

EXPLORING THE DIGITAL COMPETENCE OF LECTURERS IN HIGHER EDUCATION: A LITERATURE REVIEW

Fahlulia Rahma Shofiana¹, Mustaji², Andi Mariono³, Fajar Arianto⁴

¹ Magister Teknologi Pendidikan, Universitas Negeri Surabaya, Indonesia

^{2,3,4} Doktoral Teknologi Pendidikan, Universitas Negeri Surabaya, Indonesia

fahlulia.23001@mhs.unesa.ac.id¹, mustaji@unesa.ac.id², andimariono@unesa.ac.id³, fajararianto@unesa.ac.id⁴

INFO ARTIKEL

Riwayat Artikel:

Diterima: 22-05-2024

Disetujui: 09-07-2024

Kata Kunci:

Digital Competence;
Lecturers; Higher
Education;
21st Century Skill; Digital
Literacy

ABSTRAK

Abstract: Digital transformation demands the integration of information and communication technology tools in education. This condition is supported by the dominance of current students who are digital native generation. Although the use of technology is not new in higher education, the fact that lecturers are digital immigrants makes it difficult to integrate ICT into the lecture process, while one of the main responsibilities of higher education institutions is to facilitate students with quality learning and competent lecturers to prepare their future. This study aims to explore the level of digital competence of lecturers in higher education, the relationship, factors and efforts to improve it. The method used is a literature review with a narrative approach where the synthesised literature is international journal articles published in the 2020-2024 timeframe. The results showed 1) Digital competence is involved in ICT-integrated lectures from planning to evaluation of learning and reflective practice. 2) Lecturers with high digital competence can evaluate the quality of learning and influence student interest. 3) Age, gender, adaptability, type of institution, domicile location are significant factors of lecturers' digital competence, 4) Efforts that can be made to improve digital competence are: training, providing resource materials, reflective practice, long-term professional support, and incorporating digital competency lectures into prospective lecturer education programmes.

Abstrak: Transformasi digital menuntut integrasi perangkat teknologi informasi dan komunikasi (TIK) dalam pendidikan. Kondisi ini didukung dengan dominasi mahasiswa saat ini yang merupakan generasi *digital native*. Meski penggunaan teknologi bukan hal yang baru di perguruan tinggi namun fakta bahwa dosen merupakan generasi *digital imigrant* mengakibatkan sulitnya pengintegrasian TIK kedalam proses perkuliahan, sementara salah satu tanggung jawab utama lembaga pendidikan tinggi adalah memfasilitasi mahasiswa dengan pembelajaran berkualitas dan dosen yang kompeten untuk mempersiapkan masa depan mereka. Penelitian ini bertujuan untuk mengeksplorasi tingkat kompetensi digital dosen di perguruan tinggi, hubungan, faktor dan upaya peningkatannya. Metode yang digunakan adalah *literature review* dengan pendekatan naratif dimana literatur yang disintesis adalah artikel jurnal internasional yang diterbitkan dalam rentang waktu 2020-2024. Hasil penelitian menunjukkan 1) Kompetensi digital terlibat dalam perkuliahan terintegrasi TIK dari perencanaan sampai evaluasi pembelajaran dan praktik reflektif. 2) Dosen dengan kompetensi digital yang tinggi dapat mengevaluasi kualitas pembelajaran dan mempengaruhi minat mahasiswa. 3) Usia, gender, kemampuan beradaptasi, jenis institusi, lokasi domisili menjadi faktor signifikan kompetensi digital dosen, 4) Upaya yang dapat dilakukan untuk meningkatkan kompetensi digital yaitu: pelatihan, menyediakan sumber materi, praktik reflektif, dukungan profesional jangka panjang, dan memasukkan perkuliahan kompetensi digital ke dalam program pendidikan calon dosen.

