



DIGITALIZATION OF EDUCATION IN THE EUROPEAN UNION AND EFFECTS ON THE KNOWLEDGE ECONOMY

Vesna Petrović^{a,1}, Carolina Timbalari^{b,2}

^a Fakultet poslovne ekonomije, Bijeljina, Univerzitet u Istočnom Sarajevu

^b Lucian Blaga University of Sibiu, Romania

ARTICLE INFO

Received 12/15/2024
Sent to revision 12/16/2024
Accepted 12/23/2024
Available online 12/30/2024

Keywords:

Digitalization
Education
European Union
knowledge economy

ABSTRACT

The research of this topic is initiated by global digital transformation processes, and transition to digital economy and digital society. Digitalization in education is closely related to a new way of studying and living in a digital environment and the emergence of generations who were born and study in the specific environment. This process has been strengthened by the global pandemic and the intention to establish a continuous educational process in these circumstances through online learning. This article examines the process of digitalization of education in the countries of the European Union and the effects on the knowledge economy. The research questions evolve around the main aspects of the digital technology impact on education. The aim of the research is to collect and analyze how digital technologies have been implemented into educational system of the EU and what are the most prominent educational methods. There is no doubt that digital technology enriches learning opportunities and provides access to a great amount of information and resources. Digital technology has a huge potential for improving education, including high education. However, it also has its advantages and disadvantages. The purpose of the study is to present and critically comprehend the directions of digitalization in education, as well as its effects on modelling policies in education and science in the European Union.

Introduction

The main aim of the paper is the analysis of the current state of digitalization in education and its effects on the development of the knowledge economy. Digitalization in education entails various technologies and platforms used in the educational process, including online learning, e-learning, digital tools, etc. In order to examine the impact of digitalization on education it is important to analyze how the integration of digital technologies, such as e-learning platforms, online courses, implementation of the artificial intelligence (AI) in education can influence reshaping of the educational landscape. The objective of the paper is also to explore the benefits and challenges associated with digitalization in education, such as increased access to learning, enhanced student engagement or concerns about digital divide.

A significant number of educational stakeholders are concerned about the issue of digitalization in higher educational institutions (HEIs). Digital skills are becoming more pertinent throughout every context, particularly in the workplace. As a result, one of the key purposes for universities has shifted to preparing future managers to address issues and look for solutions, including information literacy as a vital set of skills. The research of educational technology advances in higher education is now being discussed and debated, with various laws, projects, and tactics being offered. There are still many different types of digital divisions that exist in our society, and they affect the younger generation and their digital futures. Today's students do not have the same level of preparation for the technology-rich society they will have.

¹ vesna.petrovic@fpe.ues.rs.ba

² timbalari.carolina@gmail.com

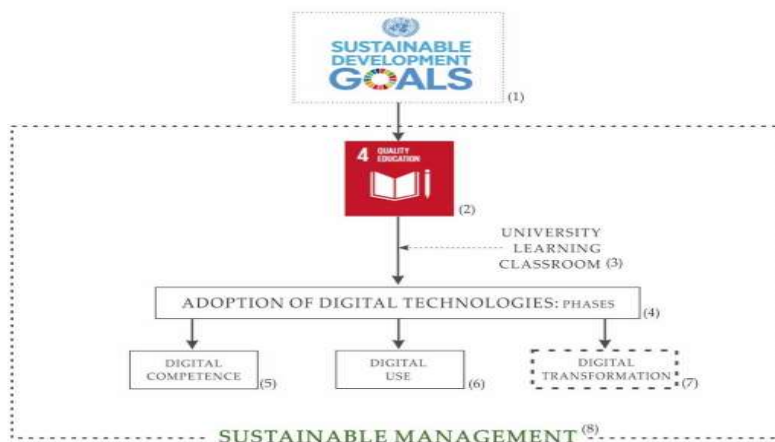
Universities and teaching should go through a significant digital transformation to fulfil the demands of today's generation and the fully digitized world they will be living in (Akour & Alenzi, 2022).

