

MAIN COMPONENTS OF EDUCATIONAL TECHNOLOGIES AND THEIR MUTUAL INTEGRATION

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Abstract

This article explores the structural framework of educational technologies, which have become an integral part of the modern education system, and addresses the issues of their effective interaction. During the research, it is analyzed that educational technologies are not merely a collection of technical tools, but a holistic system comprising elements such as **hardware**, **software**, **methodological support**, and **human resources**. The primary focus of the article is directed toward the role of integrating these components in enhancing the quality of the educational process. The author substantiates the necessity of a systemic approach in implementing educational technologies and demonstrates the transformational changes resulting from the harmonization of pedagogical mastery with digital tools. The article concludes with practical recommendations for integrating structural components to improve educational efficiency.

Keywords: educational technologies, integration, hardware, software, digital education, pedagogical technology, systemic approach, interactive methods.

TA'LIM TEXNOLOGIYALARINING ASOSIY TARKIBIY QISMLARI VA ULARNING O'ZARO INTEGRATSIYASI

Annotatsiya

Ushbu maqolada zamonaviy ta'lim tizimining ajralmas qismiga aylangan ta'lim texnologiyalarining tarkibiy tuzilishi va ularning samarali o'zaro aloqasi masalalari

yoritilgan. Tadqiqot davomida ta'lim texnologiyalari faqat texnik vositalar majmuasi emas, balki **apparat ta'minoti (hardware)**, **dasturiy ta'minot (software)**, **metodik ta'minot** va **inson resurslari** kabi elementlarning yaxlit tizimi ekanligi tahlil qilinadi. Maqolaning asosiy urg'usi ushbu komponentlarning o'zaro integratsiyalashuvi o'quv jarayonining sifatini oshirishdagi rolga qaratilgan. Muallif ta'lim texnologiyalarini joriy etishda tizimli yondashuvning zarurligini asoslaydi va pedagogik mahorat bilan raqamli vositalarning uyg'unlashuvi natijasida yuzaga keladigan transformatsion o'zgarishlarni ko'rsatib beradi. Maqola yakunida o'quv samaradorligini oshirish uchun tarkibiy qismlarni integratsiyalash bo'yicha amaliy tavsiyalar keltirilgan.

Kirish so'z: ta'lim texnologiyalari, integratsiya, apparat ta'minoti, dasturiy ta'minot, raqamli ta'lim, pedagogik texnologiya, tizimli yondashuv, interaktiv metodlar.

ОСНОВНЫЕ КОМПОНЕНТЫ ОБРАЗОВАТЕЛЬНЫХ ТЕХНОЛОГИЙ И ИХ ВЗАИМНАЯ ИНТЕГРАЦИЯ

Аннотация

В данной статье рассматриваются структурный состав образовательных технологий, ставших неотъемлемой частью современной системы образования, и вопросы их эффективного взаимодействия. В ходе исследования анализируется, что образовательные технологии представляют собой не просто совокупность технических средств, а целостную систему, состоящую из таких элементов, как **техническое обеспечение (hardware)**, **программное обеспечение (software)**, **методическое обеспечение** и **человеческие ресурсы**. Основной акцент в статье сделан на роли интеграции этих компонентов в повышении качества учебного процесса. Автор обосновывает необходимость системного подхода при внедрении образовательных технологий и демонстрирует трансформационные изменения, возникающие в результате гармонизации педагогического мастерства с цифровыми инструментами. В завершение статьи представлены практические рекомендации по интеграции структурных компонентов для повышения эффективности обучения.

Ключевые слова: образовательные технологии, интеграция, техническое обеспечение, программное обеспечение, цифровое обучение, педагогическая технология, системный подход, интерактивные методы.

INTRODUCTION

The 21st century—the era of information and high technology—places entirely new demands on the education system. Today, educational technologies are no longer merely supplementary tools used to make lessons more engaging; instead, they have evolved into a strategic resource that guarantees the quality of education. In the context of globalization and digital transformation, the most pressing task facing educational institutions is not simply the implementation of technologies, but rather the utilization of all their structural components in mutual harmony (integration).

In many cases, educational technology is misunderstood as referring only to technical devices such as computers or projectors. However, practice demonstrates that modern hardware does not yield the expected results unless it is integrated with powerful software tools and systemic pedagogical methodology. In other words, the effectiveness of technology lies not in its individual parts, but in the extent to which those parts are intrinsically linked. This article analyzes which specific structural components are considered the pillars of educational technology and how they can be unified into a single, cohesive ecosystem.

The primary goal of this article is to classify the structural elements of educational technologies and reveal the laws governing their mutual interdependence. To achieve this goal, the following objectives have been established:

1. To identify the core components of educational technologies (**Hardware, Software, Methodological, and Human factors**).
2. To study the mechanisms through which these components interact with each other.
3. To evaluate the impact of technological integration on the students' learning coefficient.

