METHODOLOGY OF USING ARTIFICIAL INTELLIGENCE IN PRIMARY SCHOOL LESSONS

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Annotation: This article analyzes the theoretical foundations, practical methodology, and pedagogical possibilities of using artificial intelligence (AI) technologies in primary school lessons. The research deeply examines the main directions of AI in primary education – adaptive learning systems, intelligent tutors, game-based learning, automated assessment, speech and text recognition technologies, and virtual assistants. The article provides specific methodological recommendations, lesson plans, and practical examples for using AI tools in various subjects (mathematics, reading literacy, natural sciences, English). Furthermore, the advantages of AI technologies, pedagogical risks, the role of teachers, and ways of implementation in primary schools are scientifically substantiated.

Keywords: artificial intelligence, primary education, adaptive learning, intelligent tutor, game-based learning, automated assessment, personalized learning, digital pedagogy, AI tools, modern educational technologies.

Introduction. Artificial Intelligence (AI) technologies are one of the most important innovations of the 21st century, fundamentally transforming almost all spheres of society, including education. According to the World Bank and UNESCO, by 2023, more than 120 countries had begun integrating AI technologies into their education systems. The use of AI in primary education is of particular interest because children of this age have a high learning ability and quickly adapt to new technologies.

The use of AI in primary education offers several important advantages: personalized learning (each child learns at their own pace), continuous feedback (the AI system immediately identifies and corrects the child's errors), saving teacher time (AI performs routine tasks), increasing motivation (through game elements and interactivity), and objective assessment (AI systems evaluate impartially and consistently). However, it is crucial to use AI technologies correctly and in a pedagogically sound manner.

1. Main directions of artificial intelligence in primary education

1.1. Adaptive learning systems

Adaptive learning systems are programs based on AI that adapt to each student's knowledge level, learning speed, and individual characteristics. These systems analyze the child's every answer and select the next task according to their needs.

For example, if a child correctly solves the example 2+3, the system gives a more difficult example (6+4). If they make a mistake, it presents a simpler example (1+2) or an explanatory video. The most popular adaptive learning platforms include: “Khan Academy Kids” (mathematics and reading), “DreamBox” (for mathematics, grades K-8), “Squirrel AI” (a Chinese company, all subjects), “Century Tech” (UK, STEM subjects).

1.2. Intelligent Tutoring Systems

Intelligent tutors are virtual teachers based on AI that work and help the child like a personal teacher. They answer the child's questions, explain, advise, and analyze errors.

For instance, the intelligent tutor of the “Carnegie Learning” platform provides step-by-step guidance in solving math problems. If the child makes a mistake somewhere, the tutor shows exactly which step the mistake was made in and explains how to solve it correctly. The AI tutor of the “Duolingo” platform detects and corrects every pronunciation error in language learning.

1.3. Game-based learning (Gamification with AI)

AI technologies increase children's motivation by introducing game elements into education. In games, AI automatically changes the difficulty level based on the child's level, gives rewards, and ensures progression to new levels.

For example, the game “Prodigy Math” combines mathematical examples with adventures in a fantasy world. The child must solve math examples to fight enemies. “Minecraft Education Edition” also includes AI elements and teaches children programming, mathematics, and natural sciences.

1.4. Automated assessment and feedback systems

AI systems can automatically assess written work (essays, stories), drawings, and mathematical solutions. This saves teachers' time and provides immediate feedback to children.

For example, “Grammarly” and “Hemingway Editor” find grammatical and stylistic errors in written texts. “Turnitin” detects plagiarism. Simplified versions can be used in primary grades.

1.5. Speech and text recognition technologies

AI-based speech recognition and text-to-speech technologies greatly help primary school children learn to read.

For instance, the “Reading Eggs” platform listens to the child reading aloud and detects pronunciation errors. The free app “Google Read Along” (formerly Bolo) develops children's reading skills and provides voice assistance.

2. Methodology of using AI tools in primary school lessons

2.1. Using AI in mathematics lessons

AI technologies can be used in mathematics lessons in the following directions:

1) Adaptive exercises. Platforms like Khan Academy Kids, Prodigy Math, DreamBox provide mathematical examples tailored to each child's level. The teacher can organize the lesson as follows:

At the beginning of the lesson, the teacher explains the new topic (e.g., "Adding two-digit numbers");

• Then children log into the AI platform on a computer or tablet and practice independently (15-20 minutes);

• The platform gives examples suited to each child's level;

• The teacher monitors the results of all children in real-time and provides individual help to those struggling;

• At the end of the lesson, the system automatically prepares a report: how many examples each child solved, how many mistakes they made, which topics they are struggling with.

2) Virtual manipulatives. AI-based virtual cubes, geometric shapes, number lines help children learn mathematical concepts visually. Such tools are available on platforms like “GeoGebra, Math Learning Center”.

3) Math games. Games like Prodigy Math, Monster Math make mathematics fun. While playing, the child unknowingly solves hundreds of math examples.

