IJECA
International Journal of
Education & Curriculum Application
http://journal.ummat.ac.id/index.php/IJECA
ISSN 2614-3380 | Vol. 7, No. 3, December 2024

Determinant Factors Influencing Teacher Performance in the Digital Era

Milatun Nadifa[1], Mustiningsih[1], Raden Bambang Sumarsono[1]
[1]Education Management, State University of Malang, Indonesia
mustiningsih.fip@um.ac.id

Keywords:
Digital Age;
Teacher Performance;
Technology.

ABSTRACT

This study aims to examine the factors influencing teacher performance in the digital age, focusing on both supportive and obstructive elements shaping their effectiveness in integrating digital tools into teaching practices. The research systematically examines how technological and pedagogical factors, personal factors, organizational support, contextual factors, technostress, and the digital divide impact teacher performance. A systematic literature review was conducted using PRISMA guidelines, analyzing 650 scholarly articles published between 2020 and 2024. Articles were sourced through the Publish or Perish (PoP) application, applying specific inclusion criteria, such as empirical studies published in accredited journals and relevance to the study objectives, while excluding articles that lacked methodological rigor or were not written in English or Indonesian. From this process, 94 high-quality articles were selected for analysis. Data were processed using a scoring matrix to assess article quality and relevance, and findings were systematically categorized using Microsoft Excel to generate narratives, tables, and diagrams. The results reveal six critical factors affecting teacher performance: technological and pedagogical competence, personal factors, organizational support, contextual factors, technostress, and the digital divide. These findings highlight the complexity of teacher performance in the digital age and underscore the necessity of institutional support, continuous professional development, and policies to address technology-related disparities and stress. This study provides valuable insights for designing evidence-based strategies to enhance teacher effectiveness and educational quality in the era of digital transformation.

Article History:
Received: 25-10-2024
Revised : 08-12-2024
Accepted: 10-12-2024
Online : 11-12-2024

https://doi.org/10.31764/ijeca.v7i3.27523

A. INTRODUCTION

The rapid advancement of digital technology in the past decade has revolutionized various sectors, including education (Almufarreh & Arshad, 2023; Alenezi et al., 2023; Alenezi, 2023). This transformation necessitates that teachers adapt to evolving teaching methods that increasingly incorporate digital devices and online learning platforms (Kallunki et al., 2023; Sprague et al., 2023; Rodrigues, 2020). Although technology offers significant opportunities to improve the quality of learning (Afriliandhi et al., 2022; Mukhadis et al., 2021), adapting to these changes brings challenges that educators cannot ignore. These challenges are mainly related to the limited resources and skills required to master the ever-evolving educational technology (Fitriati et al., 2023; Alieto et al., 2024; Adil et al., 2024). In this digital era, these challenges have direct implications for teacher performance (Orakova et al., 2024; Chen & Chen, 2024), which in turn affects the quality of education that can be provided to students (Copur-Gencturk et al., 2024).

One of the critical issues that have emerged is unequal access to technology, which creates a digital divide among teachers (Zhao, 2024; Rofi'ah et al., 2024; Nurhikmah et al., 2024). This gap is not only related to infrastructure and access to technological devices (Winata & Nugraha, 2024; (Mulyono et al., 2024), but also to varying levels of digital literacy and technical competence among educators (Karina & Cahyani, 2024; Indrawati et al., 2024). Teachers working in under-resourced schools or rural areas often face significant barriers, making it challenging to integrate technology effectively in their teaching practices. Addressing this divide is crucial for creating equitable opportunities for both teachers and students in the digital age.

Another critical factor is the phenomenon of technostress, which refers to stress or psychological pressure caused by excessive use of technology (Novianty & Sedjo, 2023; Anjasari, 2024). Technostress can arise from difficulties in managing new digital tools, constant connectivity, or balancing technological demands with other professional responsibilities. For teachers, this stress is not only a personal burden but also a professional challenge that can hinder their ability to deliver effective instruction (Damri, 2023). Consequently, understanding and addressing technostress is vital to enhancing teacher performance and well-being.

Research has also emphasized the role of institutional support in enabling teachers to navigate digital challenges successfully. Hanaysha et al. (2023), Tzafilkou et al. (2023), and Atstsaury et al. (2023) highlight that providing adequate technological infrastructure, access to digital resources, and ongoing professional development are essential for improving teacher performance. Furthermore, Mauludin et al. (2024) stress the importance of sustainability in technology training programs, ensuring that teachers have continuous opportunities to refine their skills and stay updated with technological advancements. Such support can empower educators to maximize the potential of digital tools while minimizing the negative effects of the digital divide and technostress.

Although there has been a lot of research on the factors that affect teacher performance in the digital era, most of the existing studies are still focused on certain aspects, such as technological competence or digital literacy. Unfortunately, this approach often ignores the relationship between these factors and organizational elements and the broader context. In fact, teacher performance in the digital era is not only determined by individual ability to use technology, but also influenced by organizational dynamics, institutional support, and more complex environmental conditions. Therefore, a holistic approach is needed that is able to identify the interaction between these factors to provide a more comprehensive solution.

This study aims to fill the literature gap through a systematic literature review of factors that affect teacher performance in the digital era. Using the PRISMA method, this study collects and analyzes various relevant literature to identify key elements that affect teacher performance. The focus of the research includes technological challenges, personal elements, organizational factors, and educational contexts. This approach is expected to provide a more comprehensive picture of how these various factors interact with each other in supporting or hindering teacher performance.

The results of this study are expected to provide new insights for policymakers and education practitioners in designing more effective strategies to improve teacher performance. By understanding the dynamic relationship between technology, institutional support, and the broader education ecosystem, this research can contribute to the development of evidence-based policies. In addition, these findings are also expected to encourage more inclusive and responsive teaching practices to the challenges of the digital era, thereby supporting a better transformation of education in the future.

B. METHODS

This research was conducted through a systematic literature review (SLR) to explore the factors affecting teacher performance in the digital era. The data for this review were collected from global databases using the Publish or Perish (PoP) application, which provides access to scholarly articles published between 2020 and 2024. The search parameters in PoP included keywords related to teacher performance, digital transformation, and educational technology. Articles published in accredited journals (Sinta 1-3 and Scopus Q1-Q4) and relevant conference proceedings were prioritized. The search was refined by applying filters for article type (peer-reviewed) and language (English and Indonesian).

The articles collected through PoP were categorized based on their thematic relevance to the study's objectives. These categories included technological pedagogical factor, personal factors, organizational, contextual, technostress, and the digital divide. To ensure the validity of the findings, the articles were screened and evaluated for methodological rigor, empirical evidence, and alignment with the research questions. Articles that did not meet these criteria were excluded. The final selection of 94 articles underwent in-depth analysis, which provided valuable insights into the factors affecting teacher performance in the digital era. This SLR follows the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) guidelines, which involve stages such as identifying articles through relevant keywords, applying inclusion and exclusion criteria, and conducting a detailed analysis of eligible articles. The collected data were processed using Microsoft Excel to categorize, organize, and present the information in tables, narratives, and diagrams, ensuring transparency and repeatability in the analysis.

To maintain the validity and reliability of the review process, several steps were taken. First, an assessment matrix was developed to evaluate the quality and relevance of the articles based on their research scope, methodology, and suitability with the study's objectives. Second, the matrix and inclusion/exclusion criteria were reviewed by two independent educational research experts to ensure alignment with research standards. Third, reliability between raters was tested by comparing the results of an independent article selection conducted by two raters, achieving a 95% agreement rate. For the analysis, thematic analysis was employed to identify patterns (themes) within the selected articles. This process involved categorizing articles based on the factors influencing teacher performance, such as technology pedagogy, personal, organizational, contextual factors, technostress, and the digital divide. The main findings and themes of each article were systematically coded to identify relationships between these factors. Descriptive analysis summarized quantitative data, such as the frequency of factors discussed, which were then presented in tables and visualized through diagrams. Narrative synthesis was used to integrate qualitative insights from the thematic analysis into comprehensive summaries, providing context to the findings. Figure 1 illustrates the flow of the systematic literature review conducted following the PRISMA guidelines. The review began with a pool of 650 articles covering various aspects of the factors influencing teacher performance in the digital age. Keywords used in the literature search included "Teacher performance in the digital era," "Determinants of teacher performance in the digital era," "Digital literacy and teacher performance," "Digital divide in education," "Technological competence of teachers," "Technostress among educators," "Educational technology and teacher effectiveness," "Teacher training and technology integration," "Institutional support for teachers in the digital age," and "Sustainability of technology training programs for teachers." As shown in Figure 1.

