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Enhancing Digital Skills Towards Career Readiness: A Recent Systematic Review

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ABSTRACT

This systematic review examines the convergence of digital skills and professional preparedness by conducting an extensive search on Scopus and Web of Science databases, with a specific emphasis on keywords including "digital skills", "technology", "career readiness", and "education". After conducting an extensive search, a total of 26 articles were found. These articles were carefully examined to identify and summarize three primary topics: the incorporation of digital skills in education, the influence of digital skills on professional preparedness, and the difficulties related to improving digital abilities. The amalgamation of these papers offers significant perspectives on the intricate correlation between the enhancement of digital skills and the readiness for a professional job. The results emphasize the significance of integrating digital skills into educational systems to adequately prepare persons for the changing requirements of the contemporary labour market. Furthermore, the analysis underscores the substantial impact of digital skills on improving preparedness for careers, underlining their crucial role in building prosperous professional paths. Nevertheless, obstacles to efficiently improving digital skills have been recognized, highlighting the need to remove hurdles to promote a more complete approach to developing digital literacy. This abstract enhances the scholarly discussion on digital skills, education, and career preparedness by concisely summarizing the existing knowledge in this rapidly evolving domain.

Keywords:

Digital skills; Technology; Career readiness; Education; Systematic review

1. Introduction

In a time portrayed by quick mechanical progressions and a consistently extending computerized scene, the basic for people to develop and upgrade their computerized abilities has turned into a foundation of vocational status. The digital revolution has also transformed the professional landscape, necessitating a paradigm shift in the skill sets required for success in the modern workplace [1-3]. As we stand at the crossing point of the computerized age and the

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requests of the gig market, the significance of advanced abilities could not possibly be more significant. The expression "advanced abilities" envelops a range of proficiencies going from fundamental PC education to cutting-edge capacities in regions, for example, information examination, programming, and computerized correspondence [4-6]. Fundamentally, the capability and flexibility in utilizing advanced apparatuses and innovations engage people to explore the intricacies of the cutting-edge work environment.

This article expects to dive into the basic job of upgrading computerized abilities in cultivating vocation availability. Digital literacy is now a requirement rather than merely an asset due to the increasing integration of technology across industries [7-9]. As associations progressively digitize their tasks, people with strong computerized skills end up at a critical benefit. Past the traditional IT and software engineering spaces, advanced abilities are presently indispensable to assorted areas, including medical care, money, training, and assembling. The digital age requires a multifaceted approach to career readiness [10-13]. Right off the bat, there is a requirement for a thorough comprehension of the developing computerized scene, remembering arising innovations and their possible effect on different businesses. In this way, people should gain and level up unambiguous advanced abilities pertinent to their main subject area. This remembers specialized abilities and capability for exploring computerized correspondence stages, teaming up in virtual conditions, and assessing advanced data.

In addition, the article will investigate the advantageous connection between advanced abilities and employability. As ventures proceed to mechanize and smooth out processes, the interest in a carefully proficient labour force develops dramatically. Professionals must constantly adapt and upgrade their skills because job roles that were previously unaffected by technology are now infused with digital components [14,15]. The mastery of digital skills emerges as a linchpin for individuals aspiring to survive and thrive in their careers as we navigate the dynamic landscape of the digital age.

2. Literature Review

Several studies have highlighted the ways in which digital skills can improve career readiness. For instance, a study on the impact of marketing education integration with industry found that the integration of marketing education with industry has a significant positive impact on improving students' career readiness, including practical skills development, soft skills enhancement, professional network building, and maintaining curriculum relevance to the dynamic world of work [16]. Another study investigated the role of curricular, co-curricular, and extra-curricular activities in fostering skills and preparedness for the graduate workplace. The results revealed a significant association between digital skills and employment readiness, suggesting that individuals with strong digital skills were more prepared for the workforce. Moreover, engagement in activities within the digital domain was identified as a contributing factor to the development of these essential skills, further enhancing preparedness for the demands of the workplace. This underscores the importance of incorporating digital-focused activities into educational programs to equip students with the skills necessary for success in their future careers [17].

A literature review on the impact of digital skills on developing practical skills for the workplace was conducted in a study on digitally enhanced practical skill teaching and learning in health science education [18]. The study identified potential challenges and opportunities presented by technologically supported practical skill teaching, including inaccessibility and inequity of online learning, digital illiteracy among staff, technological challenges, lack of engagement with preparatory material hindering practical learning, lack of staff-student interaction, negative

attitudes towards online learning, and skill suitability. Furthermore, a review on the importance of digital skills training in the hospitality industry highlighted the significant impact of digital training on the development of employees' skills at their workplace [19]. The study emphasized the necessity for employees to improve their digital skills to effectively engage with the various operating systems used in daily operations. This underscores the role of digital skills in facilitating employee development and aligning with the technological demands of the industry.

Integrating digital skills into career development programs can be achieved through various strategies, such as authentic assessment, collaborative learning, the integration of technology in education, and data-driven storytelling. Authentic assessment enables students to engage in real-world projects aligned with their career aspirations, fostering enthusiasm and meaningful learning experiences [20]. Collaborative learning involves encouraging interaction among students, educators, and industry professionals, bridging the gap between academic and professional settings [21]. In conclusion, digital skills can play a significant role in developing practical skills for the workplace. Digital technologies can facilitate higher-order learning, provide a safe environment for practice, and promote autonomous learning, among other benefits. Activities in the digital domain can contribute to the development of digital skills and readiness for the workplace. These findings underscore the importance of integrating digital skills in education and industry to prepare students for the rapidly evolving workplace and the competitive job market.

During the pandemic COVID-19, majority of TVET institutions had difficulties in offering and assessing training in practical skills [22]. One of the changes toward remote learning modes is the use of digital skills into TVET teaching and learning. In both affluent and developing nations, the use of digital for TVET management and delivery surged during the epidemic. For some technical specializations, smart simulator technology may be a solution, but its effects on the learning environment and the necessary training must be carefully considered. To make students ready with the industry needs, the government must move swiftly, especially the Ministry of Education, to ensure that the next generation of workers has the skills needed to meet the demands of the modern workforce [23]. An alternate remedy would be to restructure the program using an outcome-based education strategy.