A. INTRODUCTION

Digital transformation demands the integration of information and communication technology (ICT) tools in education (Wang et al., 2023). The use of

artificial intelligence, big data, Internet of Thing (IoT), Augmented Reality (AR) and other technological tools have been adopted into learning tools (Yahya et al., 2023). Although the use of technology is not new in higher education, the fact

that lecturers are a generation that did not grow up with the development of technology raises the view that they are digital immigrants who have to make more complex efforts to be able to use digital devices. This makes it difficult to integrate technology into the lecture process while one of the main responsibilities of higher education institutions is to facilitate students with quality learning and competent lecturers to prepare for their future (Fernández-Batanero et al., 2022)

The challenges of lecturers in teaching are increased by the fact that today's students are a generation that grew up with the rapid development of technology and they are very capable of using and familiar with digital devices. They are known as digital natives or a generation that is interested in things related to technological devices including in the learning process. In the context of 21st century learning, lecturers are required to be able to foster and even improve the abilities of this century, one of which is digital literacy skills, which means that lecturers as teachers must also have competencies that support the development of this ability.

Lecturers' digital competence is an aspect that occupies a crucial position today (Tejedor et al., 2020). Digital competence is a prerequisite for a lecturer to improve learners' digital literacy (Sánchez-Cruzado et al., 2021) and the integration of technology in the teaching-learning process is a significant challenge for lecturers in the 21st century.

This condition raises questions about how the digital competence of teachers in higher education is needed to design and support student learning experiences (Bolliger et al., 2019). Because in the dimensions of professional and academic competence, in addition to mastery of material and scientific fields as well as creativity and professionalism, a lecturer is also required to be able to master one aspect that is important and very relevant to the present, namely the aspect of mastery over the use of ICT for communication, collaboration, and teaching in learning activities. This aspect of mastery over the use of technology is then referred to as digital competence (Sitompul, 2022).

This research aims to analyse and provide an overview of the level of digital competence of lecturers and the factors that influence it. The information explored can be used as further studies in the assessment of research that has been

conducted in several countries around the world. Furthermore, it is useful to find out more about what can be done and taken into consideration by instructors to decide on appropriate training and coaching so that the digital competence of lecturers in higher education can be sharpened.

B. RESEARCH METHODS

This research is a literature review using a narrative approach. The data collected was analysed using the critical appraisal method to carefully and systematically evaluate the literature in order to answer the research questions. The literature analysed and synthesised are international journal articles published in several major databases, namely ScienceDirect, Springer, and Google Scholar in the period 2020-2024. The analysis technique used was content analysis. Researchers used the Harzing Publish or Perish application to collect articles, with the keywords "digital competence", "university" "teacher" and "higher education".

To avoid bias, the search for articles was limited to research that referred to the European Digicomp Framework, Educators Digital Competencies (EDC) and Teachers' Professional Digital Competence (TPDC). The research steps taken are as follows: (1) Researchers formulated the problems and themes raised, namely the digital competence of lecturers in higher education (2) Searching and collecting journal articles from large electronic databases, namely ScienceDirect, Springer and Google Scholar using Harzing Publish or Perish software. A total of 367 articles were screened based on keywords and research variables, (3) Selecting articles with Digicomp, EDC and (TPDC) frameworks (4) Evaluating data with full-text studies conducted independently and thoroughly and with regard to predetermined inclusion and exclusion criteria. Preferred inclusion criteria included the year of the study within the last 4 years, Scopus indexed articles and English language, appropriateness of the title and discussion in the study. From the articles that have been netted, 10 articles were determined as samples in the study with consideration based on the suitability of the criteria needed (5) Analyse and interpret the data and information obtained and (6) Synthesise by connecting the level of digital competence and the factors that influence it.

C. RESULT AND DISCUSSION

The search for literature sources was obtained from various international journals spread from several countries in the world, namely Korea, Portugal, Spain, England, Hong Kong and several other countries. These journals were used as samples in the study because they met the inclusion criteria which included the nearest publication year, namely 2020-2024, scopus indexed articles and English, articles in full form, and met the keywords "digital competence", "university" "teacher" and "higher education" taken from the Harzing Publish Or Perish software.

The authors then broke down each keyword and correlated the level of digital competence, its involvement in learning and the factors that influence it. The results of the breakdown by keyword are shown in Table 1.

