Contemporary education: globalization and transformation process under the influence of artificial intelligence

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Article Info

ABSTRACT

This study is aimed to investigate the problem of globalization and transformation processes in contemporary education under the influence of artificial intelligence (AI) on the basis of systemic literature review, to examine AI implications in education and to outline the opportunities for AI research in future. To achieve the objective, we analyzed 159 articles published in Scopus, Web of Science Core Collection, EBSCO, PubMed, Index Copernicus, and Google Scholar databases between 2019 and 2023. The research was conducted in accordance with the PRISMA 2020 statement in four phases: reference search, selection of relevant papers, specific analysis, evaluation of publications' contributions and preparing the review. The results show that a great number of scientific publications are related to AI research. We found that most of the articles were published in Asia, Europe, and North America in 2022. AI tools are most used while training medical students, information technologies (IT) specialists, engineers, business or management students. The analysis of publications showed that AI is used for data analytics, introduction of personalized learning, providing feedback, online learning, and automated assessment most often. We consider that AI-driven technologies currently play an important role in education and the number of publications testify that its implementations will extend in future. The study has contributions for outlining the role of AI-related tools in educational process.
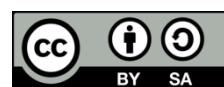
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1. INTRODUCTION

The 21st century brings radical transformations for education related to globalization, integration, and digitalization processes. Currently, globalization of knowledge, digital revolution in education, advancements in technology have become driving forces and strategy paths for the enhancing the quality and efficiency of education. At the same time, the implementation of digital technologies within the educational

process is one of the critical and strong tendencies of development of educational environment since they intensify the educational process, facilitate its mobility, flexibility, differentiation and adjustment to realities of today [1]–[3]. And most importantly, digitalization ensures continuity of education under special or extreme conditions like pandemics or armed conflicts [4]–[6].

Artificial intelligence (AI) is considered as one of the most disruptive innovations in contemporary education [7] and it has drawn the attention of many academicians and educators in many countries all over the world. First of all, AI is revolutionizing globalization and transformation processes, providing unprecedented opportunities for internationalization, integration, and digitalization changes [8]. AI is rapidly reshaping and redefining the education system [9] because it is evident that, in some perspectives, AI potentials support teaching and learning in many different ways.

Recent findings show that AI-driven technologies turn into global agents in education and have broad implications in management, planning [10], or new skills development [11]. Being a transformative technology AI provides technological improvements such as data analytics and decision making [12]–[17], adaptive or personalized systems generating more relevant suggestions for a specific profile [12], [15], [18], prediction of educational performance [15] and automated assessment [17], [19], [20]. Some scholars suggest integrating education and AI technologies to facilitate learning for students with special needs in inclusive education [21].

In addition, AI improves instructional delivery [17], introduces active learning in the classroom [20], develops innovative and effective educational content [10], [19], [20], and provides interactive and immediate feedback [14], [19], [20], [22]. Scholars report that AI tools assist in teaching different subjects, especially languages [10], [12], [16], [23], mathematics [12], [20], [24], [25], computer science [22], [24], [25], biology [26], or geography [13]. Also, AI is widely used to enhance sports training since AI models ensure real-time monitoring during workout and competition [27]–[29]. Some findings demonstrate that AI contributes to establishment of sophisticated educational environment [30], curriculum development [11], [17], [31], introduction of intelligent tutoring systems [30], [32]–[34] and learning management systems [23], [35], [36], facilitation of effective classroom discourse [14], formation of their readiness for future professional activity [19], [37], enhancement of psychological well-being of students [19], [29], [38].

It is worth mentioning that some studies reveal negative impact of AI upon education globally including lack of algorithm transparency [15], [39], fostering laziness among teachers and students, or reduced analytical skills due to extensive use of information and communication technologies (ICT) [40]. Moreover, low AI literacy may lead to dehumanization of educational process and decrease its efficiency [17]. Despite this, AI has been advancing rapidly. According to Furman and Seamans [41], the use of AI-related tools increased by 26 times between 2015 and 2017. But it is important to note that AI error rates has dropped by 25% over recent years. And accordingly, some scholars predict that by 2030 the use of AI in different areas including education can grow by 16% [15], [41]. Therefore, the aims of the research are to investigate the problem of globalization and transformation processes in contemporary education under the influence of AI based on the systemic literature review, to examine the practical implications of AI in education and to outline the opportunities for AI research in future.

