

The Ethical Side of Economic Learning Integration: Empirical Study of Prospective Economic Teacher

Lina Rifda Naufalin^{1,2*}, Cicilia Dyah Sulistyningrum Indrawati¹, Mintasih Indriayu¹ & Leny Noviani¹

¹Doctoral Program in Economics Education, Sebelas Maret University, Indonesia

²Department of Economics Education, Jenderal Soedirman University, Indonesia

*Corresponding email: lina_rifdanaufalin@student.uns.ac.id

Received: 02 July 2024

Accepted: 21 July 2024

Published: 02 October 2024

Abstract: The Ethical Side of Economic Learning Integration: Empirical Study of Prospective Economic Teacher. Objective: Technological Pedagogical Content Knowledge as a knowledge framework regarding the integration of technology and pedagogy in developing learning content in accordance with the demands of the 21st century is currently starting to touch on ethical aspects in its implementation. This research aims to describe TPACK and knowledge about digital ethics among prospective economics teacher students as a provision for implementing ethical TPACK after entering the world of work. **Method:** Descriptive quantitative methodology was used using a Likert scale questionnaire. The dimensions studied include self-perception of professional ethical knowledge, technological ethical knowledge, pedagogical technological ethical knowledge, and economics disciplinary technological ethical knowledge. Prospective economics teacher students are the population in this study. The sample of 155 was determined using convenience sampling. **Findings:** The results of the research show that the dimensions of knowledge about professional ethics, knowledge of technology ethics, knowledge of pedagogical technology ethics, knowledge of scientific discipline technology ethics are in the very good and good categories. However, the ethical aspect of technology still needs to be improved. **Conclusion:** This research contributes to the preparation of the learning curriculum for prospective economics teacher students so that prospective economics teachers have the skills to apply TPACK by paying attention to ethics therein.

Keywords: digital ethics, TPACK, prospective teacher students.

To cite this article:

Naufalin, L. R., Indrawati, C. D. S., Indriayu, M., & Noviani, L. (2024). The Ethical Side of Economic Learning Integration: Empirical Study of Prospective Economic Teacher. *Jurnal Pendidikan Progresif*, 14(2), 1234-1244. doi: 10.23960/jpp.v14.i2.202489.

■ INTRODUCTION

Current technological developments are becoming new challenges in various fields including economics, education, management, industry, health and other fields (Allen & Velden, 2012; Miguel-Revilla et al., 2020). Education as an aspect that is experiencing significant changes along with technological developments requires every educational actor to follow these developments through increasing digital literacy

(Gutierrez Martin et al., 2010). Based on BPS data (Central Statistics Agency, 2023) Currently the level of digital literacy in Indonesia is in the high category, namely at level 3.65. However, this figure does not fully describe the level of digital literacy among education practitioners. Teachers as one of the actors in education are an important component in education who are expected to have adequate digital literacy as a provision for development-oriented learning (Ata & Yıldıırım,

2019; Gómez-Trigueros et al., 2019). Digital literacy will encourage teachers' mastery of Technological Pedagogical Content Knowledge (TPACK)(Falloon, 2020).

Teachers' TPACK abilities can be prepared while still studying at university. This learning is expected to be able to equip prospective teacher students on how to integrate learning with technology based on the TPACK framework. One of the important issues in integrating technology into learning is regarding digital data protection (Reisođlu & Çebi, 2020). Universities as institutions that provide education for prospective teachers through curriculum implementation have an obligation to introduce digital ethics in the learning process. Based on research into the TPACK conditions of prospective teacher students in Indonesia, not many researchers have studied this problem, especially for prospective economics teachers. Apart from the TPACK level which is still low, prospective teacher students' knowledge of digital ethics has also not been touched. Learning for prospective teachers about integrating digital ethics into each TPACK component based on literature reviews has not been implemented in all countries, including Indonesia. In Europe, university education does not yet provide training in teachers' professional ethical knowledge and the importance of handling this knowledge in the 21st century (Gómez-Trigueros, 2023).

