

DIGITIZATION PROCESSES IN EDUCATION

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Abstract. The rapid advancement of digital technologies, driven by the Industry revolutions, has triggered significant changes in education on a global scale. The digitisation of educational processes is important because of its transformative impact on the learning experience, its increased accessibility, its alignment with market needs and its role in addressing contemporary challenges, and its potential to improve educational governance. The paper analyses the extent of scollars interest and research activities in the field of digitisation of educational processes and aims to identify future research domains in this field. The analysis and synthesis of scientific literature was carried out taking Web of Science and Scopus databases as primary sources, VOSviewer software was engaged for data analysis.

Keywords: processes digitalization, education, management.

JEL Classification: I23, M15, O32, O33.

1. Introduction

The processes of globalisation taking place in the world and the increasing integration of Lithuania's and the EU's interests constantly place new demands on the education system. One of the most important directions in educational reform is the digitization of educational processes and the updating of educational content, considering the development of social and economic life and the constantly changing needs of society and industry.

Living in the era of constant digitization requires embracing new challenges, which is why it is essential to discuss changes in education.

Encouraging digital transformation is more crucial than ever, and in the EU political agenda has been identified as a priority to ensure future economic growth in Europe (Europos Komisija, 2020). Considering the updated European Union (EU) policy initiative, a Digital Education Action Plan for 2021–2027 has been developed, outlining a common vision for quality, inclusive, and accessible digital education in Europe. The plan aims to support member states in adapting their education and training systems to the digital age. In line with documents from the European Commission, Lithuania, too, had to pay significant attention to digitization across all areas specified by the European Commission.

Lithuania's progress strategy “Lietuva 2030” states that a good infrastructure of information and digital technologies is one of the key elements. The progress strategy “Lietuva 2050” highlights the accelerating technological changes as one of the most important factors having a significant impact on the country's progress.

The importance of digitization for Lithuania is evident in the fact that a significant portion of the funds allocated in the National Economic Recovery and Resilience Plan (RRP)15 is dedicated to implementing digital transformation changes. This amounts to 700 million euros, or 31.5% of all allocations.

Key objectives of digital education are outlined in the progress measure “Implement EdTech Digital Education Transformation” within the 2021–2030 Education Development Program. (V-516 on the 2021–2030 Development Program, managed by the (Lietuvos Respublikos švietimo, mokslo ir sporto ministerija, 2022).

Digitization in education is important for: people (engaged leaders, digitally competent educators, and teachers, IT administrators)(Davidaviciene & Al Majzoub, 2022); digital infrastructure (safe, functional, properly used digital equipment, internet access, technical support); digital teaching/learning tools (digital content and virtual learning environments complementing traditional teaching/

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learning processes, e.g., digital textbooks, assignments, electronic gradebooks) (Davidavičienė et al., 2020).

It is crucial to investigate the impact of digitization on educational processes due to its transformative influence and role in addressing contemporary issues in education management. It should be noted that this issue is relatively new.

The object of the research is scientific studies of digitisation processes in education.

The aim of the study is: to identify the research areas and fields of research on digitisation in education, to group them, to show the interdependence and the interests of researchers.

To achieve this goal, a literature review, analysis, and synthesis were employed.

2. Trends in education management

The management of digitalization processes in education is a relevant issue in the current period, and its significance will either increase or remain at a similar level in the near future. The growing challenges of educational digitalization will influence trends in educational management. Modern trends in educational management include technology integration, individualization of learning, assessment of learning outcomes and data analysis, partnerships between schools/educational institutions and communities, gender equality and diversity, integration of learning and career paths, focus on developing advanced skills in teacher training and support, and international collaboration.

The integration of digital technologies into the education sector has been a priority in recent education policy agendas. Scientific studies conducted earlier and during the COVID-19 period revealed that remote learning or learning in virtual environments requires different didactic/pedagogical solutions, and the pedagogical process needs to be organized differently (Župerkiene et al., 2021; Visionary Analytics, 2021). Researchers emphasize the aspects of holistic vision and long-term perspective in addressing inequality issues and creating an inclusive and sustainable digital environment (Selwyn et al., 2020).