3. Methodology

3.1 Identification

A significant number of relevant publications were selected for this inquiry using the three core components of the systematic review methodology. Using dictionaries, thesauruses, encyclopaedias, and prior research, relevant terms are found, and keywords are chosen in the first step. Once all relevant terms have been selected, the search strings for the databases Scopus and Web of Science in Table 1 have been generated. For the current study subject, 739 publications were successfully retrieved from both databases in the first step of the systematic review approach.

Table 1
The search string

Scopus	TITLE-ABS-KEY (("digital skill*" OR "digital competenc*" OR "digital proficiency" OR "digitali*ation") AND ("technolog*" OR "information technology") AND ("career readiness" OR "job readiness" OR "work readiness" OR "industry readiness" OR "workplace preparedness" OR "career preparedness" OR "job preparedness" OR "work preparedness" OR "industry preparedness" OR "workplace preparedness" OR "transition" OR "school-to-work transition" OR "college-to-work transition" OR "apprenticeship") AND ("education" OR "learning" OR "literacy")) AND (LIMIT-TO (PUBYEAR , 2023)) AND (LIMIT-TO (DOCTYPE , "ar")) AND (LIMIT-TO (PUBSTAGE , "final")) AND (LIMIT-TO (LANGUAGE , "English"))
Web of	(("digital skill*" OR "digital competenc*" OR "digital proficiency" OR "digitali*ation") AND ("technolog*"

Science	OR "information technology") AND ("career readiness" OR "job readiness" OR "work readiness" OR "industry readiness" OR "workplace preparedness" OR "career preparedness" OR "job preparedness" OR "work preparedness" OR "industry preparedness" OR "workplace preparedness" OR "transition" OR "school-to-work transition" OR "college-to-work transition" OR "apprenticeship") AND ("education" OR "learning" OR "literacy")) (Topic) and 2023 (Publication Years) and Article (Document Types) and English (Languages)

3.2 Screening

Duplicate papers are eliminated during the first screening step once the articles have been discovered. To ensure that only original and unique materials were considered for further evaluation, duplicate papers were purposely removed from the initial screening. Twenty-four papers were removed from the first round because of duplicate material. Step two was started after 89 articles were carefully examined. Several well-considered inclusion and exclusion criteria were applied (Table 2). Research articles comprise a crucial criterion that was taken into consideration since they are the primary source of relevant information. Consequently, the current inquiry did not contain any systematic reviews, reviews, book series, books, chapters, meta-analyses, or conference proceedings. Additionally, only English-language publications were qualified for appraisal. It ought to be noticed that the methodology was produced for the latest one-year term (2023), during which time a sum of 650 articles was rejected in view of specific rules.

Table 2
The selection criterion in searching

Criterion	Inclusion	Exclusion
Language	English	Non-English
Timeline	2023	<2023
Literature type	Journal (Article)	Conference, book, review
Publication stage	Final	In press

3.3 Eligibility

For the third stage, the qualification assessment, 65 papers were gathered (Figure 1). At this step, we ensured that each article met the incorporation standards and was relevant to the objectives of the continuous concentrate by cautiously going over its title and central issues. Thirty-nine papers were excluded from the examination on the grounds that their titles were unessential, their modified works did not relate to the exploration issue or both, and they were not connected with the review's targets in view of exact information. In this manner, 26 articles were held for the extra survey.

3.4 Data Abstraction and Analysis

An integrative analysis was utilized as one of the review's assessment strategies to inspect and coordinate a few explorations draws near (quantitative, subjective, and blended techniques). Tracking down appropriate subjects and subtopics was the ability study's point. The subject's development began with the data collection. Figure 1 depicts how the authors methodically analysed a group of 26 publications for claims or facts related to the current study's issues. The authors then assessed relevant research on digital skills towards career readiness. All the research's results, as well as the methodologies used, are being scrutinized. Following that, the author and the other co-authors collaborated to develop themes based on the data within the research context.

Throughout the data analysis process, a log was kept recording any analyses, points of view, puzzles, or other notions that would be significant to the interpretation of the data. After comparing the outcomes, the authors looked for discrepancies in the theme design process. It is critical to recall that the authors explain any conceptual differences. To maintain uniformity, final changes were made to the produced themes. Two experts conducted the analytical selection to evaluate the genuineness of the issues. When the domain is specified, the expert review process finds it simpler to guarantee that each subtheme is distinct, substantial, and relevant.

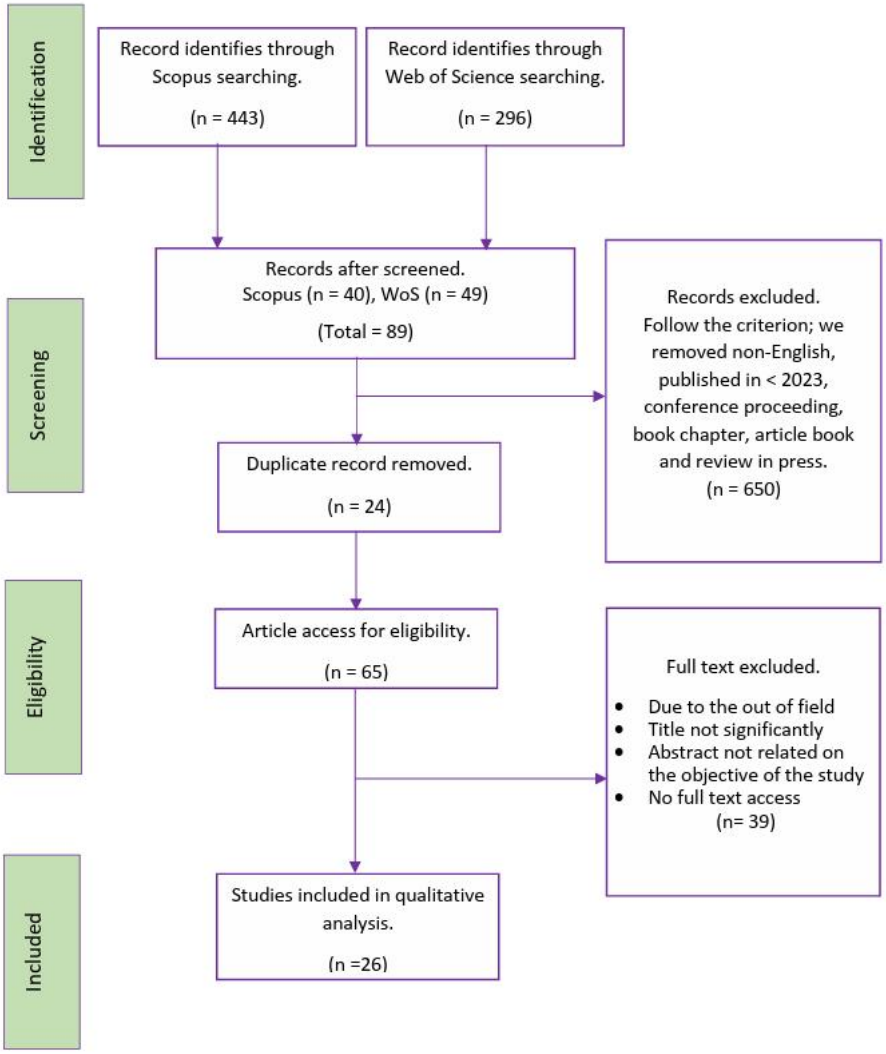

Fig. 1. The flow diagram of the proposed searching study [24]