The TPACK concept based on digital ethics in learning has not been implemented optimally in Indonesia. One of the reasons is that education providers do not yet understand the concept of TPACK learning and digital ethics (Maipita et al., 2023). This lack of understanding causes digital ethics to not be integrated into learning, namely not having the skills to use ICT correctly, students not having access to learning that teaches TPACK, and a lack of university support in the form of ICT-based learning facilities which are still low. (Hadayani et al., 2024). In addition, this

lack of understanding results in a lack of opportunities for students to gain practical experience in applying these concepts in actual learning contexts. Limited practical experience can hinder the development of students' abilities in integrating theoretical knowledge with real practice (Hilyana et al., 2023). Lack of adequate resources and facilities in the academic environment can also be a contributing factor (Gess-Newsome et al., 2019). Limited access to technology and relevant training in the use of learning technology may have limited students' ability to develop knowledge and skills in this regard (Akhwani and Widiani, 2019). Additionally, rapid changes in technology and learning approaches can create gaps in the understanding and application of these concepts among students (Muhaimin et al., 2019).

Exploration of TPACK and the level of knowledge of digital ethics will provide information for stakeholders, including institutions providing education for prospective economics teachers, to carry out planning from various aspects. These aspects include improving the curriculum in line with the demands of 21st century developments, providing adequate IT facilities, and human resource management that can help student teachers increase their capacity to integrate technology into learning based on appropriate digital ethics. Apart from that, this information can be used as material for projections regarding the work readiness of prospective economics teacher students.

An overview of the condition of TPACK and the level of knowledge of prospective economics teacher students can be obtained by carrying out a series of explorations based on TPACK components and digital ethics. TPACK covers the components and knowledge of prospective teachers in the information technology era, provides an instructional framework, and develops 21st century skills through the use of technology and teachers to plan and implement

instructional strategies more successfully ((Dunleavy et al., 2019; Gómez-Trigueros et al., 2019; Semiz & Ince, 2012; Zhao et al., 2021). (Gómez-Trigueros, 2023). The concept of ethics is a key factor in higher education, and it is important for prospective teachers to apply the ethical use of digital devices and knowledge. This includes an understanding of responsibilities, rights, and obligations during the educational process, knowledge of the possible impacts and consequences of appropriate or inappropriate behavior in the teaching process, and knowledge of the ethical conclusions involved (Robinson, 2020; Sauvola et al., 2024).

Many previous studies have tried to explore the TPACK conditions of prospective teacher students but without considering ethics in the implementation of each TPACK element. This is important because teachers must face the ethical challenges that can be posed by the use of ICT in learning so this must be understood and mastered. Research related to TPACK includes research on strategies, methods, steps to improve TPACK of prospective teacher students (Alayyar et al., 2012; Chai et al., 2019; Doering et al., 2014). Research on digital ethics includes concepts, elements of digital ethics, ethics towards AI and its application in learning (Bartenschlager et al., 2024; Ýpek et al., 2023; Kazim & Koshiyama, 2021; Salifu et al., 2024).

This research tries to examine in more detail the ethical components of the TPACK component so that the results of this research are expected to provide a clearer and more specific

picture. The components of this research are adopted from (Gómez-Trigueros, 2023) with a difference in the research object, namely that the research is aimed at measuring TPACK and the digital ethics knowledge level of economics education students in Indonesia, which has never been explored by previous researchers. Questions in this research include:

1. What knowledge have prospective economics teachers gained in the field of ethics and professional ethics (PEK-EPST) in the use of technological resources (PTEK-EPST)?
2. How important is the ethical component in the use of knowledge (PEK-EPST) explored through technological resources (PEK-EPST, EKDT-EPST, and PTEK-EPST) for prospective economics teachers?
3. What is the relationship between economics teachers' ethical knowledge and technology ethics knowledge (TEK-EPST)?

