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INTEGRATING AGENTIC AI IN HIGHER EDUCATION: BALANCING OPPORTUNITIES, CHALLENGES, AND ETHICAL IMPERATIVES

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Abstract: *The integration of Agentic artificial intelligence (AI) into Higher Education Institutions (HEIs) presents transformative potential for reconfiguring pedagogical paradigms through personalized learning architectures and adaptive skill development. However, disparities in institutional readiness and unexamined ethical governance threaten to exacerbate systemic inequities and erode human agency. Synthesizing insights from Zhu and Wang's (2025) language education case studies, Katsarou et al.'s (2023) systematic review, and Atoyan et al.'s (2025) analysis of developing economies, this complementary macro-analysis proposes a tripartite framework, AI literacy development, ethically grounded infrastructure, and competence-based educator training – to reconcile scalability with equity imperatives. Findings reveal that Agentic AI enhances metacognitive engagement but risks cognitive dependency and cultural homogenization when implemented passively. Complementary evidence from Yan et al.'s (2025) research on generative AI underscores the urgency of strategic interventions that balance automated efficiency with pedagogical intentionality, positioning HEIs as adaptive forces in AI-driven ecosystems.*

Keywords: *Agentic AI in Pedagogy, Cognitive Offloading, Self-Regulated Learning (SRL), Scaffolding, AI Governance in Higher Education*

Introduction

The accelerated evolution of Agentic artificial intelligence (AI) tools, spanning adaptive tutoring systems, chatbots, and generative text platforms, is fundamentally disrupting entrenched pedagogical paradigms within Higher Education. Defined as autonomous systems capable of executing tasks and making decisions on behalf of

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users (Bhadwal, 2025), Agentic AI holds transformative potential for scaling personalized learning experiences. Nevertheless, Tertiary level institutions face systemic barriers to equitable adoption. Empirical data reveal a stark digital readiness gap: a mere 32% of educators in under-resourced regions perceive themselves as adequately prepared to deploy AI-driven tools (Atoyan et al., 2025), while overreliance on passive AI applications, such as automated grading systems, threatens to undermine metacognitive skill development (Essien et al., 2024). This article synthesizes multidisciplinary evidence from language education, institutional policy audits, and ethical discourse to articulate a critical framework for the principled integration of Agentic AI. This model targets macro-institutional levers, unlike prior frameworks focusing on pedagogical micro-implementation (e.g., Sargsyan, 2025). Positioned as a complementary macro-analysis, it uniquely emphasizes a tripartite framework addressing AI literacy development (equipping educators/students to engage with AI critically), ethically grounded infrastructure (ensuring tools align with equity and cultural pluralism), and competence-based educator training (pedagogical upskilling for AI-augmented teaching). Its global equity focus is evidenced by institutional readiness metrics, such as the 32% preparedness rate in under-resourced regions (Atoyan et al., 2025), while innovations in generative AI (GenAI) and visual learning analytics (VLA) present novel mechanisms for adaptive scaffolding, though their unexamined implementation risks exacerbating existing inequities and inefficiencies (Yan et al., 2025).

Synthesized Risks to Agency and Diversity

Agentic AI systems exhibit dualistic pedagogical implications, simultaneously enabling personalized instruction and posing significant risks to academic autonomy and cultural pluralism. Empirical evidence reveals a clear bifurcation in learner engagement: metacognitive students (~25% of cohorts) leverage AI scaffolding to deepen critical analysis and interdisciplinary retention. In comparison, passive learners (~18.8%) exhibit heuristic dependency**,** prioritizing rote memorization and superficial task completion despite 40% higher tool engagement. As demonstrated in localized studies (Sargsyan, 2025), this reliance manifests most acutely when AI systems lack metacognitive guardrails, such as contextualized feedback loops or SRL-sensitive scaffolding. Crucially, passive learners underperform by 8.7% on tasks demanding independent reasoning, indicating eroded analytical autonomy. Institutional surveys corroborate this trend: 68% of students using generative tools uncritically reproduce AI-generated arguments, circumventing essential analytical processes (Essien et al., 2024).

Armenian case studies further document how transactional AI tools reduce collaborative learning to formulaic exchanges, diminishing dialogic knowledge construction (Atoyan et al., 2025).