4. Results and Findings

In the contemporary professional landscape, digital skills have emerged as a pivotal factor driving career readiness. Beyond mere proficiency with digital tools, digital skills encompass diverse skills that empower individuals to effectively navigate, evaluate, and create digital information. A fundamental aspect involves honing research skills for online information, enabling individuals to critically assess the reliability of sources and synthesize information for informed decision-making. Communication skills extend to proficiency in various digital platforms, including email, messaging apps, and collaborative tools, fostering effective interaction with colleagues, clients, and stakeholders in a virtual environment. Additionally, digital skills encourage a mindset of innovation

and adaptability, prompting individuals to embrace new technologies and contribute to novel solutions in a rapidly evolving professional landscape [25]. Creating and sharing digital content and analytical skills for interpreting data are integral to digital skills. Awareness of digital privacy and security issues is vital, as is the capacity to engage in continuous learning through online platforms and build a digital portfolio that showcases skills and achievements. As technology plays an increasingly central role in diverse industries, cultivating digital literacy emerges as a foundational element for long-term career success. All publications were classified into three categories: integration of digital skills in education (n=13) (Table 3), impact of digital skills on career readiness (n=5) (Table 4), and challenges to enhance digital skills (n=8) (Table 5).

Table 3
The research findings based on the proposed searching criterion. Theme 1: Integration of digital skills in education

Authors	Title	Journal	Method	Findings and Advantages
Xu J.; Zhu Y. [26]	Factors influencing the use of ICT to support students' self-regulated learning in a digital environment: The role of teachers in lower secondary education of Shanghai, China	Psychology in the Schools	Multilevel logistic regression using 2018 TALIS data from 3976 teachers in 198 schools in Shanghai	ICT use is significantly influenced by teachers' self-efficacy, preparedness, and professional development. The presence of ICT infrastructure and the amount of innovativeness within the school team does not have a major impact. Examine the effects of policy modifications on the ICT infrastructure at the school level in order to encourage the utilization of ICT with teacher support.
Steffen M.-T.; Fuhr H.; Joos S.; Koch R. [27]	'Hold the course(s)!' – a qualitative interview study of the impact of pandemic-triggered contact restrictions on online instruction in community-based family medicine teaching	Frontiers in Medicine	Qualitative interview study with 12 participants, analysing pre- and post-pandemic perspectives	Constructed a framework consisting of six sequential stages that outline the process of digital transformation in the field of family medicine education. Emphasizes the intricacies and effects of teaching on both the community and university levels. Examine the viability of the digital transformation process and its enduring impact on medical education practices.
Jalali M.; Moradi V.; Babaee T.; Aminian G.; Mojgani P.; Shahabi S. [28]	Online education for prosthetics and orthotics students in the era of COVID-19 pandemic in Iran: challenges, opportunities, and recommendations	BMC Medical Education	Qualitative study with semi-structured interviews, thematic analysis of data	Identified obstacles encompassing technical and socio-economic aspects, as well as opportunities related to technological innovations and flexible learning, in the field of P&O online education. Suggested measures consist of enhancing the technology infrastructure and implementing hybrid courses. Analyse the enduring effects of online education on the learning

				achievements and preparedness of P&O students.
Karkina S.; Mena J.; Valeeva R.; Yarmakeev I.; Dyganova E.; Bhullar M. [29]	Fostering future music teachers' professional skills: developing a signature pedagogy using e-learning	Frontiers in Education	Multi-case study with 124 students using a mixed-method approach	Created an internet-based educational program centred around distinctive teaching methods, greatly enhancing the music teacher trainees' professional abilities. Examine the ability of the trademark teaching method in music education to be expanded and duplicated in various educational institutions.
Tam C.-O.; Hui C.K.-Y. [30]	Teachers Curating Virtual Exhibitions for Learning Visual Arts: A Study of Impact and Effectiveness	International Journal of Art and Design Education	Study in six primary and secondary schools, focusing on the effectiveness of the 'teacher-curator pedagogy'	The implementation of the 'teacher-curator pedagogy' resulted in an improvement in the technological skills and self-assurance of instructors, leading to increased student engagement through virtual exhibitions. Examine approaches to address constraints such as the need for training, availability of suitable hardware and software, and challenges in evaluating the effectiveness of the 'teacher-curator pedagogy.
Abdellatif S.; Shomotova A.; Trabelsi S.; Husain S.; Alsalhi N.; Eltahir M. [31]	Transition to Distance Learning: Student Experience and Communication during the COVID-19 Pandemic in the United Arab Emirates	Sustainability (Switzerland)	Online survey and email survey at Ajman University in the UAE during the spring of 2020	Many individuals had access to digital tools, while a portion of them encountered unreliable internet connections. Students demonstrated a proficiency in digital technologies ranging from moderate to excellent. There has been a rise in the amount of time spent on digital communication, but it has also revealed a lack of proficiency in using digital technology. The communication aspect of the lessons had a beneficial effect on the level of communication among students. Explore methodologies to optimize instructor-student interaction in the online educational setting and address obstacles related to digital proficiency.
Holik I.; Kersánszki T.; Molnár G.; Sanda I.D. [32]	Teachers' Digital Skills and Methodological Characteristics of Online Education	International Journal of Engineering Pedagogy	Online questionnaire survey involving 292 educators from nine European countries in the	Respondents regarded enhanced digital proficiency as the most advantageous component of online education. Identified obstacles in motivating learners and perceived constraints in