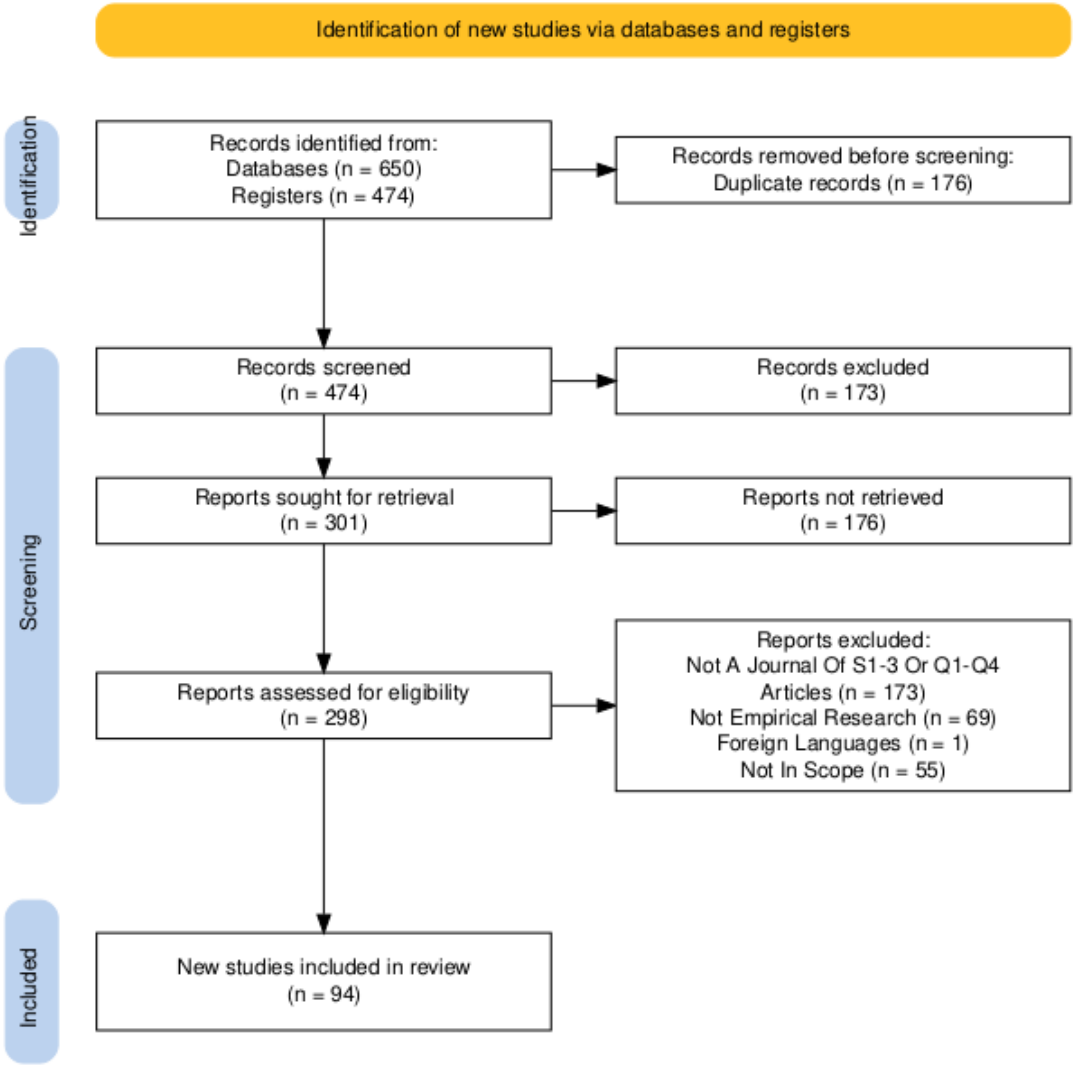


Figure 1. Prism Systematic Literature Review

The article selection process began with the identification of 650 articles sourced from multiple databases. These articles were initially assessed for relevance and quality using a set of inclusion and exclusion criteria. First, 176 duplicate records were removed, leaving 474 unique articles for further review. In the screening phase, 173 articles were excluded for not aligning with the study's focus on teacher performance in the digital era. This process involved evaluating each article's relevance to the core topic, such as its alignment with factors affecting teacher performance and digital transformation.

Next, 301 articles were selected for retrieval; however, 176 of these could not be accessed, leaving 298 articles to be further assessed for eligibility. During this stage, 173 articles were excluded for not meeting the inclusion criteria, which required articles to be published in accredited journals (Sinta 1-3 or Scopus Q1-Q4) or contain empirical research. Additionally, one article was excluded due to being written in a foreign language, and 55 articles were deemed outside the scope of the study, such as those not addressing teacher performance or digital integration. After applying these criteria, 94 articles remained that met all inclusion requirements, offering valuable insights into the factors influencing teacher performance in the digital era. These 94 articles were ultimately included in the final review, contributing significantly to the

theoretical and practical understanding of how digital transformation impacts teacher performance.

C. RESULT AND DISCUSSION

The results of this study indicate that various factors, both supportive and inhibiting, significantly influence teachers' performance in the use of educational technology. To enhance comprehension, the findings are organized into a table that summarizes the key information from the reviewed articles. Similar findings will be consolidated into a single category or theme to highlight consistent trends or patterns across different studies.

Each article analyzed will be assigned a unique code for easy identification of the information source within the table. The article code will be included on the same line or theme when multiple articles report similar findings. This method is employed to prevent redundancy and provide a comprehensive overview of the main factors affecting teacher performance. Consequently, the presentation of these findings outlines the results of each article individually while offering a clear mapping of the primary trends in research concerning teacher performance in the digital age. Below is a table format that can be utilized to present findings from a systematic literature review on the factors influencing teacher performance in the digital era, as shown in Table 1.

Table 1. Factors that affect teacher performance in the digital era

Category	Key Findings	Articles
Technological & Pedagogical Factors	This research investigates teachers' comprehension of digital literacy, crucial for effective learning, and its impact on self-efficacy. It examines how technology integration in teaching promotes innovation and boosts student engagement. The study emphasizes the need for a comprehensive approach to digital education, incorporating TPACK, and highlights the significance of instructional design in distance learning.	A2,A4,A5,A9,A18,A20,A23,A24,A33,A36,A38,A43,A44,A47,A51,A53,A55,A56,A57,A59,A64,A65,A67,A68,A69,A70,A71,A74,A75,A82,A83,A87,A91,A92,A94
Personal Factors	This research analyzes how belief in one's ability to use technology, attitudes toward technology, and perceptions of its value influence individuals' willingness to adopt new technology.	A6,A15,A16,A28,A29,A35,A42,A45,A52,A53,A60,A61,A66,A71,A72,A76,A84,A86,A89,A91,A93
Organizational Factors	This research analyzes how organizational factors, particularly leadership roles, school support, and resource allocation, influence the integration of technology in education.	A3,A12,A27,A30,A31,A32,A34,A37,A39,A40,A48,A49,A50,A51,A58,A62,A65,A78,A82
Contextual Factors	This research analyzes contextual factors influencing technology use in teaching, specifically focusing on age, gender, and experience.	A10,A14,A17,A18,A19,A39,A41,A58,A70,A77,A86,A88,A90
Technostress	This study examines stress and fatigue caused by excessive technology use, highlighting how its increasing complexity can lead to frustration and feelings of inadequacy. Prolonged technology use may result in mental exhaustion, lower job satisfaction, and detrimental effects on mental health.	A1,A7,A8,A14,A39,A46,A54,A63,A73,A78,A79,A80,A85,A90

Category	Key Findings	Articles
Digital Divide	This research analyzes the digital divide stemming from unequal access to technology and the internet, affecting learning and teaching opportunities. It also examines the availability of devices and software, along with the varying quality of connectivity across different regions.	A11,A13,A21,A22,A25,A26,A30,A81

The table above summarizes the main findings from various articles, mapping the factors affecting teacher performance in the digital era from 2020-2024. These studies cover a wide range of countries, highlighting a wide range of challenges and opportunities in the implementation of educational technology. With qualitative, quantitative, and other empirical approaches, which reflect the complexity of the current educational situation. The following graph displays the distribution of research by country and trends over time, providing deeper insights as well as identifying areas that require further exploration, as shown in Figure 2.

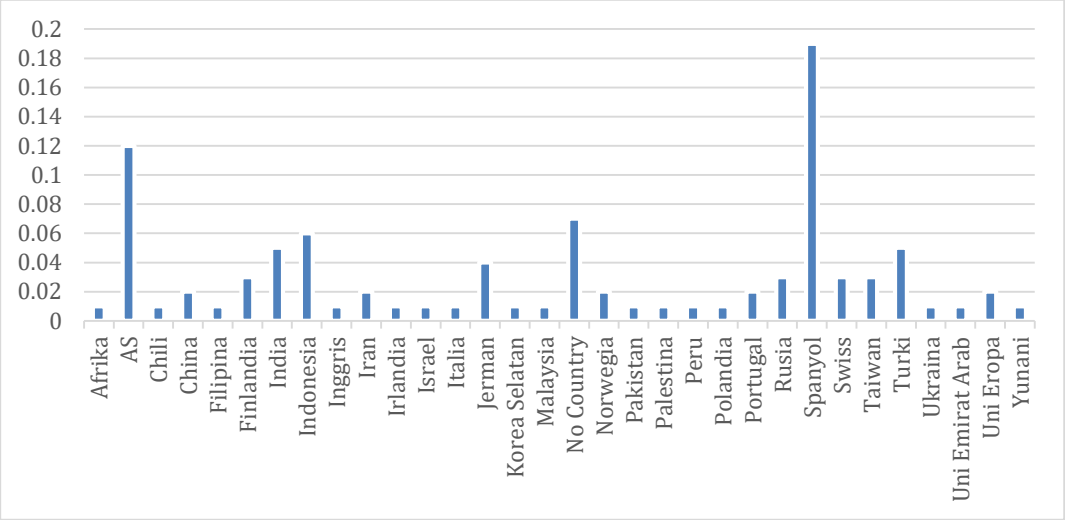
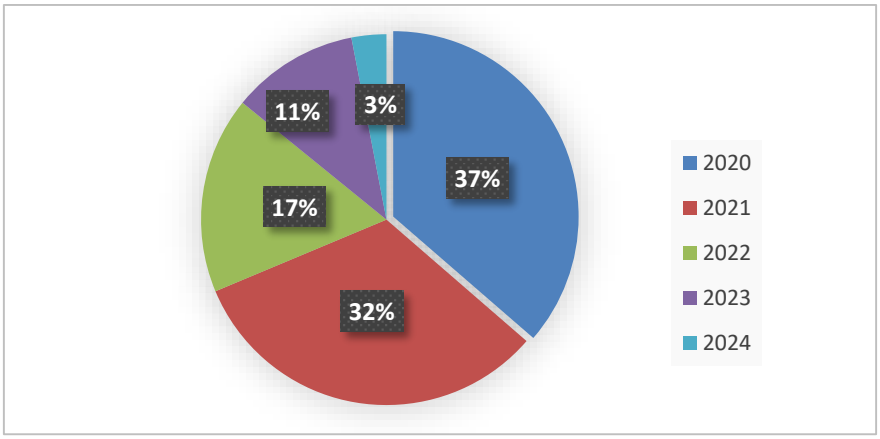


