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Integration of ChatGPT in e-Learning Systems: Comprehensive review

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ABSTRACT

The process of integrating artificial intelligence (AI) technologies, particularly ChatGPT, into e-learning has attracted considerable attention due to the potential to improve personalized education or education based on personally oriented technologies. The aim of the study is to investigate the process of integrating ChatGPT into e-learning systems, focusing on the interpretation of the results. To study the issue of ChatGPT integration in e-learning, a detailed review of the current scientific literature was conducted. Accordingly, a thorough research search covered articles from 2020 to 2023, revealing an increase in publications in recent years. An in-depth analysis of 101 publications revealed a significant interest in the use of ChatGPT to deliver personalized and adaptive learning. The results showed that the integration of ChatGPT increases the effectiveness of e-learning by adapting the content to the individual needs of all participants in the learning process. It was also shown that ChatGPT can adjust the complexity of the content according to the learner's level of understanding, provide feedback and support, and facilitate the creation of individual learning tools. The results show that the process of integrating ChatGPT into an online learning space offers many opportunities, such as personalized learning paths and rapid assessment. However, certain challenges need to be addressed, such as infrastructure limitations and ethical considerations.

Keywords: ChatGPT, E-Learning, Scientific Literature, Advantages, Artificial Intelligence

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1. Introduction

ChatGPT, one of the most well-known types of AI, has attracted considerable attention from both academics and society at large due to its potential to transform e-learning. Developed on the basis of OpenAI, ChatGPT is a modern model of natural language processing that uses deep learning methods to generate a variety of human text responses. ChatGPT is a game-changer in e-learning. ChatGPT represents a paradigm shift in how education is delivered. Unlike traditional forms of online learning based on static content and predetermined learning paths, ChatGPT offers dynamic and personalized learning. The adaptive approach of this application not only improves engagement, but also promotes more effective learning outcomes. At the same time, the integration of ChatGPT into e-learning systems opens new opportunities for organizing joint and interactive learning [1]-[9]. The process of integrating ChatGPT into e-learning systems has great prospects for the future of modern education. Using the various capabilities of artificial intelligence, teachers create more personalized and, therefore, effective educational programs that meet the various needs of all participants in the educational process [10]-[14]. ChatGPT is a game-changer in the world of automated testing and grading systems. It adapts to each student's needs, allowing you to effectively monitor their progress and respond to any problems in a flash. The authors of the article are convinced that integrating ChatGPT into modern online learning will revolutionize the learning process.

E-learning contributes to the formation of social integration, forming broad communication and intercultural exchange. The gradual development of digital technologies and the general digitalization of society have greatly expanded e-learning, contributing to rapid interaction around the world [16]-[18]. Within education, e-learning is an important part of true openness, flexibility and internationalization. This in turn improves education itself.

At the same time, the e-learning system contributes to the development of digital transformations in education, optimizing this system completely. These changes create a more conducive environment for both students and teachers. Digital technologies support the educational process with the help of various digital tools, systems or devices that generate and process data.

The modern stage of the development of society requires increasing the efficiency of education and cultivating a high level of professional competences and attitudes towards students [4], [7], [19]. This requirement is proof that we are moving towards a digital educational environment and the introduction of innovative technologies [20]. Therefore, the purpose of this article is to comprehensively study the features of using ChatGPT in modern electronic education. Solving this will require consideration of the following goals: 1. Determination of the number of articles in the period from 2020 to 2024 regarding artificial intelligence in education. 2. Determining the regions where this problem is most studied. 3. Determination of the main advantages and disadvantages of using this relationship in education on the basis of literature analysis.

A systematic review of the literature is needed to outline recent developments in research on the impact of ChatGPT on e-learning. In this regard, we consider the following research questions. First, the authors of the paper determined how many academic studies of ChatGPT were published between 2020 and 2024. Secondly, they determined which regions are most often represented in the selected works. Third, the authors assessed the value of ChatGPT and its benefits for modern e-learning. Finally, they identified the main challenges of integrating ChatGPT into e-learning systems.

2. Research method

The study adheres to the PRISMA 2020 statement, the current standard for systematic review reporting. It investigates the problem of integrating ChatGPT into e-learning systems [21], [22]. The study is divided into four main stages: finding references, choosing articles, doing specialist analysis and research, and assessing each contribution thoroughly before preparing a review. The steps involved in a systematic literature review are shown in Figure 1.