■ METHOD

Participants

Students from the Economic Education study program at Jenderal Soedirman University were the population in this research with a total of 237 students. The target student cohort years include 2020, 2021, 2022, and 2023. Sampling using techniques *convenience* sampling with the number of students who filled out the research questionnaire completely was 155 students. The following information regarding the sociodemographic dimensions of research respondents is presented in table 1.

Table 1. Sociodemographic dimensions of respondents

Characteristics	Amount	Percentage
Gender		
Man	22	14 %
Woman	133	86%
Age		
< 20 Years	78	50%
20 years	46	30
>20 Years	31	20%

Force		
2017	3	2 %
2018	1	1%
2020	13	8%
2021	1	1%
2022	55	35%
2023	82	53%

The distribution of respondents in table 1 illustrates that more than half of the respondents who participated in this research were students from the class of 2023, aged less than 20 years. Apart from that, female students participated more actively in filling out this questionnaire.

Research Design and Procedures

This research uses descriptive quantitative methods. The research process was configured through two phases: first, a theoretical review was carried out on the disciplinary pedagogical technological knowledge model, reviewing research on the measurement of the TPACK model, the concept of teacher professional ethics (pedagogical ethics and ethical knowledge measurement), virtual teaching, and previously developed research on digital competence teacher (TDC); second, the instrument is designed and then validated. The next step is to distribute instruments in the form of valid research questionnaires to obtain data, analyze data and interpret data with a research period of eight weeks.

Instrument

A closed questionnaire was used as an information gathering instrument. A 1-5 Likert scale with criteria (1, strongly disagree; 2, disagree; 3, neutral; 4, agree; 5, strongly agree) is used to measure data and is organized into four dimensions or research variables. The variables and indicators used are adopted from research (Gómez-Trigueros, 2023) which includes: (1) Professional ethical knowledge (PEK-EPST)

(items 4-6); (2) Technology ethics knowledge (TEK-EPST) (7-9), (3) Pedagogical technology ethics knowledge (PTEK-EPST) (items 10-13), and (4) Disciplinary technology ethics knowledge (EKDT-EPST) (items 14-17) attached in table 2 (Appendix).

Questions regarding sociodemographic dimensions were added to determine the respondent's profile which includes gender, age and year of the respondent's class. Research indicators for the dimensions of professional ethical knowledge include (1) knowledge of ethics and morality in teaching, (2) application of ethical and moral principles in the classroom. Knowledge of technology ethics includes indicators (1) knowledge of issues of personal security, copyright, and access to information in the use of technology, (2) belief that ICT promotes equality for all citizens in accessing information, (3) attention to copyright of digital sources and use of information that appear on the Internet ethically. The pedagogical technology ethics knowledge dimension consists of indicators (1) the ability to guide students to use technology and online educational resources ethically, (2) the ability to protect the rights of prospective students to use ICT and internet knowledge ethically, (3) the ability to use ICT resources to carry out duties in a safe and respectful manner, (4) the ability to transmit ethical values related to the appropriate use of ICT and content hosted on the internet.

The indicators of the knowledge dimension of disciplinary technology ethics include (1) knowledge to consider and respect intellectual property when adapting content hosted on the

internet to create teaching materials, (2) knowledge of ethical principles related to the use of digital resources for teaching, (3) knowledge of ethical principles related to the use of digital resources for teaching, (3) Use of digital content and resources for classes that are not discriminatory, or that contain violence, (4) the ability to convey ethical values and concepts related to justice, truth, and respect for various opinions in learning.

The validity of the questionnaire is identified based on the significance value of the Pearson correlation with the criteria of $\text{sig} > 0.05$, so it is considered valid. Based on the results of the validity test with these criteria, all items were declared valid. The reliability of the questionnaire was verified using a Cronbach's Alpha coefficient

> 0.7 and the results of the reliability test showed a Cronbach's Alpha value of $0.873 > 0.07$ so that the instrument used was reliable.

Data analysis

Data were analyzed using descriptive statistics by calculating the mean and standard deviation of each statement item. SPSS 25 is used as software that helps calculate research data. The next step is that the research data is interpreted based on the mean value and standard deviation of each question item. Data were analyzed by categorizing student scores for each research dimension into very good, good, fair, poor and poor classifications. The level criteria for data analysis results are presented in table 3.