Students use mobile gadgets to refresh their learning processes and increase their efficiency in their daily work. Also, students have developed because of the accessibility of knowledge and are more autonomous. Additionally, educators have modified their methods and taken advantage of increased accessibility. However, this could also call for more accessibility, as there are many instances where students communicate with their professors anytime or at night (Batista, 2021). Study on the assessment of the perspective of digital learning is that learning has been impacted by technological advancement and that, as a result of the opportunities offered by digital technology, the academic community has improved its understanding of implicit technology and how it is perceived and used by all. Digital learning made it easier to comprehend the possibilities, advantages, and constraints of the technology that should be researched for use in academic learning (Cilliers, 2017). The effectiveness of students' use of e-learning platforms was examined in different studies this analysis looked into the students' reliance on, adoption of, and integration of technology into academic activities. The study patterns vary, and students' opinions of the platforms' utility and usability are related to their desire to utilize them successfully. Therefore, institutions should encourage and support integrating e-learning platform functions into teaching-learning activities (Moreno, 2017). Higher education institutions are extremely important when it comes to solving technology-related joblessness in developing nations (Goulart, 2022).

Digitalization in education is closely related to a new way of studying and living in a digital environment and the emergence of generations who were born and study in the specific environment. This process has been strengthened by the global pandemic and the intention to establish a continuous educational process in these circumstances through online learning. This article examines the process of digitalization of education and the effects on the knowledge economy. The research questions evolve around the main aspects of the digital technology impact on education. The aim of the research is to collect and analyze how digital technologies have been implemented into educational system of the EU and what are the most prominent educational methods. The purpose of the paper is to present and critically comprehend the directions of digitalization in education, as well as its effects on modelling policies in education and science in the European Union. Digitalization is crucial for the educational system in the EU in the context of global challenges and competition in the knowledge economy. Therefore, the European Union pays special attention to the digitization of education through various documents, policies, strategies, programs and projects.

On the global level, United Nation's Sustainable development agenda and its goals include the goal number four, which deals with Quality education. The Figure 1 presents the conceptual structure of the sustainable management of digital education in higher education. In order to adopt digital technologies in the higher education there are three phases: acquiring of the digital competences, digital use and digital transformation.

Figure 1. Conceptual structure of digital education in higher education



Source: (Abad-Segura et al, 2020)

1. Literature review of effects of digitalization in education and links to the knowledge economy

A brief literature review on digitalization of economy (Kholiavko et al, 2020): Bell D. (1999), Castells M. (2000), and Masuda J. (1983), who formulated the methodological basis for the study of information society. F. Machlup (1962), and Porat M. (1977) created the fundament of research of information (digital) economy. Shkarlet et al. (2017) and [16] Vdovenko et al. (2019) disclosed the basic descriptors of the national economy digitalization. Andriessen D. (2004), Schuller T. (2007), and Kalenyuk I. et al. (2020) studied the role of education and intellectual capital in the economic growth. The influence of science and knowledge in countries' socio-economic development was analyzed in research papers of Bekkers R. (2008), and Brenner Th. (2015). Some scholars (Kwiek, 2008; Oakeshott, 2003-2004) substantiated the contribution of higher education institutions in the development of society. Kasatkin et al. (2019) highlighted the aspects of modern universities impact on the formation of the digital wave of Kondratiev's long cycles. Cosmulese et al. (2019), and Donald E. Hanna (2019) identified the peculiarities of the development of education in the conditions of digitalization of society and national economy. Patsiorkovskiy et al. (2019) described the regional aspects of development of education in conditions of digital society. Tran et al. (2020) characterized the national specific of digitalization of educational system.

