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TWENTY-FIRST CENTURY EDUCATION: ARTIFICIAL INTELLIGENCE IN EDUCATION, CONTEMPORARY PEDAGOGICAL TRENDS AND TEACHING STRATEGIES

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Abstract

The thesis examines the place of artificial intelligence in twenty-first century education and its relationship with current pedagogical trends. Personalised learning, formative assessment, competency-based instruction and the changing professional role of the teacher are analysed with reference to international frameworks and recent research. Teaching strategies that combine AI tools with active learning are proposed, and the ethical and methodological conditions for their use in schools and universities of Uzbekistan are outlined.

Keywords: Artificial intelligence in education, generative AI, personalised learning, formative assessment, teaching strategies, AI literacy, teacher competence.

Introduction

Over the last decade artificial intelligence (AI) has moved from research laboratories into classrooms, and since the public release of large language models in late 2022 this movement has become rapid and largely unplanned. Pupils and students now have access to tools that can write an essay, solve a problem step by step, translate a text or produce a lesson plan within seconds. Teachers, on the other hand, are often expected to respond to these changes without systematic preparation. UNESCO's guidance on generative AI notes that



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most education systems introduced such tools before national regulations, teacher training or quality standards were in place [1]. The pedagogical question is therefore no longer whether AI will be used in education, but under what conditions it can strengthen learning rather than replace the intellectual effort that learning requires.

For Uzbekistan this question has a practical dimension. The Development Strategy of New Uzbekistan for 2022–2026 sets the goals of improving the quality of education, expanding digital services and bringing teaching closer to international standards [2]. Achieving these goals requires not only technical infrastructure but also a clear pedagogical position: which tasks AI should take over, which tasks must remain with the teacher, and how the learner's independent thinking can be protected. The aim of this thesis is to analyse the role of AI in the context of current pedagogical trends and to propose teaching strategies that integrate AI tools into the learning process in a methodologically sound way.

Materials and methods

The study is based on a theoretical analysis of international policy documents (UNESCO, OECD), research monographs on AI in education published between 2018 and 2024, and national regulatory documents of the Republic of Uzbekistan. Methods of comparative analysis, generalisation and pedagogical modelling were used. At the first stage the main pedagogical trends of the twenty-first century were identified; at the second stage the potential of AI to support each trend was examined; at the third stage teaching strategies were formulated and the conditions for their use were defined. The study does not include an experimental stage, so its conclusions should be regarded as a theoretical basis for further empirical research.



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Results and discussion

Twenty-first century education is shaped by several interrelated trends. The first is the shift from transmitting knowledge to developing competences: critical thinking, communication, collaboration and creativity are now treated as learning outcomes in their own right. The second is personalisation, that is, adapting the content, pace and level of difficulty to the needs of each learner. The third is the growing importance of formative assessment, in which feedback is used to improve learning while it is still taking place rather than only to grade its results. The fourth is the changing role of the teacher, who becomes a designer of learning situations, a mentor and a facilitator rather than the only source of information. AI is relevant to all four trends, but its contribution differs in each case [3].

The idea of twenty-first century skills, which underlies these trends, emerged from the observation that routine cognitive and manual tasks are increasingly performed by machines, while work that requires complex communication, problem solving and creativity is growing. AI strengthens this tendency: if a machine can retrieve and summarise information faster than a person, the value of education lies less in memorising facts and more in knowing how to ask questions, evaluate answers and apply knowledge responsibly. Luckin describes this as a shift from valuing what learners know to valuing how they know, that is, their ability to understand the nature and limits of their own knowledge [4].

Personalisation is the area in which AI has the longest history. Intelligent tutoring systems, developed since the 1970s, model the learner's knowledge and select the next task accordingly. Holmes, Bialik and Fadel distinguish learner-supporting, teacher-supporting and system-supporting applications of AI and show that adaptive systems are most effective in well-structured subjects such as mathematics, where correct answers and typical errors can be clearly defined [3]. In less structured subjects, such as literature or history, the evidence is weaker,



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and the role of the teacher in interpreting and discussing content remains decisive. This suggests that personalisation through AI should be seen as a complement to classroom teaching rather than a substitute for it.

It should also be noted that personalisation has a social dimension that adaptive systems often ignore. Learning in primary and secondary school is not only an individual process; it takes place in a community of peers, and discussion, explanation to others and joint problem solving are important sources of understanding. A model in which each learner works alone with a screen at an individual pace may increase the amount of practice, but reduce opportunities for communication and collaboration, which are themselves key learning outcomes. A balanced approach therefore combines individual work with adaptive tools and group activities in which learners compare, defend and refine their results [5].

