measurable, empirically-based "teacher competence development roadmap" for Minahasa Regency.

For Future Researchers: (1) Develop more comprehensive research models using Structural

Equation Modeling (SEM) with mediator variables (work motivation, principal transformational leadership support) and moderator variables (industrial experience, years of service); (2) Conduct longitudinal studies to understand teacher competence development over time; (3) Expand the research scope to all vocational schools in North Sulawesi Province for broader generalizability of findings.

REFERENCES

- Aharon, S., Samuel, D., & Shoshani, A. (2023). Character strengths, resilience, and teacher performance: A structural model. *Frontiers in Psychology, 14*, 1123341.
- Aldrup, K., Klusmann, U., Lüdtke, O., & Trautwein, U. (2020). Teacher enthusiasm, emotional stability, and instructional quality. *Learning and Instruction, 66*, 101302.
- Carlson, J., & Daehler, K. (2021). Re-examining pedagogical content knowledge. *Journal of Teacher Education, 72*(4), 434-450.
- Cattaneo, A., & Boldrini, E. (2021). Teachers' professional development in vocational education. *International Journal for Research in VET, 8*(3), 258-283.
- Celik, I. (2023). Towards Intelligent-TPACK. *Computers in Human Behavior, 138*, 107468.
- Cohen, J. (1988). *Statistical power analysis for the behavioral sciences* (2nd ed.). Lawrence Erlbaum.
- Collie, R. J. (2022). Teachers' emotional well-being and professional functioning. *Teaching and Teacher Education, 117*, 103678.
- Creswell, J. W., & Creswell, J. D. (2021). *Research design* (5th ed.). SAGE.
- Fiorilli, C., et al. (2020). Burnout and emotional intelligence in teachers. *Journal of Clinical Psychology, 76*(9), 1617-1634.
- Gess-Newsome, J. (2022). Reconceptualizing pedagogical content knowledge. *Educational Psychologist, 57*(3), 145-159.
- Guerriero, S. (2022). Teacher knowledge and instructional quality. *Educational Research Review, 36*, 100433.
- Gurría, L., & Martínez, M. A. (2022). Exploring professional competence in vocational teachers. *Journal of Vocational Education & Training, 74*(4), 622-641.
- Hair, J. F., Black, W. C., Babin, B. J., & Anderson, R. E. (2022). *Multivariate data analysis* (8th ed.). Cengage.
- Kline, R. B. (2023). *Principles and practice of structural equation modeling* (5th ed.). Guilford.
- Koh, J. H. L., & Chai, C. S. (2021). Predictive modeling of teachers' technological pedagogical knowledge. *Journal of Educational Computing Research, 59*(2), 220-245.
- König, J., Frey, A., & Glutsch, N. (2020). Teacher competence and instructional quality. *Teaching and Teacher Education, 96*, 103190.
- Lavy, S., & Naama-Ghanayim, E. (2020). Teachers' character strengths and classroom engagement. *Journal of School Psychology, 82*, 1-15.
- Mutalib, A. A., Ismail, Z., & Abdullah, N. (2023). Competencies for TVET teachers in Industry 4.0. *Journal of Technical Education and Training, 15*(1), 1-18.
- Salonen, K., Kärkkäinen, R., Aunio, P., & Lerkkanen, M. (2023). Pedagogical competence and teaching effectiveness. *International Journal of Educational Research, 118*, 102123.
- Sappa, V., & Aprea, C. (2020). Competence development in vocational education. *Vocations and Learning, 13*, 289-309.
- Schmid, M., Brianza, E., & Petko, D. (2021). Teachers' TPACK trajectories. *Computers & Education, 160*, 104052.

Setiyawan, A., Soeharto, S., Wijaya, T., Korenova, L., & Lavicza, Z. (2025). Measuring teachers' competencies for integrating AI. *Computers & Education: Artificial Intelligence*, 4, 100319.

Sugiyono. (2022). *Metode penelitian kuantitatif, kualitatif, dan R&D*. Alfabeta.

Tam, M., Chan, W., & Ng, K. (2023). Digital transformation and teacher competence in vocational education. *Journal of Vocational Education & Training*, 75(2), 255-273.

Tavakol, M., & Dennick, R. (2011). Making sense of Cronbach's alpha. *International Journal of Medical Education*, 2, 53-55.

Tondeur, J., van Braak, J., Ertmer, P. A., & Ottenbreit-Leftwich, A. (2020). Understanding technological pedagogical knowledge. *British Journal of Educational Technology*, 51(4), 1353-1370.