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05.00.00 - Texnika fanlari
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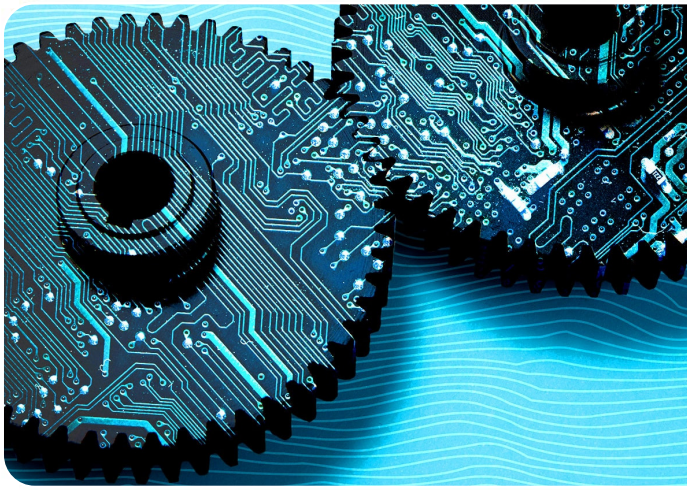

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05.01.00 – Axborot texnologiyalari, boshqaruv va kompyuter grafikasi
05.01.01 – Muhandislik geometriyasi va kompyuter grafikasi. Audio va video texnologiyalari
05.01.02 – Tizimli tahlil, boshqaruv va axborotni qayta ishlash
05.01.03 – Informatikaning nazariy asoslari
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05.01.05 – Axborotlarni himoyalash usullari va tizimlari. Axborot xavfsizligi
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05.02.00 – Mashinasozlik va mashinashunoslik
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05.03.02 – Metrologiya va metrologiya ta'minoti
05.04.01 – Telekommunikasiya va kompyuter tizimlari, telekommunikasiya tarmoqlari va qurilmalari. Axborotlarni taqsimlash
05.05.03 – Yorug'lik texnikasi. Maxsus yoritish texnologiyasi
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05.08.03 – Temir yo'l transportini ishlatish
05.08.06 – "G'ildirakli va gusenisali mashinalar va ularni ishlatish" (texnika fanlari)
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08.00.16 – Raqamli iqtisodiyot va xalqaro raqamli integratsiya
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Ma'lumot uchun, OAK Rayosatining 2024-yil 28-avgustdagi 360/5-son qarori bilan "Dissertatsiyalar asosiy ilmiy natijalarini chop etishga tavsiya etilgan milliy ilmiy nashrlar ro'yxati"ga texnika va iqtisodiyot fanlari bo'yicha "Muhandislik va iqtisodiyot" jurnali ro'yxatga kiritilgan.

Muassis: "Tadbirkor va ishbilarmon" MChJ

Hamkorlarimiz:

1. Toshkent shahridagi G.V.Plexanov nomidagi Rossiya iqtisodiyot universiteti
2. Toshkent davlat iqtisodiyot universiteti
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DEVELOPMENT OF E-LEARNING AND EDUCATIONAL PLATFORMS IN UZBEKISTAN

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Abstract. This paper aims to synthesize the evolution of e-learning, characterize contemporary technological and pedagogical shifts, and contextualize global market dynamics with a focused appraisal of platform development and adoption in Uzbekistan, including the integration of international educational platforms. Using a narrative review of reported historical milestones, platform case studies, and published market indicators, the analysis traces the development of e-learning.

E-learning is shown to accelerate content updating (for example, e-textbooks updated daily), expand interactive multimedia participation, and transform instruction toward creative, discussion-based, and flipped-classroom models.

Keywords: E-learning, online education, digital learning, Learning Management System (LMS), MOOCs, Artificial Intelligence in education, mobile learning, gamification, Virtual Reality (VR), educational platforms, distance learning, Uzbekistan education system, EdTech market, K-12 education, Internet of Things, Augmented Reality (AR).