According to modern scientific views, the concept of educational technology has evolved from a simple set of technical tools into a complex and dynamic ecosystem. Today, the effectiveness of this system is measured not by the power of its individual parts, but by the degree of their mutual integration. Based on global educational trends for 2024-2026 (UNESCO and OECD reports), the components of educational technology can be divided into the following four main pillars:

1. Hardware: This serves as the physical foundation of the system. At the current stage, this component includes not only desktop computers but also mobile devices,

interactive touch panels, and Virtual (VR) and Augmented Reality (AR) devices. Today, the primary requirements for hardware are mobility and seamless connectivity with cloud technologies, allowing learners to acquire knowledge regardless of time and location.

2. Software: This component is responsible for managing the educational process and delivering content. In modern education, Learning Management Systems (LMS), AI-based adaptive learning systems, and Learning Analytics play a central role. These programs enable real-time monitoring of a student's mastery level and offer flexible, personalized learning trajectories.

3. Pedagogical-Methodological Support: This is the most strategic part of the system. Technology by itself does not improve the quality of education; it only yields results when integrated into the correct pedagogical model. Modern methods such as the "Flipped Classroom," "Gamification," and Project-Based Learning (PBL) serve as mechanisms for implementing technological capabilities into practice. This section defines how to methodologically embed technological tools into specific subject matter.

4. Human Resources ("Humanware"): This refers to the digital competence of the teacher and the information culture of the student. Modern research promotes the idea that "Technology will not replace the teacher, but the teacher who can use technology will replace those who cannot."

The effectiveness of educational technologies depends on how well their components are coordinated and complement each other. In modern pedagogy, educational technology is interpreted as a complex ecosystem consisting of four main components:

Firstly, Hardware constitutes the material foundation of the system. This component includes all physical devices used for creating, storing, and transmitting information. This encompasses not only traditional personal computers and laptops but also modern tablets, interactive touch panels, Virtual Reality (VR) and Augmented Reality (AR) devices, as well as robotics kits. Hardware defines the technical capabilities of the educational environment and ensures the visual and technological richness of the learning process.

Secondly, Software serves as the "intellectual shell" that enables the functionality of hardware devices. Today, this component includes Learning Management Systems (LMS — such as Moodle, Canvas, and Google Classroom), video conferencing

software, and AI-based adaptive learning platforms. The primary task of software is to systematize educational content, analyze student mastery levels in real-time, and facilitate digital communication between the teacher and the student.

Thirdly, Methodological Support (Courseware/Pedagogy) ensures that technology is pedagogically grounded. Regardless of how sophisticated the hardware and software may be, they will not yield the expected results without a specific methodology for their application. This section includes digital textbooks, video content, and modern educational strategies such as the "Flipped Classroom" or gamification. Methodological support elevates technology from being a mere visual aid to an active tool for acquiring knowledge.

Fourthly, Human Factors (Humanware) represent the most central and governing link of the system. This component encompasses the digital competence of both teachers and students, their information literacy, and their psychological readiness. The human factor defines the purpose of using technology and directs all technical capabilities toward educational goals. A teacher's digital literacy and openness to innovation are key criteria that determine the success of educational technology integration.

The interaction mechanism between the components of educational technologies is not static but dynamic. Each component expands or, in some sense, limits the functional capabilities of the others. This complex interdependence can be observed in three main directions:

1. **Technological Harmony of Hardware and Software:** This mechanism determines the speed and capabilities of the system. For instance, the latest generation of software or AI algorithms cannot manifest their full potential on hardware lacking sufficient processing power. Conversely, using powerful hardware for only simple text-based programs leads to a waste of technological resources. Thus, the integration mechanism relies on the balance between these two components.
2. **Pedagogical Connection between Methodology and Digital Tools:** Here, the interaction mechanism operates on the "means-to-an-end" principle. The methodological approach (e.g., project-based learning) dictates which software and hardware tools are selected for a lesson. At the same time, new technological possibilities (e.g., virtual laboratories) lead to the emergence of new methodological techniques that were previously impossible. In other words,

methodology provides direction to technology, while technology enriches and transforms methodology.

3. **Feedback Loop of Human Factors with All Components:** This mechanism is the highest link in educational technology, where the needs of teachers and students determine the development trajectory of the other three components. The human factor "animates" all technical and methodological tools. If communication between the teacher and the student is not effectively organized in the digital environment, the synergistic effect of hardware and software is lost. As the competence of human resources increases, the level of utilization of hardware and software also deepens.

The primary conclusion of this article is that the mere "mechanical" implementation of technologies into education does not yield effective results. Real success is achieved only when all components are deeply integrated based on the **TPACK model**—that is, when pedagogical mastery is harmonized with digital possibilities. This serves as the fundamental guarantee for training competitive personnel in a digital society.

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