Knowledge economy is a vast concept and from the perspective of this paper we focus on how digitalization in education affects the alignment of educational systems with labour market needs, including the development of skills and competencies needed for the knowledge economy. In the contemporary world it is extremely important to connect education and the labour market in the digital age. Development of digital skills and competencies (e.g., programming, data analysis, cognitive skills) within education and their impact on the EU's competitiveness in the global labour market is extremely important agenda within the EU. The other important discourse is related to the impact on innovation and entrepreneurship and how digitalization in education fosters innovation and entrepreneurship in the EU, especially in the context of the knowledge economy (e.g., development of new technologies, start-up culture, and digital platforms). According to experts from across higher education (Ahmad, 2020), education should be less regimented and allow for more variation. They advocate for new courses, numerous streams, and a larger range of credentials so that people can retrain as needed and use their new abilities right away. All stakeholders will benefit from improved teaching, learning, and university operations if they have a better knowledge of the skills needed in the future and how universities are educating students to develop those skills. Having this insight is essential, especially in light of how quickly the workplace is changing. The main reason behind this transformation is technological advancement (Alenezi, 2021). Recent developing technological advances are forcing a dramatic reassessment and conversation about the necessary skills and abilities to succeed in the globalized world of the twenty-first century (Zain, 2021). Increased automation is disrupting employment opportunities and higher education delivery due to changes in labour demand, occupational sectors, job skills, and career prospects. Educational academics and policymakers are debating future career paths and higher education challenges (Leonardi, 2020).

The distinction between physical and virtual learning is blurred by the use of digital technology, which also provides options for flexible learning. The future of higher education can be summed up by the four learning models (Orr. et al, 2020), which can be seen as four trends or modes: 1. With the university acting as a closed ecosystem that supports and mentors students while they pursue a course of study, the study program offers fundamental, thorough preparation for post-graduation employment. For those who enter college or a university straight out of high school, this plan works effectively. 2. The first-degree program provides a strong base of skills and knowledge. It can resemble a condensed study schedule. On top of this base, the curriculum is continuously developed by the student using fresh learning units. Several training companies make these extra blocks available. 3. At a college or university, the course of study is no longer completed as a little unit. Instead, it consists of separately merged modules from many training providers, all of varying sizes. Which learning phases or units the students choose to finish is up to them. The university is also accountable for officially acknowledging finished learning phases by issuing certificates or other forms of evidence. 4. As high school graduates, the students in this module do not go on to higher education. They already have individual identities and life experiences. Later in life, they enrol in college or university and incorporate their life experience into their studies. They require a flexible course of study that alternates between the advisers' and teachers' didactic control and their own autonomy.

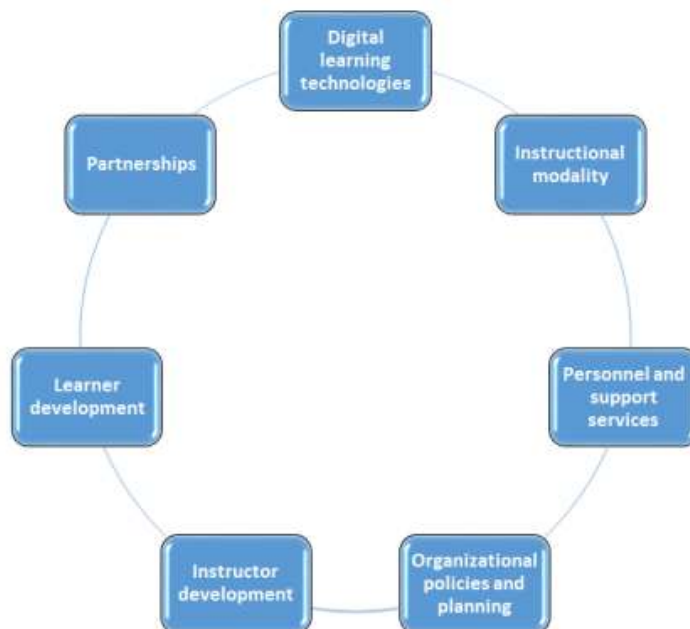
Alenezi (2023) prepared the study that addresses the digital transformation in higher education institutions from the sociological, administrative, and technological perspectives. The recent rise in publications is proof

of higher education institutions' enthusiasm to achieve their objectives. Higher education institutions are going through major changes in their education and operations. Several influences are driving these major changes. Digital transformation, online courses, digital-navy students, operational costs, and micro and nano degrees are just some examples of these influences. Digital technologies show a range of tools selected to include formalized learning environments in teaching in higher education, and students utilize these tools to promote their learning.

