

Strategies for Optimizing it Infrastructure in Organizations

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Article information:

Manuscript received: 15 Sep 2025; **Accepted:** 16 Oct 2025; **Published:** 17 Nov 2025

Abstract: This article provides an in-depth scientific analysis of strategies for optimizing information technology infrastructure in educational institutions in a pedagogical context and analyzes the digital transformation processes being implemented in the education system within the framework of the “Digital Uzbekistan – 2030” strategy. The pedagogical effectiveness of digital technologies is assessed using the example of the establishment of Cyber University, the Eduten AI platform and AI educational programs. The analysis is conducted based on the TPACK model, the Theory of Diffusion of Innovations, and the UNESCO ICT framework, and scientific proposals are presented to improve the quality of education

Keywords: IT infrastructure, educational organizations, cloud technologies, artificial intelligence, "Digital Uzbekistan - 2030", cybersecurity, resource management, e-learning platforms, Cyber University, UNESCO ICT framework, TPACK framework.

Introduction

In the context of modern globalization and digital transformation, the effectiveness and inclusiveness of the education system depends on the quality of IT infrastructure. Optimization of IT infrastructure involves not only improving technical resources, but also adapting pedagogical processes to modern requirements, developing digital competencies of teachers and students.[1] The “Digital Uzbekistan – 2030” strategy of the Republic of Uzbekistan is aimed at systematically implementing digital transformation in education, and by 2025, significant results have been achieved: for example, AI adaptive curricula were tested in 10,200 schools, and AI educational programs were developed based on models from the Massachusetts Institute of Technology. Within the framework of this strategy, initiatives such as the establishment of Cyber University, the integration of AI tools, and the expansion of digital education in rural areas are contributing to improving the quality of education.[2]

Theoretically, the optimization of IT infrastructure is viewed based on the Diffusion of Innovations theory, which explains the process of diffusion and adoption of technologies in the education system.[3] According to this theory, innovations go through five stages: knowledge, persuasion, decision-making, implementation and validation. In Uzbekistan, the “Digital Uzbekistan – 2030” strategy corresponds to the implementation stage of this theory, since in 2025 AI tools will be used by 57% of university students. At the same time, the Technology Acceptance Model theory links the adoption of technologies to usefulness and ease of use, which indicates that 78% of teachers in Uzbekistan lack training in digital education.[4]

The scientific significance of the study lies in the systematic analysis of the impact of optimizing IT infrastructure in educational institutions on pedagogical processes and the development of practical recommendations. This article discusses strategic directions for optimizing IT infrastructure based on

global experiences (UNESCO, UNICEF projects) and empirical data from Uzbekistan (Eduten pilot project: 18.2% increase in mathematics results). The UNESCO ICT Competency Framework and PISA 2022 results (Uzbekistan ranked 78th) are used as a theoretical basis, which emphasizes the need to bridge the digital divide in education.[5]

The pedagogical importance and structure of IT infrastructure

IT infrastructure includes an integrated set of information and communication systems of an organization, including:[6]

Hardware tools: Computers, servers, network infrastructure and supercomputers (supercomputer spending in Uzbekistan will double in 2026).

Software: E-learning platforms, database management systems, and AI-based tools.

Safety equipment: Encryption, authentication and access control systems.

Cloud services: Centralized data storage and remote access capabilities.

From a pedagogical perspective, IT infrastructure is viewed in terms of Constructivism theory, which emphasizes the active construction of knowledge by students.[7] In a digital environment, this theory is implemented through interactive platforms, such as virtual classrooms and gamification tools. Connectivism theory emphasizes the dissemination of knowledge through digital networks, which ensures the continuity of education through cloud technologies in Uzbekistan. IT infrastructure performs the following functions:[8]

Automation of the learning process: Spreadsheets, automatic assessment systems, and learning process monitoring.

Creating an interactive learning environment: Virtual classrooms, VR/AR technologies, and gamification tools (student motivation increased by 96.5% through Eduten).[9]

Providing distance and inclusive education: Expanding educational opportunities in remote areas (internet coverage reached 94.8% through the Giga project).

Ensuring information security: Compliance with personal data protection and information security standards (ISO/IEC 27001).[10]

In Uzbekistan, within the framework of the “Digital Uzbekistan – 2030” strategy, along with the development of IT infrastructure in educational institutions, attention is paid to improving the digital literacy of teachers. For example, in 2025, special trainings were organized for teachers through UNESCO and UNICEF projects on the development of digital competencies, which allowed for the effective use of new technologies in classrooms. New Uzbekistan University has developed AI educational programs based on MIT models and operates as a center for training school teachers.[11]

1. Introduction of cloud technologies

Cloud computing technologies enable centralized storage and universal access to educational resources in educational institutions. These technologies offer the following advantages:[12]

Increase the flexibility of the learning process (24/7 access to resources). Reduce server and infrastructure costs by 20-30%. Introducing modern learning methods, such as distance learning and virtual laboratories.

Theoretically, cloud technologies are based on the theory of Connectivism, as they ensure the distribution of knowledge over the network. For example, at Samarkand State University, cloud platforms have ensured a seamless learning process between students and professors.[13] By 2025, 73% of schools in Uzbekistan will use the Kundalik.com platform, which has accelerated digital transformation. At the same time, the doubling of supercomputer costs by 2025 will help to increase the number of cloud AI projects to 100.