2. BACKGROUND

In general, globalization means a dynamic process that includes economic, political, cultural, technological, and educational dimensions [42]. Globalization facilitates integration of society and allows extended communication [43], cross-cultural perspectives [44], [45], and global interdependence which exists within and among countries [46], [47]. Globalization processes are sharply amplified due to the advances in ICT reaching significant expansion and interaction between people worldwide [42], [48]–[50]. In the context of education globalization provides rapid flows of knowledge and technologies [51], [52] as well as the spread of pedagogical models [53], [54]. The era of globalization expands the flexibility of education [55], [56], its internationalization [57], openness [58], integration [59] and accelerates the implementation of innovations within the educational process [60]–[62].

Besides, globalization brings a number of digital transformations in education that are related to the process of using digital technologies for optimization of education system [1], [63], [64]. Today, it is obvious that digital transformations create better environment for both students and educators [65]–[67]. According to some findings [68], [69], digital technologies are oriented towards the support of educational process through digital tools, systems, devices and resources which are able to generate, store or process data.

Modern stage of society development requires to enhance the efficiency of education and builds the high-level professional competencies and attitudes among learners [67], [70]–[72]. This requirement suggests transition to digital educational environment [73], [74] and offers implementation of innovative teaching approaches [75], [76]. AI-driven transformations revolutionize education, innovate teaching and learning

practices [60], [77]–[79] since they perform various functions within the educational process and improve training of future professionals for the digital age.

We believe that a systematic literature analysis on the problem is needed to outline the recent developments of research related to the impact of AI upon education. In doing so, we address the following research questions: i) what number of academic studies on AI has been published between 2019 and 2023? ii) what regions and countries are represented in research most common? iii) what specialities are trained through AI-driven technologies most often? iv) what AI functions are described in the scientific papers? V)What is the value of AI for contemporary education?

3. RESEARCH METHOD

This article reviews the globalization and transformation process under the influence of AI that facing contemporary education. The research was conducted in accordance with the PRISMA 2020 statement that is an updated guideline for reporting systematic reviews [80], [81] in four phases: reference search, selection of relevant papers, conducting specific analysis and advanced level research and selection, evaluation of publications' contributions and preparing the review. Figure 1 presents the phases of systemic literature review.
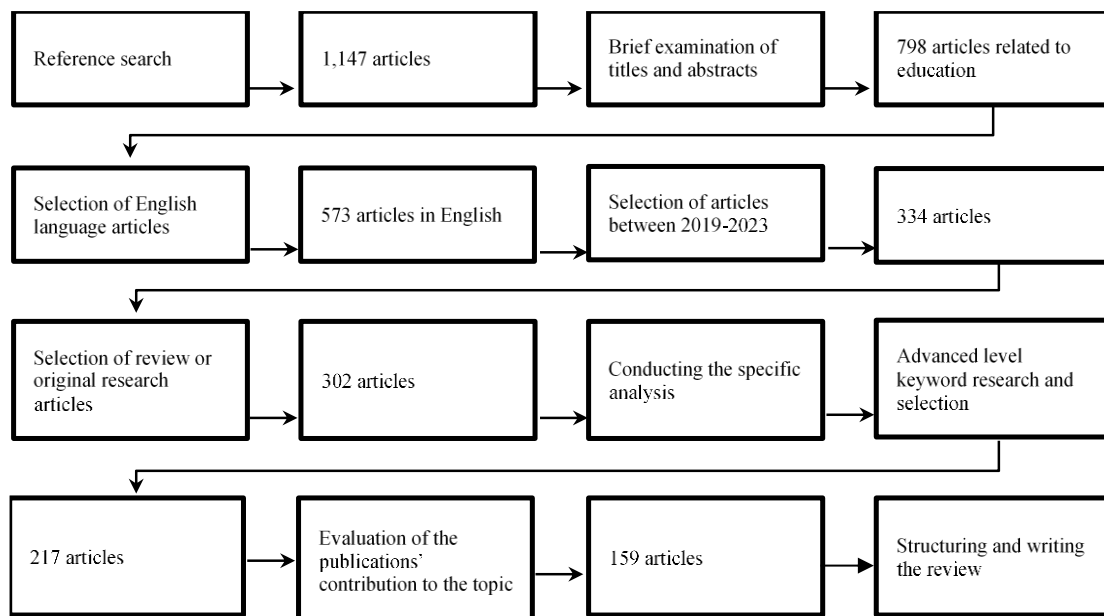

