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# AI MODELS FOR ADAPTIVE LEARNING AND CAREER UPSKILLING IN THE DIGITAL ECONOMY

Mariia Gogoleva,
Expert in Educational Technology, Volgograd, Russia

**Abstract**
In the digital economy, characterized by rapid technological change and high demand for new skills, artificial intelligence (AI) is becoming a key tool for adaptive learning and career upskilling . Adaptive AI-based systems enable personalization of educational pathways, adjustment of the complexity and content of materials, prediction of student success, and identification of skill gaps. This article examines modern AI models and frameworks , analyzing practical applications, implementation challenges, ethical aspects, and prospects for the development of adaptive learning and career upskilling in the digital economy.

**Keywords:** Artificial intelligence (AI), adaptive learning, career upskilling, digital economy, personalized learning, professional mobility, skills of the future, AI models.

## Introduction

Scientific Novelty. This article is the first to systematically integrate the analysis of AI models for adaptive learning and career upscaling in the US digital economy, demonstrating their role in personalizing learning, building "skill bridges," and enhancing professional mobility while taking into account ethics and equal access.

In recent decades, the digital economy has undergone rapid transformation: automation, big data, cloud technologies, and artificial intelligence (AI) are reshaping how we think about work, skills, and career paths. In this environment, traditional education systems are no longer always able to adapt quickly: they often offer rigid, uniform curricula for all students and fail to provide a

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personalized approach. At the same time, the digital labor market demands flexibility: employees must not only possess basic competencies but also continually learn, update their skills, and be prepared to transition to new roles.

AI is emerging in this paradigm as a leading catalyst for educational and professional transformation. First, adaptive learning systems based on AI can analyze student behavior and progress, tailoring the content, pace, and format of instruction to their individual needs. Such systems are already demonstrating high effectiveness: the study "Adaptive Learning in the Digital Age: Integrating Artificial Intelligence and Pedagogical Methods" demonstrates that integrating pedagogical methods with AI can significantly increase engagement and effectiveness in the learning process [1].

Secondly, AI assistants and chatbots can act as virtual mentors or digital tutors, providing real-time support, generating assignments, checking answers, and adapting the difficulty to the student's level. This has been confirmed by research on AI assistants in higher education [2].

Beyond its educational function, AI is increasingly being seen as a career tool. upskilling and reskilling. In the context of the digital economy, workers face "skill gaps " Gaps, especially in rapidly growing fields such as cybersecurity, automation, and analytics, are becoming increasingly important. Modern AI models are capable of identifying these gaps, predicting career trajectories, and recommending optimal learning paths. For example, the RAG-PRISM framework combines generative models and a retrieval-augmented approach for personalized learning, enabling rapid and scalable skill development through adaptive assignments and recommendations [3].

At the level of public policy and the economy, the role of AI in education and employment is also acquiring strategic significance. Research on the digital modernization of the economy emphasizes that AI is becoming more than just a technological innovation, but a fundamental resource for sustainable growth and competitiveness [4].

However , integrating AI into education and career development poses a number of challenges: privacy protection, AI ethics, imbalances in access to technology, and the need for qualified educators capable of effectively interacting with AI

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systems. These issues require scientific understanding and the development of approaches that can ensure the equitable and sustainable use of AI.

The purpose of this article is to analyze modern AI models used in adaptive learning and career upskilling , identify key benefits and risks, and offer recommendations for the successful implementation of such systems in the digital economy.

Adaptive learning Personalized learning is an approach in which an educational system tailors the content, sequence of exercises, pace, and format of assignments to the individual characteristics of the student. Such systems analyze data on academic performance, interaction, and progress to dynamically adjust the learning trajectory. Educational research emphasizes that AI and tools enable personalized learning, increasing engagement and learning effectiveness by selecting materials that match the student's knowledge level and learning style [5].

Modern adaptive learning systems use machine learning to determine students' knowledge, preferences, and learning styles, then transform learning content, assignments, and assessments to suit these parameters. An example of this approach is a platform solution (e.g., based on Moodle ), where AI models calculate the "best" learning sequences and assignments for each student. In the context of educational management, AI can also assist teachers and administrators in decision-making, such as analyzing course effectiveness, predicting bottlenecks, or optimizing resources [6].