Table 1. Resume Of Selected Scientific Article

Author/ Year	Journal	Resume
de Obesso et al., 2023	<i>Technological Forecasting & Social Change</i>	Highly digitally competent lecturers improve students' understanding/perception in learning activities. Of the 4 aspects of Digicomp are positively related to student learning perceptions.
Garzón-Artacho et al., 2021	Heliyon	The level of digital competence demonstrated was low, particularly in areas such as creation, information literacy, and problem-solving. Factors like age, teacher training, and school type significantly influenced whereas gender did not play a role.
Culp-Roche et al., 2020	SAGE Open Nursing	Faculty readiness to integrate technology to deliver online learning affects student satisfaction and learning outcomes.
Antonietti et al., 2022	Social Sciences & Humanities Open	Teachers' digital competence with technology usability and their intention to integrate in teaching are interconnected. However, intentions do not always predict future

Yoon, 2022	International Journal of Educational Research	behaviour. Male teacher candidates have relatively high training needs in the areas of professional availability and digital resources compared to female teacher candidates.
Wong & Moorhous e, 2021	Education and Information Technologies	The UTIC-EEI model instrument is a valid and reliable tool for measuring and enhancing the use of technology among university teachers.
(Nagy & Dringó-Horváth, 2024a)	Education Science MDPI Journal	Institutional & peer support is critical in that communication, co-operation and Feedback is more effective in developing teachers' digital pedagogical competencies than simply providing adequate infrastructure and individual technical support.
Saltos-Rivas et al., 2023	Educational and Information Technologies	basic digital competencies and some teacher characteristics can explain pedagogical and professional competencies.
Dias-Trindade & Albuquerque, 2022	Social Sciences MDPI Journal	The University's priority should be investing in comprehensive staff training for digital competencies, rather than attempting to customize training based on faculties, age groups, genders, or levels of teaching experience.
Basilotta-Gómez-Pablos et al., 2022	International Journal of Educational Technology in Higher Education	Despite having no problems in procuring technological tools, it turns out that the digital competence of lecturers is still low and needs support from the university to improve their digital competence.

1. Digital Competence Level of Lecturers in Higher Education

Some of the articles screened show that researchers distinguish between the terms digital competence and digital literacy as well as general and specific (in terms of instruction) digital

competence. The two are very close and interconnected, but Centre et al (2012) specifically define digital competence as a set of knowledge, skills, attitudes, strategies and awareness involved when technological devices and digital media are used to perform tasks, solve problems, communicate, manage information, collaborate, create and share content and build knowledge critically, creatively, flexibly, effectively, efficiently, ethically in a form that makes sense for the purposes of work, entertainment, participation, learning, socialisation, consumption and empowerment.

The European Union defines digital competence as the safe, critical and responsible interaction and use of digital technologies for learning, working and participating in society which includes information and data literacy, communication, collaboration, media literacy, digital content creation, data security in order to solve problems and think critically.

In the context of higher education, digital competence is specified into three dimensions (Starkey, 2020) namely: (1) the ability to teach using digital technology, (2) the critical ability to evaluate learning decisions with digital technology, and (3) the ability to teach learners who are proficient in using digital devices. According to Starkey, digital competence includes the ability of lecturers to work in the context of digitalised schools and education systems, including mastery of teaching in digital contexts, managing digital learning environments, and carrying out more professional work as an educator.

Teacher digital competence considered to be a combination of professional, pedagogical, and technological knowledge and skills (Greenhow et al., 2022), and is defined in more detail as skills related to the use of information and communication technologies in learning as well as other educational activities such as instructional management, individual and organisational communication and research activities (Nagy & Dringó-Horváth, 2024).

2. The Relationship between Lecturers' Digital Competence and Students

One of the main responsibilities of higher education institutions is to provide professional teaching qualifications to prepare students for the future (Guillén-Gámez & Mayorga-Fernández, 2021). In the dimension of professional and academic competence, in addition to mastery of material and scientific fields, creativity and professionalism, digital competence is a prerequisite for a teacher to prepare competent scholars (Sitompul, 2022) Lecturers' attitudes towards the use of digital technology are a major concern in the education sector in order to improve their digital competence capabilities (Pratolo & Solikhati, 2020).

To assess and classify lecturers' digital competencies, a number of models have been developed, such as the Technological Pedagogical Content Knowledge (TPACK) model, the Technology Integration Matrix (TIM), The Replacement, Amplification, Transformation (RAT) model, and the DigCompEdu framework which is derived from the education version of Digcomp developed by the European Commission (Caena & Redecker, 2019). This framework is general enough to be used in the context of different education levels where there is a specialised version for higher education.