Figure 1. Phases of systemic literature review

The first phase, reference search, was based on the following databases: Scopus, Web of Science Core Collection, EBSCO, PubMed, Index Copernicus, and Google Scholar where we searched for basic keywords and terms. These databases contain high-quality peer-reviewed open-access journals with strict indexing and abstracting. They provide credible and reliable information for the readers and publish international research [82], [83]. We examined 1,147 documents and found that 798 articles investigate the problems of education caused by globalization and transformation process under the effect of AI-powered technologies. Table 1 shows the list of basic keywords and terms applied during the reference search.

After examination of abstracts, we selected original research or review articles in English written between 2019-2023 as COVID-19 stimulated the need for extensive implementation of digital education, introduction of virtual educational environment, collection and processing of a large number of data sets related to educational process [84], [85]. Also, we considered the research objectives of the articles, research questions, field of research, research design, results, and implications as some researchers are selective of the evidence when they build their research and, as a result, they ignore some aspects of the problem [85]. Only detailed analysis of all article sections and comparison the implications may constitute a good contribution and bring significant scientific result. Having conducted an advanced systematic literature search for articles on AI-powered transformations in education we extracted 159 papers that fully complied with selection criteria and became the basis for the research.

Table 1. Basic keywords and terms

Category	Keywords and terms
Globalization	"globalization" OR "globalized" OR "global" OR "global process" OR "globalization impact" OR "globalization impact on education"
Transformation	"transform" OR "transformation" OR "transformation process" OR "technological transformation" OR "digital transformation"
Digitalization	"digital" OR "digitalization" OR "digital age" OR "digital technologies" OR "digital educational environment" OR "digital tools" or "digital education" OR "digitalization of education"
AI	"Artificial intelligence" OR "AI" OR "AI-driven technologies" OR "AI-related changes" OR "AI-related transformations" OR "AI tools" OR "AI impact" OR "AI in education" OR "AI for education" OR "importance of AI" OR "AI-powered systems" OR "AI techniques"

4. RESULTS

4.1. Academic studies by years

To answer the first research question, we analyzed 159 publications and found that the smallest number of articles was published in 2019 (N=12). For comparison, the most articles were published in 2022 (N=53) that demonstrates the topicality of the research problem and extensive role of AI-driven technologies in contemporary education. Table 2 shows the number of academic studies published in journals by years.

Table 2. Articles by years

Years	N
2019	12
2020	25
2021	32
2022	53
2023	37

4.2. Academic studies by regions and countries

Answering the second research question we found that most articles were published by American (N=19), Chinese (N=15), Indian (N=13), and British scholars (N=11). They conducted both national wide and comparative research to reveal the perspectives and challenges of contemporary education under the impact of AI technologies. Table 3 presents the number of academic studies published by countries.

Table 3. Articles by countries

Country	N	Country	N
USA	19	Finland	2
China	15	Ghana	2
India	13	Israel	2
UK	11	Mexico	2
Australia	9	Austria	1
Canada	7	Belgium	1
Brazil	5	Croatia	1
Germany	5	Cyprus	1
Indonesia	5	Czech Republic	1
Malaysia	5	Ecuador	1
Pakistan	5	Ireland	1
Thailand	5	Jordan	1
Turkey	5	Kuwait	1
Ukraine	5	Lebanon	1
Philippines	4	Nigeria	1
Saudi Arabia	4	Poland	1
Vietnam	4	Portugal	1
Norway	3	Romania	1
Singapore	3	Uganda	1
Spain	3		