Studies show that if an institution or a company is not engaged in digitization, it lags behind in competition. Without digital transformation or adaptation to the latest technologies in the market, everything stagnates or worsens in terms of productivity (Darius & Bogdana, 2020). Digitizing the higher education process requires applying teaching methods, shaping a new organizational culture, and optimizing the management processes of higher education institutions. Digital education technologies act as a catalyst and promote a transition to a new level of quality, demanding the modernization of the entire education system. All such changes in teaching, assessment methods, forms, tools, as well as the study process itself, must be aligned with up-to-date information and with IT technologies to ensure an appropriate educational environment (EBSCO Information Services, n.d.).

The scientist identifies the challenge that current digital progress faces in higher education, as institutions operate with outdated paradigms. There is a need for a transformation in educational management. Research indicates that hybrid learning environments, integrating digital, virtual, online, and physical settings, are more effective in the educational process. In the 21st century, scholars have observed changes in the roles and skill sets of educators as the skills students need to acquire evolve. Additionally, there is an increase in the diversity of studies and the availability of spaces where learners can create knowledge. However, sometimes higher education institutions lag behind in addressing these changes due to their traditional administrative structures and applied management methods. These factors hinder the full realization of the value that educational process transformation can provide. For this restructuring to be systematic, consistent, and sustainable, a policy that overcomes the traditional teaching paradigm and supports the learning paradigm must be developed in all dimensions of higher education (Saykili, 2019).

Researchers from various countries emphasize the importance of teachers' professional development and digital competence in ensuring the digitalization of educational management.

The implementation of the digital transformation of educational processes is only possible with proper preparation and gradual development of digitalization in education and the education management system.

It is proposed to optimize the process of developing the education management system, allowing for effective resource management and contributing to the improvement of the quality of education services in the digital paradigm (Huang & Wei, 2023).

It can be asserted that the importance of digitization in the field of education in higher education institutions and organizations, and in implementing digitalization activities in educational processes, begins with teacher training, as a teacher is the key stakeholder in education.

Digital transformation in education should not be perceived as a revolution that will happen quickly but rather as a long-term evolution. This process should be managed and led by academic professionals (Yildiz, 2022). New trends in education can be implemented in various ways, depending on how educational development participants perceive these trends. Those responsible for education management must carefully consider the goal of integrating digital content. Such consideration would help higher education institutions better embrace the impact of digital transformation (Gumaelius et al., 2023).

In the future, sustainability, collaboration with other higher education institutions, and ensuring education quality in a digital environment will influence the management of higher education institutions (Multisilta & Mattila, 2022).

The use of digital technologies in education allows for strengthening motivation, increasing engagement, and expanding students' cognitive needs; ensuring personalized learning and creating conditions for transitioning to individualized instruction; enhancing interactivity in

teaching, reinforcing visualization in education, and expanding the spectrum of educational tasks; improving the efficiency of monitoring learning outcomes.

It is believed that in the educational process, social media and mobile applications can be utilized more effectively, attracting students who are active users of these platforms (Vezirov et al., 2020).

However, evaluating research related to the analysis of educational digitization processes within the institutional context, higher education institutions still have a long way to go in terms of digital competencies. Research results indicate that university lecturers have a low level of digital competence, raising concerns as assessment issues are crucial for monitoring learners' progress, for ensuring effective feedback, and for enabling lecturers to evaluate and adapt their teaching strategies (Basilotta-Gómez-Pablos et al., 2022).

Digital technologies have fundamental impact on learning and teaching in higher education, and the pace of technological development poses a challenge. Higher education institutions should establish an integrated system that supports continuous and quality interactive learning, considering technological advancements and programming. This integration can enable higher education to expand its teaching goals and achievements (Pelletier et al., 2021).

The literature emphasizes the importance of understanding the impact of digital assessment systems on student and teacher work results, especially with the rapid increase in their use for digital examination assessments in higher education institutions.

