E- Global Congress
Hosted online from Dubai, U. A. E., E - Conference.
Date: 30th June 2026
Website: https://eglobalcongress.com/index.php/egc
ISSN (E): 2836-3612

PEDAGOGICAL POSSIBILITIES OF ARTIFICIAL INTELLIGENCE TECHNOLOGIES IN DEVELOPING STUDENTS' INDEPENDENT LEARNING ACTIVITY

Ochilova Shahnoza Samadovna
Independent Researcher, Bukhara State University
samadovnashakhnoza@gmail.com phone: +998941611412

Abstract
This article analyzes the pedagogical possibilities of artificial intelligence technologies in developing students' independent learning activity. The study highlights the didactic significance of adaptive learning systems, intelligent tutoring systems, automated formative feedback, conversational agents and learning analytics in fostering self-regulation, motivation and the ability of students to manage their own learning trajectory. The principal types of such tools are classified by didactic function, and the conditions under which their use produces a developmental effect are substantiated. The article argues that this potential is realized only where the design of learning preserves the position of the student as an active subject of cognition rather than as a recipient of ready-made solutions.

Keywords: artificial intelligence, independent learning activity, self-regulated learning, adaptive learning, intelligent tutoring systems, formative feedback, learning analytics, artificial intelligence literacy, learning motivation, digital educational technologies.

INTRODUCTION

In the modern education system, a priority task is not only the transfer of knowledge but the formation in students of the capacity to organize their own cognitive activity: to set learning goals, to select means of achieving them, to monitor their progress and to correct their actions. This capacity, designated in pedagogical literature as independent or self-regulated learning activity, constitutes the foundation of lifelong learning.

Artificial intelligence technologies have become a mass instrument accessible to every student with a network connection, and they have entered educational practice more rapidly than the pedagogical models regulating

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ISSN (E): 2836-3612

their use. A contradiction has thereby arisen which constitutes the problem of this study: a technology capable of supporting the independent activity of a student is frequently employed in a manner that substitutes for that activity, since it delivers a finished result before the student has made an independent attempt. The purpose of the article is to analyze the didactic potential of these technologies, to classify them by pedagogical function, and to determine the conditions under which their application produces a developmental rather than a substitutive effect [1].

RESEARCH METHODOLOGY

The research employed the study of scientific sources on pedagogy and educational technology, comparative and systematic analysis, generalization and pedagogical observation. The didactic potential of adaptive learning systems, intelligent tutoring systems, automated assessment tools, conversational agents, learning analytics dashboards and generative language models was analyzed.

The methodological foundation consisted of student-centered, systemic-activity, self-regulated learning and competency-based approaches. The student-centered approach organizes learning with regard to the individual characteristics and pace of each student. The systemic-activity approach holds that knowledge is acquired through inquiry and problem-solving, and establishes the principal criterion for evaluating any educational technology: a tool is justified where it increases rather than decreases the student's own cognitive activity. The self-regulated learning approach treats learning as a cycle of goal-setting, self-monitoring and reflection, within which the function of a technology is to make the learning process visible to the student [2]. The competency-based approach is supplemented under contemporary conditions by artificial intelligence literacy, understood as the capacity to understand these technologies, to apply them, to evaluate their output critically and to recognize the ethical issues involved [3].

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Integration table of artificial intelligence technologies and their didactic functions

Technology	Main didactic function	Student's role	Expected outcome
Adaptive systems	Maintaining optimal task difficulty	Active participant	Individual learning trajectory
Intelligent tutoring systems	Diagnosing the structure of reasoning	Explorer, researcher	Correction of misconceptions
Automated feedback	Immediate response to work	Author, self-assessor	Self-monitoring and revision
Conversational agents	Expanding practice opportunities	Communicative partner	Reduced anxiety, more practice
Learning analytics	Making the process visible	Subject of self-regulation	Goal-setting and reflection

RESULTS

The analyses showed that an educational process organized on the basis of these technologies is highly effective in developing independent learning activity, provided that the technology occupies an auxiliary rather than a substitutive position in relation to the student's own cognitive effort. Adaptive systems maintain the level of task difficulty within the zone in which the student succeeds through effort, which a teacher working with thirty students cannot calibrate individually; review evidence indicates measurable gains in structured areas with a clear hierarchy of skills and weaker effects where the object of learning is interpretation [4; 5].

Intelligent tutoring systems model the structure of the student's reasoning and intervene within the process of solution, indicating not the corrected answer but the point at which reasoning diverged, which forms the basis of self-monitoring [1]. Automated formative feedback exerts its principal influence through speed: a response received within seconds permits several cycles of revision within a single lesson, and it is this cycle of drafting, response and revision that forms the ability to evaluate one's own work.

Conversational agents occupy a particular position, since the principal difficulty of acquiring communicative skills is the shortage of practice. Such a system provides an interlocutor available at any hour before whom the student does not fear making an error, and the reduction of communicative anxiety is a substantial effect. Research on the components of speaking ability confirms that the volume and regularity of practice are decisive for

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ISSN (E): 2836-3612

fluency [6], and studies of the development of writing skills point in the same direction, since regular feedback on drafts proves more productive than a single final assessment [7]. Learning analytics dashboards produce a developmental effect only where the data are addressed to the student, since self-regulation presupposes that the subject of monitoring and the subject of learning coincide.

DISCUSSION

The results confirm that the developmental effect is determined not by the technology but by its position within the sequence of the student's learning actions. One and the same instrument applied before an independent attempt eliminates the productive difficulty which constitutes the mechanism of learning; applied after such an attempt, it converts that difficulty into a subject of reflection. Pedagogical regulation should therefore be directed not at prohibiting these technologies but at establishing the order of their use. The distinction between artificial intelligence directed at the learner and artificial intelligence in partnership with the learner expresses the same idea at the level of paradigm [8].

Artificial intelligence literacy occupies a special place among the conditions of effective application, since the capacity to evaluate the output of such systems critically is not formed spontaneously through use and requires purposeful instruction [9]. Effectiveness also depends on the teacher, who determines at which point in the learning cycle an instrument is introduced. Research on teachers' attitudes toward digital learning management systems shows that attitude predicts successful adoption more strongly than the platform's technical capability [10], and studies of teaching after the transition to distance formats confirm that systematic methodological support is decisive [7]. At the institutional level, the effect of integrating artificial intelligence into education, science and practice depends on organizational readiness [11], and the ethical validation of such systems with the protection of learners' data remains a mandatory condition [12].

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ISSN (E): 2836-3612

CONCLUSION

The development of students' independent learning activity through artificial intelligence technologies is one of the priority directions of contemporary education. The integrated application of adaptive systems, intelligent tutoring systems, automated formative feedback, conversational agents and learning analytics effectively develops self-regulation, motivation, self-monitoring skills and the capacity to manage one's own learning trajectory.

This effect is nevertheless conditional rather than automatic. It arises where the technology is introduced after the student's independent attempt rather than in place of it, where data on the learning process are addressed to the student, where artificial intelligence literacy is taught purposefully, and where assessment measures the process of work and not only its product. The widespread introduction of these technologies, the enhancement of teachers' professional competence and the purposeful formation of students' artificial intelligence literacy therefore serve as important factors for improving the quality of education [13].

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