ARTIFICIAL INTELLIGENCE IN HIGHER EDUCATION: PERSONALIZATION OF LEARNING, EFFECTIVENESS, AND CHALLENGES

Svitlana Lytvynova
Institute for Digitalisation of Education of the NAES of Ukraine, Kyiv, Ukraine
E-mail: s.h.lytvynova@gmail.com

Abstract. This paper critically examines the potential of artificial intelligence (AI), including generative AI, to personalize learning in higher education, its relationship with learning outcomes and psychological well-being, and the conditions for responsible implementation. Drawing on a narrative review of ten selected scholarly and institutional sources, it distinguishes AI adoption and perceived usefulness from empirically demonstrated educational effectiveness. The discussion considers intelligent tutoring systems, adaptive assessment, learning analytics, natural-language interaction, and the risks of excessive cognitive offloading, unreliable outputs, and data misuse. It emphasizes the role of instructional design, educator oversight, and transparent institutional policies in aligning AI applications with learning objectives. The paper proposes evaluating personalization through knowledge acquisition, transfer, argumentation, and independent performance, including delayed assessments, while identifying the need for comparative and longitudinal research.

Keywords: artificial intelligence; generative AI; higher education; personalized learning; learning outcomes; psychological well-being; responsible AI implementation.

The spread of artificial intelligence (AI), particularly generative AI (GenAI), across higher education institutions (HEIs) creates opportunities to adapt learning materials, tasks, and feedback to students' needs. At the same time, the pedagogical value of these technologies depends on how they are used, the quality of instructional design, and institutional support.

According to the Digital Education Council (2024), 86% of surveyed students used AI for their studies, while 54% reported using it weekly. The survey covered more than 3,800 students from 16 countries [5]. These figures describe the survey respondents and should not be interpreted as estimates of AI use among all students worldwide. Frequency of use does not in itself demonstrate improved learning outcomes or the presence of personalized learning.

The aim of this study is to systematize and critically analyze publications on the potential of AI to personalize learning in higher education, its association with learning outcomes and psychological well-being, and the conditions for its responsible implementation.

The theoretical basis of the analysis is the systematic review by Zawacki-Richter et al. (2019), which covered 146 publications from 2007 to 2018. The authors identify profiling and prediction, intelligent tutoring systems, assessment, adaptive systems, and personalization. They also note the limited involvement of educators and insufficient critical attention to pedagogical and ethical issues [10]. Because this review primarily addresses the period before the widespread adoption of contemporary GenAI, its findings should not be automatically generalized to ChatGPT use.

Bond et al. (2024) synthesized 66 review publications and confirmed the prominence of adaptive systems and personalization as research areas in AI in higher education. At the same time, they emphasize the need for greater methodological rigour, ethical analysis, and interdisciplinary

collaboration [3]. For the present paper, this underscores the importance of distinguishing the technical capabilities of AI systems from empirically established educational effects.

Figueroa de la Fuente and Farhadian (2025) analyzed 243 articles published between 2017 and 2025 using PRISMA and thematic analysis methods. They identify ethical governance, personalized learning, and the development of faculty AI competencies as prominent themes, while administrative applications remain less extensively investigated [7]. The thematic clusters identified in this review reflect the structure of the research field but do not, in themselves, establish the effectiveness of particular pedagogical interventions.

In a review article, Ahamed (2025) describes adaptive assessment, learning analytics, and the construction of individual learning pathways as potential mechanisms of personalization [2]. This work helps explain the technological capabilities of AI; however, its broad claims should not be interpreted as universal quantitative estimates of improvements in academic achievement.

Al-Zahrani and Alasmari (2024) examine perceptions of AI among higher education stakeholders in Saudi Arabia using a survey of 1,113 respondents. Alongside positive expectations regarding teaching and administration, they emphasize issues of privacy, security, and algorithmic bias [1]. As this study focuses on attitudes and expectations, it does not provide direct evidence of improved learning outcomes.

Elshaer, Hasanein, and Sobaih (2024), drawing on a sample of 500 students and the Unified Theory of Acceptance and Use of Technology (UTAUT), analyze the acceptance and use of ChatGPT, including differences associated with gender and field of study [6]. These relationships can inform support for different groups of students, but they do not justify attributing identical motivations for AI use to all men, women, or students in a particular discipline.