Digital knowledge assessment should be continued to ensure equal opportunities for remote learning and evaluations. Multidisciplinary collaboration is necessary among academic subjects, higher education institutions, education policymakers, security system providers, and legislative authorities. (Han et al., 2023)

The diversity and intensity of research on this topic pose a complex challenge, and addressing it would require a comprehensive analysis of publications.

Integrating digital technologies into the education sector is the priority for education policy. This requires a digital transformation of all learning and management processes in higher education, as this is the only way to ensure quality education processes that meet the challenges of industry.

3. Research methodology

This article and research are targeted to systematic literature review seeking to identify mostly researched topics in the field of education processes digitalization, change of intensity and shown interest:

- keywords on the subject and series of strings,
- databases – Web of Science and Scopus,
- keyword and citation network analysis and visualization in VOSviewer,
- clustering research results.

In order to use more recent sources, which would have been published not longer than ten years ago, the study focused on the period from 2012 to 2023. The keyword network visualization map was processed with VOSviewer.

The identified keywords were “education processes digitalization” on the subject, and according to these keywords series of strings were generated. Articles were reviewed according to the identified relevant keywords and citation networks. The search of papers for the period from 2012 to 2023 was chosen.

The initial list of 1309 contributions were generated by keyword search within the Web of Science database for citation statistics. The Scopus database was checked in parallel, and 2112 publications were found in the same period (2012–2023 years) (see Table 1 and Figure 1).

From the correlation of the obtained publication data with the year of publication, we can see that the number of publications using the keywords “education processes digitalization” is increasing during the analysis period.

Table 1. The number of publications in WoS and Scopus databases by keyword

Year	Scopus Documents	Web of Science documents
2023	471	200
2022	515	274
2021	505	303
2020	310	228
2019	162	166
2018	59	53
2017	29	32
2016	27	22
2015	7	14
2014	3	3
2013	4	6
2012	9	7

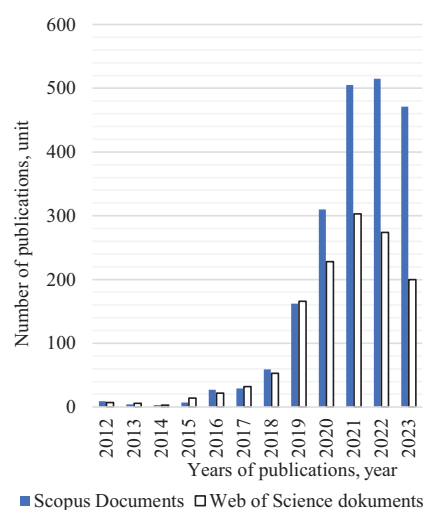


Figure 1. The number of publications in WoS and Scopus databases by keyword (created by author, Web of Science, n.d., Scopus, n.d.)