Annotatsiya. Ushbu maqola elektron ta’limning rivojlanish bosqichlarini umumlashtirish, zamonaviy texnologik va pedagogik o‘zgarishlarni tavsiflash hamda global bozor dinamikasini O‘zbekiston misolida ta’lim platformalarining rivojlanishi va joriy etilishi, jumladan, xalqaro ta’lim platformalari integratsiyasi nuqtai nazaridan tahlil qilishga qaratilgan. Tarixiy bosqichlar, platformalar tajribasi va e’lon qilingan bozor ko‘rsatkichlari asosidagi sharh usuli orqali elektron ta’lim taraqqiyoti yoritilgan.

Tahlil natijalari shuni ko‘rsatadiki, elektron ta’lim o‘quv materiallarini tezkor yangilashga (masalan, elektron darsliklarni kundalik yangilash), interaktiv multimedia ishtirokini kengaytirishga hamda ta’lim jarayonini ijodiy, munozaraga asoslangan va “flipped classroom” usullariga yo‘naltirishga xizmat qiladi.

Kalit so‘zlar: elektron ta’lim, onlayn ta’lim, raqamli ta’lim, Learning Management System (LMS), MOOC, ta’limda sun’iy intellekt, mobil ta’lim, gamifikatsiya, Virtual Reality (VR), ta’lim platformalari, masofaviy ta’lim, O‘zbekiston ta’lim tizimi, EdTech bozori, K-12 ta’lim, Internet of Things, Augmented Reality (AR).

Аннотация. Данная статья направлена на обобщение этапов развития электронного обучения, характеристику современных технологических и педагогических изменений, а также анализ глобальной рыночной динамики на примере Uzbekistan с точки зрения развития и внедрения образовательных платформ, включая интеграцию международных образовательных платформ. На основе обзора исторических этапов, практики платформ и опубликованных рыночных показателей прослеживается эволюция электронного обучения.

Результаты анализа показывают, что электронное обучение способствует оперативному обновлению учебных

материалов (например, ежедневному обновлению электронных учебников), расширению интерактивного мультимедийного участия и трансформации образовательного процесса в сторону творческих, дискуссионных и моделей «перевернутого класса».

Ключевые слова: электронное обучение, онлайн-образование, цифровое обучение, Learning Management System (LMS), MOOC, искусственный интеллект в образовании, мобильное обучение, геймификация, Virtual Reality (VR), образовательные платформы, дистанционное обучение, система образования Uzbekistan, рынок EdTech, образование K-12, Internet of Things, Augmented Reality (AR).

INTRODUCTION

With the beginning of the information and communication technology era, digital technologies have been integrated into many fields and have initiated large-scale digital transformation processes. In the education system, digital platforms such as virtual learning, remote learning, and web-based education have been introduced, significantly contributing to the development of e-learning. Over the years, this model of education has transformed not only the learning process but also teaching methods.

E-learning is considered an important tool for meeting the growing demand for highly qualified specialists in the modern technological world. Consequently, a new market segment — the e-learning market — has emerged. Within this market, educational platforms such as Udemy, Khan Academy, Skillshare, and Canvas are widely used and continuously developing[1].

LITERATURE REVIEW

The evolution of e-learning has been shaped by significant technological, pedagogical, and market developments since the 19th century. Early forms of distance education began with correspondence courses, which allowed students to study remotely through mailed learning materials. The introduction of radio and television in the mid-20th century further expanded these opportunities, laying the foundation for more interactive and accessible learning models. The 1960s marked an important transition with the emergence of Computer-Based Training (CBT), which enabled learners to access educational content stored on computers, increasing interactivity and self-paced learning opportunities.

The 1990s witnessed a transformative stage driven by the internet, which facilitated the development of Learning Management Systems (LMS) such as Blackboard, Moodle, and Canvas. These platforms centralized course management and content delivery, enabling institutions to organize digital classes more efficiently. At the same time, Massive Open Online Courses (MOOCs) emerged, broadening access to education by offering affordable or free courses from leading universities worldwide.

The late 2000s and early 2010s introduced mobile learning and micro-content, aligning educational delivery with the rapid adoption of smartphones and tablets. This mobile-first approach enabled learners to participate in short, focused learning sessions anytime and anywhere, significantly improving completion rates and knowledge retention.