2. Strengthening information security

In educational institutions, the security of personal data, student grades, and other sensitive information is essential to ensuring the reliability of pedagogical processes. [14]

Data encryption.

Implementing multi-factor authentication systems.

Compliance with international information security standards such as ISO/IEC 27001.

Theoretically, information security is optimized based on the ITIL (Information Technology Infrastructure Library) framework, which provides service management and security. In 2025, a new authentication system was introduced in one of the schools in Tashkent, which reduced data breaches by 60%. At the same time, the establishment of Cyber University began training cybersecurity specialists, which serves to increase the level of security in the education system. According to the SoSafe Cybercrime Trends 2025 report, cyber threats through AI have increased by 87%, so ethical standards and data protection are necessary.[14]

3. Effective resource management

By optimizing IT infrastructure, efficient use of resources and reduction of operating costs are ensured. Virtualization technologies increase server performance and optimize energy consumption. Theoretically, this is seen on the basis of the SETI (Social, Educational, Technological, Institutional) framework, which combines four dimensions of technology integration. For example, as a result of the implementation of a virtualization system in an educational institution in the Khorezm region, server efficiency increased by 30% and IT costs decreased by 29%. In global education experience, for example, in Singapore, the operational costs of educational institutions were reduced by 25% through virtualization. The introduction of a digital system for water resources management in Uzbekistan in 2025 is an example of efficient resource allocation.[15]

4. Artificial Intelligence Integration

AI is an important tool for personalizing educational processes, analyzing student learning outcomes, and optimizing teacher workload. Theoretically, AI is integrated through the TPACK framework (Mishra & Koehler, 2006), which combines technology, pedagogy, and content. In Uzbekistan, as part of the “Strategy for the Development of Artificial Intelligence - 2030” adopted in 2024, an investment of 50 million US dollars was made, AI faculties were opened in 16 higher education institutions, and 572 students are studying in this direction. By 2030, Uzbekistan aims to enter the top 50 countries in AI and the “Artificial Intelligence Alliance” was established.[16]

In the case of the Eduten platform, an AI-based math program tested in 17 schools (1,046 students) in 2023-2024 increased students' math scores by 18.2% and improved student engagement by 96.5%. [17] An increase of 12.2% was observed in the arithmetic test, which indicates an effect size of Cohen's $d = 0.42$. In 2025, AI adaptive programs were tested in 10,200 schools, and AI lessons will be introduced in schools starting in 2026. At the same time, early prediction of students' learning skills and identification of deficiencies through AI have been proven to increase the quality of education by 20-30%.[18]

Analysis and results

The impact of optimizing IT infrastructure in the education sector is assessed through the following indicators (based on 2025 data):

Indicator	Before optimization	After optimization	Change (%)
IT expences (sum)	120 000 000	85 000 000	-29%
Time spent by students using online resources (hours/month)	12	28	+133%
Information security level	Past	Yugori	+60%
Number of AI integration projects	5	20	+300%
Teachers' level of digital literacy	40%	75%	+88%
Mathematics results (Eduten pilot)	8.60	10.17	+18.2%
Arithmetic test results	100.28	112.54	+12.2%

(Data is based on projects in educational institutions in Uzbekistan and UNESCO/UNICEF reports.)

These indicators confirm that the optimization of IT infrastructure has increased the efficiency of educational processes.[19] For example, the Kundalik.com platform is used in 73% of schools, which ensures the continuity of the educational process. AI integration has had a positive impact on pedagogical processes by increasing student motivation and reducing teacher workload by 20-30%. In the Eduten pilot, student time reached 84 minutes per week, and accuracy was 76%.[20]

Issues:

1. Infrastructure constraints: Lack of modern devices and high-speed internet in rural areas (the Giga project has not yet achieved full coverage, 30% of schools do not have reliable internet).[21]
2. Staff readiness: Teachers have limited experience using AI tools; the gender gap is 23-26%.
3. Database: The lack of a local database for training AI systems increases dependence on foreign platforms and raises issues of academic integrity (a survey of 200 students found ethical issues in the use of AI).

Conclusion

Optimizing IT infrastructure in educational institutions is a strategically important process from both a technical and pedagogical perspective. The Digital Uzbekistan 2030 strategy was taken to a new level in 2025, in particular, the establishment of the Cyber University and AI initiatives have increased the competitiveness of the education system. Through the integration of cloud technologies, information security and AI, educational processes have become more efficient, inclusive and flexible. Educators and organizational leaders can significantly improve the quality of education by systematically applying these strategies, but by eliminating problems and developing local resources, it is possible to bring the quality of education to a new level by 2030. This analysis, based on PISA and other international indicators, emphasizes the need to close the gaps in education through AI.

Suggestions

1. Expanding the Giga project to provide internet and devices in rural areas.
2. Organize ongoing training based on the UNESCO ICT competency framework and develop specific AI courses for women.
3. Development of AI tools and creation of a local database in the Uzbek language (a national AI language model is being developed).
4. Supporting edtech startups through IT Park's \$10 million venture fund.

5. Implement a KPI-based monitoring system to assess project performance and create a legal framework for AI ethics.

In the future, by 2030, Uzbekistan's education system can become a regional leader through AI and digital infrastructure. Cyber University and AI research centers will increase the competitiveness of education by adapting global experience (for example, the Singapore and MIT models) to local conditions. At the same time, the development of inclusion and digital literacy will serve to equalize the quality of education.

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