



GLOBAL EDUCATIONAL ADAPTATION: AN ANALYSIS OF DIGITAL TECHNOLOGY INTEGRATION AND ITS IMPACT ON LEARNING PROCESSES IN DEVELOPED AND DEVELOPING COUNTRIES

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Abstract:

The article examines global educational adaptation in the context of the digitalization of learning processes in developed and developing countries. The integration of digital technologies such as online platforms, artificial intelligence, virtual reality, and augmented reality is analyzed. The successful experiences of developed countries, such as the United States and Finland, where digitalization fosters personalized learning and improves education quality, are highlighted. Special attention is given to the challenges faced by developing countries, including the digital divide and limited infrastructure. Examples of initiatives in Russia and Kyrgyzstan aimed at overcoming digitalization barriers are presented.

Keywords: digitalization, artificial intelligence, online platforms, virtual reality and augmented reality, educational technologies, developed countries, developing countries

1. Introduction

The modern world is undergoing a profound transformation of educational processes under the influence of digital technologies (DT). Online platforms, artificial intelligence (AI), and mobile applications (MA) create new learning opportunities that go beyond traditional methods. These tools expand access to knowledge, which, on the one hand, helps overcome geographical and social barriers, but on the other hand, challenges conventional approaches to organizing the learning process.

The implementation of DT is uneven: economic, cultural, and infrastructural differences between countries exacerbate disparities in educational opportunities. Developed countries adapt to the transformations more effectively, but emerging

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countries face tremendous challenges in the form of weak digital knowledge, lack of resources, and poor internet penetration.

The purpose of this article is to address the characteristics of digital transformation in education across the globe and identify drivers of success of this transformation. To understand how socio-economic conditions and cultural characteristics shape the perception and use of digital tools in educational processes, examples from both developed and developing countries are analyzed.

2. Main part. Digital technologies in education: global trends

In the past few years, digitalization of learning has established itself as one of the main drivers of transformation in learning processes. The COVID-19 pandemic accelerated the introduction of DT, and their advantages – accessibility, flexibility, and interactivity – became evident to education systems worldwide. Today, digital tools continue to evolve, offering new learning and interaction solutions.

Online platforms have been among the most significant elements of the learning process, opening up access to learning materials to millions of users. According to a Statista report, in 2024, the online education market revenue totaled \$185,2 billion [1]. Platforms such as American Coursera and EdX or Russian SberClass give access to courses from leading universities, allowing one to acquire knowledge regardless of geographical or social status.

A prime example of a local project is Kyrgyzstan, where the national educational platform «Sanarip Sabak» («Digital Lesson») is actively developing. It was initiated to provide distance learning for students in rural areas where there is no opportunity to attend regular schools. Sanarip Sabak's popularity stems from the fact that it is directed at local specifics and localizes content based on the country's specifics.

Another engaging trend in the education sector is the integration of AI-powered tools, which incredibly unlock new opportunities for educators and students. In 2024, Research and Markets estimated the AI market in education to be worth \$10,248 billion (Figure 1).

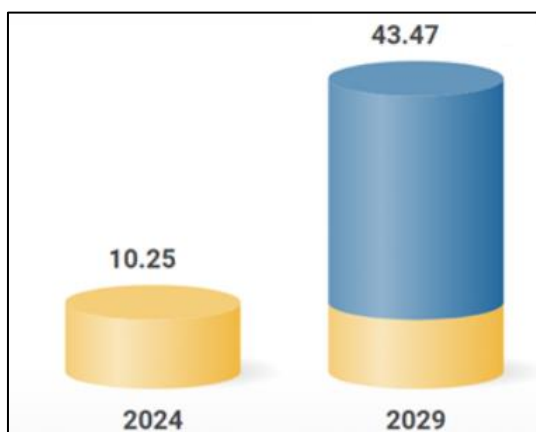


Figure 1: Current and projected market value of AI in education, billion dollars [2]

Educators can utilize AI in various ways. For example, it can be used for visualizing complex materials, creating interactive presentations, diagrams, and charts that make the learning process more engaging and understandable. Additionally, AI can assist in designing lesson plans and test assignments based on the competency level of a specific group of students.