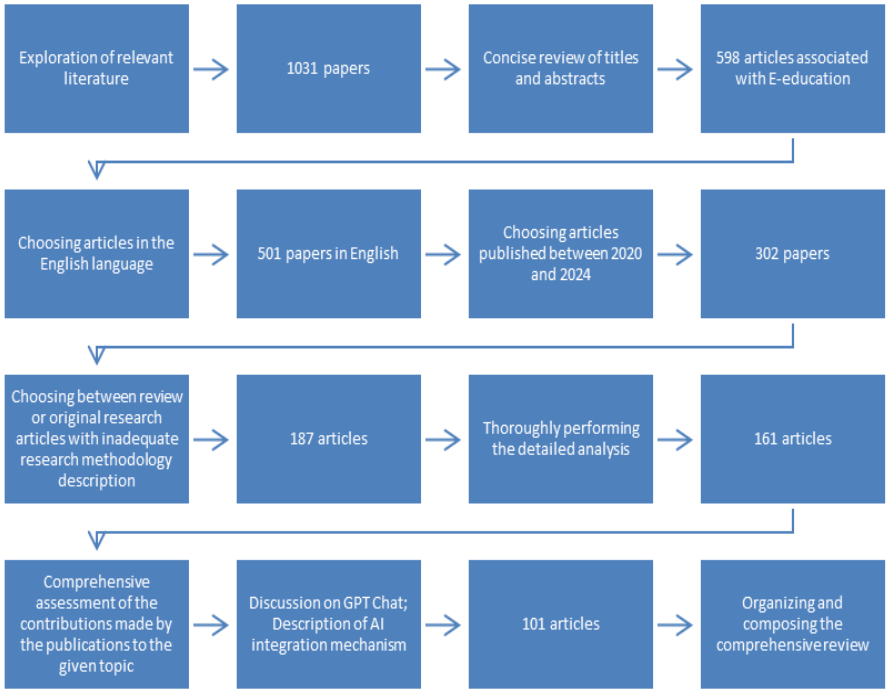

Figure 1. Main stages involved in a systematic literature review

Source: Author's development

The databases used were well-known and comprehensive investigations were conducted employing essential keywords and terminology related to the subject matter. A total of 1031 publications were identified, documented and organized using bibliographic software, including EndNote 9.0.1 and Reference Manager v11. Subsequently, a filtering process incorporating critical analysis of titles (or abstracts) was implemented to eliminate irrelevant and non-relevant results related to ChatGPT integration into e-Learning Systems. Of the initially identified 1031 documents, 598 articles were found to concentrate on the development of e-education

through the integration of AI, specifically ChatGPT. Table 1 enumerates the primary keywords and terms utilized during the reference search.

Table 1. Fundamental keywords and phrases

Category	Keywords and terms
ChatGPT	"ChatGPT integration" OR "Chat-based learning" OR "ChatGPT applications in education" OR "Interactive e-learning with ChatGPT" OR "ChatGPT and educational outcomes" OR "ChatGPT for online courses".
Artificial Intelligence (AI)	"Artificial intelligence" OR "AI- technologies" OR AI OR "AI tools" "Artificial intelligence integration" OR "Incorporating AI in education", OR "AI-driven educational technologies" OR "Transformations facilitated by AI" OR "Educational AI tools" OR "AI-powered learning systems" OR "Role of AI in education".
E-Learning	"E-Learning Systems" OR "Online education" OR "Educational technology integration" OR "Adaptive learning with ChatGPT" OR "Virtual learning environment" OR "Pedagogy in e-learning" OR "Digital learning" OR "Technology-enhanced learning" OR "E-Learning platform" OR"Online courses".

Source: Author's development

The following classification was carried out according to specific exclusion standards:

1. Articles that did not provide a thorough explanation of the main research approach for putting artificial intelligence systems into practice were disqualified.
2. Articles that omitted information about the integration of artificial intelligence were disregarded.
3. Articles that made no mention of GPT discussion at all were disqualified.
4. Items that were not offered in either Ukrainian or English were not included.
5. Papers that repeated what was already known without adding anything new to the scientific conversation were not accepted.

By using these standards, a 101-item refined list of references was produced, indicating a targeted collection of pertinent books. Following that, a thorough data analysis was conducted using both content and theme analysis. A thorough content analysis was carried out on the 101 references that were chosen. This involved a comprehensive study of the titles, abstracts and main content of the articles. The aim was to identify valuable information regarding the integration of ChatGPT into e-learning systems, including methodologies, results and key findings. Simultaneously, thematic analysis was used to identify the most significant recurring themes, patterns and overarching themes present in the selected references.

3. Results and discussion

3.1. Academic studies by years

To address the initial research query, an examination of 101 publications was conducted, revealing the lowest number of articles in 2020 (N=3). Contrarily, the highest number of articles appeared in 2023 (N=73), underscoring the relevance of the research issue and the widespread application of ChatGPT technologies in modern e-Learning. The distribution of academic studies published in journals by year is presented in Table 2.