Recent years have seen the integration of Artificial Intelligence (AI) and Machine Learning (ML) into e-learning, creating adaptive learning environments that personalize content according to individual learner profiles. AI-driven systems analyze real-time data to identify knowledge gaps and tailor instructional materials accordingly, progressing from basic chatbots to advanced virtual tutors capable of providing immediate feedback. Gamification and immersive technologies such as Virtual Reality (VR) and Augmented Reality (AR) have further increased engagement by transforming learning into interactive, mission-based experiences, particularly effective in skill-oriented fields such as medicine and engineering.

Social and collaborative learning tools have also become essential components of modern e-learning, shifting education from an individual activity toward a community-based process. Platforms now integrate discussion forums, peer-review networks, and social media tools to facilitate global interaction and knowledge exchange among learners. In addition, advanced analytics embedded in modern LMS platforms enable educators to monitor not only course completion, but also learner engagement and performance patterns, allowing timely support and continuous content improvement.

Globally, the e-learning market has experienced rapid growth, valued at approximately USD 210 billion in

1 https://www.researchgate.net/publication/355737261_Development_of_E-learning_A_Historical_Review_with_Global_Perspective

2021 and projected to reach USD 439.92 billion by 2025, with forecasts exceeding USD 2.3 trillion by 2034 at a compound annual growth rate (CAGR) of 20.4%. The Asia-Pacific region leads this expansion, supported by cloud-based deployment models, substantial investments in K–12 education, smart classrooms, Internet of Things (IoT) interactivity, and evidence-based pedagogical evaluation. In Europe, government-led digital education strategies and lifelong learning initiatives continue to support market growth, strengthened by high broadband penetration and public funding, resulting in a dynamic and competitive environment focused on platform scalability and educational quality.

Uzbekistan provides an example of regional adaptation and growth in e-learning. The country introduced Moodle in 2011, initially as a supplementary tool with limited faculty engagement, but it has since achieved broader adoption across universities. The COVID-19 pandemic accelerated distance learning implementation in schools through platforms such as Maktab.uz[2] and ZiyoNET, which provide resources including textbooks, tests, and video lessons. The introduction of electronic examination systems has improved assessment quality and transparency. Investments in smart classrooms equipped with modern computers, internet access, and interactive whiteboards have further strengthened digital education infrastructure.

Modern technologies have entered traditional education, updating and enhancing many of its features. As a result, the concept of e-learning has emerged as an important component of the education sector. E-learning enables students to use multimedia educational content created once and reused multiple times in an interactive format. In this way, students can not only observe the content creation process but also actively participate in it.

E-learning integrates social networks, forums, and chats into educational content. Furthermore, it enables the development of dynamic systems for continuously improving platform content. In the traditional education system, textbooks are often updated once every three to four years, whereas in e-learning, electronic textbooks can be updated regularly and efficiently. While preserving the valuable aspects of traditional education, e-learning also allows users to access additional resources through hyperlinks embedded in digital educational materials.

In e-learning, teachers are encouraged to master methods of remote communication and digital instruction. This also enables educators to create, supplement, edit, and publish learning materials independently. As a result, the structure of lectures changes significantly. In a traditional lecture, students mainly receive new information directly from the teacher, whereas in e-learning, educational materials are presented beforehand in multiple formats. Therefore, teachers can adopt a more creative approach by guiding students toward information sources, encouraging independent research, and organizing discussions based on prior preparation. During these discussions, students' views are considered, and common conclusions are reached. Teachers may also assign independent study topics to deepen understanding.

In Uzbekistan, the role of e-learning in the development of the education system is steadily increasing. The rapid advancement of the internet and digital technologies has supported the broad introduction of new forms of education, particularly distance learning and e-learning.

Over the past five years, several important achievements and developments have been observed in the field of e-learning in Uzbekistan. These achievements are mainly aimed at integrating technologies into the educational process, creating online platforms, modernizing the education system, and expanding opportunities for students to receive distance education.