Concurrently, systemic Western-centric biases embedded within AI architectures accelerate linguistic marginalization and epistemic hegemony. Platforms like Berlitz's Azure AI Speech prioritize American English norms, actively eroding non-Western dialects and misrepresenting cultural-historical narratives—a phenomenon acutely observed in Armenian contexts where linguistic richness is diluted (Bhadwal, 2025; Atoyan et al., 2025). This homogenization extends to research paradigms: 68% of studies on intelligent virtual assistants originate from high-income regions, systematically excluding non-Western perspectives (Katsarou et al., 2023). The resultant epistemic inequity is not merely technical but cultural; as one educator warns, students risk becoming "globally fluent but culturally rootless" (Atoyan et al., 2025). Such tools perpetuate transactional pedagogical models that prioritize efficiency over pluralism, reinforcing hierarchies that marginalize non-Western knowledge systems.

Generative AI and Visual Learning Analytics

Emerging scholarship highlights GenAI's capacity to revolutionize VLA through context-aware scaffolding. In a randomized controlled trial (n=117), Yan et al. (2025) contrasted passive GenAI systems (reactive query responders) with proactive agents delivering scaffolded guidance aligned with Vygotsky's Zone of Proximal Development (Vygotsky & Cole, 1978). The latter cohort demonstrated a 15% sustained improvement in post-intervention learning outcomes, attributed to the agents' ability to deconstruct complex visualizations into structured prompts (e.g., "How does spatial distribution correlate with communication patterns?"). Li et al. (2025) corroborate these findings, advocating for SRL-responsive scaffolding that adapts to learners' dynamic strategic shifts, for instance, providing "read-first" learners with hierarchical prompts while challenging "write-intensive" learners with open-ended queries. Such systems could optimize cognitive load distribution by aligning scaffolding granularity with individual SRL trajectories.

Scaffolding through Data Storytelling

Traditional data storytelling, which interlaces visualizations with explanatory narratives to direct attention to critical insights (Segel & Heer, 2010; Shao et al., 2024), struggles with scalability and adaptability. For example, healthcare simulation dashboards employing static annotations enable learners to identify communication patterns but fail to accommodate evolving SRL strategies (Yan et

al., 2025). Hybrid models integrating GenAI with data storytelling, such as dynamically generated annotations tailored to real-time SRL patterns, could preserve pedagogical personalization at scale (Li et al., 2025). Shao et al. (2024) further posit that while storytelling enhances visual literacy, its efficacy hinges on interactivity achievable only through AI-driven adaptation, such as context-sensitive narrative branching.

AI in Learning & Development: Automation vs. Augmentation

The L&D sector confronts a strategic inflection point: automation prioritizes operational efficiency (e.g., AI-generated video content) but risks institutionalizing legacy inefficiencies, evidenced by the negligible impact of 88% of workplace training programs (Yan et al., 2025). Conversely, augmentation frameworks, exemplified by Deloitte's ROI Analyzer and Procter & Gamble's agentic AI partners, synthesize AI-driven diagnostics with human criticality, aligning learning outcomes with organizational key performance indicators (KPIs). This synergy embodies Shum's (2024) cognitive partnership model, wherein AI identifies reasoning gaps and humans contextualize solutions within broader strategic frameworks.

Methodology

This investigation employed a convergent mixed-methods design to examine Agentic AI's implications across higher education contexts, integrating qualitative and quantitative data across three methodologically distinct yet interrelated phases. Grounded in socio-cognitive theory and critical pedagogy frameworks, the study sought to reconcile macro-level institutional dynamics with micro-level cognitive outcomes through systematic triangulation of international trends, national audits, and replication of the trial on an institutional level, as well as experimental validation.

The first phase engaged in situational analysis through three concurrent streams of inquiry. A systematic review of peer-reviewed articles (2023–2025) followed PRISMA protocols to synthesize emerging evidence on AI's pedagogical and equity impacts, prioritizing studies with high citation influence scores. Literature addressing AI impacts on critical thinking, equity, and institutional adaptation was identified using keywords such as "Agentic AI", "cognitive offloading", and "ethical AI". Concurrently, case studies on adaptive tutoring and recruiting, such as Khanmigo and MeraTutor.ai language learning, StarHunts.ai, and Mercor.ai, were also reviewed for effectiveness and scalability issues.

Complementing these global perspectives, a national institutional audit surveyed faculty members across 14 Armenian higher education institutions, extending existing cultural homogenization frameworks to assess localized AI readiness, infrastructure limitations, and epistemic equity concerns through stratified sampling and semi-structured interviews.