Figure 2. Percentage of Research by Country

The graph shows the contribution of research from various countries related to factors that affect teacher performance in the digital era. Countries such as Finland, India, Indonesia, Malaysia, Germany, Russia, Switzerland, Taiwan, and Turkey have a balanced contribution, with percentages ranging from 0.03% to 0.06%, reflecting that this issue is faced globally with varying social, cultural, and technological infrastructure challenges. Spain and the United States recorded the highest percentages, 0.19%, and 0.12%, respectively, indicating more intensive research activities and the influence of national policies in the use of educational technology. Contributions from other countries such as Africa, Chile, and China also confirm global developments in teacher performance research in the digital era.



Graph 2. Percentage of Research by Year

The distribution graph of the study shows a significant increase in the study of factors affecting teacher performance in the digital era, especially in 2020 (37%) and 2021 (32%), triggered by the COVID-19 pandemic and the shift to online learning. In 2022, the percentage of research decreased to 17%, reflecting a stabilization phase as teachers began to adapt to technology. The decline continued in 2023 (11%) and 2024 (3%), although this topic remains relevant. The decrease in the number of studies does not reduce the urgency of the topic, given the rapid development of digital technology. The world of education must remain relevant to technology to ensure optimal teacher performance and better learning outcomes. Furthermore, this study explores six main aspects related to teacher performance in the digital era based on the findings obtained.

1. Pedagogical Technology Factors

The integration of technology in contemporary education relies heavily on teachers' digital literacy and their capability to utilize technology to enhance learning outcomes. Studies indicate that digital proficiency, technical skills, and the use of technology-driven teaching strategies play a crucial role in shaping teacher performance (Zabolotska et al., 2021; Ngongo et al., 2022; Quaicoe & Pata, 2020; Mercader & Gairín, 2020). Although many teachers claim to have good digital literacy, the application of technology in teaching is not optimal (Quaicoe & Pata, 2020; Hämäläinen et al., 2021). Mastery of digital competencies and previous ICT training also affected teacher performance (Artacho et al., 2020; Carpenter et al., 2020). A solid grasp of Technological Pedagogical Content Knowledge (TPACK) is essential for teachers to optimize the use of technology in education (Guggemos & Seufert, 2021; Dogan et al., 2021; Santos & Castro, 2021), which leads to better teaching effectiveness (Bakar et al., 2020; Sulasmi, 2022; Habibi et al., 2020).

Teachers with higher digital proficiency tend to experience lower anxiety, while effective use of digital pedagogy can reduce feelings of incompetence (Bartra-Rivero et al., 2024). The selection of frameworks such as DigCompEdu has been proven to improve teachers' digital literacy competencies and have a positive impact on their performance (Cabero-Almenara et al., 2020). List et al. (2020) Find digital literacy competencies, particularly in ICT and information processing, are crucial in enhancing the effectiveness of prospective teachers. Various digital literacy profiles highlight their technological usage and critical thinking approaches, reflecting the significant role these skills play in their overall performance improvement (Rusydiyah et al., 2020), Meanwhile, the lack of digital literacy is an inhibiting factor in preschool education (Anisimova, 2020).

The limited digital skills of teachers significantly hinder their ability to adapt to teaching, which in turn affects the quality of education (Damşa et al., 2021). Key factors influencing

teachers' success in integrating technology include their participation in professional development, their technological skills, and the importance they place on utilizing technology in their practice (Bowman et al., 2022; Guggemos & Seufert, 2021). Teachers with low digital skills, especially in content creation and information literacy, face difficulties in utilizing technology effectively (Garzón-Artacho et al., 2021; Valverde-Berrocoso et al., 2021). Training models and involvement in ICT-based innovation projects also affect their adaptability in the digital age (Valverde-Berrocoso et al., 2021). Technological advancements, especially the internet, and technology-based teaching methods can improve teacher performance (Xu, 2023). Teachers with good technology skills are more effective in using learning software, so their performance improves (Dogan et al., 2021). The improvement of teaching methods and international collaboration through technology also has a significant impact on teaching in the global era (Mikheev et al., 2021).

Teachers' knowledge of digital threats, such as sexting and cyberbullying, is essential to face the challenges of the digital age (Potyrała & Tomczyk, 2021). Improving information literacy, digital collaboration, and digital security competencies are needed (Reisoğlu & Çebi, 2020). Teachers who are proficient in digital strategies tend to experience lower anxiety and are more effective in digital pedagogy (Bartra-Rivero et al., 2024). Awareness of information technology ethics also improves teachers' ability to learn meaningfully (Novella-García & Cloquell-Lozano, 2021). Digital literacy and technology use skills affect teacher performance (Christopoulos & Sprangers, 2021). Zimmer & Matthews (2022) stated that the development of teachers' digital competencies can strengthen their digital learning identity. These competencies, according to various frameworks, play an important role in teacher performance in the digital era (Cabero-Almenara et al., 2020). In addition, digital literacy, the role of lecturers, and the use of social media also have a significant impact on the performance of prospective teachers (Akayoğlu et al., 2020). Teachers with low digital competence often have difficulty utilizing technology in learning (Garzón-Artacho et al., 2021). However, proper guidance in the use of digital tools can improve the performance of prospective teachers.

Research shows the importance of technology integration in teaching. König et al. (2020) identify that digital competencies and digital teaching-learning opportunities play a role in teacher success in online environments. García-Vandewalle García et al. (2023) dan Raygan & Moradkhani (Raygan & Moradkhani, 2022) emphasized that teachers' positive attitude towards technology, supported by a good school climate, makes it easier to integrate technology. Digital competence and knowledge of cyber ethics are also important in the effective use of technology (McGarr & McDonagh, 2021). A holistic approach, including peer support and school policies, also supports teacher competency development. (Grande-De-prado et al., 2020). A good understanding of TPACK allows for more effective integration of technology in learning (Bakar et al., 2020; McGarr & McDonagh, 2021). Thus, strong digital competencies increase the effectiveness of teaching and student learning experiences.

2. Personal Factors

Personal factors, such as information literacy and digital literacy, significantly influence technology adoption, acting both as facilitators and barriers. These forms of literacy are crucial in shaping individuals' intentions to utilize digital technologies, which in turn has notable effects on enhancing performance (Nikou & Aavakare, 2021). Integrating digital literacy enhances teaching effectiveness and equips students to face the challenges of the 21st century (Sadaf & Gezer, 2020; Nikolopoulou et al., 2021). Teachers' trust in their digital competencies has a positive effect on the

perception of the usefulness of technology and its intention to apply it in learning (Antonietti et al., 2022; Thurm & Barzel, 2020; Cattaneo et al., 2022). Teachers' self-efficacy in utilizing technology for lesson planning, instruction, assessment, providing feedback, and communication with both students and parents significantly influences how often technology is integrated into classroom activities (Beardsley et al., 2021; Bakar et al., 2020). Furthermore, teachers' confidence in these abilities has a direct impact on their performance (Cazan et al., 2024; Lucas et al., 2021). Positive attitudes, hedonistic motivations, established habits, and performance expectations also shape teachers' intentions to adopt technologies, such as mobile internet and Massive Open Online Courses (MOOCs), which enhance their performance (Nikolopoulou et al., 2021; Tseng et al., 2022). These elements contribute to the development of 21st-century skills, including critical thinking, collaboration, and communication (Liesa-Orús et al., 2020).

Teachers' trust in AI-based technology and professional development support also play a crucial role in the use of AI-EdTech, influencing teachers' performance in the digital age (Nazaretsky et al., 2022). Epistemic beliefs about creativity and assessment challenges also have an impact on the integration of technology by teachers (Bereczki & Kárpáti, 2021), Powered by technology observation experience (Nelson & Hawk, 2020). Other factors such as system quality, self-efficacy, and professional support also improve teachers' abilities in technology-based learning (Suzianti & Paramadini, 2021; Barton & Dexter, 2020). Teachers who have high motivation and trust in the value of technology are more open to technology integration in the classroom (Backfisch et al., 2021), although varying technological skills can affect their performance (Hämäläinen et al., 2021). Confidence in the technology as well as understanding TPACK allows teachers to use it more effectively, improving learning performance (Bakar et al., 2020; Garzón-Artacho et al., 2021). Positive attitudes towards technology and job satisfaction also have an impact on teachers' welfare and performance (Bangun et al., 2021), while motivation and positive attitudes towards ICT support the use of technology for student learning (Cabero-Almenara et al., 2022; Dogan et al., 2021).