RESEARCH METHODOLOGY

This study employs a qualitative research design based on a narrative literature review and secondary data analysis to examine the development of the e-learning market and international educational platforms. Relevant data were collected from academic articles, industry reports, and official educational sources using keywords related to e-learning evolution, digital platforms, and Learning Management System (LMS) technologies.

The collected information was analyzed thematically and chronologically to identify key trends such as technological advancements, market growth, and regional developments, with a particular focus on Uzbekistan. A case-based approach was also applied to illustrate practical examples of global and local platforms, ensuring a comprehensive understanding of the topic.

ANALYSIS AND RESULTS

The findings of this study demonstrate that the development of e-learning has progressed through several

2 www.edu.uz - Portal of the Ministry of Higher and Secondary Special Education

distinct technological and pedagogical stages, each contributing to the transformation of education into a digitally driven system. Initially, distance education emerged in the 19th century through correspondence courses, which allowed learners to access instructional materials remotely. This model was further enhanced by the introduction of radio and television in the mid-20th century, enabling broader dissemination of educational content. A significant advancement occurred in the 1960s with the introduction of Computer-Based Training (CBT), which facilitated interactive and self-paced learning through digital systems.

The widespread adoption of the internet in the 1990s marked a critical turning point, leading to the emergence of Learning Management Systems (LMS) such as Blackboard and Moodle. These platforms enabled centralized course management, content distribution, and communication between instructors and students. Simultaneously, Massive Open Online Courses (MOOCs) expanded access to education by offering free or low-cost courses through global platforms such as Coursera and edX. These developments significantly increased participation in higher education and professional training worldwide.

The results further reveal that the late 2000s and early 2010s introduced a shift toward mobile learning and microlearning, driven by the rapid proliferation of smartphones and portable devices. This transition enabled learners to engage with short, focused educational content at any time and location, thereby improving flexibility, accessibility, and knowledge retention. In recent years, the integration of Artificial Intelligence (AI) and Machine Learning (ML) has further transformed e-learning environments by enabling adaptive learning systems. These systems analyze user data to identify knowledge gaps and provide personalized learning pathways, enhancing both engagement and learning outcomes.

In addition to personalization, modern e-learning systems incorporate immersive and interactive technologies, including Virtual Reality (VR) and Augmented Reality (AR), which allow learners to simulate real-world scenarios in a controlled digital environment. Gamification strategies—such as reward systems, challenges, and interactive storytelling—have also been widely adopted to increase motivation and participation. Furthermore, the inclusion of social and collaborative tools, such as discussion forums, peer-review systems, and real-time communication platforms, has shifted learning from an individual activity to a community-based experience.

From a market perspective, the global e-learning industry has experienced substantial growth. The market, valued at approximately USD 210 billion in 2021, is projected to exceed USD 2.3 trillion by 2034, reflecting a compound annual growth rate (CAGR) of over 20%. This growth is primarily driven by increased internet penetration, widespread use of mobile technologies, and the expansion of cloud-based infrastructure. Cloud computing, in particular, has emerged as the dominant deployment model due to its scalability, cost-efficiency, and ability to support remote access to educational resources.

Regional analysis indicates that the Asia-Pacific region leads global market expansion due to strong technological adoption and large-scale investments in education. In contrast, Europe demonstrates steady growth supported by government-led digital education strategies and lifelong learning initiatives. These regional variations highlight the importance of policy frameworks, infrastructure, and institutional readiness in shaping e-learning development.

In the context of Uzbekistan, the findings reveal a rapid and ongoing digital transformation in the education sector. The introduction of Moodle in 2011 marked the beginning of LMS adoption, although its initial implementation was limited due to developing levels of digital literacy among educators. Over time, however, the platform has been successfully integrated into higher education institutions nationwide. The COVID-19 pandemic further accelerated this process, leading to the widespread use of digital platforms such as Maktab.uz for distance learning in schools.

Significant advancements have also been made in the development of digital educational resources, including electronic textbooks, interactive learning materials, and online assessment systems. The implementation of electronic examinations has improved transparency, efficiency, and fairness in student evaluation. Additionally, investments in smart classrooms equipped with modern technologies—such as computers, high-speed internet, and interactive whiteboards—have enhanced the quality of teaching and learning.