Table 3. Criteria for grouping the research dimension scores that are measured

Value interval (Mean Value)	Classification
$> 4.20 - 5.00$	Very good
$> 3.40 - 4.20$	Good
$> 2.60 - 3.40$	Enough
$> 1.80 - 2.60$	Not good
$1.00 - 1.80$	Not enough

RESULT AND DISCUSSION

Data testing was carried out using SPSS.25 to calculate the average student answer score, standard deviation, maximum and minimum values for each statement item. This value helps researchers interpret students' conditions in each dimension in the research. The calculation results are presented in table 4.

Student answers to statement items representing research dimensions show results with good and very good criteria.

Knowledge of Professional Ethics for Prospective Economics Teacher Students

In the PEK-EPST dimension, students' answers provide an illustration that they have

Table 4. Mean and standard deviation test results of the research questionnaire

Dimensions and statement items	Minimum	Maximum	Mean	Std. Deviation
PEK-EPST¹				
I know what ethics and morality are applied in teaching economics	2	5	4.37	.646
I am able to apply ethical and moral principles in the classroom, with my prospective students	2	5	4.27	.658
I know how to act ethically in situations related to teaching and learning economics	2	5	4.34	.573

TEK-EPST²				
I am aware of personal security, copyright, and information access issues in the use of technology	2	5	4.18	.639
I believe that ICT enables all citizens to access information, thus promoting equality among all people	2	5	4.25	.708
I pay attention to issues related to the copyright of digital sources and use information appearing on the internet ethically	1	5	4.06	.667
PTEK-EPST³				
I am able to guide students to use technology and online educational resources ethically	2	5	4.21	.634
I am able to protect the rights of prospective students to use ICT and Internet knowledge ethically	2	5	4.22	.627
I am able to use ICT resources to carry out my duties as a prospective teacher in a safe and respectful manner	2	5	4.27	.617
I am able to transmit ethical values related to the appropriate use of ICT and content hosted on the internet to my future students	2	5	4.15	.632
EKDT-EPST⁴				
I know that I must consider and respect intellectual property when adapting content hosted on the Internet to create economics teaching materials	2	5	4.32	.642
I am aware of the ethical principles regarding the use of digital resources to teach economics	2	5	4.16	.629
I will always use digital content and resources for classes that are not discriminatory, or violent	2	5	4.19	.713
I will convey ethical values and concepts related to justice, truth, and respect for various opinions.	2	5	4.37	.665

understood the knowledge of professional ethics with the mean score for all items > 4.20, which means they know what ethics and morality must be adhered to when interacting with students during learning, how to later apply ethics and morality to students, as well as acting ethically in learning.

Learning for prospective economics teacher students involving the use of technology increased rapidly after the Covid-19 pandemic (Ađçam et

al., 2020). After the pandemic, the technology that has been used is not immediately abandoned but is maintained in achieving sustainable economic education transformation (Park & Kim, 2021; Wells et al., 2023). Currently, the TPACK concept that has been implemented is increasingly developing and increasing ethical awareness.

Alignment of TPACK with ethical knowledge for prospective economics teacher

students is a must. Aspects of professional ethical knowledge including ethics and morality in learning must be taught. The results of the analysis of students' answers regarding what knowledge of ethics and morality is applied in teaching obtained a score (mean: 4.37 SD: 0.646). Two other statements related to the application of ethical and moral principles in the classroom with prospective students as well as knowledge about how to act ethically in situations related to teaching and learning >4.20 so they are included in the very good category.

The high number of student answers on this dimension confirms that prospective economics teacher students feel that ethics and morality are important to maintain the quality of professional learning. Apart from knowledge, the courage to implement ethical and moral principles in economics learning is a must for every prospective economics teacher. These results support the research (Chounta et al., 2022; Zhao et al., 2021) which states that currently ethical knowledge in the use of learning technology is something that must be considered.