According to Digicomp there are 6 areas that are focused on in the professional activities of a teacher, namely: (1) Professional Engagement where the use of digital technology for communication, collaboration and professional development (2) Digital Resources, namely the sourcing, creation and sharing of digital resources (3) Teaching and Learning, namely organising and leading the use of technology in learning and teaching (4) Assessment, namely the use of digital technology and strategies to improve assessment. (5) Empowering Learners or the use of digital technologies to enhance inclusion, personalisation and active engagement of learners. (6) Facilitating Learners' Digital Competence is allowing learners to use digital technologies creatively and responsibly for information, communication, content creation, well-being and problem solving.

In addition, in research conducted by (Núñez-Canal et al., 2022), there are 4 areas that can be used to evaluate the digital competence of lecturers, namely: 1) instrumental, which is about the use of ICT in the teaching and learning process; 2) attitude, which refers to the motivation to integrate ICT into learning; 3) promotion, which refers to the role of teaching in encouraging activities that involve the correct use of digital resources by students; and 4) security, regarding data protection and the safe use of digital resources in the learning process.

In Garzón-Artacho et al (2021) measuring the level of digital competence of higher education lecturers showed that the level of digital competence of lecturers is still low, especially in terms of creation, information literacy, and problem solving. The lowest and most worrying level is in the dimension of digital content creation. This indicates that lecturers have minimal skills to make the most of ICT, but do not have the necessary skills to carry out methodological or strategic tasks that require more knowledge of computer devices. The results of this study are in line with other studies conducted by Amhag et al (2019); Del-Moral-Pérez et al (2019) which showed the same thing. But even so, the results of this study also show optimal skills in digital content communication and collaboration.

In line with previous research, Basilotta-Gómez-Pablos et al (2022) also found that lecturers' digital competence is still at a low to medium level. These skills include the ability to solve problems using ICT, working in networks, and integration of ICT into learning evaluation activities. Even in another study Demeshkant et al (2020) found that lecturers at Polish universities were classified as medium in terms of digital competence, both in terms of pedagogical and technological knowledge and research Saltos-Rivas et al (2023) reinforced these findings with data on the digital competence of lecturers in Portugal being low in the assessment area in the DigCompEdu framework.

These studies indicate that lecturers in higher education need to improve their level of digital competence in order to successfully

implement learning in their courses (Srivastava & Dangwal, 2021). In conclusion, despite having adopted technology in learning for a long time and not encountering significant difficulties in building infrastructure and procuring technological devices, it turns out that the digital competence of lecturers in higher education is still relatively low, especially in certain aspects, which has an impact on learning activities and the achievement of learning objectives, so training and support activities for lecturers may be needed to improve their digital competence. era globalisasi ini sudah banyak mengalami pergeseran nilai-nilai kebaikan diganti dengan karakteristik kurang baik khususnya di tingkat menengah ke atas (Syaharuddin, 2017).

3. Factors Affecting Digital Competence

In a study conducted by de Obesso et al (2023) shows that a lecturer who has digital competence supports students' learning perceptions as an asset to their learning success. There are 4 hypotheses tested in this study. Of the 4 hypotheses, 3 of them are confirmed, namely first, that the digital competence of lecturers has a positive relationship with student learning perceptions. This means that lecturers who have good digital competence can improve students' understanding/perception in learning activities. Second, learning resources used to communicate, monitor, and assess students have a positive impact on student learning perceptions. Third, lecturers' involvement in the digital ecosystem has a positive impact on students' learning process.

This is because digital competence has an important role in higher education as analysed by Kay & Knaack (2008) that digital competence is an aspect that has a significant positive influence on the use of ICT in learning. This analysis is in line with the findings from the research of Joo et al (2016) and Dong et al (2020) which concluded that if the digital competence of a teacher is low, it can also affect the integration of digital technology in learning which results in decreased student interest in learning, because lecturers prefer to use traditional methods in learning.

These studies provide evidence of a strong relationship between lecturers' digital competence and their use of technology and

intention to use digital tools in teaching and overall, the conclusions of these studies provide an understanding of the relationship between the digital competence of lecturers and students.