International collaboration has played a crucial role in expanding access to global educational resources. Uzbek students increasingly participate in online courses offered by platforms such as Coursera and edX. A notable example of localization is the adaptation of Khan Academy into the Uzbek language through the “Khan Academy Uzbek” initiative. This project has translated millions of words and developed hundreds of educational videos, supporting modern teaching approaches such as the flipped classroom model (Figure 1).

Figure 1. Key Shifts in modern E-learning.[3]

Artificial Intelligence (AI) and Machine Learning (ML) are no longer viewed as optional additions; they have become a central component of the modern learning experience. By analyzing real-time student data, these systems identify specific knowledge gaps and recommend content tailored to each learner's cognitive profile. Educational technology has also progressed beyond basic chatbots. Today's AI virtual assistants provide immediate and sophisticated feedback, creating an experience similar to one-on-one tutoring. Major platforms such as Coursera began implementing these solutions earlier, and adaptive systems are now becoming a standard model for scalable, high-quality education.

Traditional long-form lectures are gradually being complemented by microlearning models that emphasize short, focused, and efficient learning sessions suited to modern lifestyles. This trend is supported by a mobile-first philosophy, where smartphones and tablets allow learners to access educational content anytime and anywhere. Beyond convenience, this approach supports higher completion rates and stronger knowledge retention.

Gamification has evolved far beyond simple points and badges. Modern platforms increasingly apply narrative-based mechanics that turn learning into interactive missions and goal-oriented experiences. At the same time, immersive learning through Virtual Reality (VR) and Augmented Reality (AR) has become more widespread. Instead of only reading about tasks, students can now use headsets or AR overlays to practice realistic scenarios in a safe digital environment. This "learning by doing" model has significantly advanced skill-based education in areas such as medicine and engineering.

Learning is no longer viewed as an isolated activity. Modern educational platforms integrate social tools such as discussion forums, collaboration hubs, and peer-review networks that transform individual study into a community-based experience. By connecting learners globally, these tools encourage diverse idea exchange and create a more engaging and human-centered educational environment.

Today's Learning Management Systems (LMS) do far more than store files or host courses; they function as comprehensive data platforms. Educators can now use advanced analytics to monitor not only whether students completed a course, but also how they interacted with the content. These insights allow institutions to improve materials in real time and provide targeted support to learners who need additional assistance, helping to achieve stronger educational outcomes for all students.

Uzbekistan's cooperation with international educational organizations continues to strengthen. Access to global online learning platforms such as Coursera, edX, and other widely recognized educational websites is steadily expanding. In addition, new opportunities are being created for Uzbek students to participate in distance learning programmes offered by foreign universities.

Overall, the e-learning system in Uzbekistan is developing rapidly, achieving important progress not only in higher education, but also in school education and professional development. The expansion of this system contributes to improving educational quality and creating broader opportunities for learners.

3 https://trainingmag.com/top-trends-shaping-the-future-of-the-e-learning-market/

The Impact of Khan Academy Uzbek. A major catalyst for independent online learning is Khan Academy, founded in 2006 by Sal Khan. What began as simple YouTube tutorials for family members has evolved into a comprehensive free platform offering thousands of short video lessons and interactive exercises in subjects such as mathematics, physics, and economics. Today, Khan Academy serves millions of users across more than 190 countries and is available in numerous languages.

To bring this resource to the region, Bilim Online launched Khan Academy Uzbek, the first large-scale Uzbek-language online educational initiative. Available at uz.khanacademy.org, the project aims to provide free, world-class education in mathematics and natural sciences for Uzbek-speaking learners worldwide.

Key achievements include:

Translating 2.8 million words into Uzbek.

Fully translating video and text materials for elementary mathematics.

Producing and uploading the first 315 video lessons to its YouTube channel.

Importantly, the platform supports the flipped classroom methodology, where students watch instructional videos at home and use classroom time for discussion, practice, and clarification of complex topics.