3. Organizational Factors

Organizational factors are crucial in the successful integration of technology in education. Visionary leadership, such as principals' support for digital transformation, technology-driven professional development, and a culture of digital learning, is key (Karakose et al., 2021; Ubaidillah et al., 2019). Planning and organizing community participation is also important, especially in religious values-based schools that combine digital renewal with traditional values (Mustiningsih & Kusumaningrum, 2019). School support, both cultural and policy, contributes significantly to the optimal use of technology and teacher performance (Chou & Chou, 2021). The provision of resources, including infrastructure and training, is crucial to ensure effective and sustainable adoption of the technology (Francom, 2020; Boice et al., 2021). Lack of institutional support, financial resources, and technical support can reduce the effectiveness of teaching and technology integration (Joshi et al., 2020; Turugare & Rudhumbu, 2020). Similar research shows the relationship between lecturers' pedagogic competence, quality of administrative services, and facilities, and student satisfaction with learning motivation, supporting the importance of organizational support and resources in the successful integration of technology in education (Sumarsono et al., 2021).

The success of technology integration in education is influenced by organizational factors and adaptation to digital technology, which affects the smooth implementation (Iglesias-Pradas et al., 2021). Digital transformation involving technology and curriculum can improve teachers'

capabilities in facing challenges in the digital era (Wang et al., 2023). Research by Nadifa & Ambarwati (2024) also emphasized the importance of developing a holistic curriculum that integrates Islamic values with digital culture and training teachers to master technology while still understanding Islamic values. The digital training received by teachers is also a major factor affecting their performance (Sosa Díaz, 2021). Conversely, less effective training models can cause difficulties for teachers in the educational process (Valverde-Berrocoso et al., 2021). Peer support and technical support can reduce technostress, thereby improving teacher performance (Khlaif et al., 2023). A high level of organizational support also plays a role in reducing technostress and increasing job satisfaction (Solís et al., 2023). Research also shows that spiritual leadership can play a role in improving performance through the mediation of organizational citizenship behavior and job satisfaction (Supriyanto et al., 2020). Greater support and good TPACK knowledge correlated with lower stress levels, which had a positive impact on teacher performance (Özgür, 2020). In addition, social support from colleagues contributes to reducing technostress and increasing productivity (Cazan et al., 2024).

On the other hand, a lack of training and support can hinder teachers' performance in integrating technology in the classroom, especially in elementary learning (Taghizadeh & Hasani Yourdshahi, 2020). Pedagogical support and appropriate training can improve the effectiveness of teacher teaching in a digital context (Christopoulos & Sprangers, 2021). The absence of institutional support, including inadequate supervision of school principals during the pandemic, hinders teachers' ability to adapt their teaching methods, which in turn lowers the quality of education (Damşa et al., 2021). To establish a successful digital learning environment, education policies must prioritize the enhancement of digital infrastructure and recognize teachers as key facilitators within the digital learning ecosystem (Bygstad et al., 2022). Therefore, the success of technology integration in education depends not only on the technology itself but also on the support of the organization and the resources available.

4. Contextual Factors

The integration of technology in teaching is shaped by various contextual factors, such as age, gender, and experience. Studies indicate that younger teachers and women generally exhibit higher digital proficiency than their older or male counterparts (Guillén-Gámez et al., 2021; Cabero-Almenara et al., 2021; Lucas et al., 2021). In addition, age, gender, and professional experience play a role in the level of technostress experienced by teachers. Female teachers, especially those working on temporary contracts, are more susceptible to technostress (Solís et al., 2023). Teachers with over 15 years of experience often encounter greater difficulties in integrating technology into their teaching practices compared to younger teachers, who tend to be more proficient with ICT tools (Guillén-Gámez et al., 2022). On the other hand, experience in designing technology-based content is an important factor that affects teacher performance, where teachers with broader experience are better able to integrate technology effectively (Lee & Hwang, 2022).

Other sociodemographic factors, such as the context of work and the type of institution, also play a role in influencing teacher performance as well as potential burnout in the use of technology (Marrinhas et al., 2023). Overall, age, gender, professional experience, and access to technology training are factors that play a big role in shaping educators' digital competencies, which in turn affects their performance in technology-based learning (Çebi & Reisoglu, 2020; Nascimento et al., 2024). There is a difference in perception between genders regarding digital competence, where men tend to feel more competent in technical aspects, while women are more proficient in the use

of social media and content creation (Grande-De-prado et al., 2020; Özgür, 2020). Additionally, training and access to technology are significant in improving teachers' ability to adopt new technologies, with age and level of training affecting their speed of adaptation (Garzón-Artacho et al., 202; Ertl et al., 2020). Overall, these variables contribute to teachers' digital competencies and their impact on the implementation of technology in learning.

5. Technostress

Technostress is an inevitable phenomenon in the development of modern technology, especially in the world of education. Increased workloads, privacy demands, and limited technology adaptation are often stressors that lead to burnout among faculty (Martens et al., 2020). The inability to effectively manage technology impacts emotional balance, job satisfaction, and productivity (Solís et al., 2023; Bourlakis et al., 2023). A study by Califf and Brooks (2020) Shows that technostress among K-12 teachers in the U.S. is related to the intention to change professions and how digital literacy can reduce its negative impact. An important aspect of the literature is techno-anxiety and techno-fatigue, which cause teachers to feel overwhelmed and perform poorly (Rey-Merchán & López-Arquillos, 2022; Bourlakis et al., 2023). Cazan shows that technostress among K-12 teachers in the U.S. is related to the intention to change professions and how digital literacy can reduce its negative impact. An important aspect of the literature is techno-anxiety and techno-fatigue, which cause teachers to feel overwhelmed and perform poorly (Cazan et al., 2024). The combination of burnout and technostress in the digital era shows a significant impact on the decline in teacher performance in supporting students (Marrinhas et al., 2023).

Technology affects teachers' perception of its ease of use, which impacts their intention to adopt technology in teaching (Gabbiadini et al., 2023). Research shows that differences in technostress levels are not significant by gender, but vary by branch of teaching (Arslan et al., 2022). Even so, teachers' motivation to leave the profession due to technological pressure is increasing, especially when facing technical problems in online teaching (Siddiqui et al., 2023). Although technostress generally has a negative impact, some studies show that well-managed techno-eustress can have a positive impact on teacher performance and job satisfaction in higher education (Nascimento et al., 2024). However, the literature highlights more than high technostress negatively impacts teachers' productivity and well-being, ultimately affecting their ability to teach in a digital environment (Thiyagu, 2021; Estrada-Muñoz et al., 2020; Q. Wang & Yao, 2023). Research also indicates that high levels of spirituality contribute positively to mental well-being, helping to cope with the stress of technostress among teachers (Nadifa et al., 2024). Therefore, educational institutions need to integrate spiritual aspects into professional development programs to support the welfare and effectiveness of teachers' teaching.

6. Digital Divide

The digital divide in education involves more than just access to technological devices and connectivity. It includes technological skills, training, and infrastructure that support the use of technology, which impacts the teaching-learning process. Indicates that the digital divide in Europe is shaped by two key factors: access to e-services, which is linked to education levels, and the use of social networks, which is influenced by age. This highlights that access limitations are driven not only by material factors but also by demographic ones. Liu (2021) stated that the inequality of access to technology resulted in differences in the learning experience of students, which had an impact on the ability of teachers to deliver material effectively. Mathrani et al. (2022) added that limited access to technology and additional responsibilities also affect student

learning outcomes and teacher performance. Radovanović et al. (2020) emphasizing the importance of digital literacy, adequate training, and local infrastructure, such as local language interfaces, which have a profound impact on people's digital skills, especially in remote or underdeveloped areas.

Furthermore, Karsenti et al. (2020) highlight that restricted technology use in classrooms, limited time for internet access, and inadequate digital learning space organization significantly influence the digital competence of future teachers. This finding is in line with Iivari et al. (2020), which states that the inequality of technology skills affects teachers' ability to teach and the overall quality of education. Sosa Díaz (2021) emphasized that in areas where resources are scarce, limited access to technology hinders teachers' performance in teaching effectively. AlSadrani et al. (2020) added that the lack of training and resources has an impact on student engagement in ICT use, widening the gap in learning. Overall, factors like unequal access to technology, inadequate training, and varying digital skills hinder teachers' effectiveness in using technology, which further widens the gaps in student learning outcomes, particularly in areas with limited technology and internet access.

D. CONCLUSION AND SUGGESTIONS

This research reveals that teacher performance in the digital era is influenced by six main factors: technological and pedagogical factors, personal factors, organizational factors, contextual factors, technostress, and the digital divide. Technological and pedagogical factors reflect teachers' ability to use digital tools and integrate them into effective teaching strategies. Teachers must not only understand technology, but also be able to apply it appropriately in teaching methods to ensure an engaging learning experience. Personal factors refer to teachers' attitudes and readiness to technological changes, while organizational factors include institutional support through infrastructure, training, and policies. Contextual factors include age, gender, and experience with technology use. Technostress refers to pressure due to excessive use of technology, while the digital divide indicates the existence of a gap in access to technology between regions. All of these factors contribute to the complexity of teacher performance in the digital era.

To increase the validity and relevance of the conclusions, further research needs to show how each factor is supported by the data or analysis obtained in the study. For example, statistical techniques such as multiple regression analysis or structural equation modeling (SEM) can be applied to measure the impact of each factor on teacher performance. By collecting data through large-scale surveys of teachers, this study will provide empirical evidence of how these factors affect teacher performance in the digital era.