Generative AI has changed the situation further. Unlike earlier adaptive systems, large language models can produce explanations, examples and feedback in natural language on almost any topic. This creates new opportunities: a pupil can ask for a simpler explanation of a concept, receive several worked examples or practise a foreign language in dialogue. At the same time, the output of such models may contain factual errors, biased statements or invented references, and the learner may not have the knowledge needed to recognise them [1]. Consequently, the pedagogical value of generative AI depends on whether the learner is taught to question, verify and improve what the system produces.

A further problem is the so-called illusion of understanding. When a learner reads a clear and fluent explanation produced by a language model, he or she may feel that the topic has been understood, although the knowledge has not been actively processed. Research on learning has long shown that durable knowledge requires effort: retrieval, self-explanation, solving problems without immediate help. If AI removes this effort, learning becomes easier in the short term but weaker in the



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long term. For this reason, tasks involving AI should be designed so that the learner first attempts the task independently and uses the tool only for checking, comparison or additional explanation [3].

Generative AI also changes the nature of language learning, which is especially relevant for Uzbekistan, where pupils study the state language, Russian and English. A learner can practise conversation with a chatbot, ask for correction of a written text or request examples of the use of a word in context. These possibilities are valuable in schools where opportunities for communication with native speakers are limited. However, the teacher should explain that the language of such tools is not always natural, that their corrections may be inaccurate, and that the purpose of practice is to develop the learner's own ability to express ideas rather than to produce a perfect text with the help of a machine [1].

Formative assessment is a second field where AI can reduce the teacher's workload while increasing the amount of feedback learners receive. Automated analysis of written answers, tests with immediate feedback and dashboards that show the progress of a class allow the teacher to identify difficulties earlier. The OECD Digital Education Outlook 2023 emphasises, however, that such tools are useful only when they are embedded in a coherent digital education ecosystem, with clear rules on data protection and on the use of results [6]. Feedback generated by a machine should be treated as information for the teacher's decision, not as a final judgement on the learner's work.

The question of academic integrity is closely related to assessment. When AI tools can produce essays, solve homework tasks and answer test questions, traditional forms of control lose part of their reliability. Detection programmes that claim to identify texts written by AI do not provide reliable results and may wrongly accuse learners, especially those writing in a second language. A more productive response is to rethink assessment itself: to give more weight to



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classroom work, oral presentation, projects based on local material and reflection on the learning process, and to agree openly with learners on which uses of AI are acceptable in each task [1].

The third issue concerns the teacher. Selwyn argues that the debate about whether robots can replace teachers misrepresents the nature of teaching, which involves care, judgement, moral responsibility and the creation of relationships that machines cannot provide [5]. Luckin similarly stresses that the most valuable human capacities, such as metacognition, self-regulation and the ability to understand the context of knowledge, are precisely those that AI does not possess and that education should therefore develop [4]. From this perspective AI does not reduce the importance of the teacher; it changes the content of the teacher's work, shifting it towards the design of tasks, the evaluation of sources and the development of learners' independent thinking.

The teacher's workload is another argument often used in favour of AI. Preparing lesson plans, worksheets, tests and reports takes a considerable part of a teacher's time, and AI tools can reduce this burden. The OECD notes that the time saved in this way is meaningful only if it is redirected to activities that require human judgement: individual work with learners, communication with parents and professional collaboration with colleagues [6]. Otherwise there is a risk that AI will simply increase administrative demands or that teachers will begin to use unverified materials. The decision about how to use the time saved should therefore be part of school-level planning.

On the basis of this analysis, four teaching strategies can be proposed. The first is the strategy of critical verification: learners receive an AI-generated text on the topic of the lesson and work in groups to find factual errors, unsupported claims and missing perspectives, comparing the text with the textbook and other sources. This strategy turns the weakness of generative AI into a learning resource and



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develops source evaluation skills. The second is the strategy of guided dialogue, in which the learner uses an AI tool as a tutor, but the teacher defines the questions, the limits of help and the form in which the final result must be presented. This prevents the tool from simply giving ready answers and keeps the learner responsible for the solution.

The third strategy is process-oriented assessment. When a final product such as an essay can be produced by a machine, the teacher shifts the focus of assessment to the stages of work: the plan, drafts, the learner's reflection on changes and an oral defence of the result. Such assessment makes the learning process visible and reduces the risk of academic dishonesty. The fourth strategy is co-design of materials, in which the teacher uses AI to prepare differentiated tasks, examples and texts of different levels of difficulty, and then checks and adapts them to the curriculum and to the characteristics of the class. In this case AI saves preparation time, while the pedagogical decisions remain with the teacher.