Particularly popular among students, AI is widely used for learning foreign languages. Neural networks such as Tweek provide personalized language training, analyze pronunciation and grammar errors, offer vocabulary development exercises, and simulate dialogues [3].

One of the significant trends in education is the use of gamification technologies. With the help of AI algorithms, educational institutions can develop personalized learning games that adapt to the needs of each student. According to research [4], the adoption of gamification technologies in learning processes using AI is expected to grow significantly in the near future (Figure 2).

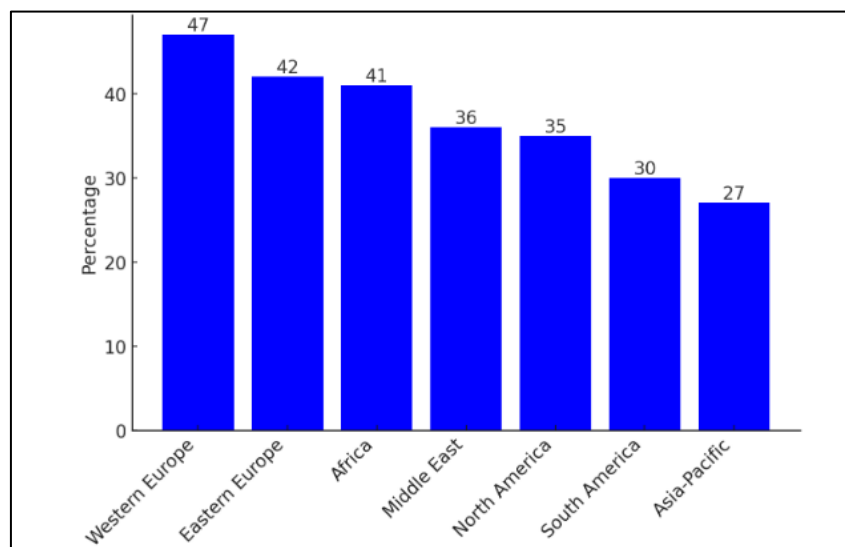


Figure 2: Growth rate of the game-based learning market by region, % (2019-2024)

However, the overall application of AI in learning has some risks. AI is more and more used by students for homework, essays, or assignments, reducing independent learning. This has the risk of replacing the learning process with automated task completion. So, there's a need to implement ethical guidelines for the utilization of AI in education, as well as have systems that not only execute the work but also guide the students towards self-learning.

Virtual Reality (VR) and Augmented Reality (AR) technologies are increasingly used in school education. They transform traditional lessons into interactive and unforgettable ones. For example, for the subjects of history and geography, VR provides an opportunity to «travel» to the past or explore faraway locations. AR, in turn, significantly expands the possibilities of traditional learning materials. Augmented reality applications allow overlaying 3D models of molecules onto the pages of chemistry textbooks or «bringing to life» major historical events through smartphones and tablets.

Particular attention is drawn to the connection between VR/AR and mnemonics, as these technologies can create vivid, multisensory images that improve information retention.

3. The integration of digital technologies into the educational process of developed countries

Developed countries demonstrate a high degree of digital technology integration into educational processes, which is associated with a rich infrastructure, significant investments in innovation, and a high level of digital literacy among the population. The United States holds one of the leading positions in integrating DT into schools [5]. A particularly important role is played by major educational platforms. According to a survey conducted in the 2023-2024 academic year, Google Classroom was the most popular learning management system used by students and teachers in the United States aged 6 to 12 [6].

An integral part of the American education system, AI is increasingly being adopted. For example, adaptive learning programs such as Khan Academy or DreamBox monitor student progress data and offer personalized solutions. This makes it possible to consider individual requirements of all students, which is especially important for large classes with varying levels of preparation. However, surveys of adults on the impact of AI on education have shown mixed results. According to Statista, as of March 2024, approximately 33% of respondents reported that, in their opinion, AI had either a minor or very strong negative impact on education, while about 32% noted a positive effect.

Additionally, the United States is in the process of actively integrating VR and AR into the educational process. In STEM education (Science, Technology, Engineering, Mathematics), for example, students are able to visit virtual laboratories and conduct complex experiments that are impossible in real life due to the costliness of equipment.