Technology Ethics Knowledge of Prospective Economics Teacher Students

In contrast to the dimensions of professional ethics which are very well understood by prospective economics teacher students, the dimensions of technological ethics knowledge still need to be improved. The results of data analysis show that two statement items are in the good category. It should be noted in TEK-EPST3 (Mean: 4.06, SD: 0.667) where the minimum score for the statement "I pay attention to issues related to copyright of digital sources and use information that appears on the internet ethically" is 1 which means there are still prospective teacher students. The current economy does not yet have special attention to copyright ethics when utilizing internet sources.

Understanding personal security, copyright, and access to information in the use of technology are new things that universities must strive to introduce to students. This introduction is through strategies for including ethics material in learning or creating special courses related to digital ethics (McDonald & Pan, 2020). Students must also know from an early age that the consequences of copyright infringement can increase the risk of plagiarism in academic circles, which is a concern in educational institutions today, especially the increasing number of students choosing to utilize AI. This is in line with research (D'Hondt et al., 2020; Dignum, 2021; Michel-Villarreal et al., 2023).

Pedagogical Technological Ethics Knowledge of Prospective Economics Teacher Students

The PTEK-EPST4 statement (Mean: 4.15, SD: 6.32) describes a good condition where students feel that they will be able to transmit ethical values related to the use of ICT to students but must always be improved habituation in learning.

Knowledge of pedagogical technological ethics must be strengthened so that students have the capacity to transmit ethical values related to the appropriate use of ICT and content hosted on the internet to my future students. These ethical values include openness, justice, truth and respect for copyright. The results of this research also confirm that knowledge of technology ethics has not been touched upon in learning for prospective economics teachers.

The results of this research support previous research that in the era of technology and its very rapid development prospective teachers must be introduced to the use of technological tools in an equal, fair and responsible way in the use of technology in the teaching and learning environment as expressed by (Gómez-Trigueros, 2023).

Disciplinary Technological Ethics Knowledge of Prospective Economics Teacher Students

In the dimension of disciplinary technological ethics knowledge which is related to the ethics of using knowledge extracted from technological resources, it shows that students generally have a good understanding of how to utilize digital resources in accordance with ethical principles related to the use of digital resources for teaching. The highest score in students' answers is reflected in the dimension of disciplinary technology ethics knowledge in the EKDT-EPST4 statement (Mean: 4.37, SD: 0.665). Prospective economics teacher students have the capacity to convey ethical values and concepts related to justice, truth and respect for various opinions.

Knowledge of disciplinary technology ethics must be strengthened so that students have the capacity to transmit ethical values related to the appropriate use of ICT and content hosted on the internet to my future students. These ethical values include openness, justice, truth and respect for copyright.

This knowledge will guide students to be careful when quoting learning material from certain sources by always stating the origin of the source. Students are aware of the importance of using resources hosted on the internet, using digital content and resources for classes that are not discriminatory or contain violence, as well as awareness of transmitting ethical principles in using ICT in learning. This supports research regarding the importance of ethics in the use of learning technology, among others (Davy Tsz Kit et al., 2022; Hamiti et al., 2014).

CONCLUSION

Learning for prospective economics teacher students has experienced an increase in the use of technology after the COVID-19 pandemic and this technology is still being used for sustainable

educational transformation. The TPACK concept that was developed now also emphasizes the importance of knowledge of professional ethics and technology. Prospective economics teacher students understand the importance of ethics and morality in learning, but knowledge of technology ethics such as personal security, copyright, and access to information still needs to be improved. Universities are expected to introduce digital ethics through learning materials or special courses. Strengthening knowledge of technology ethics is important so that prospective teachers can teach ethical values such as openness, justice, truth and respect for copyright. Students generally understand the ethics of utilizing digital resources, which is important for responsible and fair use of digital resources in learning.