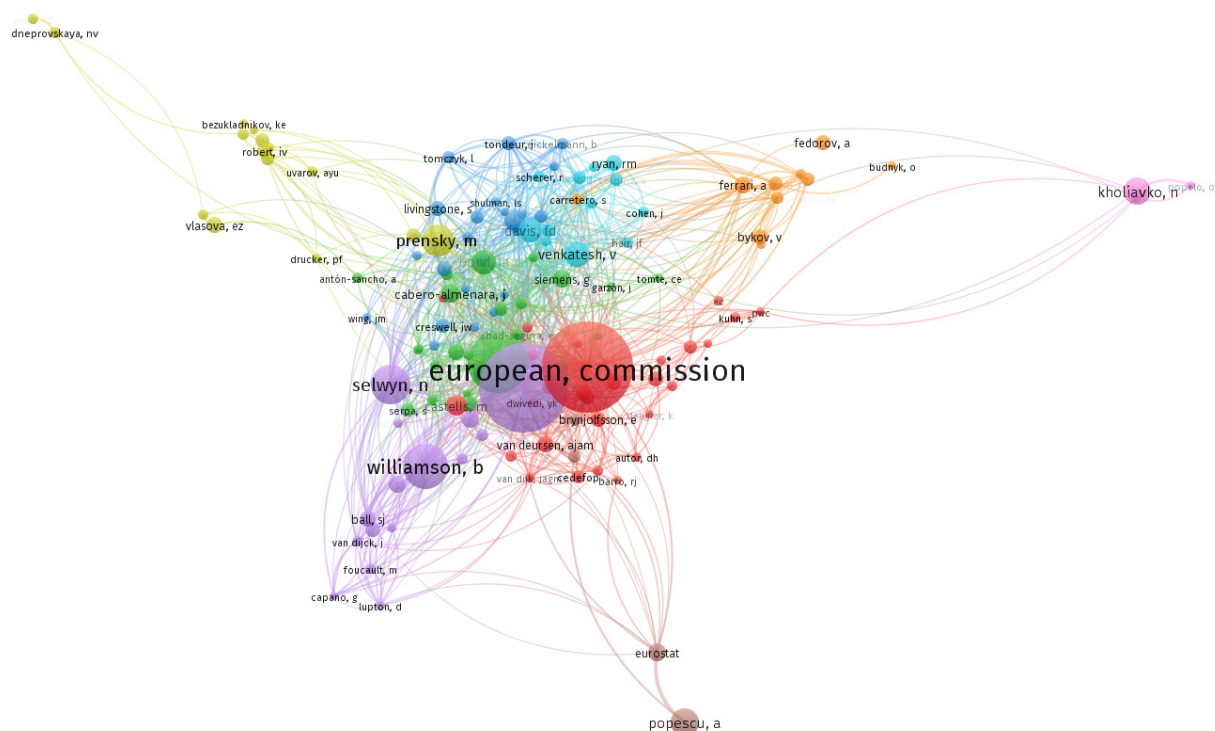


Figure 3. Most cited authors in the research of “education processes digitalization” by VOSviewer (created by author)

the less recurrent keywords: model, management, impact, innovation, industry 4.0, digitisation, design, skills. This shows that there are fewer themes discussed in the digitisation of education.

The assessment of the most frequent key-words, their links and the clusters formed suggests that digitisation is relevant. The main digitization trend in education is the digitization of higher education. Meanwhile, the topic of education digitization management is an even less analyzed area.

The following analysis was conducted about scientific society identified as running research in “education processes digitalization” (Figure 3): European Commission, OEC, Unesco, Wiliamson, B., Selwyn, N., Prenskey, M., Popescu, M., etc. are identified. However, if we look from the other side – what researchers are working in the “education processes digitalization” area and publish most works we see the following authors in WoS: Akhmetshin, E. M. (5), Bochkareva, T. N. (5), Frolova, E. V. (5), Isenhardt, I. (5), Rogach, O. V. (5), Vasilev, V. L. (5), Baeva, L. V. (4), etc.

At the same time, in the Scopus database are seen different scientists such as Makarova, I. (8), Makhachashvili, R. (7), Semenist, I. (7), Buyvol, P. (6), etc. However, on top the Scopus database are seen and the same scientist as in Web of Science: Akhmetshin, E. M. (8), Bochkareva, T. N. (6), Frolova, E. V. (8), Isenhardt, I. (3), Rogach, O. V. (8), Vasilev, V. L. (7), Baeva, L. V. (4). From this overview, the conclusions come to mind: researchers and scientists choose different journals for their research

results and insights publication and scientific discussion. They have different motivations to be seen in one or another database.

Meanwhile, the scope of cited authors is quite similar. After a detailed analysis of publications, such authors who work directly in the field of education processes digitization were identified (Table 3).

The most cited papers in the education pro-cesses digitalization are presented in Table 4.

Table 3. The most productive authors in the education processes digitalization in WoS and Scopus databases

Author	No. of citations
European Commission	115
OECD	113
Unesco	75
Wiliamson, B.	55
Selwyn, N.	48
Prenskey, M.	38
Popescu, M.	33

The EU’s digitisation policy is boosting Lithuania’s digital transformation: funding opportunities motivate people to explore the opportunities offered by technology and deploy innovative solutions. In addition, EU membership provides opportunities to join international co-operation networks in the fields of blockchain and artificial intelligence.