This research makes a unique contribution both in theory and practice. Theoretically, this study develops the existing literature by offering a holistic framework that integrates various factors that affect teacher performance in the digital era, as well as emphasizing the linkages between these factors. In practical terms, the findings of this study provide valuable insights for designing more focused intervention strategies, especially in terms of teacher training, policy reform, and stress management related to the use of technology. The resulting recommendations are expected to help educators, policymakers, and educational institutions understand the dynamics of teacher performance in the digital era, as well as lead to improved teaching practices and better learning outcomes.

REFERENCES

Adil, H. M., Ali, S., Sultan, M., Ashiq, M., & Rafiq, M. (2024). Open education resources' benefits and challenges in the academic world: a systematic review. *Global Knowledge, Memory and Communication*, *73*(3), 274–291. https://doi.org/10.1108/GKMC-02-2022-0049

Afriliandhi, C., Hidayati, D., Istiqomah, I., & Melawati, A. (2022). Teacher's Digital Literacy to Improve Quality in Learning. *IJECA (International Journal of Education and Curriculum Application)*, *5*(1), 17–24. https://doi.org/10.31764/ijeca.v5i1.7327

Akayoğlu, S., Satar, H. M., Dikilitaş, K., Cirit, N. C., & Korkmazgil, S. (2020). Digital literacy practices of Turkish pre-service EFL teachers. *Australasian Journal of Educational Technology*, *36*(1), 85–97. https://doi.org/10.14742/ajet.4711

Alenezi, M. (2023). Digital Learning and Digital Institution in Higher Education. *Education Sciences*, *13*(1), 88–106. https://doi.org/10.3390/educsci13010088

Alenezi, M., Wardat, S., & Akour, M. (2023). The Need of Integrating Digital Education in Higher Education: Challenges and Opportunities. *Sustainability (Switzerland)*, *15*(6), 4782–4794. https://doi.org/10.3390/su15064782

Alieto, E., Abequibel-Encarnacion, B., Estigoy, E., Balasa, K., Eijansantos, A., & Torres-Toukoumidis, A. (2024). Teaching inside a digital classroom: A quantitative analysis of attitude, technological competence and access among teachers across subject disciplines. *Heliyon*, *10*(2), 1–15. https://doi.org/10.1016/j.heliyon.2024.e24282

Almufarreh, A., & Arshad, M. (2023). Promising Emerging Technologies for Teaching and Learning: Recent Developments and Future Challenges. *Sustainability (Switzerland)*, *15*(8), 6917–6218. https://doi.org/10.3390/su15086917

AlSadrani, B., Alzyoudi, M., Alsheikh, N., & Elshazly, E. E. (2020). The digital divide in inclusive classrooms. *International Journal of Learning, Teaching and Educational Research*, *19*(3), 69–85. https://doi.org/10.26803/ijlter.19.3.5

Anisimova, E. (2020). Digital Literacy of Future Preschool Teachers. *Journal of Social Studies Education Research*, *11*(1), 230–253. www.jsser.org

Anjasari, E. (2024). Technostress Dan Kaitannya Dengan Dunia Pendidikan Saat Ini. *Prosiding Seminar Nasional Ilmu Pendidikan*, *3*(1), 173–180. http://e-jurnal.fkip.unila.ac.id/index.php/psnip/article/view/708

Antonietti, C., Cattaneo, A., & Amenduni, F. (2022). Can teachers' digital competence influence technology acceptance in vocational education? *Computers in Human Behavior*, *132*(1), 107266–107275. https://doi.org/10.1016/j.chb.2022.107266

Arslan, H., Şahin, Y. L., Ferhan Odabaşı, H., & Okur, M. R. (2022). An investigation of change in teachers' technostress levels before and after the Covid-19 outbreak. *Educational Media International*, *59*(2), 95–111. https://doi.org/10.1080/09523987.2022.2101202

Artacho, E. G., Martínez, T. S., Ortega Martín, J. L., Marín Marín, J. A., & García, G. G. (2020). Teacher training in lifelong learning-the importance of digital competence in the encouragement of teaching innovation. *Sustainability (Switzerland)*, *12*(7), 2852–2865. https://doi.org/10.3390/su12072852

Atstsaury, S., Hadiyanto, H., & Supian, S. (2023). Principal's Strategy to Improve Teachers Professional Competence. *Munaddhomah: Jurnal Manajemen Pendidikan Islam*, *5*(1), 1–10. https://doi.org/10.31538/munaddhomah.v5i1.775

Backfisch, I., Lachner, A., Stürmer, K., & Scheiter, K. (2021). Variability of teachers' technology integration in the classroom: A matter of utility! *Computers and Education*, *166*(1), 104159–104159. https://doi.org/10.1016/j.compedu.2021.104159

Bakar, N. S. A., Maat, S. M., & Rosli, R. (2020). Mathematics teacher's self-efficacy of technology integration and technological pedagogical content knowledge. *Journal on Mathematics Education*, *11*(2), 256–276. https://doi.org/10.22342/jme.11.2.10818.259-276

Bangun, Y. R., Pritasari, A., Widjaja, F. B., Wirawan, C., Wisesa, A., & Ginting, H. (2021). Role of Happiness: Mediating Digital Technology and Job Performance Among Lecturers. *Frontiers in Psychology*, *12*(1), 1–10. https://doi.org/10.3389/fpsyg.2021.593155

Barton, E. A., & Dexter, S. (2020). Sources of teachers' self-efficacy for technology integration from formal, informal, and independent professional learning. *Educational Technology Research and Development*, *68*(1), 89–108. https://doi.org/10.1007/s11423-019-09671-6

Bartra-Rivero, K. R., Vásquez-Pajuelo, L., Avila-Sánchez, G. A., Andrade-Díaz, E. M., Méndez-Ilizarbe, G. S., Rodriguez-Barboza, J. R., & Alarcón-Villalobos, Y. J. (2024). How Digital Competence Reduces Technostress. *Data and Metadata*, *3*(1). https://doi.org/10.56294/dm2024303

Beardsley, M., Albó, L., Aragón, P., & Hernández-Leo, D. (2021). Emergency education effects on teacher abilities and motivation to use digital technologies. *British Journal of Educational Technology*, *52*(4), 1455–1477. https://doi.org/10.1111/bjet.13101

Bereczki, E. O., & Kárpáti, A. (2021). Technology-enhanced creativity: A multiple case study of digital technology-integration expert teachers' beliefs and practices. *Thinking Skills and Creativity*, *39*(1), 1–27. https://doi.org/10.1016/j.tsc.2021.100791

Boice, K. L., Jackson, J. R., Alemdar, M., Rao, A. E., Grossman, S., & Usselman, M. (2021). Supporting teachers on their STEAM journey: A collaborative STEAM teacher training program. *Education Sciences*, *11*(3), 1–20. https://doi.org/10.3390/educsci11030105

Bourlakis, M., Nisar, T. M., & Prabhakar, G. (2023). How technostress may affect employee performance in educational work environments. Technological Forecasting and Social Change. *Technological Forecasting and Social Change*, *193*(1), 1–10. https://doi.org/10.1016/j.techfore.2023.122674

Bowman, M. A., Vongkulluksn, V. W., Jiang, Z., & Xie, K. (2022). Teachers' exposure to professional development and the quality of their instructional technology use: The mediating role of teachers' value and ability beliefs. *Journal of Research on Technology in Education*, *54*(2), 188–204. https://doi.org/10.1080/15391523.2020.1830895

Bygstad, B., Øvrelid, E., Ludvigsen, S., & Dæhlen, M. (2022). From dual digitalization to digital learning space: Exploring the digital transformation of higher education. *Computers and Education*, *182*(1), 1–11. https://doi.org/10.1016/j.compedu.2022.104463

Cabero-Almenara, J., Barroso-Osuna, J., Gutiérrez-Castillo, J. J., & Palacios-Rodríguez, A. (2021). The teaching digital competence of health sciences teachers. A study at andalusian universities (Spain). *International Journal of Environmental Research and Public Health*, *18*(5), 1–13. https://doi.org/10.3390/ijerph18052552

Cabero-Almenara, J., Guillén-Gámez, F. D., Ruiz-Palmero, J., & Palacios-Rodríguez, A. (2022). Teachers' digital competence to assist students with functional diversity: Identification of factors through logistic regression methods. *British Journal of Educational Technology*, *53*(1), 41–57. https://doi.org/10.1111/bjet.13151

Cabero-Almenara, J., Romero-Tena, R., & Palacios-Rodríguez, A. (2020). Evaluation of teacher digital competence frameworks through expert judgement: The use of the expert competence coefficient. *Journal of New Approaches in Educational Research*, *9*(2), 275–283. https://doi.org/10.7821/naer.2020.7.578

Califf, C. B., & Brooks, S. (2020). An empirical study of techno-stressors, literacy facilitation, burnout, and turnover intention as experienced by K-12 teachers. *Computers and Education*, *157*(1), 1–15. https://doi.org/10.1016/j.compedu.2020.103971

Carpenter, J. P., Rosenberg, J. M., Dousay, T. A., Romero-Hall, E., Trust, T., Kessler, A., Phillips, M., Morrison, S. A., Fischer, C., & Krutka, D. G. (2020). What should teacher educators know about technology? Perspectives and self-assessments. *Teaching and Teacher Education*, *95*(1), 1–13. https://doi.org/10.1016/j.tate.2020.103124

Cattaneo, A. A. P., Antonietti, C., & Rauseo, M. (2022). How digitalised are vocational teachers? Assessing digital competence in vocational education and looking at its underlying factors. *Computers and Education*, *176*(1), 1–18. https://doi.org/10.1016/j.compedu.2021.104358