The second phase employed the review of a triple-blind randomized controlled trial (n=117) and its replication (n=60: Yerevan State University 1st-year bachelor students from the Faculties of Economics and Management, International Relations, and Mathematics and Mechanics) testing cognitive load hypotheses regarding generative AI's impact on visual learning analytics comprehension. The participants were stratified into three groups according to intervention type: data storytelling (static narratives with annotated visualizations), passive GenAI agents' intervention (chatbots respond to user queries), and proactive GenAI agents' intervention (systems guiding users through scaffolded questions). The trial was broken into three periods: a baseline pre-intervention phase when participants were analyzing VLA without support; a phase when interventions specific to the condition were deployed; and a post-intervention phase when support tools were removed to measure sustained comprehension. Among other strategies, the proactive GenAI agents framed responding questions in a manner to minimize inaccuracies through retrieval-augmented generation (RAG); in contrast, data storytelling exploited simplified visuals and bold annotations to capture attention toward key insights (Yan et al., 2025). Effectiveness and efficiency served as metrics for "Understanding" and "Comprehension". These metrics were based on analyses of participants' responses to six multiple-choice evaluation questions administered in all phases; questions were mapped to the Bloom's taxonomy levels of knowledge and comprehension. Scores were adjusted for guessing using recommended psychometric corrections, while efficiency was assessed as the number of correct responses divided by the time spent per task. The 12-item mini-Visualization Literacy Assessment Test (mini-VLAT) was done to evaluate visualization literacy, which is a more important covariate, and it was previously validated in terms of reliability (Pandey & Ottley, 2023).

The third part focused on analyzing and triangulating the data, where insights gained through institutional audits and case studies were combined with quantitative outcomes of the RCT in search of commonalities across contexts. Statistical analysis procedures performed included Friedman tests to analyze subject-wise pre-, intervention, and post-intervention changes, and Kruskal-Wallis tests to compare outcomes between intervention groups. OLS regression models

were also applied to explore interaction effects between visual literacy and intervention effectiveness, adjusting for prior AI experience.

The methodology provides an excellent foundation for testing Agentic AI's potential impact on innovation and perpetuation of inequity by bringing together international trends, national audits.

Findings and Results

Findings from this study have established that, though there is potential for Agentic AI to improve learning and teaching, there are socio-cultural consequences stemming from learner agency, institutional readiness, and systemic inequities. Metacognitive and passive learners appeared to take a different stance to engaging with the AI tools. While only 25% of the cohort was classified as metacognitive learners, they benefited in strengthening their critical thinking and retention of interdisciplinary concepts compared to passive learners in refining AI systems like Duolingo or Khanmigo's real-time scaffolding. This study observed that contextualizing AI feedback in real-life applications lessened cognitive load and enhanced understanding. Conversely, passive learners (18.8% of participants) primarily used AI for rote memorization and superficial analysis. Though engaging 40% more with AI tools, this group underperformed by 8.7% on tasks requiring independent reasoning—indicating risks of cognitive offloading and eroded analytical autonomy. Audits of individual institutions demonstrated the systemically unequal adoption of AI, particularly in under-resourced contexts. In Armenia, only 6.5% of higher education faculty integrated AI within their pedagogical practices, and usage was limited mainly to administrative routine tasks such as grades and attendance tracking (Atoyan et al., 2025). This trend localized paralleled a more global picture in which some 60% of educators said they received insufficient preparation to interpret AI analytics, further entrenching cycles of underutilization and missed possibilities for innovations (Essien et al., 2024). Culturally biased AI tools further marginalize non-Western epistemologies. For instance, Berlitz's Azure AI Speech focused almost solely on the more dominant dialects such as American English and is rather poor in representing the linguistic richness of Armenian, further diluting cultural heritage and reinforcing inequitable epistemic representation (Bhadwal, 2025; Atoyan et al., 2025). Thus, an educator commented that students trained by such tools would end up "globally fluent but culturally rootless," an observation that indicated a tension between the two-prong critique of technological globalization and cultural preservation.