			summer of 2022	comparison to traditional in-person education. Examine methods to increase the motivation of students in online education and overcome obstacles using creative teaching methods.
Tkachuk V.; Yechkalo Y.; Brovko D.; Sobczyk W. [33]	Augmented and Virtual Reality Tools in Training Mining Engineers	Inzynieria Mineralna	Methods implemented in laboratories of Kryvyi Rih National University, Ukraine, during the COVID-19 pandemic	The utilization of virtual and augmented reality technologies has shown its efficacy in training mining engineers during remote educational programs. Additional investigation is required to fully include contemporary digital technology in the training of mining engineers. Examine the utilization of virtual and augmented reality technologies in mining engineering education to assess its effects on students' skills and abilities in the long run.
Guraliuk A.; Zakatnov D.; Lapaenko S.; Ahalets I.; Varaksina N. [34]	Integrative Technology for Creating Electronic Educational Resources	International Journal of Engineering Pedagogy	Development of Ontos.xyz resource, an ontological graph editor	Ontos.xyz enables the generation of ontographs that depict the organization of Entity-Relationship Models (EERs) along with relevant contextual details. This enables the integration of data from various sources and the ability to adapt to any subject area. Examine the potential of Ontos.xyz to handle increasing demands in various educational settings and analyse the effects of ontological methods on students' academic achievements.
Makarova I.; Mustafina J.; Boyko A.; Fatikhova L.; Parsin G.; Buyvol P.; Shepelev V. [35]	A Virtual Reality Lab for Automotive Service Specialists: A Knowledge Transfer System in the Digital Age	Information (Switzerland)	Development and presentation of virtual laboratories for automotive service education, including functionality and scenarios	Virtual laboratories utilizing virtual reality (VR) technologies have demonstrated superior efficacy compared to conventional techniques, resulting in heightened student engagement and improved academic outcomes. The immersive quality of virtual reality (VR) technology enhances the process of comprehending and integrating information. Examine the lasting effects of virtual reality (VR) virtual laboratories on students' ability to retain knowledge and develop digital skills relevant to

				high-tech industries.
Doz E.; Cuder A.; Caputi M.; Pellizzoni S.; Passolunghi M.C. [36]	Distance learning environment: a perspective of Italian primary and secondary teachers during COVID-19 pandemic	Learning Environments Research	Content analysis of a semi-structured questionnaire administered to 270 primary and secondary teachers between April and May 2020	The majority of teachers implemented both synchronous and asynchronous modalities. The primary vulnerabilities were technology deficiencies and a dearth of interactions. Implementing distance learning in primary schools posed greater challenges compared to secondary education. Teachers encountered adverse emotions; however, a few expressed fortitude and optimism. Examine methods to improve the quality of remote education, particularly in elementary schools, and explore approaches to promote the mental and emotional health of teachers amid similar emergencies.
Subramanian S.; Kleib M. [37]	Leveraging Clinical Preceptorship to Enhance Nursing Students' Readiness in Digital Health	Quality Advancement in Nursing Education	Discussion paper presenting arguments for the integration of nursing informatics in clinical nursing education and the role of preceptors	Highlights the necessity of promoting the progress of clinical nursing education to improve the preparedness of nursing students in the field of digital health. Advocates for additional investigation into the function of preceptors in promoting this state of preparedness. Examine the efficacy of incorporating nursing informatics into nursing education and evaluate the influence of improved preceptorship experiences on nursing students' preparation for digital health.
Pang T.Y.; Lee T.-K.; Murshed M. [38]	Towards a New Paradigm for Digital Health Training and Education in Australia: Exploring the Implication of the Fifth Industrial Revolution	Applied Sciences (Switzerland)	Presentation of a new paradigm leveraging Industry 5.0-enabling technologies for educating healthcare professionals	Emphasizes the capacity of the suggested paradigm to connect the training and the professional environment in the digital health sector. Highlights the significance of cutting-edge technologies in developing individuals who are prepared for employment. Examine the real-world use of the suggested model in educational programs and evaluate its efficacy in equipping students for the digital health sector. Examine the difficulties and potential advantages associated with implementing Industry 5.0 technology in healthcare

				education.

Table 4
The research findings based on the proposed searching criterion. Theme 2: Impact of digital skills on career readiness

Authors	Title	Journal	Method	Findings and Advantages
Feng Y.; Wang Y.; Liang C.; Lu L.; Xie C. [39]	The effect of digitalization on the career intentions of nursing students: A cross-sectional study	Nurse Education in Practice	A cross-sectional study with 549 geriatric nursing students employed a questionnaire covering expectation confirmation, perceived usefulness, perceived safety, digital technology satisfaction, task fit, job satisfaction, and career intentions.	Students' career intentions are positively influenced by confirming their expectations for digital technologies in elderly care services. The influence of perceived security on digital technology satisfaction is not statistically significant, and the impact of job satisfaction on career intentions is also not statistically significant. Investigate methods to optimize the digital work environment in order to effectively facilitate student needs. Examine the utilization of sophisticated and suitable technological tools in educational and therapeutic settings to enhance the quality of the learning process.
Urbanek A.; Losa A.; Wieczorek-Kosmala M.; Hlaváček K.; Lokaj A. [40]	Did the Quality of Digital Communication Skills in Education Improve after the Pandemic? Evidence from HEIs	Sustainability (Switzerland)	Exploratory research assessing the quality of digital communication skills between students and teachers during and after the COVID-19 pandemic, comparing satisfaction levels.	Following the COVID-19 epidemic, there has been a notable and statistically significant enhancement in the proficiency of digital communication abilities among both students and teachers. The epidemic has had a beneficial impact on the adoption and use of digital education technology, leading to increased efficiency. Examine the long-term effects of the COVID-19 pandemic on the proficiency of digital communication abilities in higher education. Examine tactics to enhance proficiency in digital communication and tackle obstacles that may arise due to heightened dependence on digital technologies.
Glushenkova M.; Zagato M. [41]	Effect of COVID-19 on digitalization of higher education. A tale of one business school	Journal of University Teaching and Learning Practice	Analysis based on interview responses from twelve business school teachers at a Sino-foreign university in China. Examines changes in perception, factors acting as barriers, and the role	The perception of e-learning experienced a positive shift following a semester of mandatory remote teaching. Obstacles encompass substandard Internet quality, excessive workload, and absence of training in online