4. Efforts to Improve Lecturers' Digital Competence

There are several factors that influence the level of digital competence of lecturers. These factors have been revealed in several studies conducted by researchers in various countries. However, in some conditions, some factors do not always have a significant effect. Among the studies that reveal these factors are described as follows.

Garzón-Artacho et al (2021) found that age, teacher training, and type of institution (private or public) are factors that determine the level of digital competence. According to his research, gender showed no influence/difference on lecturers' mastery of digital competence. However, further research conducted by Yoon (2022) shows that gender differences have an effect in preparing future lecturers, this is evidenced by the finding that men have relatively high educational or training needs in professional engagement and digital resources. He further explained that the reflective practice of training in the use of digital technology is more important and influential. Based on these findings, it is important to address gender differences in the design and implementation of digital competency training programmes.

While in research (Wong & Moorhouse, 2021), adaptability is an important factor that affects the digital competence of lecturers in learning activities, especially if learning occurs in an online environment. This can also be seen in the initial phase of the transition from offline to online learning during covid-19, many lecturers had difficulties and felt frustrated because in addition to having to know the use of various platforms for implementing learning, lecturers also spent a lot of time preparing lesson materials and evaluations considering the different abilities of students. In addition, self-efficacy was also found to affect their digital competence, thus emphasising the need to overcome resistance to change in improving their digital competence

(Alanoglu et al., 2022). Therefore, after the transition phase, lecturers have started to find pedagogical strategies that enable them to plan and implement learning.

Another study found that the location where lecturers live also has a significant influence on their digital competence, but not on their communication and collaboration skills. In particular, lecturers from more developed regions have higher levels of digital competence than lecturers from less developed regions. As has been proven in the research of Demeshkant et al (2020)

5. Digital Competence & Higher Education

For almost two decades higher education around the world has gradually adopted digital technologies in its learning including online and blended learning (Singh & Thurman, 2019). However, studies that have been conducted show that despite the long adoption of digital technology, the digital competence of lecturers is still relatively low. Therefore, efforts are needed to improve lecturers' digital competence.

From the previously discussed studies, the researcher identified several efforts that can be made to improve lecturers' competence and belief in the value of using technology by: (1) digital competency training. (2) provision of self-directed learning materials, which are widely used through collegial self-learning environments. (3) reflective practice to develop the necessary knowledge and skills. (4) long-term professional support. (5) incorporating digital competency training into future educator education programmes. By addressing these needs, digital competency improvement programmes can be put in place earlier to effectively integrate digital technologies into their teaching practice.

However, emphasising the usefulness of technology is only the first step: what is most important is strengthening lecturers' confidence in their own ability to use technology effectively and in a way that is relevant to educational goals and objectives.

D. CONCLUSION AND SUGGESTION

Digital competence as a set of knowledge, skills, attitudes, strategies and awareness involved to

teach using digital technology, along with the critical ability to evaluate learning decisions with digital technology has a very important role in the context of 21st century education dominated by the digital native generation. A lecturer with good digital competence can evaluate the quality of learning. However, age, gender differences, adaptability, type of institution, location of domicile are often factors that significantly affect the level of digital competence of lecturers. Therefore, some strategic efforts such as digital competency training, providing widely used self-learning materials through collegial self-learning environments, reflective practice, long-term professional support, and incorporating digital competency training into prospective educators' education programmes are tailored to the needs and gaps that occur.

This research is limited by the strict criteria set to capture scientific articles as references to obtain high quality literature. Therefore, the conditions studied from Asian countries including Indonesia are not well illustrated. Despite the limitations, the synthesised data is useful as a reference material for future research, such as determining instrument grids to quantitatively measure and explore lecturers' digital literacy.