Diverse Delivery Technologies[4]. Modern distance learning relies on several technological frameworks to deliver educational content effectively:

Information Technology (IT): The most important driver of modern LMS development, using internet connectivity and multimedia tools to create interactive and continuous communication between students and educational institutions.

Case (“Keys”) Technology: A structured independent learning model in which a full package of educational materials is delivered to the learner, supported by periodic consultations with instructors or training centers.

Television and WebTV: Traditional digital television formats continue to evolve, while WebTV models allow learners to access and download educational programmes directly to home devices through internet-based systems.

Ultimately, internet-based distance learning represents a comprehensive ecosystem of hardware, software, and organizational strategies designed to deliver information efficiently and continuously assess learner progress.

CONCLUSION AND RECOMMENDATIONS

The study reviews how information and communication technologies have transformed education into a distinct e-learning market in which digital learning platforms and Learning Management Systems (LMS) — including Udemy, Khan Academy, Skillshare, Canvas, Blackboard, and Moodle — function as key educational services. Using a narrative synthesis of historical milestones, platform case studies, and reported market indicators, the study traces the evolution of e-learning from 19th-century correspondence education to radio- and television-supported distance learning, 1960s computer-based training, the 1990s internet-enabled LMS era and early MOOC expansion, the late-2000s transition toward mobile learning and micro-content, and the current phase characterized by AI/ML-powered adaptive learning, advanced learning analytics, social and collaborative tools, and immersive VR/AR environments supported by gamified design.

The analysis highlights several pedagogical and operational consequences. These include reusable interactive multimedia content, the integration of forums, chats, and social networks into learning environments, rapid updating of digital resources (for example, e-textbooks updated daily rather than through multi-year print cycles), hyperlink-based access to external materials, and a changing role for teachers toward remote communication and continuous content development. Such developments support discussion-based instruction and flipped-classroom models.

Market dynamics[5] indicate rapid global growth, with estimated market value rising from approximately USD 210 billion in 2021 to USD 439.92 billion in 2025, with projections exceeding USD 2.3 trillion by 2034. The Asia-Pacific region remains a leading growth area. Cloud deployment is presented as a major driver of expansion, supported by investments in K–12 education, smart classrooms, Internet of Things (IoT)-enabled interactivity, and increasingly systematic evaluation of teaching methods. Additional emphasis is placed on microlearning and measurable productivity gains in training environments.

The study also notes regional differences. Europe demonstrates stable growth supported by government-led digital education and lifelong learning strategies, within a competitive environment where platform scalability, pedagogical quality, and systems integration are central success factors.

4 https://repo.ijiert.org/index.php/ijiert/article/view/101/92
5 https://www.polarismarketresearch.com/industry-analysis/e-learning-market

A focused appraisal of Uzbekistan shows rapid institutionalization of e-learning. The introduction of Moodle in 2011 evolved from limited supplementary use into effective nationwide adoption across universities. During the 2020–2021 phase of the COVID-19 pandemic, school distance learning expanded rapidly through Maktab.uz and the ZiyoNET portal, which offered textbooks, tests, and video lessons. This period also saw growth in digital resources, e-examinations, and smart classroom infrastructure equipped with computers, internet access, and interactive whiteboards[6].

Uzbekistan's international integration is reflected in expanding access to Coursera and edX, along with broader opportunities for distance study through foreign universities. The paper highlights Khan Academy Uzbek, implemented by Bilim Online, as an important open-education initiative. Building on Khan Academy's short lecture format and extensive exercise library, the localization project translated 2.8 million words, fully adapted elementary mathematics materials, and produced 315 educational videos. These resources support flipped-classroom instruction in which classroom time is used for addressing complex concepts and guided practice.

Finally, the study situates platform-based distance learning within broader delivery technologies, including IT-driven interactive LMS systems, case-based self-study models supported by consultations, and the transition from broadcast television toward WebTV solutions. Overall, the expansion of e-learning reflects the convergence of technological capacity, supportive policy frameworks, and scalable platform ecosystems, with important implications for equitable access, continuous quality monitoring, and workforce reskilling.

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