			of online teaching elements despite challenges.	pedagogy. Teachers commonly include online teaching components despite obstacles. Examine the lasting effects of emergency remote teaching on the continuous enhancement of perceptions toward online instruction. Examine methods to surmount obstacles hindering the acceptance of e-learning in higher education.
Palomino C.L.; Marín S.C.O.; Betancur V.R.; Semenic S. [42]	Impact of the COVID-19 pandemic on the nursing students' education in a public university in Colombia	Investigacion y Educacion en Enfermeria	Descriptive qualitative study using content analysis of virtual online interviews with 14 undergraduate nursing students. Addresses challenges, supportive factors, and opportunities related to nursing education during the pandemic.	The identified categories encompass the following areas: the process of adapting to online learning, effectively navigating the digital realm, the effects on clinical training, and pressures related to employment. The challenges encompassed in this context involve factors such as the conditions of one's living environment, limited opportunities for social connections, restricted access to technology, and inadequate training for clinical practice. Possibilities encompass the enhancement of digital competencies. Explore methodologies to optimize the online learning encounters for nursing students. Evaluate the enduring effects of the pandemic on the advancement of digital proficiencies in nursing education.
Glotova A.; Samoylenko N.; Zharko L.; Georgiadi A.; Shevchenko M. [43]	Shadow education: Shapes of private tutoring in an e-learning environment	E-Learning and Digital Media	Review of legislative sources, analysis of tutoring services, an overview of educational platforms, and a questionnaire to academic staff at three universities. Discusses the advantages and disadvantages of private tutoring.	The inadequate quality of education and misalignment with job market demands have led to a significant demand for private tutoring services. Educators engage in online tutoring as a supplementary professional endeavour. Examine the legal structures that underpin private tutoring in different locations and countries. Analyse the enduring consequences of private tutoring on the quality of education. Evaluate the efficacy of digital educational resources employed in individualized instruction.

Table 5
The research findings based on the proposed searching criterion. Theme 3: Challenges to enhance digital skills

Authors	Title	Journal	Method	Findings and Advantages
Phan d.m.; dinh h.t. [44]	Digital transformation of business community in globalization: an empirical study in a typical developing country	Eastern-European journal of enterprise technologies	Positivist analysis using quantitative (5-point scale/percentage point assessment) and qualitative indicators (structured observations, in-depth interviews, literature review).	Nearly 90% of Vietnamese organizations have an understanding of digital transformation (dx), while 40% allocate a budget for dx consultation, and 20% do not have a budget for dx. The industries that are most prepared for direct delivery of products and services have the highest level of dx readiness. The challenges encompass worries around personal data, expenses associated with technology investment, and opposition to changing company habits. Analyse the influence of particular obstacles on the preparedness for diagnosis. Explore methodologies to surmount obstacles in the implementation of diagnostic solutions. Analyze the impact of government policies on the promotion of dx.
Dai k.; garcia j.; olave-encina k. [45]	In-between worlds: Chilean university lecturers' experiences of teaching transition between face-to-face and virtual reality contexts during the COVID-19 pandemic	Educational technology research and development	Qualitative exploratory study using interviews with 18 Chilean lecturers.	The process of shifting from traditional to virtual teaching is intricate, as it involves transforming one's identity and agency through a state of being in-between and acquiring various digital skills. Participants were instructed using an intermediate approach facilitated by several teaching methods. Conduct a thorough investigation into the intermediate mode and its influence on the effectiveness of teaching. Examine supplementary variables that

				impact instructors' shift to virtual worlds. Evaluate the enduring impact of virtual world adoption on instructional methodologies.
Mospan N. [46]	Trends in emergency higher education digital transformation during the COVID-19 pandemic	Journal of University Teaching and Learning Practice	Systematic literature review, case studies, and descriptive survey research with 468 students and 179 lecturers from four Ukrainian universities.	The global shift to emergency higher education during 2020-2021 was marked by a lack of preparation and a wide range of challenges. Universal ramifications encompass variations in preparedness, teaching methods, financial assistance, integration of educational technology, and inclusivity in the shift to online education. Divergent preferences on the future method of education have been observed between professors and Generation Z students. Analyse the different approaches taken by higher education institutions in reaction to emergencies in specific geographical areas. Examine the difficulties encountered by universities during the process of transitioning. Analyse the influence on various scholarly fields.
Awdziej m.; jaciow m.; lipowski m.; tkaczyk j.; wolny r. [47]	Students' digital maturity and its implications for sustainable behaviour	Sustainability (Switzerland)	An online survey (cawi) was conducted with 358 students from three Polish universities.	Proficiency in digital skills has a favourable impact on the acceptability of digital transformation in universities. Acceptance is influenced by personal innovation and motivation. The acceptance of digital transformation has a favourable impact on the pleasure of online learning. Participation in online learning has a negligible effect on informal digital learning. The moderating effects of commitment to sustainable development are negligible. Examine the digital skills that have an impact on acceptability. Analyse the disparities in digital advancement among various academic fields. Evaluate the impact of digital maturity on the efficacy of online instructional techniques.

Mospan N. [48]	Digitalisation of writing in higher education: the COVID-19 pandemic impact	Journal of University Teaching and Learning Practice	Empirical evidence was gathered through quantitative and qualitative research methods involving surveys of higher education teachers and students in a Ukrainian university during the 2020-22 lockdowns.	The COVID-19 epidemic has prompted the adoption of digital formats in higher education, leading to the digitization of writing. This shift has also facilitated the emergence of new collaborative methods in the realm of digital writing. Emerging approaches encompass comprehensive depictions and visual representations of interactive educational exercises augmented by supplementary information and communication technology (ICT) resources. Examine the precise influence of digital writing on cooperation in virtual educational settings. Evaluate the enduring impacts of the heightened digitization of writing in higher education. Examine the many ways of writing that exist in various academic fields.
Child g.s.; song k. [49]	Digital inequities: promoting digital justice during the COVID-19 pandemic	Sustainability (Switzerland)	Semi-structured focus group interviews with 12 us content teachers, data collected and analysed through open and axial coding.	The COVID-19 pandemic has necessitated the integration of digital platforms in higher education, resulting in the conversion of writing into digital media. This transition has also enabled the rise of novel collaborative techniques in the domain of digital writing. New methods involve detailed descriptions and visual displays of interactive instructional activities enhanced by additional information and communication technology (ICT) resources. Analyse the specific impact of digital writing on collaboration in virtual educational environments. Analyse the long-lasting effects of the increased digitization of writing in higher education. Analyse the diverse methodologies of written expression that are employed throughout different academic disciplines.
Leshchenko m.; lavrysh y.; halatsyn k.; feshchuk a.; prykhodko d.	Technology-enhanced personalized language learning: strategies and	International journal of emerging technologies in learning	An empirical study among 101 students from two universities involving surveys on personalized learning	The implementation of technology-enhanced personalized learning methodologies has led to an improvement in students'