REFERENCES

- Alanoglu, M., Aslan, S., & Karabatak, S. (2022). Do teachers' educational philosophies affect their digital literacy? The mediating effect of resistance to change. *Education and Information Technologies*, 27(3), 3447–3466. <https://doi.org/10.1007/s10639-021-10753-3>
- Amhag, L., Hellström, L., & Stigmar, M. (2019). Teacher Educators' Use of Digital Tools and Needs for Digital Competence in Higher Education. *Journal of Digital Learning in Teacher Education*, 35(4), 203–220. <https://doi.org/10.1080/21532974.2019.1646169>
- Antonietti, C., Cattaneo, A., & Amenduni, F. (2022). Can teachers' digital competence influence technology acceptance in vocational education? *Computers in Human Behavior*, 132. <https://doi.org/10.1016/j.chb.2022.107266>
- Basilotta-Gómez-Pablos, V., Matarranz, M., Casado-Aranda, L. A., & Otto, A. (2022). Teachers' digital competencies in higher education: a systematic literature review. In *International Journal of Educational Technology in Higher Education* (Vol. 19, Issue 1). Springer Science and Business Media Deutschland GmbH. <https://doi.org/10.1186/s41239-021-00312-8>
- Bolliger, D., Shepherd, C., & Bryant, H. (2019). Faculty members' perceptions of online program community and their efforts to sustain it. *British Journal of Educational Technology*, 50, 3283–3299. <https://doi.org/10.1111/bjet.12734>
- Caena, F., & Redecker, C. (2019). Aligning teacher competence frameworks to 21st century challenges: The case for the European Digital Competence Framework for Educators (Digcompedu). *European Journal of Education*, 54(3), 356–369. <https://doi.org/10.1111/ejed.12345>
- Centre, J. R., Studies, I. for P. T., & Ferrari, A. (2012). *Digital competence in practice – An analysis of frameworks*. Publications Office. <https://doi.org/doi/10.2791/82116>
- Culp-Roche, A., Hampton, D., Hensley, A., Wilson, J., Thaxton-Wiggins, A., Otts, J. A., Fruh, S., & Moser, D. K. (2020). Generational Differences in Faculty and Student Comfort With Technology Use. *SAGE Open Nursing*, 6. <https://doi.org/10.1177/2377960820941394>
- de Obesso, M. de las M., Núñez-Canal, M., & Pérez-Rivero, C. A. (2023). How do students perceive educators' digital competence in higher education? *Technological Forecasting and Social Change*, 188. <https://doi.org/10.1016/j.techfore.2022.122284>
- Del-Moral-Pérez, M. E., Villalustre-Martínez, L., & Neira-Piñeiro, M. del R. (2019). Teachers' perception about the contribution of collaborative creation of digital storytelling to the communicative and digital competence in primary education schoolchildren. *Computer Assisted Language Learning*, 32(4), 342–365. <https://doi.org/10.1080/09588221.2018.1517094>
- Demeshkant, N., Potyrała, K., & Tomczyk, Ł. (2020). *Levels of academic teachers digital competence: Polish case-study*.
- Dias-Trindade, S., & Albuquerque, C. (2022). University Teachers' Digital Competence: A Case Study from Portugal. *Social Sciences*, 11(10). <https://doi.org/10.3390/socsci11100481>
- Dong, Y., Xu, C., Chai, C. S., & Zhai, X. (2020). Exploring the Structural Relationship Among Teachers' Technostress, Technological Pedagogical Content Knowledge (TPACK), Computer Self-efficacy and School Support. *Asia-Pacific Education Researcher*, 29(2), 147–157. <https://doi.org/10.1007/s40299-019-00461-5>
- Fernández-Batanero, J. M., Montenegro-Rueda, M., Fernández-Cerero, J., & García-Martínez, I. (2022). Digital competences for teacher professional development. Systematic review. *European Journal of Teacher Education*, 45(4), 513–531. <https://doi.org/10.1080/02619768.2020.1827389>
- Garzón-Artacho, E., Sola-Martínez, T., Romero-Rodríguez, J. M., & Gómez-García, G. (2021). Teachers' perceptions of digital competence at the lifelong learning stage. *Heliyon*, 7(7). <https://doi.org/10.1016/j.heliyon.2021.e07513>
- Greenhow, C., Graham, C. R., & Koehler, M. J. (2022). Foundations of online learning: Challenges and opportunities. *Educational Psychologist*, 57(3), 131–147. <https://doi.org/10.1080/00461520.2022.2090364>