The psychological dimension is addressed in studies by Cambra-Fierro et al. and Shahzad et al. The former investigates faculty adoption of ChatGPT through the Technology Acceptance Model (TAM) and its associations with higher levels of positive well-being and lower stress [4]. The latter, based on a survey of 401 students at Chinese universities, identifies positive associations between AI and social media use and self-reported academic performance and well-being [9]. Such findings require careful interpretation: statistical associations in surveys do not establish causality or long-term effects.

Reports by the Digital Education Council and by Inside Higher Ed and Hanover Research complement academic publications with data on AI use and institutional readiness [5; 8]. They are most appropriately used to describe the context of implementation, rather than as evidence of pedagogical effectiveness. Overall, the literature supports the potential of personalization but leaves open the question of whether sustained GenAI use fosters learner autonomy and critical thinking.

Personalization entails adapting instruction to learners' prior knowledge, current difficulties, and progress. In a functional description of intelligent tutoring systems (ITS), one may distinguish a domain model, a learner model, a pedagogical module, and an interaction interface. The domain model represents subject content and relationships between concepts; the learner model records task performance and identified knowledge gaps; the pedagogical module determines the sequence of tasks and hints; and the interface enables interaction. This is a generalized description rather than a mandatory architecture for every system [2; 3; 10].

GenAI expands opportunities for natural-language dialogue, explanations of course material, and the generation of alternative tasks. However, an individualized chatbot response does not in itself amount to a pedagogically grounded learning pathway: this requires evidence of student progress, explicit adaptation criteria, and verification of alignment with learning objectives. Because generated materials may contain errors and biases, they require educator review [1; 3].

Cognitive offloading involves transferring some cognitive operations to an external tool and is not necessarily harmful. Risks arise when ready-made answers replace independent reasoning and verification. Learning tasks should therefore require students to explain their reasoning, compare arguments, and verify sources. Dialogue based on probing questions can be proposed as a pedagogical scenario for supporting learner autonomy, but its effectiveness in a particular course must be evaluated separately.

The effectiveness of personalization should be assessed in terms of knowledge acquisition, transfer of knowledge to new contexts, quality of argumentation, and the ability to complete tasks independently without AI. User satisfaction and response speed are additional indicators, but they cannot substitute for assessments of learning outcomes. Comparative studies and delayed assessments are needed to establish whether the effects persist.

The 2024 survey conducted by Inside Higher Ed and Hanover Research found that only 9% of surveyed chief technology and information officers considered higher education prepared for the spread of AI, while 23% rated investment in AI as an essential or high priority [8]. The survey included 82 technology leaders, predominantly from U.S. higher education institutions, and had a low response rate. The results describe perceptions within this sample and do not support a conclusion that most universities worldwide are unprepared.

A comparison of sources [1; 3; 5; 8] suggests that barriers to implementation can be grouped into regulatory and ethical, resource and staffing, pedagogical, and technological and organizational categories. These include clear rules governing acceptable AI use, faculty development, access to tools, alignment with learning objectives, and appropriate data governance. This classification is an analytical synthesis developed for the present review.

Psychological well-being also warrants consideration. The cited empirical studies report positive associations between AI use and well-being in particular samples of students and faculty [4; 9]. At the same time, concerns about privacy and the reliability of AI responses, documented in the student survey [5], support the need for transparent institutional rules. The sources considered here do not provide sufficient grounds for claiming that AI inevitably reduces anxiety or causes loneliness and technostress. Testing such effects requires specifically designed research.

AI offers opportunities to adapt content, task difficulty, and feedback to learners' needs. Realizing these opportunities requires pedagogically sound instructional design and educator involvement. The prevalence of AI use, technology acceptance, and educational effectiveness are distinct dimensions that should be assessed separately.

HEIs should establish rules for GenAI use across different types of assignments, disclosure requirements, and procedures for verifying AI-assisted work. Institutional support should include competence development, access to tools, and data protection. Differences in technology acceptance observed in particular samples should be considered without reinforcing gender- or discipline-based stereotypes.

Future research should examine the longer-term effects of specific AI personalization scenarios on independent thinking, knowledge transfer, and psychological well-being. The findings of this narrative review are limited to the sources considered and do not constitute an exhaustive evaluation of all research on AI in higher education.

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