REFERENCES

- Aoçam, R., Akbana, Y. E., & Rathert, S. (2020). Dealing with emergency remote teaching: the case of pre-service english language teachers in Turkey. *Journal of Language and Education*, 7(4), 16–29.
- Akhwani, A., & Rahayu, D. (2021). Analysis of elementary teachers' TPACK components as a framework for professional teacher competencies in the 21st century. *Jurnal Basicedu*, 5, 1918–1925.
- Alayyar, G. M., Fisser, P., & Voogt, J. (2012). Developing technological pedagogical content knowledge in pre-service science teachers: Support from: Blended learning. *Australasian Journal of Educational Technology*, 28(8), 1298–1316.
- Allen, J. P., & Velden, R. K. W. Van der. (2012). Skills for the 21st century: Implications for education. cris.maastrichtuniversity.nl.
- Ata, R., & Yıldırym, K. (2019). Exploring turkish pre-service teachers' perceptions and views of digital literacy. *Education Sciences*, 9(1).
- Central Bureau of Statistics. (2023). *No Title*.

- <https://www.bps.go.id/id/statistics-table/2/MTE3OSMy/tingkat-pengangguran-terbuka-berdasarkan-tingkat-pendidikan.html>
- Bartenschlager, C. C., Gassner, U. M., Römmele, C., Brunner, J. O., Schlögl-Flierl, K., & Ziemann, P. (2024). The AI ethics of digital COVID-19 diagnosis and their legal, medical, technological, and operational managerial implications. *Artificial Intelligence in Medicine*, *152*, 102873.
- Chai, C. S., Hwee Ling Koh, J., & Teo, Y. H. (2019). Enhancing and modeling teachers' design beliefs and efficacy of technological pedagogical content knowledge for 21st century quality learning. *Journal of Educational Computing Research*, *57*(2), 360–384.
- Davy Tsz Kit, N. G., Luo, W., Chan, H. M. Y., & Chu, S. K. W. (2022). Using digital story writing as a pedagogy to develop AI literacy among primary students. *Computers and Education: Artificial Intelligence*, *3*, 100054.
- D'Hondt, C., De Winne, R., Ghysels, E., & Raymond, S. (2020). Artificial intelligence alter egos: who might benefit from robo-investing? *Journal of Empirical Finance*, *59*, 278–299.
- Dignum, V. (2021). The role and challenges of education for responsible ai. *London Review of Education*, *19*(1), 1–11.
- Doering, A., Koseoglu, S., Scharber, C., Henrickson, J., & Lanegran, D. (2014). Technology integration in k–12 geography education using tpack as a conceptual model. *Journal of Geography*, *113*(6), 223–237.
- Dunleavy, G., Nikolaou, C. K., Nifakos, S., Atun, R., Law, G. C. Y., & Car, L. T. (2019). Mobile digital education for health professions: Systematic review and meta-analysis by the digital health education collaboration. In *Journal of Medical Internet Research* (Vol. 21, Issue 2).
- Falloon, G. (2020). From digital literacy to digital competence: the teacher digital competency (TDC) framework. *Educational Technology Research and Development*, *68*(5), 2449–2472.
- Gess-Newsome, J., Taylor, J. A., Carlson, J. F., Gardner, A. L., Wilson, C. D., & Stuhlsatz, M. A. M. (2019). Teacher pedagogical content knowledge, practice, and student achievement. *International Journal of Science Education*, *41*, 944–963.
- Gómez-Trigueros, I. M. (2023). Digital skills and ethical knowledge of teachers with TPACK in higher education. *Contemporary Educational Technology*, *15*(2).
- Gómez-Trigueros, I. M., Ruiz-Bañuls, M., & Ortega-Sánchez, D. (2019). Digital literacy of teachers in training: Moving from icts (information and communication technologies) to lkts (learning and knowledge technologies). *Education Sciences*, *9*(4).
- Gutierrez Martin, A., Palacios Picos, A., & Torrego Egido, L. (2010). School teacher training and ICT integration in education: anatomy of a mismatch. *Education Magazine*, *353*(353), 267–293.
- Hamiti, M., Reka, B., & Baloghová, A. (2014). Ethical use of information technology in high education. *Procedia - Social and Behavioral Sciences*, *116*, 4411–4415.
- Handayani, S., Hussin, M., & Norman, H. (2024). Evaluating teaching readiness using the TPACK model: factor, reliability and validity analyses for Indonesian economics teacher candidates. *Perspektive Nauki i Obrazovanja*, *68*(2), 679–698.
- Hilyana, F. S., Fakhriyah, F., & Masfuah, S. (2023). Analysis on the ability of primary