These strategies differ in the degree of the learner's independence and in the role assigned to AI. In critical verification, AI is an object of analysis; in guided dialogue, it is a tutor whose role is limited by the teacher; in process-oriented assessment, it is a factor that the teacher takes into account when designing control; in co-design, it is an assistant to the teacher. Such a distinction helps teachers choose a strategy according to the aims of the lesson, the age of the learners and their level of digital and subject knowledge. For younger pupils, strategies in which the teacher works with AI directly are preferable, while older learners can gradually be given more independence.

The effective use of these strategies requires a new component of teacher competence. UNESCO's AI competency framework for teachers identifies a human-centred mindset, the ethics of AI, AI foundations and applications, AI pedagogy and the use of AI for professional development as the main areas



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teachers should master [7]. For pre-service and in-service teacher training in Uzbekistan this means that courses on information technologies should not be limited to the technical use of software. They should also include the analysis of risks, the design of tasks that require independent thinking and the rules of academic integrity in the age of generative AI.

Teacher training institutions face a particular task here. Future teachers are usually familiar with digital tools in everyday life, but this familiarity does not automatically become pedagogical competence. Courses in pedagogy and subject methodology should include practical sessions in which students analyse lessons where AI is used, design their own tasks and assess the risks of each tool. For practising teachers, short courses are less effective than regular methodological seminars, in which teachers share experience, analyse difficulties and gradually change their practice. Such continuous support corresponds to the developmental logic of the UNESCO framework, which describes the progression from acquiring to deepening and creating knowledge [7].

The ethical and methodological conditions for the use of AI deserve special attention. Personal data of learners must be protected, and tools that collect such data should be used only in accordance with legislation and with the informed consent of parents for younger pupils [1]. Age restrictions set by the developers of AI services should be observed. The use of AI should be transparent: learners need to know when and how they may use it and how such use must be acknowledged in their work. Finally, schools should avoid deepening the digital divide, since unequal access to devices and the internet may turn AI into a source of new educational inequality rather than a means of reducing it [6].

Another condition is the cultural and linguistic adequacy of AI tools. Most large language models are trained primarily on English-language data, and their knowledge of the Uzbek language, national history, literature and educational



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standards may be incomplete or inaccurate. Materials generated by such tools may contain examples that do not correspond to the national curriculum or to the cultural context of learners. Teachers should therefore check the content of AI-generated materials carefully and adapt them, and the development of high-quality resources in the Uzbek language should become one of the priorities of national digital education policy [2].

The analysis also shows that AI does not create entirely new pedagogical principles. Most of the strategies described above are based on well-known ideas: active learning, feedback, differentiation and reflection. What changes is the context in which these principles are applied. The availability of ready answers makes tasks that require only the reproduction of information less meaningful, and increases the value of tasks that require analysis, argumentation and the application of knowledge in new situations. In this sense the spread of AI may become an impulse for the long-discussed transition from reproductive to productive learning.

The experience of other countries confirms the importance of such a cautious approach. Many education systems that introduced AI tools quickly later had to issue additional rules on their use in examinations, on age limits and on the protection of learners' data. In several cases schools first banned generative AI and then allowed it again under defined conditions, after teachers and learners had been prepared. This experience suggests that neither a complete ban nor uncontrolled use is effective; what matters is a clear framework agreed at the level of the education system and adapted by each school to its own conditions [1].

For the practical introduction of these strategies in Uzbekistan, a gradual approach seems most realistic. At the first stage, methodological associations of schools and departments of higher education institutions can select a limited number of subjects and pilot one or two strategies, for example critical



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verification in language and history lessons and guided dialogue in mathematics. At the second stage the results of the pilot, including learners' achievement, teachers' workload and observed difficulties, should be analysed and discussed. Only after this should the strategies be recommended more widely and reflected in curricula and in-service training programmes. Such a sequence reduces the risk of formal implementation, in which AI tools are present in lessons but do not change the quality of learning [6].

Conclusion

Artificial intelligence has become a significant factor in twenty-first century education, and its influence is closely linked with the main pedagogical trends: competency-based learning, personalisation, formative assessment and the changing role of the teacher. AI can support each of these trends, but only when it is used within a clear pedagogical framework. The strategies of critical verification, guided dialogue, process-oriented assessment and co-design of materials allow AI tools to be integrated into teaching while preserving the learner's intellectual effort and the teacher's professional responsibility. Further research should test these strategies experimentally in schools and higher education institutions of Uzbekistan and develop criteria for assessing teachers' AI competence.

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