

**USING ARTIFICIAL INTELLIGENCE IN PRIMARY EDUCATION: THEORETICAL FOUNDATIONS AND ANALYSIS OF INTERNATIONAL EXPERIENCES**

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**Abstract:** This article analyzes the integration of artificial intelligence (AI) technologies into the primary education system, their theoretical foundations, and the experiences of foreign countries. It also highlights the advantages and limitations of AI tools, as well as effective ways to use them considering students' individual characteristics. In the conclusion, recommendations are provided for using AI in the education system of Uzbekistan.

**Keywords:** Artificial intelligence, primary education, pedagogical technologies, international experience, adaptive learning, AI literacy

Modern technological development, especially advances in artificial intelligence (AI), is fundamentally transforming the education system. In particular, at the primary education level, AI provides the opportunity to create an effective and interactive learning environment that takes into account the individual needs of students. This article discusses the impact of AI technologies on primary education, their theoretical foundations, and practical experiences from countries around the world.

## 1. Theoretical Foundations of Artificial Intelligence

The use of artificial intelligence in education is based on the following theoretical approaches:

**Constructivism:** Learners acquire knowledge through activity. AI tools support this approach through interactive tasks.

**Social Learning Theory (Bandura):** AI agents (e.g., learning robots) assist the learning process through imitation.

**Adaptive Learning:** Providing tasks tailored to the student's level enhances educational effectiveness.

In addition, AI supports the development of 21st-century skills such as computational thinking, algorithmic reasoning, and media literacy.

## 2. Analysis of International Experiences

### 2.1. USA and European Countries

Interactive learning platforms (e.g., Khan Academy, Duolingo) implement adaptive learning using AI.

In Estonian schools, the “AI Leap” program teaches students to practically use AI technologies.

## 2.2. China

AI agents (robots) are used in primary schools to implement bilingual education.

Students use AI to improve language learning, pronunciation, and phonological skills.

## 2.3. Saudi Arabia

Since 2025, an AI-based curriculum has been implemented for over six million students.

## 2.4. Hong Kong

A six-week experiment with 5-year-old children showed that interactive learning with AI agents is effective.

## 3. Advantages of Artificial Intelligence

Personalized education tailored to students’ needs.

Reduces teachers’ workload through automated assessment.

Develops skills through interactive games.

Increases interest in language learning and coding.

Encourages independent learning habits among students.

Artificial intelligence offers significant opportunities to personalize the learning process, make it interactive, and develop modern skills in primary education. International experiences show that AI tools facilitate learning and foster advanced thinking skills in students. However, careful methodological approaches and proper infrastructure are crucial for successful implementation.

## 4. Innovation in Pedagogy and Methodology

The step-by-step development of innovative technologies in pedagogy ensures the education system’s adaptability to modern requirements. Successful implementation depends not only on technical and methodological infrastructure but also on the contemporary competencies of teaching staff. Therefore, mastering and applying innovative technologies is a priority in today’s education system.

Innovative technologies are not only a means to modernize education but also a strategy for its development. The modern stage of pedagogy and methodology involves in-depth study, analysis, and practical application of innovations. By using them effectively, it is possible to nurture a competitive, independent, and modern-minded generation.

### 1. Essence and Role of Innovative Technologies in Pedagogy

Innovative technologies are understood as a set of new methods, tools, and organizational forms aimed at fundamentally improving the educational process. They shift from traditional knowledge transmission to active, interactive, and learner-centered approaches.

## 2. Stages of Development of Innovative Technologies

### Stage 1: Transition from Traditional Education to Innovations (1960–1980)

Focused on learner-centered approaches in pedagogy and psychology.

Activity-based, problem-based, and communicative teaching methods emerged.

### Stage 2: Experimental and Scientific-Innovative Research (1980–2000)

Interactive methods, project-based learning, modular and problem-based systems were widely implemented.

First electronic learning tools were developed.

### Stage 3: Integration of Digital Technologies (2000–2015)

With the spread of the internet, computers, and mobile devices, e-learning, distance education, and virtual labs developed.

Platforms like Moodle and Google Classroom became widely used.

### Stage 4: Era of Artificial Intelligence and Personalized Learning (2015–Present)

AI-based adaptive learning systems, platforms that automatically analyze students' achievements, virtual reality (VR), and augmented reality (AR) technologies are rapidly developing.

## 3. Practical Advantages and Current Challenges of Innovative Technologies

### Advantages:

Increases students' interest in learning.

Enables independent learning.

Ensures diversity of educational approaches.

Provides real-time analysis and monitoring.

### Challenges:

Teachers' technological literacy is insufficient.

Technical infrastructure in most schools and universities is weak.

National standards for innovative methodologies are not fully developed.

### Essence and Necessity of Innovative Technologies

The term “innovation” comes from Latin *innovatio*, meaning “introducing something new.” In education, innovative technologies are methods and tools that modernize and improve the effectiveness of existing education systems.

Through innovative technologies, education achieves:

Increased learner activity rather than teacher-centered instruction.

Interactive, engaging, and real-life-oriented learning.

Consideration of each student’s individual abilities.

Implementation of distance, hybrid, and personalized learning.

Step-by-step development of innovative technologies in pedagogy ensures the education system’s adaptability to modern demands. Successful implementation relies on technical infrastructure, methodological support, and teachers’ competencies. By applying innovations effectively, it is possible to nurture competitive, independent, and modern-thinking young people.

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