2.2. Using AI in reading literacy lessons

Reading literacy is the most important area of primary education. AI technologies significantly improve this process:

1) Learning to read through speech recognition. Platforms like Reading Eggs, Raz-Kids, Epic! listen to the child reading aloud and point out errors. Methodology:

• The child selects a text on the computer/tablet;
• Reads aloud (via microphone);
• The AI system listens carefully and analyzes pronunciation, intonation, and speed;
• Highlights incorrectly pronounced words and shows the correct pronunciation;
• The child reads again and tracks improvement;
• The system provides a report on reading speed, accuracy percentage, and progress dynamics.
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2) Assessing reading comprehension. AI systems ask questions to check how well the child understood the text and analyze the answers. For example, the ReadTheory platform asks questions after reading a text and selects subsequent texts based on the answers.

2.3. Using AI in natural science lessons

In natural science lessons, AI technologies are used to conduct experiments and observations in a virtual environment, simulate natural phenomena, and facilitate interactive learning:

1) Virtual laboratories. Platforms like Labster, PhET Interactive Simulations allow children to conduct experiments in a safe virtual environment. For example, observing plant growth, studying animal life, seeing simple chemical reactions.

2) AI-based identification of animals and plants. Using apps like iNaturalist, Seek by iNaturalist, children can take a picture of a plant or animal around them using their phone camera, and the AI system will identify its name and characteristics within seconds. This is very useful for conducting lessons outdoors in nature.

2.4. Using AI in foreign language (English) lessons

AI technologies are particularly effective in language learning because they allow checking pronunciation, correcting grammar, and conducting conversations:

1) Improving pronunciation. Apps like Duolingo, ELSA Speak, Pronunciation Coach listen to the child's English pronunciation and point out errors. The child repeats a word or sentence, the AI system analyzes it and gives a score from 1 to 100.

2) Conversing with a chatbot. By having simple conversations with AI chatbots (Andy English Bot, Mondly), children develop their communicative skills. The chatbot asks a question, the child writes or says the answer, the chatbot analyzes the answer and asks a new question.

3. Pedagogical advantages and risks of AI technologies

3.1. Pedagogical advantages

The main pedagogical advantages of AI technologies in primary education:

1. Personalized learning – each child learns at their own level and pace. Strong children develop faster, weak children receive additional support;

2. Immediate feedback – the AI system corrects the child as soon as they make a mistake, which speeds up the learning process;

3. Objective assessment – AI systems have no personal bias; all children are assessed according to the same criteria;

4. Increased motivation – game elements, virtual rewards, progress indicators encourage children to learn;

5. Saving teacher time – AI performs routine tasks (checking, grading, reporting), allowing the teacher more time for creative pedagogical tasks;

6. 24/7 availability – children can learn at any time and also have the opportunity to practice at home;

7. Broad accessibility – also convenient for children with special needs (special AI tools exist for children with speech or hearing problems).

3.2. Pedagogical risks and limitations

However, several risks and limitations must be considered when using AI technologies:

1. Reduced human interaction – AI cannot completely replace the teacher; children need social communication, emotions, and collaboration;

2. Screen dependence – excessive screen time can harm children's health (eyes, posture);

3. Digital divide – not all children have access to modern technology or internet at home;

4. Limiting creativity – some AI systems only accept standard answers and cannot evaluate creative solutions;

5. Data security – children's personal data must be protected;

6. Lack of teacher training – not all teachers know how to use AI technologies;

7. Costs – quality AI platforms are usually paid, placing an additional burden on school budgets.

4. The teacher's role in the AI environment and recommendations

AI technologies cannot replace the teacher but rather support them. The teacher's new roles:

1. Facilitator – the teacher does not directly impart knowledge but manages, guides, and supports the learning process;

2. Mentor –pays attention to children's emotions, provides motivation, gives individual advice;

3. Technology manager – selects the right AI tools and ensures their effective use;

4. Data analyst –analyzes reports obtained from AI systems and makes pedagogical decisions;

5. Creative designer – designs interesting, interactive lessons using AI tools.

Practical recommendations for teachers to effectively use AI technologies:

• Introduce gradually – first try out one AI tool, then add others;

• Set clear goals – understand why you are using AI (time saving, personal approach, motivation);

• Maintain balance – use AI for part of the lesson and traditional methods for another part (e.g., 20 minutes AI, 25 minutes with the teacher);

• Prepare the children – teach them how to use AI tools, help with technical issues;

• Involve parents – inform parents about AI platforms, encourage their use at home;

• Analyze results – regularly review AI reports and adjust your lesson plans accordingly;

• Pay attention to safety – use only trusted, safe platforms, protect children's personal data.

Conclusion and recommendations

Artificial intelligence technologies have great pedagogical potential in primary education. They provide personalized learning, save teachers' time, increase children's motivation, and improve learning effectiveness. However, it is important to use AI technologies correctly and responsibly.

To introduce AI technologies in Uzbek primary schools, the following steps are recommended:

1. Start pilot projects. Trial the implementation of platforms like Khan Academy, Prodigy Math in several schools and study the results.
2. Train teachers. Conduct special training on AI technologies for primary school teachers.
3. Create national content. Develop AI-based educational platforms and programs in the Uzbek language or adapt foreign platforms.
4. Improve technical infrastructure. Provide schools with high-speed internet, computers/tablets, and other technical equipment.
5. Encourage research. Support scientific research studying the effectiveness of AI in primary education.

In conclusion, AI technologies have the potential to fundamentally transform primary education. The education system of Uzbekistan can use these opportunities to prepare our children according to the requirements of the 21st century. The main condition is to properly balance AI with the human factor (teacher, parent).

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