Table 4. The most cited papers in the education processes digitalization

	Authors	Title	Year published	Source	Keywords	No. of citation
1	(Uhlemann et al., 2017)	The Digital Twin: Demonstrating the potential of real time data acquisition in production systems	2017	7TH CONFERENCE ON LEARNING FACTORIES	physical production system, manufacturing education, learning factories, industrie 4.0, smart, management, efficiency, creation	222
2	(Sima et al., 2020)	Influences of the Industry 4.0 Revolution on the Human Capital Development and Consumer Behavior: A Systematic Review	2020	JOURNAL OF SUSTAINABILITY	industry 4.0, automation, digitalization, artificial intelligence, information technology, communication technology, human capital development, labour market, customer behaviour	180
3	(García-Morales et al., 2021)	The Transformation of Higher Education After the COVID Disruption: Emerging Challenges in an Online Learning Scenario	2021	FRONTIERS IN PSYCHOLOGY	higher education, innovation, COVID-19, digital transformation, online learning	178
4	(Liboni et al., 2019)	Smart industry and the pathways to HRM 4.0: implications for SCM	2019	SUPPLY CHAIN MANAGEMENT-AN INTERNATIONAL JOURNAL	organizational innovation, learning factories, future, work, management, digitalization, competences, challenges, system, participation	116
5	(Bnavides et al., 2020)	Digital Transformation in Higher Education Institutions: A Systematic Literature Review	2020	JOURNAL SENSORS	systematic literature review, digital transformation, digitalization, university, higher education institution	87
6	(Brunetti et al., 2020)	Digital transformation challenges: strategies emerging from a multi-stakeholder approach	2020	TQM JOURNAL	Place-based strategies, Regional innovation system, Culture and skills, Infrastructure and services, Technology, Digital ecosystems	82
7	(Skulmowski & Rey, 2020)	COVID-19 as an accelerator for digitalization at a German university: Establishing hybrid campuses in times of crisis	2020	HUMAN BEHAVIOR AND EMERGING TECHNOLOGIES	COVID-19, digitalization, e-learning, human cognition, human-computer interaction, hybrid campus, internet, multimodal learning, social media, social networking	81
8	(Carayannis & Morawska-Jancelewicz, 2022)	The Futures of Europe: Society 5.0 and Industry 5.0 as Driving Forces of Future Universities	2022	JOURNAL OF THE KNOWLEDGE ECONOMY	Quadruple, Quintuple Helix Model, Digital (social innovation), Society 5.0, Digital transformation	69
9	(Hao et al., 2022)	Digitalization and electricity consumption: Does internet development contribute to the reduction in electricity intensity in China?	2022	ENERGY POLICY	Electricity intensity, Spatial spillover effect, Threshold model, Comprehensive indicators of internet development level	66
10	(Versteijlen et al., 2017)	Pros and cons of online education as a measure to reduce carbon emissions in higher education in the Netherlands	2017	CURRENT OPINION IN ENVIRONMENTAL SUSTAINABILITY	teaching models, university, performance, quality, design	61

5. Conclusions

This literature review provided valuable knowledge and insights into the implementation of digitization processes in education, including advancements in technology, concerns of stakeholders, and implementation issues and challenges. Digitization is described as a catalyst for systematic educational reform, an inevitable choice in developing education in a smart environment where artificial intelligence, big data, blockchain, and other new technologies not only transform the teaching and learning processes but also shape the digitization of the education process itself.

The literature review revealed the importance, novelty, and complexity of the digitization processes in education. Analysis of the sample permitted the identification of essential research directions and popular research areas. Based on existing scientific insights the results of systematic analysis were presented. The summarized research material allowed for the grouping of potential research areas, highlighting common interests, researcher groups, and identifying the most frequently occurring research interests by country.

The assessment of the most frequent keywords, their links and clusters show that it is necessary for future researchers to review recent articles in the field of digitisation in education, even if they do not have a high level of citations.

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