[50]	challenges		skills and digital resources ranking.	personalized learning skills and their view of this educational phenomenon. There is no discernible disparity in the outcomes of students hailing from various universities. Illustrations of the practical implementation of digital resources are presented. Examine the ability of technology-enhanced individualized learning methodologies to be expanded and used to other contexts. Analyse the differences in individualized learning abilities across various academic fields. Evaluate the enduring effects of individualized learning on students' attainment of their professional potential.
Feldman j.; czerniewicz l. [51]	Transitions in education: educators, digitalisation, and datafication	Journal of Education (South Africa)	Data from four focus group discussions with 19 educators in diverse South African contexts. Framed by archer's nuanced concepts of agency.	During the pandemic, educators engaged in the negotiation of educational programs while socio-technical systems underwent transformation. The main concerns revolved around the management of the educational setting, the role of major technology companies in education, the involvement of many parties, and the choice of digital tools and systems. Educators exhibited a sense of dread and discomfort; however, they maintained a reflective and proactive role. Examine the lasting impacts of increased digitization and data collection on the autonomy of educators. Examine methods to improve instructors' authority and decision-making in digital instructional settings. Evaluate the influence of different business models on the level of discomfort and unease experienced by educators.

5. Conclusions

The most obvious finding to emerge from this study is that the use of ICT in education is influenced by various factors such as instructors' self-viability, readiness, and professional development, as well as the creativity of the school team and the availability of ICT infrastructure. Additionally, the text highlights the challenges and opportunities in online education, the

effectiveness of virtual and augmented reality technologies in training, and the benefits of virtual laboratories using VR technologies. The main weaknesses identified were technology deficiencies and a lack of communication in the implementation of instructional modalities.

It was also shown that students' expectations for digital technologies in elderly care services positively influence their career intentions, while perceived security and job satisfaction do not have a statistically significant impact. It is important to optimize the digital work environment to meet student needs. The COVID-19 epidemic has significantly improved digital communication abilities among students and teachers, leading to increased efficiency in digital education technology. Despite obstacles such as substandard Internet quality and excessive workload, teachers continue to incorporate online teaching components. Challenges in this context include living conditions, limited social connections, restricted access to technology, and inadequate clinical practice training. There is a demand for private tutoring services due to the inadequate quality of education and misalignment with job market demands.

In summary, Vietnamese organizations have varying levels of readiness for digital transformation, with some allocating a budget for consultation while others do not. The challenges faced in this process include concerns about personal data, expenses related to technology investment, and resistance to changing company habits. In the context of higher education, the COVID-19 pandemic has necessitated the integration of digital platforms and the adoption of new collaborative methods in the domain of digital writing. Additionally, the implementation of technology-enhanced personalized learning methodologies has shown improvement in students' personalized learning skills, with no discernible differences in outcomes between students from different universities. Educators have faced challenges negotiating educational programs and adapting to socio-technical transformations but have maintained a reflective and proactive role.

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References

[1] Carlisle, Sheena, Stanislav Ivanov, and Corné Dijkmans. "The digital skills divide: evidence from the European tourism industry." *Journal of tourism futures* 9, no. 2 (2023): 240-266. https://doi.org/10.1108/JTF-07-2020-0114

[2] Stofkova, Jana, Adela Poliakova, Katarina Repkova Stofkova, Peter Malega, Matej Krejnus, Vladimira Binasova, and Naqibullah Daneshjo. "Digital skills as a significant factor of human resources development." *Sustainability* 14, no. 20 (2022): 13117. https://doi.org/10.3390/su142013117

[3] Van Laar, Ester, Alexander JAM Van Deursen, Jan AGM Van Dijk, and Jos De Haan. "Determinants of 21st-century skills and 21st-century digital skills for workers: A systematic literature review." *Sage Open* 10, no. 1 (2020): 2158244019900176. https://doi.org/10.1177/2158244019900176

[4] Haleem, Abid, Mohd Javaid, Mohd Asim Qadri, and Rajiv Suman. "Understanding the role of digital technologies in education: A review." *Sustainable operations and computers* 3 (2022): 275-285. https://doi.org/10.1016/j.susoc.2022.05.004

[5] A'mar, Fadia, and Derar Eleyan. "Effect of principal's technology leadership on teacher's technology integration." *International Journal of Instruction* 15, no. 1 (2022): 781-798. https://doi.org/10.29333/iji.2022.15145a

[6] Vargo, Deedra, Lin Zhu, Briana Benwell, and Zheng Yan. "Digital technology use during COVID-19 pandemic: A rapid review." *Human Behavior and Emerging Technologies* 3, no. 1 (2021): 13-24. https://doi.org/10.1002/hbe2.242

[7] Reddy, Pritika, Kaylash Chaudhary, and Shamina Hussein. "A digital literacy model to narrow the digital literacy skills gap." *Heliyon* 9, no. 4 (2023). https://doi.org/10.1016/j.heliyon.2023.e14878

[8] Nikou, Shahrokh, Mark De Reuver, and Matin Mahboob Kanafi. "Workplace literacy skills—how information and digital literacy affect adoption of digital technology." *Journal of Documentation* 78, no. 7 (2022): 371-391. https://doi.org/10.1108/JD-12-2021-0241

[9] Suwarto, Dyna Herlina, Benni Setiawan, and Siti Machmiyah. "Developing digital literacy practices in Yogyakarta elementary schools." *Electronic Journal of E-Learning* 20, no. 2 (2022): pp101-111. https://doi.org/10.34190/ejel.20.2.2602

[10] Kim, Hye Jeong, Ah Jeong Hong, and Hae-Deok Song. "The roles of academic engagement and digital readiness in students' achievements in university e-learning environments." *International Journal of Educational Technology in Higher Education* 16, no. 1 (2019): 1-18. https://doi.org/10.1186/s41239-019-0152-3

[11] Puriwat, Wilert, and Suchart Tripopsakul. "Preparing for Industry 4.0--Will Youths Have Enough Essential Skills?: An Evidence from Thailand." *International Journal of Instruction* 13, no. 3 (2020): 89-104. https://doi.org/10.29333/iji.2020.1337a