The Industrial Revolution 4.0's technological growth has penetrated higher education institutions (HEIs), forcing them to deal with the digital transformation (DT) in all of its dimensions. As they enable us to characterize the various interrelationships among stakeholders in a digitally enabled context of teaching and learning, applying digital transformation techniques to the education sector is an emerging field that has attracted attention recently. Technology in higher education institutions necessitates revisiting, reorganizing, and reinventing because of its multipurpose, multi-process, multidisciplinary, multi-state, and multi-auctorial nature, as is demonstrated by this. It is a team effort that centres the individual in the process of growth, change, and its effects on society. Digital transformation needs to be a fundamental and comprehensive change in higher education institutes. According to this study, the digital transformational dimensions within higher education institutions go beyond simply implying technological advancement and instead accordingly make adjustments of meaning that have an impact on the institution's cultural context, its individuals (Alenezi, 2021).

Further developing on his work, Alenezi (2023) presented and elaborated the Digital learning ecosystem in higher education (Figure 2.) that is consisted of the seven pillars: digital learning technologies, instructional modality, personnel and support services, organisational policies and planning, instructor development, learner development and partnership. While the ecosystem features seven unmistakable regions, accomplishing it requires an iterative cycle. These initiatives will become commonplace for higher education institutions as advanced digital technologies develop. It is crucial to the success of ecosystem implementation to prepare students to solve problems in the digital world and to embrace flexibility and accessibility.

Figure 2.: Digital Learning Ecosystem in Higher Education



Source: (Alenezi, 2023, p. 11)

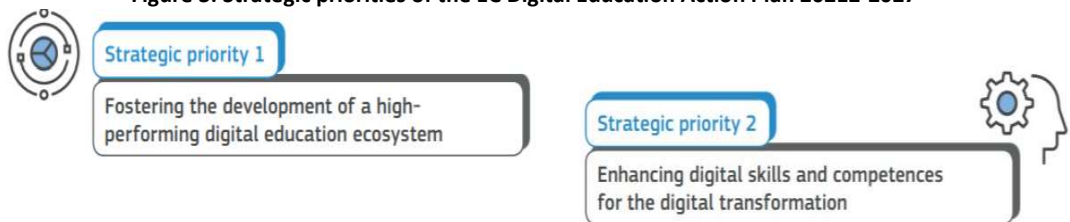
2. Digitalization of education in the European Union

Digitalization of education in the European Union includes the EU Policies and Initiatives related to the digitalization of education. The paper presents an overview of key policies, programs, and initiatives the EU is implementing to accelerate digitalization in education (e.g., programs such as Erasmus+ or the Digital Education Action Plan). The implementation of Digital Technologies in Education Systems of EU Member States involves analyzing the current state of digitalization in educational institutions in various EU member states, with a focus on the adoption of digital tools and platforms. There are different approaches in the implementation of digitalization across primary and secondary schools, universities, and adult education, but this paper focuses on the higher education, i.e. the universities in the EU.

It is possible to review EU policies and strategies related to digital education, such as the Digital Education Action Plan (DEAP) or Horizon Europe, and how they support innovation, workforce development, and economic growth. EU DEAP 2021-2027 is called Resetting Education and training for digital age and the main findings related to the fact that the COVID-19 crisis led to the first experience of distance and online learning for many educators, education and training staff and learners. Digital capacity is identified as a key element, leading to faster and better responses among education institutions. There are many obstacles that influence this process, and one of the most obvious is a different perception between education and training staff and parents and learners. The COVID-19 crisis has been a turning point for the use of technology in education, and it significantly accelerated the use of digital technologies in all levels of education from primary to universities. Main concern may be deepening of socioeconomic inequalities and creating new divides.

Therefore, the EU recognised that a more effective and coherent approach to digital education at EU level is needed and the DEAP had been drafted. The key aspects of the DEAP include recognition digital education as a strategic priority for the EU in order to adjust to the digital age. An integrated approach for technology use in education and improving digital skills has been set as the top priority, but also it was suggested that there is a scope beyond formal education, and that lifelong learning agenda should be promoted. The DEAP has been planned for duration of seven years, which is aligned with the programming period of the EU. The strong focus is given to the quality and inclusion, as well as transforming education for the digital age recognised as a task for the whole of society via reinforced cooperation and stakeholder engagement (Figure 3).