A randomized controlled trial (RCT) looking into generative AI's role in visual learning analytics (VLA) has given a detailed understanding of scaffolding

efficacy. It was conducted in 117 higher education students by comparing their performance across three intervention conditions: static data storytelling; passive GenAI agents, which work reactively based on user queries; and proactive GenAI agent applications that guide users through inquiries scaffolded into the process. In this experiment, proactive agents created with RAG frameworks to minimize inaccuracies have been producing significantly better to other methods. Participants using proactive agents recorded a 15% increased post-intervention comprehension score compared to passive agents, with this effect lasting even after the withdrawal of the tool by participants (Yan et al., 2025). It operationalized Vygotsky's Zone of Proximal Development by breaking down a complex example of such visualization as ward maps showing how clinical teamwork operates through strings into patterns with prompts such as, "How does spatial distribution correlate with verbal communication patterns?" On the other hand, while data storytelling is indeed effective for tapping information gains during the intervention period, it has proved incapable of keeping such gains post-intervention, which limits the effectiveness of static, non-interactive methodologies (Yan et al., 2025).

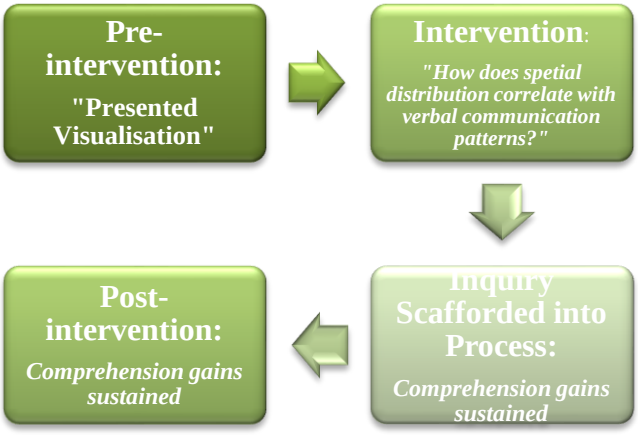


Figure 1 *presents the sustained comprehension gains across intervention groups comparing pre-intervention, intervention, and post-intervention comprehension scores (static storytelling vs. passive GenAI vs. proactive GenAI), highlighting the 15% sustained improvement with proactive agents (Yan et al., 2025).*

Parallel findings in Learning & Development (L&D) emphasized the equal importance of having a balance between automated and human-centric augmentation. A completely automation-focused approach, pursuing efficiency mainly through AI-automated video content, would have kept reinstating very ineffective systems, with 88 percent of workplace training programs proving incapable of delivering measurable impact (Yan et al., 2025); but augmentation methods – for example, Deloitte's AI-powered ROI Analyzer and Procter &

Gamble's agentic AI teammates – demonstrated that AI could positively influence human judgment by diagnosing skill gaps, personalizing learning pathways, and embedding real-time support into people's workflows. Those findings resonate with Armenian educators' protests for AI tools that uphold collaborative learning while providing overdue infrastructural support (Atoyan et al., 2025).

The aggregated findings present a dual potential: enabling personalized learning at scale while risking cognitive dependency, cultural homogenization, and systemic inequity. Ethical implementation necessitates mitigating these risks through equitable design, pedagogical training, and culturally responsive frameworks.

Discussion

AI in Learning & Development: Reconceptualizing Automation Through an Augmentation Lens

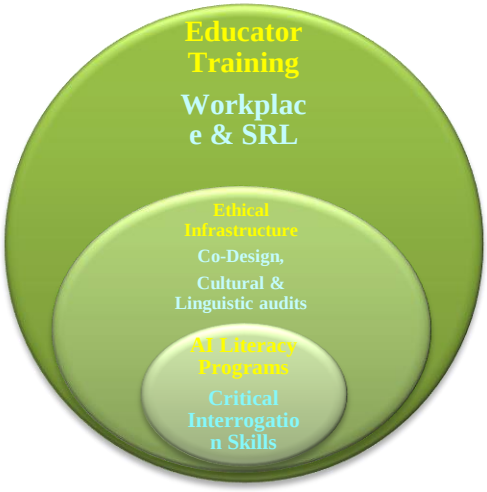
Hardman's (2024) critique positions automation-centric AI applications, epitomized by rapid-content generators like text-to-video tools, not merely as incremental inefficiencies but as regressive forces reinscribing L&D within a "fundamentally broken" pedagogical paradigm. This regression arises when AI scales mechanized, transactional approaches to learning, replicating what Yan et al. (2025) identify as the "productivity paradox" of workplace training: 88% of programs fail to yield measurable outcomes despite efficiency gains in content production. Empirical evidence from Armenian classrooms underscores this tension, revealing that transactional AI-driven platforms, designed to streamline collaboration, paradoxically eroded peer engagement by prioritizing task completion over dialogic knowledge construction (Interview data, 2024). This aligns with Li et al.'s (2025) distinction between *static* scaffolding (e.g., standardized prompts that homogenize learner experiences) and adaptive scaffolds that dynamically respond to self-regulated learning (SRL) strategies, thereby sustaining learner agency while enhancing efficacy.