Cazan, A. M., David, L. T., Truța, C., Maican, C. I., Henter, R., Năstasă, L. E., Nummela, N., Vesterinen, O., Rosnes, A. M., Tungland, T., Gudevold, E., Digernes, M., Unz, D., Witter, S., & Pavalache-Ilie, M. (2024). Technostress and time spent online. A cross-cultural comparison for

teachers and students. *Frontiers in Psychology*, *15*(1), 1–16. https://doi.org/10.3389/fpsyg.2024.1377200

Çebi, A., & Reisoglu, I. (2020). Digital competence: A study from the perspective of pre-service teachers in Turkey. *Journal of New Approaches in Educational Research*, *9*(2), 294–308. https://doi.org/10.7821/naer.2020.7.583

Chen, X., & Chen, R. (2024). Examining the influence of the performance of mobile devices on teaching quality based on the technological acceptance mode. *Library Hi Tech*, *42*(2), 670–695. https://doi.org/10.1108/LHT-12-2021-0489

Chou, H. L., & Chou, C. (2021). A multigroup analysis of factors underlying teachers' technostress and their continuance intention toward online teaching. *Computers and Education*, *175*(1), 1–12. https://doi.org/10.1016/j.compedu.2021.104335

Christopoulos, A., & Sprangers, P. (2021). Integration of educational technology during the Covid-19 pandemic: An analysis of teacher and student receptions. *Cogent Education*, *8*(1), 1–27. https://doi.org/10.1080/2331186X.2021.1964690

Copur-Gencturk, Y., Li, J., Cohen, A. S., & Orrill, C. H. (2024). The impact of an interactive, personalized computer-based teacher professional development program on student performance: A randomized controlled trial. *Computers and Education*, *210*(1), 1–15. https://doi.org/10.1016/j.compedu.2023.104963

Damri, R. (2023). Rintangan Tak Terduga Berujung Stres: Peran Psikologi Positif pada Kesehatan Mental di Era VUCA. *Proceeding Conference on Psychology and Behavioral Sciences (Vol. 2)*, *2*(1), 301–333. http://proceedings.dokicti.org/index.php/CPBS/index

Damşa, C., Langford, M., Uehara, D., & Scherer, R. (2021). Teachers' agency and online education in times of crisis. *Computers in Human Behavior*, *121*(1), 1–16. https://doi.org/10.1016/j.chb.2021.106793

Dogan, S., Dogan, N. A., & Celik, I. (2021). Teachers' skills to integrate technology in education: Two path models explaining instructional and application software use. *Education and Information Technologies*, *26*(1), 1311–1332. https://doi.org/10.1007/s10639-020-10310-4

Ertl, B., Csanadi, A., & Tarnai, C. (2020). Getting closer to the digital divide: An analysis of impacts on digital competencies based on the German PIAAC sample. *International Journal of Educational Development*, *78*(1), 1–10. https://doi.org/10.1016/j.ijedudev.2020.102259

Estrada-Muñoz, C., Castillo, D., Vega-Muñoz, A., & Boada-Grau, J. (2020). Teacher technostress in the chilean school system. *International Journal of Environmental Research and Public Health*, *17*(15), 1–17. https://doi.org/10.3390/ijerph17155280

Fitriati, F., Rosli, R., Iksan, Z., & Hidayat, A. (2023). Exploring challenges in preparing prospective teachers for teaching 4C skills in mathematics classroom: A school-university partnership perspectives. *Cogent Education*, *11*(1), 1–21. https://doi.org/10.1080/2331186X.2023.2286812

Francom, G. M. (2020). Barriers to technology integration: A time-series survey study. *Journal of Research on Technology in Education*, *52*(1), 1–16. https://doi.org/10.1080/15391523.2019.1679055

Gabbiadini, A., Paganin, G., & Simbula, S. (2023). Teaching after the pandemic: The role of technostress and organizational support on intentions to adopt remote teaching technologies. *Acta Psychologica*, *236*(1), 1–9. https://doi.org/10.1016/j.actpsy.2023.103936

García-Vandewalle García, J. M., García-Carmona, M., Trujillo Torres, J. M., & Moya Fernández, P. (2023). Analysis of digital competence of educators (DigCompEdu) in teacher trainees: the context of Melilla, Spain. *Technology, Knowledge and Learning*, *28*(2), 585–612. https://doi.org/10.1007/s10758-021-09546-x

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), 1–8. https://doi.org/10.1016/j.heliyon.2021.e07513

Grande-De-prado, M., Cañón, R., García-Martín, S., & Cantón, I. (2020). Digital competence and gender: Teachers in training. a case study. *Future Internet*, *12*(11), 1–15. https://doi.org/10.3390/fi12110204

Guggemos, J., & Seufert, S. (2021). Teaching with and teaching about technology – Evidence for professional development of in-service teachers. *Computers in Human Behavior*, *115*(1), 1–11. https://doi.org/10.1016/j.chb.2020.106613

Guillén-Gámez, F. D., Cabero-Almenara, J., Llorente-Cejudo, C., & Palacios-Rodríguez, A. (2022). Differential Analysis of the Years of Experience of Higher Education Teachers, their Digital Competence and use of Digital Resources: Comparative Research Methods. *Technology, Knowledge and Learning*, *27*(4), 1193–1213. https://doi.org/10.1007/s10758-021-09531-4

Guillén-Gámez, F. D., Mayorga-Fernández, M. [a]J, Bravo-Agapito, J., & Escribano-Ortiz, D. (2021). Analysis of Teachers' Pedagogical Digital Competence: Identification of Factors Predicting Their Acquisition. *Technology, Knowledge and Learning*, *26*(3), 481–498. https://doi.org/10.1007/s10758-019-09432-7

Habibi, A., Yusop, F. D., & Razak, R. A. (2020). The role of TPACK in affecting pre-service language teachers' ICT integration during teaching practices: Indonesian context. *Education and Information Technologies*, *25*(3), 1929–1949. https://doi.org/10.1007/s10639-019-10040-2

Hämäläinen, R., Nissinen, K., Mannonen, J., Lämsä, J., Leino, K., & Taajamo, M. (2021). Understanding teaching professionals' digital competence: What do PIAAC and TALIS reveal about technology-related skills, attitudes, and knowledge? *Computers in Human Behavior*, *117*(1), 1–15. https://doi.org/10.1016/j.chb.2020.106672

Hanaysha, J. R., Shriedeh, F. B., & In'airat, M. (2023). Impact of classroom environment, teacher competency, information and communication technology resources, and university facilities on student engagement and academic performance. *International Journal of Information Management Data Insights*, *3*(2), 1–12. https://doi.org/10.1016/j.jjimei.2023.100188

Iglesias-Pradas, S., Hernández-García, Á., Chaparro-Peláez, J., & Prieto, J. L. (2021). Emergency remote teaching and students' academic performance in higher education during the COVID-19 pandemic: A case study. *Computers in Human Behavior*, *119*(1), 1–18. https://doi.org/10.1016/j.chb.2021.106713

Iivari, N., Sharma, S., & Ventä-Olkkonen, L. (2020). Digital transformation of everyday life – How COVID-19 pandemic transformed the basic education of the young generation and why information management research should care? *International Journal of Information Management*, *55*(1), 1–6. https://doi.org/10.1016/j.ijinfomgt.2020.102183

Indrawati, R. S. , Reiginayosi, M. , Wibowo, E. S. I. , & Syifa, A. N. (2024). Kesenjangan Digital dan Akses Internet di Kabupaten Katingan: Studi Kasus pada Masyarakat Pedesaan. *Jurnal Kaganga: Jurnal Ilmiah Sosial Dan Humaniora*, *8*(1), 65–73. https://doi.org/10.33369/jkaganga.8.1.65-73

Joshi, A., Vinay, M., & Bhaskar, P. (2020). Impact of coronavirus pandemic on the Indian education sector: perspectives of teachers on online teaching and assessments. *Interactive Technology and Smart Education*, *18*(2), 205–226. https://doi.org/10.1108/ITSE-06-2020-0087

Kallunki, V., Katajavuori, N., Kinnunen, P., Anttila, H., Tuononen, T., Haarala-Muhonen, A., Pyörälä, E., & Myyry, L. (2023). Comparison of voluntary and forced digital leaps in higher education – Teachers' experiences of the added value of using digital tools in teaching and learning. *Education and Information Technologies*, *28*(8), 10005–10030. https://doi.org/10.1007/s10639-022-11559-7

Karakose, T., Polat, H., & Papadakis, S. (2021). Examining teachers' perspectives on school principals' digital leadership roles and technology capabilities during the covid-19 pandemic. *Sustainability (Switzerland)*, *13*(23), 1–20. https://doi.org/10.3390/su132313448

Karina, D., & Cahyani, E. P. (2024). Penerapan Model Pembelajaran Group Investigation Melalui Pendekatan Saintifik Untuk Meningkatkan Kemampuan Penalaran Matematis dan Resiliensi Matematis Siswa. *Jurnal Sadewa : Publikasi Ilmu Pendidikan, Pembelajaran Dan Ilmu Sosial*, *2*(2), 149–161. https://doi.org/10.61132/sadewa.v2i2.765

Karsenti, T., Kozarenko, O. M., & Skakunova, V. A. (2020). Digital technologies in teaching and learning foreign languages: Pedagogical strategies and teachers' professional competence. *Education and Self Development*, *15*(3), 76–88. https://doi.org/10.26907/esd15.3.07