Table 2. Articles by years

Years	N
2020	3
2021	5
2022	13
2023	73
2024	5

Source: Author's development

Table 2 clearly shows the distribution of academic studies published in journals by year. This distribution is easily explained by the fact that ChatGPT was introduced to widespread use in 2022. At that time, its possibilities in e-learning were not known to researchers. Instead, we can talk about scientific hypotheses regarding the use of artificial intelligence in education in general, which only increased after the coronavirus pandemic. However, it is important to note that not much time has passed in 2024, and many trade journals have not yet updated their pages.

3.2. Academic studies by regions

Simultaneously, an examination was conducted on the distribution of regions and continents in ChatGPT-related research, revealing Asia as the leading contributor with 34 % of publications. Europe follows with 13 % publications, while North America presents 25 % academic studies on the research topic. In contrast, Africa and Middle East are represented by fewer articles – with 10 % and 10% of publications respectively. Other regions are represented by 8 % of publications (See Figure 2).

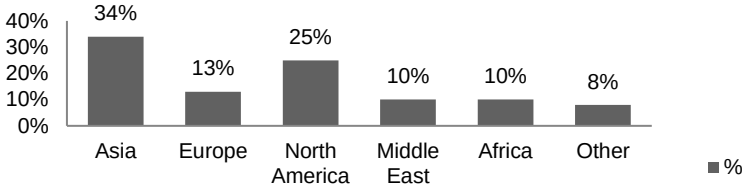

Figure 2. Diagram of academic studies by region
Source: Author's development

3.3. The value of ChatGPT for contemporary e-Learning

At the same time, we conducted an examination of the distribution of regions and continents in ChatGPT-related research. The results show that Asia is the leading contributor, with 34% of publications. Europe follows with 13% publications, while North America presents 25% academic studies on the research topic. In contrast, Africa and Middle East are represented by fewer articles – with 10 % and 10% of publications respectively. Other regions are represented by 8 % of publications (See Figure 2). The next research question examines the value of ChatGPT for contemporary e-Learning during globalization and transformation processes. Modern academic research has revealed a range of perspectives on the role of ChatGPT-driven technologies in the digital age. Approximately 30% of the publications highlight the significant impact of these technologies on e-learning. They emphasize the importance of these technologies in increasing efficiency and positively impacting learning outcomes. It is believed that the proper use of ChatGPT increases the effectiveness of the e-learning environment and has a positive effect on learning outcomes [8], [22]-[25]. Moreover, about 25% of studies demonstrate that ChatGPT is an important component of e-learning and should be integrated into online classrooms. However, about 20% of papers indicate that ChatGPT implementation is difficult for developing countries due to poor infrastructure and insufficient funding. 15% of academics believe that ChatGPT is most useful for majors related to information technology or those that require extensive use of digital tools. In such cases, methods related to ChatGPT are the best way to develop digital literacy, ICT competence and prepare future specialists for virtual environments [18], [31]-[34]. Interestingly, 10% of academic studies express uncertainty about the value of ChatGPT in e-Learning, suggesting that further research is needed to clarify AI ethics and develop more sophisticated and transparent algorithms. Figure 3 illustrates the value of ChatGPT-driven technology in contemporary e-Learning [35]-[39].

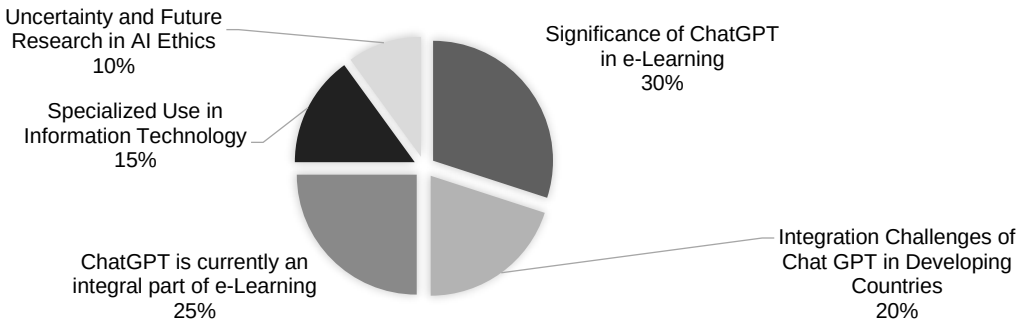

Figure 3. Value of Chat GPT in contemporary E-education systems, Source: Author's development

The importance of the review is further emphasized by the recent increase in the number of articles related to the research topic. The findings demonstrate how AI technologies, which are closely linked to processes of globalization and transformation, promote openness and flexibility.