[12] Ananta, Mahardeka Tri, Lutfi Fanani, Ivanna Adista Sihombing, and Zainul Abidin. "User Experience Design for Information Technology Career Preparation Platform Using the Design Thinking Method." *Journal of Information Technology and Computer Science* 8, no. 2 (2023): 125-136. https://doi.org/10.25126/jitecs.202382559

[13] Potgieter, Ingrid, Melinde Coetzee, and Nadia Ferreira. "University students' digital world of work readiness in relation to their employability competency." *Journal of Learning Development in Higher Education* 27 (2023). https://doi.org/10.47408/jldhe.vi27.922

[14] Tzafilkou, Katerina, Maria Perifanou, and Anastasios A. Economides. "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, no. 12 (2023): 16017-16040. https://doi.org/10.1007/s10639-023-11848-9

[15] Vitalii, Honcharuk, "Digital competence as a component of professional culture of teacher," *Humanity Science Current issues* (2021). https://doi.org/10.24919/2308-4863/41-1-31

[16] Risdwiyanto, Andriya, Bambang Sugeng Dwiyanto, Jemadi Jemadi, Djoko Wijono, and Etty Sri Hertini. "The Impact of Marketing Education Integration with Industry in Improving Student Career Readiness." *Indo-MathEdu Intellectuals Journal* 4, no. 2 (2023): 509-523. https://doi.org/10.54373/imeij.v4i2.232

[17] v Swingler, Maxine, Archie Roy, Aikaterini Manoli, Maria Gardani, William Hasty, Debra Macfarlane, Anoushka Kapoor, and Grigorios Kokkinidis. "Bridging the gap: skill development in curricular, co-curricular and extra-curricular activities and the impact on readiness for employment." (2022). https://doi.org/10.35542/osf.io/dvhmf

[18] Forde, Cuisle, and Annie OBrien. "A literature review of barriers and opportunities presented by digitally enhanced practical skill teaching and learning in health science education." *Medical education online* 27, no. 1 (2022): 2068210. https://doi.org/10.1080/10872981.2022.2068210

[19] Yaacob, Siti Alwani Mat, Wan Nazriah Wan Nawawi, Noorazlin Ramli, Malina Hanum Mohd Kamal, and Hayati Adilin Abd Majid. "The Importance of Digital Skills Training Towards Employees' Development in the Hospitality Industry." *International Journal of Business and Technology Management* 5, no. S1 (2023): 283-291.

[20] Joyner, Jessica Lee, and Kelly L. O'Donnell. "Developing data literacy skills and connecting the student experience in the classroom to the community through biodiversity projects." (2021). https://doi.org/10.24918/cs.2021.13

[21] Shaw, Mary. "Time to move on." *International journal of epidemiology* 37, no. 3 (2008): 427-429. https://doi.org/10.1093/ije/dyn076

[22] Masrom, Maslin, Mohd Nazry Ali, Wahyunah Ghani, and Amirul Haiman Abdul Rahman. "The ICT implementation in the TVET teaching and learning environment during the COVID-19 pandemic." *International Journal of Advanced Research in Future Ready Learning and Education* 28, no. 1 (2022): 43-49.

[23] Zaini, Zaryati, and Mardhiah Binti Shari. "Kajian Keberkesanan Latihan Industri Pelajar Sijil Teknologi Elektrik (Tahun 2018-2020), Kolej Komuniti Jelebu dari Persepsi Majikan: Study of the Effectiveness of Industrial Training for Electrical Technology Certificate Students (Year 2018-2020), Jelebu Community College from the Perception of Employers." *International Journal of Advanced Research in Future Ready Learning and Education* 28, no. 1 (2022): 17-23.

[24] Moher, David, Larissa Shamseer, Mike Clarke, Davina Ghersi, Alessandro Liberati, Mark Petticrew, Paul Shekelle, Lesley A. Stewart, and Prisma-P Group. "Preferred reporting items for systematic review and meta-analysis protocols (PRISMA-P) 2015 statement." *Systematic reviews* 4 (2015): 1-9. https://doi.org/10.1186/2046-4053-4-1

[25] Roslan, Nur Widad, Normaliza Abd Rahim, Nur Maisarah Roslan, and Siti Nur Aliaa Roslan. "Students' presupposition towards incooperating AI (Artifical Intelligence) technology in virtual and face-to-face classes." *International Journal of Advanced Research in Future Ready Learning and Education* 27, no. 1 (2022): 16-19.

[26] Xu, Jinjie, and Yan Zhu. "Factors influencing the use of ICT to support students' self-regulated learning in digital environment: The role of teachers in lower secondary education of Shanghai, China." *Psychology in the Schools* 60, no. 11 (2023): 4312-4331. https://doi.org/10.1002/pits.22938

[27] Steffen, Marie-Theres, Hannah Fuhr, Stefanie Joos, and Roland Koch. "'Hold the course (s)!'–a qualitative interview study of the impact of pandemic-triggered contact restrictions on online instruction in community-

based family medicine teaching." *Frontiers in Medicine* 10 (2023): 1231383. https://doi.org/10.3389/fmed.2023.1231383

[28] Jalali, Maryam, Vahideh Moradi, Taher Babaee, Gholamreza Aminian, Parviz Mojgani, and Saeed Shahabi. "Online education for prosthetics and orthotics students in the era of COVID-19 pandemic in Iran: challenges, opportunities, and recommendations." *BMC Medical Education* 23, no. 1 (2023): 342. https://doi.org/10.1186/s12909-023-04339-5

[29] Karkina, Svetlana, Juanjo Mena, Roza Valeeva, Iskander Yarmakeev, Elena Dyganova, and Mandeep Bhullar. "Fostering future music teachers' professional skills: developing a signature pedagogy using e-learning." In *Frontiers in Education*, vol. 8, p. 1162748. Frontiers Media SA, 2023. https://doi.org/10.3389/feduc.2023.1162748

[30] Tam, Cheung-On, and Claire Ka-Yan Hui. "Teachers Curating Virtual Exhibitions for Learning Visual Arts: A Study of Impact and Effectiveness." *International Journal of Art & Design Education* 42, no. 3 (2023): 469-485. https://doi.org/10.1111/jade.12471

[31] Abdellatif, Soumaya, Aizhan Shomotova, Safouane Trabelsi, Salwa Husain, Najeh Alsalhi, and Mohamed Eltahir. "Transition to Distance Learning: Student Experience and Communication during the COVID-19 Pandemic in the United Arab Emirates." *Sustainability* 15, no. 8 (2023): 6456. https://doi.org/10.3390/su15086456