At the same time, we analyzed the representation of regions and continents in AI-related research and found that most articles were published in Asia (N=60). Europe is represented by 43 publications and North America has 46 academic studies on the research problem. Middle East, Australasia, and Africa are represented by a relatively smaller number of articles (N=9, N=9, and N=4 respectively). Figure 2 shows the representation of regions and continents in research since 2019.
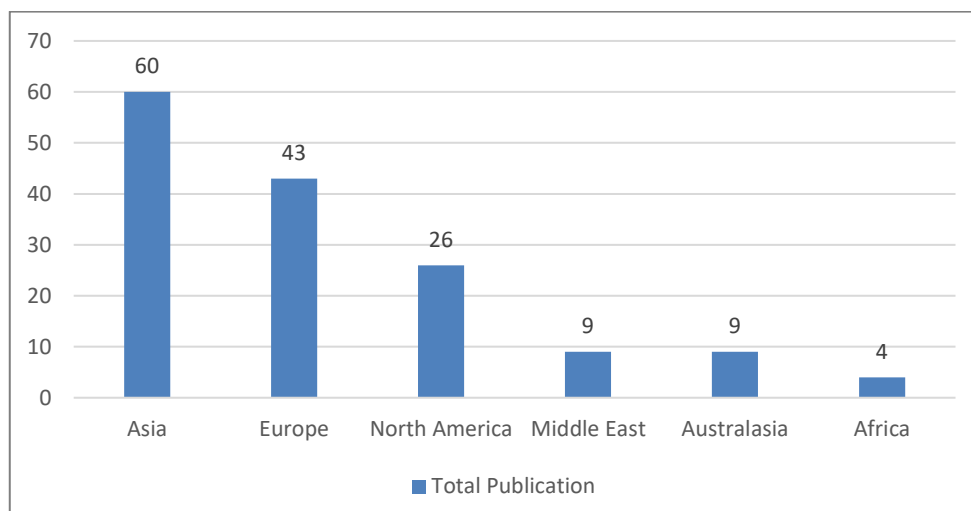
Figure 2. Articles by regions and continents

4.3. Specialities trained through AI-driven technologies

The third research question is about the specialities of students training in higher educational institutions through AI-driven technologies. The findings show that most of the publications concern original research or systemic reviews that can be applicable for the students of all specialities (N=64). But we found that AI tools are most used while training medical students (N=22), information technologies (IT) specialists (N=15), engineers (N=13), business or management students (N=11), and while teaching natural sciences (N= 9). Some articles described the possibilities for implementation of AI-driven technologies in electronics, language education, and educational sciences. Table 4 shows the representation of specialities or sciences in the publications.

Table 4. Articles by specialities or sciences

Speciality/science	N
Undefined	64
Medicine	22
IT, cybersecurity	15
Engineering	13
Business or management	11
Natural sciences	9
Electronics	7
Linguistics	6
Educational sciences	5
Tourism and recreation	2
Military	1
Law	1
Design	1
Media and arts	1
Sports and physical training	1

4.4. Functions of AI-driven technologies in education

To answer the fourth research question, we analyzed the publications by functions of AI-driven technologies in contemporary education and found that AI is used for data analytics, introduction of adaptive or personalized learning, providing interactive and immediate feedback, implementation of online learning, and automated assessment most often. Some rare functions include the following: integration of curriculum with industry, comparison of different pedagogical models to enhance the efficiency of educational process, Geography and Biology learning, formation of AI-related knowledge and skills among students to adjust to future professional activities, maintenance of psychological well-being among students in the classroom, formation of readiness for change and innovation, and improvement of classroom discourse. Table 5 shows the studies by functions of AI-driven technologies in contemporary education.

Table 5. Studies by functions of AI-driven technologies

Function	N
Data analytics	17
Adaptive or personalized systems	12
Enhancement the efficiency of classroom	11
Interactive and immediate feedback	10
Online learning	10
Automated assessment	10
Evaluation of educational outcomes	9
Content development, learning materials	9
Intelligent tutoring systems	8
Simulation-based learning	8
Language learning	7
Peer learning	6
Strategic or innovative planning	6
Machine learning	6
Mathematics learning	5
Computer science learning	5
Prediction of defaults	4
Implementation of active learning	3
Learning management systems	3
Virtual reality	3
Monitoring	3
Provide guidance	3
Decision making	3
Curriculum development	3
Skills development	3
Sports apps	2
Optimization of complicated processes	2
Readiness for life-long education	2
Enhancement of students' readiness to work with digital tools in future	2
Instructional delivery	2
Integration of curriculum with industry	1
Comparison of different pedagogical models	1
Geography learning	1
Biology learning	1
Gaining AI-related knowledge and skills	1
Decrease anxiety	1
Formation of readiness for change and innovation	1
Improvement of classroom discourse	1