Figure 3: Strategic priorities of the EC Digital Education Action Plan 2021-2027



Stronger coordination and cooperation– the launch of a **European Digital Education Hub**.

Source: (Dimitrov, 2020)

Priority one encompassed robust infrastructure (including for remote learning) and digital equipment; updated teaching and learning practices and new approaches to assessment; teacher professional development; high-quality digital education content, user-friendly tools and secure platforms, respecting

privacy and ethics. Its actions include: a European Digital Education Content Framework and check feasibility of a European exchange platform; support digital transformation through Erasmus Cooperation projects for all levels of education, enhance pedagogy and expertise in the use of digital tools for teachers, through Erasmus Teacher Academies and launch an online self-assessment tool for teachers, SELFIE for Teachers. Ethical guidelines on artificial intelligence and data usage in teaching and learning and related research & innovation activities through Horizon Europe. The second priority covers sound understanding of the digital world, including digital literacy and knowledge on new and emerging technologies, such as artificial intelligence; basic and advanced digital skills; gender gaps in digital and STEM studies and careers; cross-national data on student digital skills; certification of digital skills. Its actions encompass: common guidelines for teachers and educational staff to foster digital literacy and tackle disinformation through education and training; updated European Digital Competence Framework to include AI and data-related skills and support the development of AI learning resources for education and training; incentivised advanced digital skills development through targeted measures including scaling up the Digital Opportunity traineeships, encouraged women's participation in STEM in cooperation with the European Institute of Innovation and Technology and support the EU STEM Coalition to develop new higher education curricula for engineering and information and communications technology based on the STEAM approach and to be more attractive for women. European Digital education Hub is envisaged to be a cross-sector collaboration and new models for the exchange of digital learning content, and it also includes common standards for digital education user-driven innovation through the Digital Education Hackathon. DigiEduHack is an European Institute of Innovation and Technology's (EIT) initiative under the European Commission's Digital Education Action Plan (Dimitrov, 2020).

3. Digital Education – drivers, challenges and opportunities

The drivers, challenges, barriers and opportunities in the digitalization of education include technical and infrastructure challenges related to access to technology, internet connections, and appropriate digital tools, especially in rural and less-developed regions of the EU. The second challenge relates to inequality in access to digital resources including disparities in access to digital tools and resources between different social and economic groups, and how this affects the quality of education. It is also important to pay attention on the social determinants and cultural resistance to change, Resistance to digitalization among teachers, students, and parents, and the need to change educational practices and attitudes. It is important to give recommendations for improving digital education policies and initiatives in the EU (e.g., investment in infrastructure, teacher training, and integration of digital tools in curricula) and redefine strategies for enhancing digitalization in education. But, in the global context and the role of the EU in global knowledge economy competition it is possible to analyze how the EU can use the digitalization of education as a tool to enhance its position in the global knowledge economy, compared to other regions (e.g., the US, China). Digitalization processes are global and performed in all spheres of economic activities. The development of the digital economy correlates with the dynamics of educational, scientific and technical, and innovative activities in the country. Higher education particularly affects the development of the digital economy because it is a system training highly qualified personnel, conducting quality research, and generating innovations. Higher Education Institutions (HEI) should focus on understanding the main drivers of digitalization which are promising to lead to positive results and popularize them (Figure 4). These include: enhanced competitiveness, controlling costs, better user experience and greater agility.

Figure 4: Drivers of digital transformation in HEI



Source: (Digarc, 2018)

HEIs must become themselves digital organizations in order to provide digital teaching, digital learning, digital experiences, and finally, digital skills for their students. Becoming digital organizations requires digital endowments and specialized staff. It is important that the necessity of change is well understood, is approved and accordingly prepared by all parties involved. Changes in the economic, political, social and cultural fields lead, without mistake or delay, to changing priorities in the field of higher education. Organizations that really want to prepare for a successful future, leverage technology and data to transform processes and upgrade systems - in order to achieve, what is now called -the digital transformation. Further, we present the main drivers that should motivate HEIs to pursue this goal actively (Bejinaru, 2019).