[32] Holik, Ildikó, Tamás Kersánszki, György Molnár, and István Dániel Sanda. "Teachers' Digital Skills and Methodological Characteristics of Online Education." *International Journal of Engineering Pedagogy* 13, no. 4 (2023). https://doi.org/10.3991/ijep.v13i4.37077

[33] TKACHUK, Viktoriia, Yuliia YECHKALO, Dmytro BROVKO, And Wiktoria SOBCZYK. "Narzędzia rozszerzonej i wirtualnej rzeczywistości w szkoleniu inżynierów górnictway." *Inżynieria Mineralna* 1, no. 1 (51) (2023): 137-146. https://doi.org/10.29227/http://doi.org/10.29227/IM-2023-01-17

[34] Guraliuk, Andrii, Dmytro Zakatnov, Svitlana Lapaenko, Inna Ahalets, and N. V. Varaksina. "Integrative technology for creating electronic educational resources." *International Journal of Engineering Pedagogy (iJEP)* 3, no. 13 (2023): 68-79. https://doi.org/10.3991/ijep.v13i3.36109

[35] Makarova, Irina, Jamila Mustafina, Aleksey Boyko, Larisa Fatikhova, Gleb Parsin, Polina Buyvol, and Vladimir Shepelev. "A virtual reality lab for automotive service specialists: A knowledge transfer system in the digital age." *Information* 14, no. 3 (2023): 163. https://doi.org/10.3390/info14030163

[36] Doz, Eleonora, Alessandro Cuder, Marcella Caputi, Sandra Pellizzoni, and Maria Chiara Passolunghi. "Distance learning environment: perspective of Italian primary and secondary teachers during COVID-19 pandemic." *Learning Environments Research* 26, no. 2 (2023): 555-571. https://doi.org/10.1007/s10984-022-09451-9

[37] Subramanian, Shrinithi, and Manal Kleib. "Leveraging Clinical Preceptorship to Enhance Nursing Students' Readiness in Digital Health." *Quality Advancement in Nursing Education-Avancées en formation infirmière* 9, no. 3 (2023): 6. https://doi.org/10.17483/2368-6669.1412

[38] Pang, Toh Yen, Tsz-Kwan Lee, and Manzur Murshed. "Towards a New Paradigm for Digital Health Training and Education in Australia: Exploring the Implication of the Fifth Industrial Revolution." *Applied Sciences* 13, no. 11 (2023): 6854. https://doi.org/10.3390/app13116854

[39] Feng, Yuting, Ying Wang, Changyong Liang, Liyan Lu, and Chenze Xie. "The effect of digitalization on the career intentions of nursing students: A cross-sectional study." *Nurse Education in Practice* 71 (2023): 103726. https://doi.org/10.1016/j.nepr.2023.103726

[40] Urbanek, Anna, Anna Losa, Monika Wieczorek-Kosmala, Karel Hlaváček, and Aleš Lokaj. "Did the Quality of Digital Communication Skills in Education Improve after the Pandemic? Evidence from HEIs." *Sustainability* 15, no. 15 (2023): 11878. https://doi.org/10.3390/su151511878

[41] Glushenkova, Marina, and Margherita Zagato. "Effect of COVID-19 on digitalisation of higher education. A tale of one business school." *Journal of University Teaching & Learning Practice* 20, no. 6 (2023): 10. https://doi.org/10.53761/1.20.6.10

[42] Leon Palomino, Cecilia, Sandra Catalina Ochoa Marín, Vanessa Restrepo Betancur, and Sonia Semenic. "Impact of the COVID-19 pandemic on the nursing students' education in a public university in Colombia." *Investigación y Educación en Enfermería* 41, no. 1 (2023). https://doi.org/10.17533/udea.iee.v41n1e11

[43] Glotova, Alexandra, Nataliya Samoylenko, Ludmila Zharko, Alexandra Georgiadi, and Maria Shevchenko. "Shadow education: Shapes of private tutoring in e-learning environment." *E-Learning and Digital Media* 20, no. 4 (2023): 314-330. https://doi.org/10.1177/20427530221109716

[44] Phan, Duc Minh, and Ha Thu Dinh. "Digital Transformation of Business Community in Globalization: An Empirical Study in a Typical Developing Country." *Eastern-European Journal of Enterprise Technologies* 123, no. 13 (2023). https://doi.org/10.15587/1729-4061.2023.283251

[45] Dai, Kun, Jaime Garcia, and Karen Olave-Encina. "In-between worlds: Chilean university lecturers' experiences of teaching transition between face-to-face and virtual reality contexts during the COVID-19 pandemic." *Educational technology research and development* 71, no. 4 (2023): 1851-1867. https://doi.org/10.1007/s11423-023-10217-0

[46] Мосьпан, Наталя Вікторівна. "Trends in emergency higher education digital transformation during the COVID-19 pandemic." *Journal of University Teaching & Learning Practice* 20 (2023): 1. https://doi.org/10.53761/1.20.01.05

[47] Awdziej, Marcin, Magdalena Jaciow, Marcin Lipowski, Jolanta Tkaczyk, and Robert Wolny. "Students digital maturity and its implications for sustainable behavior." *Sustainability* 15, no. 9 (2023): 7269. https://doi.org/10.3390/su15097269

[48] Mospan, Natalia. "Digitalisation of writing in higher education: The COVID-19 pandemic impact." *Journal of University Teaching and Learning Practice* 20, no. 2 (2023). https://doi.org/10.53761/1.20.02.08

[49] Child, Gregory Scott, and Kim Song. "Digital Inequities: Promoting Digital Justice during the COVID-19 Pandemic." *Sustainability* 15, no. 17 (2023): 12862. https://doi.org/10.3390/su151712862

[50] Leshchenko, Mariya, Yuliana Lavrysh, Kateryna Halatsyn, Alla Feshchuk, and Dmytro Prykhodko. "Technology-Enhanced Personalized Language Learning: Strategies and Challenges." *International Journal of Emerging Technologies in Learning* 18, no. 13 (2023). https://doi.org/10.3991/ijet.v18i13.39905

[51] Feldman, Jennifer, and Laura Czerniewicz. "Transitions in education: Educators, digitalisation, and datafication." *Journal of Education (University of KwaZulu-Natal)* 92 (2023): 41-57. https://doi.org/10.17159/2520-9868/i92a03