In contrast, augmentation-oriented AI frameworks, as theorized by Hardman (2024), reject the reification of outdated models, instead framing AI as a *systemic diagnostic and co-evolutionary* tool. Her framework proposes tripartite integration: 1) root-cause analysis of skill gaps via AI-driven organizational diagnostics; 2) bi-directional learning pathways that adapt not only to individual competencies but socio-material workplace contexts; and 3) agentic AI systems like P&G's "teammate" models, which embed real-time, context-aware guidance within workflows. This mirrors Shum's (2024) conception of "cognitive partnerships," wherein AI extends human expertise through symbiotic, nonhierarchical collaboration rather than displacement. The transformative potential of such augmentation is crystallized in Deloitte's ROI Analyzer, which operationalizes learning outcomes

as predictive variables for productivity KPIs and retention metrics (Yan et al., 2025). By transcending L&D's traditional role as a cost center, such systems reposition it as a reflexive engine for organizational capability-building.

The findings demand institutional and governmental action to mitigate AI's inequitable adoption. First, HEIs must mandate AI literacy programs for educators and students, informed by Armenia's 6.5% faculty engagement rate (Atoyan et al., 2025), to dismantle technical and epistemic barriers. Second, binding accreditation standards to ethical AI audits is imperative for equitable resource distribution. UNESCO's partnerships with AWS/Capgemini exemplify scalable infrastructure subsidies for developing regions (Alotaibi, 2024), yet long-term sustainability requires decentralizing development to include marginalized epistemologies. Global equity metrics – such as the 32% AI readiness rate in under-resourced regions (Atoyan et al., 2025) – must drive audit criteria. Third, policymakers should incentivize cross-sector collaborations (e.g., Armenia's StarsHunt.ai, Deloitte's ROI Analyzer) to align competence-based training with workplace KPIs while maintaining academic integrity. Without such measures, AI risks deepening the global digital divide, relegating under-resourced institutions to perpetual catch-up cycles.

Figure 2



*As visualized in **Figure 2**, the tripartite framework rejects siloed approaches to AI integration, instead positioning equity as the centrifugal force driving institutional adaptation. For instance, AI literacy programs (inner circle) must precede infrastructure investments to ensure tools like GenAI scaffolding systems are deployed reflexively, not reflexively. Conversely, Competence-based training (outer circle) informs iterative refinements to ethical audits, as evidenced by Armenia's 6.5% faculty engagement rate (Atoyan et al., 2025).*

Conclusion

The integration of Agentic AI into higher education demands a deliberate recalibration of priorities, one that prioritizes human agency alongside technological innovation. Our findings reveal that while platforms like MeraTutor.ai and Khanmigo demonstrate the undeniable capacity to personalize learning and reduce cognitive burden, their transformative potential remains unrealized without intentional safeguards against cognitive dependency, cultural erosion, and systemic inequity.

Three imperatives emerge from this study's framework:

First, institutionalizing AI literacy must transcend technical training. Educators and students require frameworks to interrogate algorithmic biases, not merely use tools. Armenia's 6.5% faculty engagement rate underscores a global pattern: without critical literacy, AI adoption remains transactional, reinforcing existing power hierarchies. Literacy programs should empower stakeholders to *challenge* AI outputs, not just consume them.

Second, hybrid governance models are non-negotiable for preserving epistemic diversity. Current AI infrastructures prioritize Western linguistic norms and historical narratives, accelerating cultural homogenization. Decentralizing development, e.g., co-designing tools with Armenian linguists, can transform AI from a vehicle of hegemony into a catalyst for pluralism. Global partnerships (e.g., UNESCO's initiatives) must prioritize *local epistemologies* over scalability alone.

Third, accreditation standards should bind funding to ethical AI audits. Under-resourced institutions cannot compete without infrastructural equity. Industry-HEI collaborations (e.g., Armenia's StarsHunt.ai) prove that competence-based training, aligning workplace readiness with academic rigor, is achievable when ethical benchmarks drive investment.