Finland, known for its advanced educational reforms, is also actively integrating DT into schools. Particular attention is paid to the development of digital literacy from an early age. The government funds the development of educational platforms and also conducts professional development courses for teachers. For example, the Education Finland program supports the development and implementation of digital platforms for managing education at the level of classrooms, school administration, and the entire education system.

One of the landmark projects is Generation AI, aimed at introducing AI technologies into school education. Students and teachers gain access to AI tools for personalizing the learning process, analyzing academic performance, and creating interactive educational materials. Generation AI also focuses on developing digital literacy among students, teaching them safe AI use and critical thinking when interacting with digital content. A recent study conducted among more than 200 Finnish fourth- and seventh-grade students showed that children's and teenagers' understanding of AI technologies improved when schools began teaching the basics of AI through practical lessons [7].

Finnish educational institutions are also developing digital learning materials and applications to improve educational outcomes. For example, the Freadom app improves reading skills by offering personalized assignments and analytical data to enhance performance. Additionally, online labs such as Virtual Living Labs provide learners with the opportunity to interact with real-world situations within a safe virtual environment. This contributes to a deeper understanding of subjects and the practical application of acquired knowledge.

The global adaptation of education in developed countries demonstrates high efficiency due to the combination of technological solutions, stable infrastructure, and significant investments in digitalization [8]. The United States and Finland clearly demonstrate how digital platforms, AI, and VR/AR technologies can transform the educational process, making it more flexible and individualized.

4. The use of information and communication technologies in education in developing countries

However, in the case of developing countries, the penetration of digital technologies in the education sector is notably less equitable than in developed nations due to disparities in economic development pace, infrastructure accessibility, and levels of digital literacy. But many states are making remarkable progress in implementing digital solutions despite challenges, driven by the goal to improve access and encourage balance in access to quality education.

One of the initiatives is being co-implemented with the support of international organizations to provide computers and internet facilities to school classrooms in Kyrgyzstan. In some educational institutions, programs are being introduced to use MA for teaching mathematics and languages. In 2024, in the nation, the «Sanarip Kampa» initiative was started as a digital repository of education with AI for STEM disciplines. While significant successes have been registered, digitalization is obstructed by weak finance and below-requisite levels of competent staff to apply new technologies.

In Russia, educational integration of DT takes place in national projects and federal large-scale programs. Under the «Digital Educational Environment» project, schools have received financing for equipping classrooms with digital equipment. Electronic platforms such as «My School» and «Sferum» are also being actively developed, providing access to electronic textbooks, homework, and virtual classrooms for group activities. The introduction of computer technologies into Russian schools is being actively implemented, relying on the state programs and intelligent AI solutions. Among the key projects is the introduction of an AI assistant for preparation in computer science for EGE, developed by Yandex.

Implementation of digital technology into education processes in developing countries largely faces the most significant hurdles related to economic, infrastructural, and societal issues. The Democratic Republic of the Congo is no exception, and the level of digitalization of education is extremely low. More than 70% of schools in the country

lack a constant supply of electricity, thus rendering the implementation of computers and other digital technology impossible. The unavailability of the internet and other new technologies also hinders students' and teachers' learning resources access and learning tool access online. Amidst the attempts by international organizations to introduce education technologies, such as MA for primary numeracy and literacy education, the lack of sufficient trained teachers and digital literacy is a major concern. Under these conditions, the uptake of DT is slow and uneven, further increasing educational inequality within the country as well as relative to other states.

5. Conclusion

Global educational adaptation demonstrates significant changes in learning approaches under the influence of DT. But the rhythm and extent of such changes differ with the level of economic development in different countries. In the economically advanced nations such as the United States and Finland, digitalization enables a person to construct an individualized and adaptive learning space, where virtual platforms, AI, and virtual reality technologies are used extensively.

On the other hand, developing nations such as Russia and Kyrgyzstan are paying attention to the digital split in their homes, especially in rural and remote localities. However, good if limited initiatives – such as having AI assistants to help students study for exams or constructing national education platforms – can help survive, which represents the potential of digitalization that makes resource materials for a better life widely available. But in third-world countries like the Democratic Republic of the Congo, where infrastructure is abysmal and technology exposure is limited, nations continue to be plagued with every kind of problem.

Conflict of Interest Statement

The author declares no conflicts of interest.

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