- teacher education lecturers in TPACK-based E-learning. *International Conference on Applied Computational Intelligence and Analytics (ACIA-2022)*.
- Ýpek, Z. H., Gözüm, A. Ý. C., Papadakis, S., & Kallogiannakis, M. (2023). Educational applications of the chatgpt ai system: a systematic review research. *Educational Process: International Journal*, 12(3), 26–55.
- Kazim, E., & Koshiyama, A. S. (2021). A high-level overview of AI ethics. *Patterns*, 2(9), 100314.
- Maipita, I., Dongoran, F. R., Syah, D. H., & Sagala, G. H. (2023). TPACK, organizational support, and technostress in explaining teacher performance during fully online learning. *Journal of Information Technology Education: Research*, 22, 41–70.
- McDonald, N., & Pan, S. (2020). Intersectional AI: A study of how information science students think about ethics and their impact. *Proceedings of the ACM on Human-Computer Interaction*, 4 (CSCW2).
- Michel-Villarreal, R., Vilalta-Perdomo, E., Salinas-Navarro, D. E., Thierry-Aguilera, R., & Gerardou, F. S. (2023). Challenges and Opportunities of Generative AI for Higher Education as Explained by ChatGPT. *Education Sciences*, 13(9).
- 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.
- Muhaimin, M., Habibi, A., Mukminin, A., Saudagar, F., Pratama, R., Wahyuni, S., Sadikin, A., & Indrayana, B. (2019). A sequential explanatory investigation of TPACK: Indonesian science teachers' survey and perspective. *Journal of Technology and Science Education*, 9, 269.
- Park, S., & Kim, S. (2021). Is sustainable online learning possible with gamification? the effect of gamified online learning on student learning. *Sustainability (Switzerland)*, 13(8).
- Reisođlu, Ý., & Çebi, A. (2020). How can the digital competences of pre-service teachers be developed? Examining a case study through the lens of DigComp and DigCompEdu. *Computers and Education*, 156.
- Robinson, S. C. (2020). Trust, transparency, and openness: How inclusion of cultural values shapes Nordic national public policy strategies for artificial intelligence (AI). *Technology in Society*, 63, 101421.
- Salifu, I., Arthur, F., Arkorful, V., Abam Nortey, S., & Solomon Osei-Yaw, R. (2024). Economics students' behavioural intention and usage of ChatGPT in higher education: a hybrid structural equation modelling-artificial neural network approach. *Cogent Social Sciences*, 10(1).
- Sauvola, J., Tarkoma, S., Klemettinen, M., Riekkí, J., & Doermann, D. (2024). Future of software development with generative AI. *Automated Software Engineering*, 31(1).
- Semiz, K., & Ince, M. L. (2012). Pre-service physical education teachers' technological pedagogical content knowledge, technology integration self-efficacy and instructional technology outcome expectations. *Australasian Journal of Educational Technology*, 28(7), 1248–1265.
- Sugiono. (2018). Educational research methods quantitative, qualitative, and R&D Approaches. *ALPHABET, Cv*, 199.

- Wells, M. S., Irish, C. K., Peck, K. A., Davis, J. S., & Clayton, C. (2023). Innovations in intern/mentor relationships and conceptions of the technological pedagogical content knowledge (TPACK) framework. *Teacher Educators' Journal*, 16(1), 1–26.
- Zhao, Y., Sánchez Gómez, M. C., Pinto Llorente, A. M., & Zhao, L. (2021). Digital competence in higher education: Students' perception and personal factors. *Sustainability (Switzerland)*, 13(21).