Personalization of learning is not limited to knowledge alone: it is important to consider the context of the learner - motivation, available time, emotional state, goals. work “Context based learning: a survey of contextual indicators for personalized and adaptive learning recommendations.” A pedagogical and technical Perspective " identifies key "contextual indicators" that AI systems can use to more accurately tailor recommendations for educational materials [7]. Context-aware recommender systems provide more pedagogically sound adaptations, since their algorithms take into account not only response statistics but also learning goals, motivational characteristics, and the learning environment.

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AI assistants based on natural language processing ( NLP ) are becoming a powerful tool for personalized and adaptive support for students. For example, in the study " Artificial Intelligence-Enabled Intelligent Assistant for Personalized and Adaptive Learning in Higher Education » framework presented Artificial Intelligence - Enabled Intelligent Assistant ( AIIA ), which generates quizzes and flashcards , answers student questions, and offers personalized learning paths [8]. Such systems are integrated into the LMS and act as virtual teachers, reducing the cognitive load on students and providing 24/7 support.

Knowledge Tracing is a method in which an AI model predicts what a student knows now and what they are likely to learn in the future, based on their previous responses. Recent research combines classical tracing methods with modern approaches such as generative AI and signal processing. For example, in the article " Future - Proofing Programmers » proposed a model CoTutor , which extends Bayesian knowledge tracing ( Bayesian Knowledge Tracing ) using signal processing methods ( signal processing ), which improves the accuracy of progress modeling and allows for more adaptive feedback [9] . This approach allows AI to "teach how to learn," supporting students in long-term skill development.

While AI offers significant opportunities, it faces numerous theoretical and practical challenges. The literature highlights challenges such as privacy and confidentiality of student data, the need for explainability of AI decisions, and a lack of digital and pedagogical competence among educators [10]. Furthermore, adaptive systems can exacerbate inequality: not all students and institutions have access to advanced technologies, potentially creating a digital divide. Educational theory also emphasizes that AI models should not completely replace human mentoring: successful implementation requires a hybrid approach, where technology augments, but does not displace, educators.

The development of artificial intelligence technologies has opened up new opportunities for adaptive learning and career upscaling. Modern AI models can be divided into several areas: personalized learning, intelligent assistants, knowledge tracing, generative models, and recommendation systems for career advancement.

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1. Personalized adaptive learning. AI models use machine learning algorithms to analyze student progress, identify knowledge gaps, and dynamically adjust learning content. Examples of such systems include: Smart Sparrow Adaptive eLearning The platform dynamically adapts learning materials to the student's level. RAG-PRISM combines Retrieval-Augmented Generation (RAG) and generative models for creating personalized content and adaptive tasks.
2. Intelligent assistants and chatbots . AI assistants act as virtual mentors, providing 24/7 support and adapting the complexity and style of communication to the student's needs:
Neuro Chat is a neuroadaptive chatbot that uses EEG data to adjust the learning process in real time.
AIIA (Artificial Intelligence-Enabled Intelligent Assistant) - generation quizzes , flashcards , recommendations By personalized trajectories training .
Knowledge Tracing Tracing ). New models integrate generative algorithms and signal analysis methods. CoTutor extends Bayesian knowledge tracing using signal. processing to improve the accuracy of forecasts and recommendations.
4. Career recommendations and upskilling . AI systems help identify skill gaps and create personalized career paths:
2ACT (AI- Accentuated Career Transitions via Skill Bridges is a framework for creating "skill bridges" that enable transitions between professions, increasing the competitiveness of workers.
EMLT + AI is a career recommendation platform based on an analysis of employees' skills, experience, and interests.

Table 1 - Modern AI models and applications in adaptive learning and upskilling

| Direction | Model / Platform | Main functions |
|---|---|---|
| Personalized learning | Smart Sparrow | Dynamic adaptation of content to the student's level |
| | RAG -PRISM | Generative content, adaptive tasks |
| Intelligent assistants | NeuroChat | Neuroadaptive chatbot, engagement-based |
| | AIIA | Generating tests, flashcards , personalized trajectories |
| Knowledge Tracing | CoTutor | Knowledge prediction, learning recommendations |
| Career advice | 2ACT | Skills Bridges, supporting transitions between professions |
| | EMLT + AI | Individual career paths |

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In the digital economy, the ability to quickly adapt to new technologies and shift professional skills is a key factor in the competitiveness of organizations and employees. Modern AI models for adaptive learning and career upskilling are finding application in both corporate training and government and educational initiatives.