Khlaif, Z. N., Sanmugam, M., & Ayyoub, A. (2023). Impact of Technostress on Continuance Intentions to Use Mobile Technology. *Asia-Pacific Education Researcher*, *32*(2), 151–162. https://doi.org/10.1007/s40299-021-00638-x

König, J., Jäger-Biela, D. J., & Glutsch, N. (2020). Adapting to online teaching during COVID-19 school closure: teacher education and teacher competence effects among early career teachers in Germany. *European Journal of Teacher Education*, *43*(4), 608–622. https://doi.org/10.1080/02619768.2020.1809650

Lee, H. J., & Hwang, Y. (2022). Technology-Enhanced Education through VR-Making and Metaverse-Linking to Foster Teacher Readiness and Sustainable Learning. *Sustainability (Switzerland)*, *14*(8), 4786–4807. https://doi.org/10.3390/su14084786

Liesa-Orús, M., Latorre-Cosculluela, C., Vázquez-Toledo, S., & Sierra-Sánchez, V. (2020). The technological challenge facing higher education professors: Perceptions of ICT tools for developing 21st Century skills. *Sustainability (Switzerland)*, *12*(13), 5339–5353. https://doi.org/10.3390/su12135339

List, A., Brante, E. W., & Klee, H. L. (2020). A framework of pre-service teachers' conceptions about digital literacy: Comparing the United States and Sweden. *Computers and Education*, *148*(1), 1–20. https://doi.org/10.1016/j.compedu.2019.103788

Liu, J. (2021). Bridging Digital Divide Amidst Educational Change for Socially Inclusive Learning During the COVID-19 Pandemic. *SAGE Open*, *11*(4), 1–8. https://doi.org/10.1177/21582440211060810

Lucas, M., Bem-Haja, P., Siddiq, F., Moreira, A., & Redecker, C. (2021). The relation between in-service teachers' digital competence and personal and contextual factors: What matters most? *Computers and Education*, *160*(1), 1–17. https://doi.org/10.1016/j.compedu.2020.104052

Marrinhas, D., Santos, V., Salvado, C., Pedrosa, D., & Pereira, A. (2023). Burnout and technostress during the COVID-19 pandemic: the perception of higher education teachers and researchers. *Frontiers in Education*, *8*(1), 1–10. https://doi.org/10.3389/feduc.2023.1144220

Martens, M., Hajibayova, L., Campana, K., Rinnert, G. C., Caniglia, J., Bakori, I. G., Kamiyama, T., Mohammed, L. A., Mupinga, D. M., & Oh, O. J. (2020). "Being on the wrong side of the digital divide": seeking technological interventions for education in Northeast Nigeria. *Aslib Journal of Information Management*, *72*(6), 963–978. https://doi.org/10.1108/AJIM-05-2020-0172

Mathrani, A., Sarvesh, T., & Umer, R. (2022). Digital divide framework: online learning in developing countries during the COVID-19 lockdown. *Globalisation, Societies and Education*, *20*(5), 625–640. https://doi.org/10.1080/14767724.2021.1981253

Mauludin, I., Nadifa, M., Akhmad, K. F., Setiawan, K. A., Arifin, I., & Ubaidillah, A. F. (2024). Analisis Keberlanjutan Program Pelatihan Pemanfaatan Teknologi Bagi Guru Di Era Post Pandemic. *Proceedings Series of Educational Studies*, 32–46. http://conference.um.ac.id/index.php/pses/article/view/8643

McGarr, O., & McDonagh, A. (2021). Exploring the digital competence of pre-service teachers on entry onto an initial teacher education programme in Ireland. *Irish Educational Studies*, *40*(1), 115–128. https://doi.org/10.1080/03323315.2020.1800501

Mercader, C., & Gairín, J. (2020). University teachers' perception of barriers to the use of digital technologies: the importance of the academic discipline. *International Journal of*

Educational Technology in Higher Education, *17*(4), 1–14. https://doi.org/10.1186/s41239-020-0182-x

Mikheev, A., Serkina, Y., & Vasyaev, A. (2021). Current trends in the digital transformation of higher education institutions in Russia. *Education and Information Technologies*, *26*(4), 4537–4551. https://doi.org/10.1007/s10639-021-10467-6

Mukhadis, A., Putra, A. B. N. R., Kiong, T. T., Sumarli, Sutadji, E., Puspitasari, P., Sembiring, A. I., & Subandi, M. S. (2021). The innovation of learning plan designer based mobile web to improve quality of learning media in vocational technology for education 4.0. *Journal of Physics: Conference Series*, *1833*(1), 1–8. https://doi.org/10.1088/1742-6596/1833/1/012030

Mulyono, R. D. A. P. , Rosa, D. V. , Prasetyo, H. , & Mahardiyanto, A. (2024). Mentoring Smart Cultural Tourism Berbasis Potensi Lokal Menuju Kemandirian Ekonomi di Desa Klungkung Kabupaten Jember. *Warta Pengabdian*, *18*(1), 70–88. https://doi.org/10.19184/wrtp.v18i1.46992

Mustiningsih, & Kusumaningrum, D. E. (2019). Development of Planning and Organization Model of Community Participation in the Pesantren Based Junior High School. *In 5th International Conference on Education and Technology*, 580–583. http://creativecommons.org/licenses/by-nc/4.0/

Nadifa, M., & Ambarwati, R. D. (2024). Islamic School With Digital Culture in Era Society 5.0. *JCP (Jurnal Cahaya Pendidikan*, *10*(1), 10–19. https://doi.org/10.33373/chypen.v10i1.5857

Nadifa, M., Latif, R. A., Sobri, A. Y., & Ubaidillah, A. F. (2024). The Importance of the Spiritual Dimension in Improving the Mental Well-Being of College Students. *Studies in Learning and Teaching*, *5*(2), 370–381. https://doi.org/10.46627/silet

Nascimento, L., Correia, M. F., & Califf, C. B. (2024). Towards a bright side of technostress in higher education teachers: Identifying several antecedents and outcomes of techno-eustress. *Technology in Society*, *76*(1), 1–16. https://doi.org/10.1016/j.techsoc.2023.102428

Nazaretsky, T., Ariely, M., Cukurova, M., & Alexandron, G. (2022). Teachers' trust in AI-powered educational technology and a professional development program to improve it. *British Journal of Educational Technology*, *53*(4), 914–931. https://doi.org/10.1111/bjet.13232

Nelson, M. J., & Hawk, N. A. (2020). The impact of field experiences on prospective preservice teachers' technology integration beliefs and intentions. *Teaching and Teacher Education*, *89*(1), 1–12. https://doi.org/10.1016/j.tate.2019.103006

Ngongo, A., Talok, D., Niha, S. S., Manafe, H. A., & Kaluge, A. H. (2022). Pengaruh Sarana Pembelajaran Digital dan Kompetensi Digital Guru terhadap Kinerja Guru SMK Negeri 2 Kupang dengan Motivasi Berprestasi Sebagai Variabel Intervening. *Jurnal Manajemen Pendidikan Dan Ilmu Sosial*, *4*(1), 231–245. https://doi.org/10.38035/jmpis.v4i1

Nikolopoulou, K., Gialamas, V., & Lavidas, K. (2021). Habit, hedonic motivation, performance expectancy and technological pedagogical knowledge affect teachers' intention to use mobile internet. *Computers and Education Open*, *2*(1), 100041–100050. https://doi.org/10.1016/j.caeo.2021.100041

Nikou, S., & Aavakare, M. (2021). An assessment of the interplay between literacy and digital Technology in Higher Education. *Education and Information Technologies*, *26*(4), 3893–3915. https://doi.org/10.1007/s10639-021-10451-0

Novella-García, C., & Cloquell-Lozano, A. (2021). The ethical dimension of digital competence in teacher training. *Education and Information Technologies*, *26*(3), 3529–3541. https://doi.org/10.1007/s10639-021-10436-z

Nurhikmah, A. A., Zamroni, C., Ula, M. S., & Hapsoro, J. W. (2024). Pengaruh Teknologi Digital dalam Implementasi Kurikulum Merdeka Terhadap Peningkatan Mutu. *Jurnal Penelitian Pendidikan Indonesia (JPPI)*, *9*(1), 2477–3921. http://i-rpp.com/index.php/jpp

Orakova, A., Nametkulova, F., Issayeva, G., Mukhambetzhanova, S., Galimzhanova, M., & Rezuanova, G. (2024). The Relationships between Pedagogical and Technological Competence and Digital Literacy Level of Teachers. *Journal of Curriculum Studies Research*, *6*(1), 1–21. https://doi.org/10.46303/jcsr.2024.2

Özgür, H. (2020). Relationships between teachers' technostress, technological pedagogical content knowledge (TPACK), school support and demographic variables: A structural equation modeling. *Computers in Human Behavior*, *112*(1), 1–9. https://doi.org/10.1016/j.chb.2020.106468

Potyrała, K., & Tomczyk, Ł. (2021). Teachers in the lifelong learning process: examples of digital literacy. *Journal of Education for Teaching*, *47*(2), 255–273. https://doi.org/10.1080/02607476.2021.1876499

Quaicoe, J. S., & Pata, K. (2020). Teachers' digital literacy and digital activity as digital divide components among basic schools in Ghana. *Education and Information Technologies*, *25*(5), 4077–4095. https://doi.org/10.1007/s10639-020-10158-8