4.5. Value of AI for contemporary education during globalization and transformation processes

The fifth research question is related to the analysis of academic studies as far as value of AI for contemporary education during globalization and transformation processes. As a result, we found that most of publications (37%) reveal the significant role of AI-related technologies in the digital age and emphasize the importance of their implementation in the educational process. The authors are confident that the appropriate use of AI-driven technologies enhances the efficiency of educational environment and affects the training positively. 23% of studies reveal the idea that currently AI is an integral part of educational process and must be introduced in the classroom both offline or online. At the same time 18% or works show that introduction of AI is difficult for the developing nations due to poor infrastructure or insufficient financing. 10% of scholars assume that AI may be widely used only for some specialities since they are related to IT or involve extensive use of digital tools. In such case AI-related techniques may assist to form digital literacy, ICT competency and prepare future specialists to act in the virtual environment. 12% of academic studies are unclear about the value of AI in education and consider that more research is needed in the area to outline AI ethics and elaborate more sophisticated and transparent algorithms. Figure 3 shows the value of AI-driven technology in contemporary education.

At the same time, the number of recent publications related to the research problem prove the topicality and importance of the review. The findings show AI technologies are closely connected with globalization and transformation process and lead to openness, flexibility, and internationalization of education. In addition, these technologies contribute to increasing of cross-cultural communication and international scientific collaboration significantly.
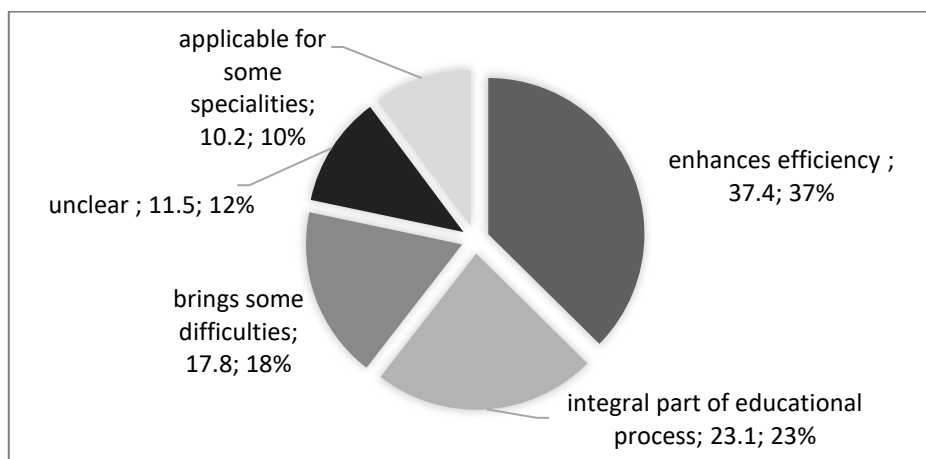
Figure 3. Value of AI in contemporary education

5. DISCUSSION
5.1. Overview
This section summarizes the findings of the impact of AI-driven technologies upon contemporary education during globalization and transformation processes. The research reveals some key results based on the recent publications in the area. The systemic literature review is followed by a discussion section that outlines the theoretical contributions of the study and presents the implications.

Firstly, conducting systematic literature review, we extracted and analyzed 159 publications on the impact of AI-driven technologies upon contemporary education that were published in peer-reviewed and open-access journals between 2019-2023 in details. The analysis of publications contributed to the examination of conceptual framework of research, outlining of research methodology, evaluation of publications' contributions, and identification of values of AI in education. In recent years globalization and transformation process have contributed to the spread of AI-driven technologies in through internationalization and integration [87], [88]. The demand for modernization of education has led to a wide introduction of innovative teaching technologies and progressive changes within the educational environment worldwide [89], [90]. According to [91], [92], educational institutions see innovations as opportunities for their growth strategy and formation of innovative educational environment.