Digital education has its own challenges and as presented on the Figure 5, these include : digital literacy, lack of direct interaction, need for self-discipline, technological obstacles, demand to meet deadline and practicality. Digital literacy means the ability to effectively use technology to locate information, evaluate sources, produce content, and communicate with others, and it is known as digital literacy. Digital literacy is a set of skills used to navigate society's new technological paradigm (Danmuchiwali et al, 2020). Discipline, technological obstacles and meeting the deadlines are quite self-explicatory challenges. The practicality relates to the fact that implementing practical projects in an online course needs far more advanced planning than theoretical instruction. Several research studies highlighted that digital education is inappropriate to teach practical competencies and hands-on skills.

Figure 5: Digital education challenges

Source: (Alenezi et al 2023, p. 7)

When it comes to digital education opportunities Figure 6. shows a summary of these opportunities regarding digital learning, there are numerous variables. For a course to be considered an online course, it needs more than just a Zoom call. Digital learning may be beneficial for both students and teachers when done right. Students are able to learn at their own pace and benefit from both group and solitary instruction in the classroom. It is considered a great addition to developing time management skills. Students must master a variety of technical applications that go beyond what they would learn in a basic computer class due to the increasing use of technology in daily life. The opportunities include: improving teaching and learning, growing return on investment, increasing engagement, reducing inequality, and the fact that digital education can be performed anywhere and anytime. The virtual classroom is available around the clock. Time availability is another benefit of the online learning style. The ability to interact in classroom activities while juggling work, social, and study commitments is made possible through communications using online meeting systems (Danmuchikwali et al, 2020).

Figure 6: Digital education opportunities

Source: (Alenezi et al 2023, p. 9)

Conclusion

Digitalization is currently one of the most important trends that change society and business. There is no doubt that the digital economy is profoundly changing the methods of companies manufacturing and delivering goods and services worldwide. Thus, in the education sector, digitalization can be implemented at the levels: administrative, teaching-learning, evaluation, research, development and for the benefit of society. Due to the accelerated pace with which developments in information and communications technology are taking place, digital society and the digital economy have become real and, in turn, are generating specific challenges. In this environment, digital skills and competencies are essential in order to achieve professional success and the personal development of any individual. There is no doubt that digital technology enriches learning opportunities and provides access to a great amount of information and resources. Digital technology has a huge potential for improving education, including high education. However, it also has its challenges and opportunities, as discusses above.

Although it existed in a few different forms earlier, digital education is essentially a modern invention, even within the EU. It is the digitalization of a segment of the educational system. With the development of internet technology, we have observed a significant shift in how we communicate and collaborate among academics. The digital revolution encouraged unrestricted access to information on a global scale. Today's classrooms are equipped with a wealth of ICT tools, and almost all instructors have made significant progress in integrating digital technology to improve students' access to information and cooperative learning opportunities. The higher education system must seek to utilize the power of ICT to be competitive and provide high-quality education as a consequence of digital transformation, disruptive technological innovations, and accelerated change. To accomplish these ambitions, this paper describes some challenges that higher education encounters, as well as technological resources and methodologies they have used in the current scenario to transform higher education to adopt digital transformation and to knowledge economy. The paper aims to synthesize considerable insights that can be applied to the digitalization of higher education in the current and near future.

Despite the wide range of technologies and applications, they are mostly used in environments that integrate in-person and online instruction, typically in conjunction with flipped classroom strategies, to create flexible learning environments and provide access to those environments. Studies regularly discussed the advantages of encouraging students' active participation in the learning process both inside and outside the classroom. Overall, using all digital technology categories was more frequently associated with improved student learning outcomes and processes (Alenezi et al, 2023).

In the process of adaptation, HEIs must focus on improving largely on their traditional mission of teaching and learning. Today, the society is asking for much more from universities regarding their contribution. They must develop a third mission that concerns the provision of services to society and the more active involvement in the triple helix university-state-industry. In this context, universities should contribute more to the development of students' digital skills, especially in countries with emerging economies. In a world of rapid and unpredictable change, leading to a turbulent business environment, HEIs must not only adapt to all these changes but become driving forces for change and leaders in building new contracts. Universities should develop strategies to increase their intellectual capital and become digital organizations. In the new economic and social landscape, universities should be able to become leaders of change and innovation. In conclusion, we consider it important to monitor the fundamental transformations induced by the advance of the digital age and to carry on future research in this area.