- Guillén-Gámez, F. D., & Mayorga-Fernández, M. J. (2021). Design and validation of an instrument of self-perception regarding the lecturers' use of ICT resources: to teach, evaluate and research. *Education and Information Technologies*, 26(2), 1627–1646. <https://doi.org/10.1007/s10639-020-10321-1>
- Joo, Y. J., Lim, K. Y., & Kim, N. H. (2016). The effects of secondary teachers' technostress on the intention to use technology in South Korea. *Computers & Education*, 95, 114–122. <https://doi.org/https://doi.org/10.1016/j.compedu.2015.12.004>
- Kay, R. H., & Knaack, L. (2008). An examination of the impact of learning objects in secondary school. *Journal of Computer Assisted Learning*, 24(6), 447–461. <https://doi.org/10.1111/j.1365-2729.2008.00278.x>
- Nagy, J. T., & Dringó-Horváth, I. (2024a). Factors Influencing University Teachers' Technological Integration. *Education Sciences*, 14(1). <https://doi.org/10.3390/educsci14010055>
- Nagy, J. T., & Dringó-Horváth, I. (2024b). Factors Influencing University Teachers' Technological Integration. *Education Sciences*, 14(1). <https://doi.org/10.3390/educsci14010055>
- Núñez-Canal, M., de Obesso, M. de las M., & Pérez-Rivero, C. A. (2022). New challenges in higher education: A study of the digital competence of educators in Covid times. *Technological Forecasting and Social Change*, 174(September 2021), 1–17. <https://doi.org/10.1016/j.techfore.2021.121270>
- Pratolo, B. W., & Solikhati, H. A. (2020). Investigating teachers' attitude toward digital literacy in EFL classroom. *Journal of Education and Learning (EduLearn)*, 15(1), 97–103. <https://doi.org/10.11591/edulearn.v15i1.15747>
- Saltos-Rivas, R., Novoa-Hernández, P., & Rodríguez, R. S. (2023). Understanding university teachers' digital competencies: a systematic mapping study. *Education and Information Technologies*, 28(12), 16771–16822. <https://doi.org/10.1007/s10639-023-11669-w>
- Sánchez-Cruzado, C., Santiago Campión, R., & Sánchez-Compañía, M. T. (2021). Teacher digital literacy: The indisputable challenge after covid-19. *Sustainability (Switzerland)*, 13(4), 1–29. <https://doi.org/10.3390/su13041858>
- Singh, V., & Thurman, A. (2019). How Many Ways Can We Define Online Learning? A Systematic Literature Review of Definitions of Online Learning (1988-2018). *American Journal of Distance Education*, 33(4), 289–306. <https://doi.org/10.1080/08923647.2019.1663082>
- Sitompul, B. (n.d.). *Kompetensi Guru dalam Pembelajaran Di Era Digital*.
- Srivastava, S., & Dangwal, K. L. (2021). Digital Competence: Where do the Higher Education Teachers Stand? *Universal Journal of Educational Research*, 9(10), 1765–1772. <https://doi.org/10.13189/ujer.2021.091005>
- Starkey, L. (2020). A review of research exploring teacher preparation for the digital age. *Cambridge Journal of Education*, 50(1), 37–56. <https://doi.org/10.1080/0305764X.2019.1625867>
- 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>
- Wang, C., Zhang, M., Sesunan, A., & Yolanda, L. (2023). *PERAN TEKNOLOGI DALAM TRANSFORMASI PENDIDIKAN DI INDONESIA Tinjauan dampak terkini gerakan Merdeka Belajar*.
- Wong, K. M., & Moorhouse, B. L. (2021). Digital competence and online language teaching: Hong Kong language teacher practices in primary and secondary classrooms. *System*, 103. <https://doi.org/10.1016/j.system.2021.102653>
- Yahya, M., Otomotif, P. T., & Elektro, W. T. (2023). *PROSIDING SEMINAR NASIONAL Implementasi Artificial Intelligence (AI) di Bidang Pendidikan Kejuruan Pada Era Revolusi Industri 4.0*. <https://journal.unm.ac.id/index.php/Semnasdies62/index>
- Yoon, S. H. (2022). Gender and digital competence: Analysis of pre-service teachers' educational needs and its implications. *International Journal of Educational Research*, 114. <https://doi.org/10.1016/j.ijer.2022.101989>