Secondly, AI is obviously used to drive innovation process in many areas including education [10], [79], [93]. The COVID-19 pandemic stimulated the extensive use of the AI techniques in education and demonstrated the vivid opportunities for high-quality online education. Over recent decades a number of researchers paid the attention to development of AI-related educational models and their integration within the educational process through data analytics [12]–[17], learning management systems [23], [35], or personalized learning [12], [15], [18]. Currently, we observe extensive use of AI worldwide, including developing nations. These functions concern the following: content development [10], [19], [20], introduction of simulation-based learning [94], strategic or innovative planning [10], machine learning [95], virtual reality [96], curriculum development [11], [17], [31], optimization of complicated processes [68], enhancement of students readiness for life-long education [97] and to work with digital tools in future [67], [70]–[72], instructional delivery [17].

Thirdly, Chan [98] state that academicians and educators must have realistic views on the use of AI-driven technologies in contemporary education and outline relevant guidelines for its perspective usage in future. Other findings [99]–[101] showed that effective introduction of AI in education still requires the development of relevant strategies that include identification of objectives, explanation of AI role, evaluation capabilities, organization the environment, planning, considering objective feedback, further improvements, and use of facilitation techniques in the classroom. It is worth mentioning that incorporation of AI-related tools requires building AI literacy among the participants of the educational process [17]. Also, special attention must be paid towards the moral issues related to the use of AI in education [102].

A number of findings are devoted to the investigation of replacement of human teachers by AI in the classroom through using of automated assessment [19], [20], personalized learning [12], [15], tutoring systems [30], [32] or creating of virtual learning environment where students will learn independently [103]. Despite of these findings we agree that modernized education should not diminish the role of the pedagogues in training of future specialists [40] as well as the construction of efficient educational requires direct involvement of teachers [19], [85], [86] and implementation of active techniques [94].

The main findings of this systematic literature review concern as: i) although there is a number of research in the area of AI-based education and implementation of AI-driven technologies within the educational process, AI is not a part of conventional educational curricula yet, in particular in developing nations. It occurs because of lack of infrastructure [4], limited access to technology [4], [11], [58], skills gap [37], [72], data quality and availability [25]. Besides, implementation of AI-driven technologies is hindered by the absence of well-established regulatory frameworks [77], [79]. Special attention was paid towards integration of curriculum with industry since it involves harmonization of educational programs with the needs and demands of future specialists and ensuring that students are equipped with the skills and knowledge required for carrying out professional duties in future; ii) globalization and transformation process lead to spread of AI tools in educations through internationalization and integration tendencies but contemporary education does not require obligatory implementation of AI-driven technologies while training future specialists. We found that it is, first of all, efforts of some educators or necessity to vary teaching methods and techniques. According to our findings AI tools can be introduced within the educational process through flipped classroom [63], personalized learning trajectories [12], [15], gamification and simulation-based learning [94], collaborative learning [68], and project-based learning [75]. Also, continuous professional development of teachers is very important [97] as it helps improve pedagogical competencies and build methodical orientations on enhancement of educational process where AI tools are used; and iii) a great number of instructors still unclear about using AT-driven technologies within the educational process due to confusion about AI ethics or lack of understanding about AI-related algorithms [30], [103]. Therefore, institutions must use and assimilate official documents of such organs as the OECD, the World Bank, UNESCO, EU Commission to provide the teaching staff with appropriate information and ensure its relevance for efficient educational process. Since the existing documents concern data protection, privacy laws, security regulations, intellectual property laws, and introduce government guidelines and initiatives [87], [104], the educational establishments must collaborate with technology provides and policymakers to develop regulatory framework aimed at protection of rights of students and instructors and enhancement of educational process through innovative approaches based on AI technologies.

5.2. Limitations and implications for further research

Some limitations must be considered while analyzing the research findings. First, we included only English language publications that potentially minimizes the number of papers written in other languages. Second, the research included 159 original research and literature review articles published between 2019-2023. Some of them considered the references published in 1990s or 2000s; and it demanded scrupulous analysis for the existing trends of globalization in contemporary education or applicability of AI-related technologies under modern conditions.