3.4. Benefits of ChatGPT for online learning

Setting up training is one of the main functions of ChatGPT [40]. While traditional schools often struggle to accommodate the varying demands and learning styles of their students, ChatGPT can tailor information to meet each student's needs. Students can receive a personalized learning path from an artificial intelligence system that can recognize their skills and weaknesses.

It provides specific resources. It also provides quizzes and interactive modules that are precisely designed to target and enhance the areas where the student requires improvement. This personalized methodology empowers learners to advance at their individual pace, fostering confidence and proficiency in subjects that may have previously posed challenges. Additionally, ChatGPT has the ability to adapt the complexity of content according to the learner's comprehension level. The foundation of ChatGPT's proficiency in delivering personalized learning experiences lies in its incorporation of adaptive learning strategies. Researchers have succinctly summarized these notable advantages (see Table 4).

Table 4. Advantages of ChatGPT using in e-Learning

Pros	Description	Scholars
Adjusting content complexity	Dynamic adaptability of content difficulty based on the level of understanding of the learner. Formation of personalized training.	[25], [27], [31]-[33], [41]-[45].
Tailored Paths	Development of individual study plans for each student. The program offers a variety of topics and resources that match its goals and learning pace.	[3]-[5], [7], [12], [15]-[18], [46]-[50].
Assessments	Real-time and fast assessments	[8], [18], [25]-[27], [30], [51]-[56].
Feedbacks and support	Fast feedback, improving understanding between all students of the learning process.	[9]-[11], [14], [33], [57]-[60].
Recommendation engines	Using the recommendation function to suggest relevant learning resources or interactive modules, providing varied learning.	[17], [19], [29], [61]-[64].

Source: Author’s development

3.5. Challenges of integration ChatGPT in e-Learning Systems

W. Berkowitz [65] in his literature review notes the following shortcomings of using distance education: unbalanced online teaching, lack of rational self-analysis, weakened value of the educational subject, social isolation, learning environment, classroom teaching, student needs, readiness to use digital tools, lack of opportunities, negative indicators, lack of experience. Other researchers [24], [26], [50], [66]-[69] conducted a thorough literature review on the use of distance higher education. They identify the following problems of distance education in higher education institutions: low level of motivation and satisfaction of students, problems with the mental health of teachers and students, lack of digital competence and self-effectiveness, obstacles to the implementation of new teaching methods, lack of access to technological infrastructure and software. Low motivation, classroom teaching, and social isolation are inextricably linked. The lack of personal communication with classmates and teachers impedes the exchange of ideas, engagement in discussions, and mutual support, which in turn affects understanding of the material and the importance of learning tasks [4], [6], [70]. Without a clear schedule and commitments inherent in traditional classes, students may find it difficult to manage their time independently and adhere to the schedule of educational activities.

T. Fütterer [71] identified the following problems of online learning for learners: difficulty in understanding materials, technical difficulties, limited internet traffic quota, poor communication, less effective learning. In article by J.-O. Park [72], the authors identify the following problems in organizing and conducting online

learning: difficulties with electrical and internet networks, lack of appropriate software, inability of learners to express their thoughts clearly and understandably, difficulties in formulating and succinctly arguing their position. Other researchers pointed out the following shortcomings of distance learning [7], [19], [44]: limited technical capabilities, lack of trust in electronic communication and learning tools, certain dependence of learning success on computer management skills, difficulty in acquiring some practical skills, which are obtained only during real (not virtual) practical and laboratory work, user identification problem, low level of self-discipline. On the other hand, some scholars mentioned "a range of potential destructions" [19], [24], [79]: insufficient student involvement in educational activities, lack of attention, cases of unethical behavior and failure to comply with academic integrity by higher education learners. Ethical behavior and adherence to academic integrity are integral parts of programming education, as it is built on trust and professionalism [80]-[84].

3.6. Discussion

The obtained results indicate the emergence of significant interest of modern scientists in the study of artificial intelligence systems. This is confirmed in other works, where the role of artificial intelligence programs to support personalized learning is defined in detail [85], [86]. At the same time, the process of modernization of education accelerated the widespread introduction of innovative learning technologies throughout the world, forming the beginning of progressive changes in the educational environment [87]-[90]. According to modern research, innovations based on both artificial intelligence and various digital technologies are increasingly perceived as strategic ways of educational development, forming innovative educational institutions [91], [92]. In addition, the results of the study coincide with other large-scale studies that emphasize the role of AI, particularly ChatGPT, in promoting various innovations in the education sector [10], [79], [93]. In the study, it was determined that in recent years, modern scientists have highlighted various possibilities of chat for improving education. This is in line with other studies, and it is indicated that over the past decades, studies have highlighted the development of initial models related to artificial intelligence based on data analysis [94]-[96] or individual learning management systems [68], [77], [97].