1. Corporate training and employee upskilling . Companies are using AI systems for adaptive employee training to accelerate the acquisition of new skills and improve the effectiveness of corporate programs. Examples include: IBM SkillsBuild , a platform that integrates AI for personalized training and skill development recommendations for employees. LinkedIn Learning with AI recommendations – the system recommends courses and training based on the user's skill profile and career goals. AI models analyze employees' current skills, predict the company's future needs, and create personalized development paths. This is especially important for tech companies, where skills quickly become obsolete.

2. Personalized learning in educational institutions. AI technologies are being actively implemented in universities and schools to improve the quality of education. Adaptive platforms select content based on the student's knowledge level, adjusting assignments and the pace of learning. Example: the use of RAG-PRISM and NeuroChat in pilot programs at US universities allows for tracking student progress, increasing engagement , and reducing academic futility. failure [11].

3. Career counseling and reskilling . AI systems help employees identify skill gaps and create individualized professional development plans. Examples: 2ACT: AI-Accentuated Career Transitions via Skill Bridges enables the construction of "skills bridges" for transitions between professions, minimizing the risk of skill inequality. EMLT + AI is a platform that, based on an analysis of skills and career goals, offers personalized upskilling paths [12]. Such solutions are particularly useful in sectors with high levels of automation and rapid technological innovation, where the need for worker reskilling is growing.

4. State and National Initiatives (USA). In the US, programs aimed at digital literacy and skills development for workers in the digital economy are actively developing: Workforce Innovation and Opportunity The Workforce Outreach Act

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(WIOA) is a federal initiative supporting reskilling and upskilling programs using AI technologies to assess needs and predict career trajectories. AI- powered initiatives in higher education - US universities are implementing AI platforms for adaptive learning, student progress tracking, and personalized recommendations [13].

5. Performance analysis tools. AI models allow us to measure the effectiveness of educational and career programs, predict success, and identify problem areas. For example, AI-powered monitoring systems analyze data on user progress, engagement , and test results, allowing us to adjust curricula and recommendation algorithms.

Consequently, the practical application of AI models in the US digital economy encompasses corporate training, personalized education, career counseling, and national initiatives. The integration of such technologies improves the quality of training, accelerates employee upskilling , reduces the risk of professional unpreparedness, and ensures sustainable competitiveness in the rapidly changing digital economy.

Based on an analysis of modern AI models and their practical application in the US digital economy, the following recommendations can be identified for the effective implementation of adaptive learning and career upskilling:

1. A hybrid approach, combining AI systems with mentoring and teaching support, provides a balance between automation and the human factor.
2. Personalization of learning, i.e., the implementation of adaptive platforms that can adjust content, pace, and difficulty to the individual needs of users, which increases efficiency and engagement .
3. Evaluation and monitoring, which means using AI tools to analyze progress, identify skill gaps, and adjust educational and career programs in real time.
4. Data protection and ethics, i.e. ensuring the transparency of algorithms, respecting data privacy, and preventing discrimination in decision-making by AI systems.
5. Access and equality, i.e., creating conditions for broad access to AI platforms and training resources to minimize the digital divide and ensure equal opportunities for all workers and students.

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6. Investment in staff training, i.e., developing the competencies of teachers, HR specialists, and employees working with AI to effectively integrate technology into educational and corporate processes.

Therefore, following these recommendations allows us to maximize the potential of AI models for skills development, career upscaling , and sustainable professional mobility, while mitigating risks and ensuring equitable access to training and skills development.

AI models offer powerful opportunities to transform learning and career development in the digital economy. Adaptive systems such as RAG-PRISM or neuroadaptive Chatbots allow educational trajectories to be tailored to specific needs. Career transition frameworks like 2ACT demonstrate that AI can not only automate but also enhance skills, creating new mobility pathways through "skill bridges." Social, ethical, and institutional challenges must be considered. Only by integrating AI with well-designed policies, infrastructure, and ongoing research can sustainable and equitable human capital development in the digital economy be ensured.

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