Radovanović, D., Holst, C., Banerjee Belur, S., Srivastava, R., Vivien Houngbonon, G., Le Quentrec, E., Miliza, J., Winkler, A. S., & Noll, J. (2020). Digital literacy key performance indicators for sustainable development. *Social Inclusion*, *8*(2), 151–167. https://doi.org/10.17645/si.v8i2.2587

Ratih Novianty, & Praesti Sedjo. (2023). Pengaruh Technostress Dan Efikasi Diri Terhadap Kinerja Guru SMA Negeri Kecamatan Tapos. *Jurnal Ekonomi, Bisnis Dan Manajemen*, *2*(3), 236–247. https://doi.org/10.58192/ebismen.v2i3.1285

Raygan, A., & Moradkhani, S. (2022). Factors influencing technology integration in an EFL context: investigating EFL teachers' attitudes, TPACK level, and educational climate. *Computer Assisted Language Learning*, *35*(8), 1789–1810. https://doi.org/10.1080/09588221.2020.1839106

Reisoğlu, İ., & 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*(1), 1–16. https://doi.org/10.1016/j.compedu.2020.103940

Rey-Merchán, M. del C., & López-Arquillos, A. (2022). Occupational Risk of Technostress Related to the Use of ICT among Teachers in Spain. *Sustainability (Switzerland)*, *14*(14), 1–11. https://doi.org/10.3390/su14148746

Rodrigues, A. L. (2020). Digital technologies integration in teacher education: The active teacher training model. *Journal of E-Learning and Knowledge Society*, *16*(3), 24–33. https://doi.org/10.20368/1971-8829/1135273

Rofi'ah, A. M., Shobirin, M., Fadllillah, M., Farah, N., Ah, W. ', Kunaifi, M. H., & Furqon Wahyudi, M. (2024). Analisis Kesiapan Guru Dalam Penerapan Kurikulum Merdeka Di Sekolah Menengah Pertama. *Journal Educatione*, *1*(2), 12–25. https://journal.univgresik.ac.id/index.php/je/article/view/136

Rusydiyah, E. F., Purwati, E., & Prabowo, A. (2020). How to use digital literacy as a learning resource for teacher candidates in Indonesia. *Cakrawala Pendidikan*, *39*(2), 305–318. https://doi.org/10.21831/cp.v39i2.30551

Sadaf, A., & Gezer, T. (2020). Exploring factors that influence teachers' intentions to integrate digital literacy using the decomposed theory of planned behavior. *Journal of Digital Learning in Teacher Education*, *36*(2), 124–145. https://doi.org/10.1080/21532974.2020.1719244

Santos, J. M., & Castro, R. D. R. (2021). Technological Pedagogical content knowledge (TPACK) in action: Application of learning in the classroom by pre-service teachers (PST). *Social Sciences and Humanities Open*, *3*(1), 1–8. https://doi.org/10.1016/j.ssaho.2021.100110

Siddiqui, S., Arif, I., & Hinduja, P. (2023). Technostress: A catalyst to leave the teaching profession - A survey designed to measure technostress among teachers in Pakistan during COVID-19 pandemic. *E-Learning and Digital Media*, *20*(1), 53–79. https://doi.org/10.1177/20427530221107506

Solís, P., Lago-Urbano, R., & Real Castelao, S. (2023). Factors That Impact the Relationship between Perceived Organizational Support and Technostress in Teachers. *Behavioral Sciences*, *13*(5), 1–12. https://doi.org/10.3390/bs13050364

Sosa Díaz, M. J. (2021). Emergency Remote Education, Family Support and the Digital Divide in the Context of the COVID-19 Lockdown. *International Journal of Environmental Research and Public Health*, *18*(15), 1–18. https://doi.org/10.3390/ijerph18157956

Sprague, D. R., Zumpano, N. M., Richardson, J. W., Williamson, J., & Gray, L. (2023). Technology Infusion and the Development of Practice: The Quest to Create Digitally Able Teachers. *Contemporary Issues in Technology and Teacher Education*, *23*(1), 199–227. https://www.learntechlib.org/primary/p/221545/

Sulasmi, E. (2022). Primary School Teachers' Digital Literacy: An Analysis On Teachers' Skills In Using Technological Devices. *Journal of Innovation in Educational and Cultural Research*, *3*(2), 140–145. https://doi.org/10.46843/jiecr.v3i2.81

Sumarsono, R. B., Gunawan, I., Kusumaningrum, D. E., Benty, D. D. N., & Bhayangkara, A. N. (2021). Influence of Lecturer's Pedagogic Competency Level, Quality of Administrative Services, Completeness of Lecture Supporting Facilities, and Student Satisfaction on Learning Motivation. *Jurnal Ilmu Pendidikan*, *27*(1), 23–33. https://doi.org/10.17977/um048v27i1p23-33

Supriyanto, A. S., Ekowati, V. M., & Maghfuroh, U. (2020). Do organizational citizenship behavior and work satisfaction mediate the relationship between spiritual leadership and employee performance? *Management Science Letters*, *10*(5), 1107–1114. https://doi.org/10.5267/j.msl.2019.10.031

Suzianti, A., & Paramadini, S. A. (2021). Continuance intention of e-learning: The condition and its connection with open innovation. *Journal of Open Innovation: Technology, Market, and Complexity*, *7*(1), 97–111. https://doi.org/10.3390/JOITMC7010097

Taghizadeh, M., & Hasani Yourdshahi, Z. (2020). Integrating technology into young learners' classes: language teachers' perceptions. *Computer Assisted Language Learning*, *33*(8), 982–1006. https://doi.org/10.1080/09588221.2019.1618876

Thiyagu, K. (2021). Techno-Stress Scale of Teacher Educators: Construction of the Tool. *International Journal of Recent Technology and Engineering (IJRTE)*, *9*(5), 114–117. https://doi.org/10.35940/ijrte.E5189.019521

Thurm, D., & Barzel, B. (2020). Effects of a professional development program for teaching mathematics with technology on teachers' beliefs, self-efficacy and practices. *ZDM - Mathematics Education*, *52*(7), 1411–1422. https://doi.org/10.1007/s11858-020-01158-6

Tseng, T. H., Lin, S., Wang, Y. S., & Liu, H. X. (2022). Investigating teachers' adoption of MOOCs: the perspective of UTAUT2. *Interactive Learning Environments*, *30*(4), 635–650. https://doi.org/10.1080/10494820.2019.1674888

Turugare, M., & Rudhumbu, N. (2020). Integrating technology in teaching and learning in universities in Lesotho: opportunities and challenges. *Education and Information Technologies*, *25*(5), 3593–3612. https://doi.org/10.1007/s10639-019-10093-3

Tzafilkou, K., Perifanou, M., & Economides, A. A. (2023). Assessing teachers' digital competence in primary and secondary education: Applying a new instrument to integrate pedagogical and professional elements for digital education. *Education and Information Technologies*, *28*(12), 16017–16040. https://doi.org/10.1007/s10639-023-11848-9

Ubaidillah, A. F., Bafadal, I., Ulfatin, N., & Supriyanto, A. (2019). Hubungan Antara Kepemimpinan Pembelajaran Kepala Sekolah, Kompetensi Pedagogik Guru Pendidikan Agama Islam dan Karakter Religius-Toleran Siswa Muslim di Sekolah Multikultural. *Education and Human Development Journal*, *4*(2), 1–12. https://doi.org/10.33086/ehdj.v4i2.1209

Valverde-Berrocoso, J., Fernández-Sánchez, M. R., Dominguez, F. I. R., & Sosa-Díaz, M. J. (2021). The educational integration of digital technologies preCovid-19: Lessons for teacher education. *PLoS ONE*, *16*(8), 1–22. https://doi.org/10.1371/journal.pone.0256283

Wang, K., Li, B., Tian, T., Zakuan, N., & Rani, P. (2023). Evaluate the drivers for digital transformation in higher education institutions in the era of industry 4.0 based on decision-making method. *Journal of Innovation and Knowledge*, *8*(3), 1–12. https://doi.org/10.1016/j.jik.2023.100364

Wang, Q., & Yao, N. (2023). The impact of technostress creators on novice teachers' job satisfaction. *Journal of Education for Teaching*, *49*(1), 104–119. https://doi.org/10.1080/02607476.2021.2013712

Winata, M. S. , & Nugraha, R. N. (2024). Transformasi Pendidikan Digital Dalam Pendidikan Indonesia untuk Menghadapi Era Industri 4.0: Tantangan dan Peluang. *Sindoro: Cendikia Pendidikan*, *4*(5), 101–110. https://doi.org/10.9644/sindoro.v4i5.3317

Xu, J. (2023). Optimizing English Education in the Information Era: A Multimodal Approach Based on BOPPPS Teaching Model. *Journal of Combinatorial Mathematics and Combinatorial Computing*, *118*(1), 33–48. https://doi.org/10.61091/jcmcc118-03

Zabolotska, O., Zhyliak, N., Hevchuk, N., Petrenko, N., & Alieko, O. (2021). Digital competencies of teachers in the transformation of the educational environment. *Journal of Optimization in Industrial Engineering*, *14*(1), 43–50. https://doi.org/10.22094/JOIE.2020.677813

Zhao, W. (2024). A study of the impact of the new digital divide on the ICT competences of rural and urban secondary school teachers in China. *Heliyon*, *10*(7), 1–12. https://doi.org/10.1016/j.heliyon.2024.e29186

Zimmer, W. K., & Matthews, S. D. (2022). A virtual coaching model of professional development to increase teachers' digital learning competencies. *Teaching and Teacher Education*, *109*(1), 1–16. https://doi.org/10.1016/j.tate.2021.103544