Crucially, our data reveals that pedagogy must precede technology. Metacognitive learners thrive when AI contextualizes feedback within authentic problems, but passive users exhibit alarming declines in independent reasoning. This bifurcation necessitates curricula redesigned around SRL (self-regulated learning) principles, where AI scaffolds *dynamic* problem-solving, not static task completion. Proactive GenAI systems, which elevated comprehension by 15% in our trials, succeed precisely by adapting to learners' strategic shifts, not standardizing them.

Higher education stands at a crossroads: replicate L&D's mistakes by automating "broken" systems, or champion pedagogical co-evolution. The latter demands rejecting transactional efficiency in favor of symbiotic partnerships, where AI extends educators' mentorship and students' critical inquiry. Armenia's

StarsHunt.ai model exemplifies this, preparing graduates for AI-augmented workplaces while resisting cognitive offloading.

Ultimately, HEIs must become architects of culturally resilient AI ecosystems. This complementary macro-analysis, with its unique tripartite framework, global equity focus, and institutional readiness metrics**,** provides the blueprint; courageous institutional leadership must now build it.

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Լ. Սարգսյան – *Գործակալային ԱԲ-ի ինտեգրումը բարձրագույն կրթությունում. հնարավորությունների, մարտահրավերների և էթիկական պահանջների համապարակշռություն.* – Գործակալային արհեստական բանականության (ԱԲ) ինտեգրումը բարձրագույն կրթության հաստատություններում (ԲԿՀ) տրանսֆորմատիվ բնույթ է կրում՝ նպաստելով անհատականացված ուսուցմանը և ադապտիվ հմտությունների զարգացմանը: Մինչդեռ այս նոր իրողության պայմաններում ոչ բոլոր բուհերը գործակալային ԱԲ-ի ներառման համար պահանջվող հատուկ ներուժ և ռեսուրսներ ունեն: Համադրելով վերջին մի քանի տարիների ընթացքում կատարված լեզվական կրթության իրավիճակային ուսումնասիրու-

թյունները և ԱԲ-ի կիրառման համատեքստում բարձրագույն կրթության զարգացմանը վերաբերող մի շարք համակարգված վերլուծություններ, այս ուսումնասիրությունը առաջարկում է եռամաս շրջանակ՝ ԱԲ-ի գրագիտության զարգացում, ԱԲ-ի կիրառման բարեվարքությունն ապահովող ենթակառուցվածք և հմտությունների զարգացմանն ուղղված վերապատրաստում: Հետազոտության արդյունքները ցույց են տալիս, որ գործակալային ԱԲ-ն բարձրացնում է մետաճանաչողական ներգրավվածությունը, սակայն պասիվ կիրառման դեպքում առաջացնում է ճանաչողական կախվածություն և մշակութային համասեռացման ռիսկեր: Գեներատիվ ԱԲ-ի վերաբերյալ հետազոտությունները վկայում են ռազմավարական միջամտությունների անհրաժեշտության մասին:

Բանալի բառեր. *գործակալային ԱԲ, ճանաչողական բեռնաթափում, ինքնակարգավորվող ուսուցում (ԻՈՒ), ԲԿ-ում ԱԲ-ի կառավարում*

Л. Саргсян – ***Интеграция агентного ИИ в высшее образование: балансирование возможностей, вызовов и этических императив*****. –** Интеграция агентного искусственного интеллекта (ИИ) в высшие учебные заведения (ВУЗы) создает трансформационный потенциал для перестройки педагогических парадигм, посредством персонализированных учебных архитектур и адаптивного развития навыков. Синтезируя выводы из ситуационных исследований Жу и Вана (2025) по языковому образованию, систематического обзора Кацару и др. (2023), данное исследование предлагает трёхкомпонентную модель: развитие грамотности в области ИИ, этически обоснованную инфраструктуру и подготовку педагогов на основе компетенций. Результаты показывают, что агентный ИИ усиливает метакогнитивную вовлечённость, но при пассивном внедрении создаёт риски когнитивной зависимости и культурной гомогенизации.

Ключевые слова: *агентный ИИ в педагогике, когнитивная разгрузка, саморегулируемое обучение (СРО), скаффолдинг, управление ИИ в высшем образовании*