References

1. Abad-Segura, E., González-Zamar, M. -D., Infante-Moro, J. C., & Ruipérez García, G. (2020). Sustainable Management of Digital Transformation in Higher Education: Global Research Trends. *Sustainability*, 12(5), 2107. <https://doi.org/10.3390/su12052107>.
2. Abduvakhidov, A. M., Mannapova, E. T., & Akhmetshin, E. M. (2021). Digital Development of Education and Universities: Global Challenges of the Digital Economy. *International Journal of Instruction*, 14(1), 743-760.
3. Ahmad, T. (2020). Scenario based approach to re-imagining future of higher education which prepares students for the future of work. *Higher Education, Skills and Work-Based Learning*, 10(1), 217-238.

4. Akour, M., & Alenezi, M. (2022). Higher education future in the era of digital transformation. *Education Sciences, 12*(11), 784. <https://doi.org/10.3390/educsci12110784>.
5. Alenezi, M. (2021). Deep Dive into Digital Transformation in Higher Education Institutions. *Education Sciences, 11*(12), 770. <https://doi.org/10.3390/educsci11120770>.
6. Alenezi, M. (2023). Digital learning and digital institution in higher education. *Education Sciences, 13*(1), 88. <https://doi.org/10.3390/educsci13010088>.
7. Alenezi, M., Wardat, S., & Akour, M. (2023). The need of integrating digital education in higher education: Challenges and opportunities. *Sustainability, 15*(6), 4782. <https://doi.org/10.3390/su15064782>.
8. Bejinaru, R. (2019). Impact of digitalization on education in the knowledge economy. *Management Dynamics in the Knowledge Economy, 7*(3), 367-380. DOI 10.25019/MDKE/7.3.06.
9. Batista, J., Santos, H., & Marques, R. P. (2021). The use of ICT for communication between teachers and students in the context of higher education institutions. *Information, 12*(11), 479. <https://doi.org/10.3390/info12110479>.
10. Cilliers, L. (2017). Wiki acceptance by university students to improve collaboration in higher education. *Innovations in Education and Teaching International, 54*(5), 485-493.
11. Digarc (2018). 4 Drivers of Digital Transformation in Education. Retrieved on November 28, 2024 from <https://www.digarc.com/blog/2018/08/four-drivers-of-digitaltransformation-in-education/>
12. Danmuchikwali, B. G., & Suleiman, M. M. (2020). Digital education: Opportunities, threats, and challenges. *Jurnal Evaluasi Pendidikan, 11*(2), 78-83.
13. Dimitrov, G. (2020). *Digital Education Action Plan 2021-2027: Resetting Education and Training for the Digital Age*. EUDigitalEdu.
14. Goulart, V. G., Liboni, L. B., & Cezarino, L. O. (2022). Balancing skills in the digital transformation era: The future of jobs and the role of higher education. *Industry and Higher Education, 36*(2), 118-127.
15. Kholiavko, N., Djakona, A., Dubyna, M., Zhavoronok, A., & Lavrov, R. (2020). The higher education adaptability to the digital economy. *Bulletin of the National Academy of Sciences of the Republic of Kazakhstan, 4*(386), pp. 294-306. DOI: <https://doi.org/10.32014/2020.2518-1467.130>.
16. Leonardi, P. M., & Treem, J. W. (2020). Behavioral visibility: A new paradigm for organization studies in the age of digitization, digitalization, and datafication. *Organization Studies, 41*(12), 1601-1625.
17. Moreno, V., Cavazotte, F., & Alves, I. (2017). Explaining university students' effective use of e-learning platforms. *British Journal of Educational Technology, 48*(4), 995-1009.
18. Orr, D., Luebcke, M., Schmidt, J. P., Ebner, M., Wannemacher, K., Ebner, M., & Dohmen, D. (2020). *Higher education landscape 2030: A trend analysis based on the ahead international horizon scanning*. Berlin/Heidelberg, Germany: Springer Nature.
19. Zain, S. (2021). Digital transformation trends in education. In *Future directions in digital information* (pp. 223-234). Amsterdam, The Netherlands: Elsevier.