Further academic scholars and educational experts must concentrate on improvement of research methodology, using multiple methods in particular, because mixed-method approach may contribute to in-depth exploration of the problem, its comprehensive understanding, increasing the reliability and validity of the research. We are sure that the mixed methods pattern may improve the flexibility of outcomes and correlate the research design to scientific insights. Moreover, mixed methods research may help develop theory through hypotheses generation, their testing and validation, resulting in advancement of theoretical framework and formulating of practical implications.

Also, our study revealed some gaps in the research methodologies used in the previous reviews which where oriented towards training of students of certain specialities [7], [25] or applications of AI models for particular functions like educational analytics or decision making [12]. This suggests that future research must verify the findings based on the data of educational establishments and further outline the most effective teaching methods and approaches for AI implementation. The main efforts should be drawn to introduction of effective learning styles, building of positive instruction delivery, creation of adaptive learning platforms, and incorporation of automated assessment.

Findings show that AI technologies may be implied within the educational process to adapt learning materials to students' learning needs and offer them targeted assistance, create high-quality educational content, automate the assessments, and analyze educational data. We completely agree that AI technologies are used to provide a safe and cost-effective educational environment for students through immerse simulations and virtual reality technologies. In addition, the educational process may benefit from learning analytics since AI technologies show their efficiency in tracking students' progress. As a result, instructors will identify strength and weaknesses within the educational environment and then they will generate real-time insights and make data-driven decisions.

Understanding AI-driven technologies and their functions in contemporary education may help all the participants of educational process benefit from these opportunities and create innovative educational environment oriented towards training of competitive and flexible specialists who are able to act in the digital

age. Based on these results, future research must consider the students' attitudes towards the use of AI tools in the classroom and, also, they must evaluate the growth of efficiency of educational process due to implementation AI-related techniques as it was unclear from the publications we used in the review.

6.   CONCLUSION

The research presents a systemic literature review of scientific articles related to the impact of AI-driven technologies in contemporary education during globalization and transformation processes. We extracted 159 studies published between 2019-2023 in different databases such as Scopus, Web of Science Core Collection, EBSCO, PubMed, Index Copernicus, and Google Scholar. We considered the English-language original research and review papers using the list of basic keywords or terms.

Firstly, the findings show that the smallest number of articles was published in 2019 (N=12). At the same time, in 2022 53 were published that demonstrates the topicality of the research problem and extensive role of AI-driven technologies in contemporary education. Secondly, we found that most articles were published by American, Chinese, Indian, and British scholars. They conducted empirical and theoretical research to reveal the perspectives and challenges of using AI-driven technologies in contemporary education. In addition, it is important to mention that most articles were published in Asia (N=60). Europe is represented by 43 publications and North America has 46 academic studies. Middle East, Australasia, and Africa are represented by a relatively smaller number of articles.

Thirdly, most of the publications concern original research or systemic reviews that can be applicable for the students of all specialities. But we found that AI tools are most used while training medical students, IT specialists, engineers, business or management students, and while teaching natural sciences. Also, some publications mentioned the possibilities for implementation of AI-driven technologies in electronics, language education, and educational sciences.

Fourthly, we came to the conclusion that AI is used for data analytics, introduction of adaptive or personalized learning, providing interactive and immediate feedback, implementation of online learning, and automated assessment most often. Some rare functions include integration of curriculum with industry, comparison of different pedagogical models to enhance the efficiency of educational process, geography and biology learning, formation of AI-related knowledge and skills among students to adjust to future professional activities, maintenance of psychological well-being among students in the classroom, formation of readiness for change and innovation, and improvement of classroom discourse.

Fifthly, we found that most of publications reveal the significant role of AI-related technologies in the digital age and emphasize the importance of their implementation in the educational process. 23% of studies present the idea that currently AI is an integral part of educational process and must be introduced in the classroom both offline or online. 18% or works show that introduction of AI is difficult for the developing nations and 10% of scholars assume that AI may be widely used only for some specialities since they are related to IT or involve extensive use of digital tools. 12% of academic studies are unclear about the value of AI in education and consider that more research is needed in the area. Thus, AI-driven technologies and their functions play an important role in contemporary education and the number of publications related to the topic testify that their use will extend in future.

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