The systematic literature review brings to light persisting challenges despite the burgeoning research on ChatGPT integration in e-Learning Systems. Notably, AI, particularly ChatGPT, has yet to become a standard component of conventional educational curricula, particularly in developing nations. Obstacles include limitations in infrastructure, restricted technology access, skills deficiencies, and challenges related to data quality and availability [98], [99], [100]. Given the fact that research on the process of ChatGPT integration into e-learning systems attracts considerable attention of modern scientists, it is worth comparing the obtained results with other scientific works. This should be done so that our contribution. In particular, the obtained results coincide with Farhi et al.'s work regarding the interpretation of the main views of students on ChatGPT. These two studies emphasize the positive attitude of participants in the educational process towards artificial intelligence and contribute to the formation of an ethical discourse regarding its large-scale use [44].

At the same time, this study mainly delved into the integration of ChatGPT into e-learning systems, however, other studies focus on the relevant ethical and philosophical aspects. Although current works are different in scope, they make a valuable contribution to the understanding of the ethical principles of ChatGPT, which is not covered in this work [76], [89], [101]. Bhanushali et al. also emphasized the consequences of responsible use of AI, which in turn are consistent with our research on the negative aspects of using AI [46]. In addition, this work does not address the issue of overcoming the limitations of ChatGPT. However, the comparison determined the variety of promising directions in the wider research space. This study focuses on the aspect of e-learning, while Lund and Ting described the impact of AI on the development of academia and libraries. Therefore, both works contribute to the formation of multifaceted consequences of ChatGPT [35]. At the same time, the topic of ChatGPT's potential as an academic editing tool in modern studios echoes our findings [98]. This emphasizes the universality of this tool in education [96], [100]. An important work for comparison is O'Connor's study, which describes different AI platforms for medical education. The author stated that they are important for acquiring practical skills [37]. Furthermore, the study contradicts Lytras [83]'s view on whether ChatGPT should be banned. While other studies have highlighted concerns about potential bans, this study also made it clear that ethical issues are important in e-learning. Disagreements may arise from differing opinions regarding the appropriateness and value of ChatGPT in academic settings. The comparison shows the variety of applications of artificial intelligence in different fields of education. This study aligns with the forward-thinking approach of Hill-Yardin et al., which highlights the potential impact of ChatGPT on the future creation

and distribution of educational content [38]. This discussion clearly demonstrates the diversity of views on the role of ChatGPT in education. A detailed comparative analysis demonstrates that these studies, although related to different aspects of ChatGPT programs. However, modern scientists are divided into two groups: supporters of the use of AI and opponents of the use of this tool in education. The most surprising results include the existence of various ethical considerations regarding the responsible use of AI and the potential role of ChatGPT in changing education.

Despite the novelty of this research, certain limitations should be recognized. Conclusions are subject to generalizability limitations due to the specific focus of the study on the selected time, databases and keywords. To address these limitations and advance knowledge in this area, several directions for future research are suggested. It is important to conduct a cross-cultural analysis that will provide a more inclusive perspective on the integration of ChatGPT into e-learning systems.

4. Conclusions

Hence, the systematic review of 101 publications demonstrated the importance of ChatGPT in the e-learning system. It has been proven that there is a noticeable increase in publications from 2020 to 2023. This shows the growing interest and recognition of the importance of this tool in modern education. At the regional level, Asia is the dominant country in the number of studies related to ChatGPT. At the same time, the works of authors from North America and Europe are of great importance. Such geography emphasized the global importance of ChatGPT for educational purposes. Looking ahead, the limited data available for 2024 suggest that the number of publications using this platform will continue to grow. The process of integrating ChatGPT into e-Learning offers several advantages, including the possibility of practicing a person-oriented approach. Unlike the traditional form of classes, based on which it can be difficult to satisfy the needs of all students, ChatGPT facilitates the adaptation of educational content to the specific requirements of each student. ChatGPT has also been proven to help adjust the difficulty of content based on the student's level of understanding, ensuring systematic and consistent learning. At the same time, the integration of ChatGPT into e-learning systems has certain difficulties (unbalanced online teaching, inconsistency of material and technical infrastructure, low level of digital literacy). Thus, for this platform to be widely used in the education system, it should be optimized.

Declaration of competing interest

The author declares that he has no known financial or non-financial competing interests in any material discussed in this paper.

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