RUDN Journal of Psychology and Pedagogics
ISSN 2618-8163 (Print); ISSN 2618-8171 (Online)
2025 Vol. 22 No. 2 337–360
Вестник РУДН. Серия: Психология и педагогика
http://journals.rudn.ru/psychology-pedagogics

DOI: 10.22363/2313-1683-2025-22-2-337-360
EDN: VDDJBF
UDC 159.923

Review article

# Artificial Intelligence Technologies, In-Person and Online Learning in Higher Education: A Review of the Impact on Students' Perceptual Features, Psychological Climate and Academic Performance

**Olga A. Ulyanina**[1,2] ✉, **Ekaterina N. Vikhrova**[2]

[1]Moscow State University of Psychology & Education, *Moscow, Russian Federation*
[2]Moscow Institute of Physics and Technology (National Research University), *Dolgoprudny, Russian Federation*
✉ulyaninaoa@mgppu.ru

**Abstract.** Rapid digitalization of higher education and the rise of artificial intelligence (AI) in instruction call for careful evaluation of their impact on students. Traditional face-to-face lectures and those given by an AI-avatar, remote online courses, each create distinct conditions that shape the classroom psychological climate and comfort. Prior research shows AI integration increases engagement, but comparative evidence on comfort, performance, and perception across formats remains limited. The purpose of this review is to examine students' perceptions of three instructional formats (in-person, online, AI-avatar lectures), their impact on class psychological climate and academic performance, and the risks and prospects of AI use in higher education. This narrative review synthesizes literature on AI applications in higher education over approximately the past seven years, drawing on Russian (RSCI, eLIBRARY) and international (Scopus, Web of Science) databases, as well as relevant reports and surveys. Empirical studies (2018–2025, Russian/English) comparing pedagogical formats or assessing AI's impact on students were included, while incomplete reports, duplicates, and irrelevant works were excluded. Review findings indicate that most students rated face-to-face instruction as most comfortable, though well-designed online courses and realistic avatar lectures yielded comparable satisfaction. No single format was universally superior; instructional effectiveness depended on contextual factors. Online learning outcomes varied; in some cases they equaled or exceeded in-person results. Early studies of AI-avatar lectures showed neutral-to-positive reception, noting clear speech and accessibility. The presence of a virtual instructor positively influenced satisfaction, and visual feedback proved more effective than text-only interaction. Students' digital literacy facilitated adaptation, while skill gaps or low trust contributed to anxiety. Risks included reduced live communication, limited avatar authenticity, academic dishonesty, and ethical concerns. Overall, AI-avatars and digital technologies can enhance interactivity and flexibility in higher education but cannot fully replace live human contact. Therefore, a balanced, human-centered implementation that accounts for psychological factors is recommended.

**Key words:** artificial intelligence, higher education, digital avatar, online learning, in-person learning, psychological climate, perception, academic performance, educational experience

**Funding.** The research was conducted within the framework of the agreement with the Ministry of Science and Higher Education of the Russian Federation dated January 17, 2025, number 075-03-2025-662 (code FSMG-2025-0086, project topic: "Applied research on the implementation of artificial intelligence technologies in higher education").

## Introduction

The digital transformation of higher education has produced new learning formats. Artificial intelligence (AI) technologies are becoming integral to curricula and educational processes. The COVID-19 pandemic accelerated the adoption of online learning (e.g., in 2020–2021 universities transitioned to remote instruction). In 2022–2023, under the "Digital Departments" program, over 112,000 students across 114 Russian universities participated in supplementary IT courses. By 2023, according to official data, one in six Russian students (~689,000 people) had a curriculum with an AI module, and one in five first-year students enrolled in a program containing an AI component—reflecting efforts to provide basic AI knowledge (Bondarenko et al., 2025).

Students are also actively employing digital tools. Recent surveys indicate that AI has firmly entered student academic practice. In early 2025, about 85% of Russian university students were using generative AI tools for their studies. Nearly half use AI in preparing term papers and other assignments, primarily for information search (around 77% of respondents), as well as tasks like image generation (36%), creating presentations (24%), and even programming (22%)[1].

A generally positive attitude toward AI is common. For example, a survey of 250 students at a technical university found only about 5% viewed AI negatively, while approximately 47% had a positive view (the rest were neutral) (Kostikova et al., 2025). Thus, for today's students, using AI has become a normal part of academic practice. However, these trends also a need to improve digital literacy and understanding of how these tools work. This, in turn, prompts an important question: how do the new AI-supported learning formats affect the educational process and the students themselves? Do they cause discomfort? Is academic performance improved or worsened? Does the class atmosphere change?

Extensive research has compared in-person and distance learning. Classic meta-analyses report mixed results: some studies find online students perform as well as or better than in-person students, while others note declines in motivation and engagement (Zhao et al., 2005). A large meta-analysis of 230 studies (Bernard et al., 2004; Bernard et al., 2009) did not yield definitive conclusions about the effectiveness of distance education, concluding that "it is incorrect to state that distance learning is better, worse, or equivalent to classroom instruction"—everything depends on the implementation conditions. The pandemic provided

[1] *43% of students use artificial intelligence for writing term papers* (2025, March 31). Vedomosti. (In Russ.) Retrieved 3 April, 2025 from https://www.vedomosti.ru/society/articles/2025/03/31/1101211-iskusstvennii-intellekt-dlya-napisaniya-kursovih-rabot

abundant data on this issue. The global shift to emergency remote teaching in 2020–2021 compelled rapid adaptation but also exposed notable quality losses. Key difficulties included technical problems, lack of live contact, student stress, and procrastination. Conversely, students and instructors reported benefits such as flexible scheduling and greater autonomy in learning. A global review of the 2020 experience (Bond et al., 2021) documented how universities responded and supported students. In Russia, studies of the remote-learning period showed similarly ambivalent results. For example, a 2021 survey of 289 students found that while 65% described online learning as comfortable, 38% reported poorer comprehension of material and 17% experienced organizational difficulties. At the same time, around one-third acknowledged advantages, such as having more free time (35%) and improved sleep patterns (18%) due to flexible schedules.

Despite a substantial body of research dedicated to the comparative analysis of face-to-face and distance learning, comparative studies incorporating AI technologies, such as lectures delivered by virtual instructor avatars, remain remarkably scarce. Consequently, the analysis of such innovative formats is at the core of this review. The use of AI-generated virtual pedagogical agents and avatars in education represents one of the most recent advancements. While the number of such projects is still limited, initial experimental findings are promising. Another emerging direction is the use of virtual pedagogical agents and AI-generated instructor avatars. Though still few, early experiments are encouraging. In Australia, a 2022–2023 trial had an AI lecturer avatar teach a business ethics course (with ~1,200 students). Focus groups ($N = 20$) revealed no strong negative reactions; on the contrary, many students found the AI lecturer acceptable and some preferred it to a human in certain situations. They highlighted the avatar's clear, intelligible speech (helpful for non-native speakers). Overall feedback was neutral-to-positive. In Malaysia, an AI-generated instructor avatar in a learning management system similarly prompted mostly neutral reactions; no student found it completely unacceptable. Notably, avatar design matters: a warm, friendly, emotionally expressive avatar generated more trust and engagement than a monotone "machine-like" presence. This aligns with the concept of social presence — the feeling of a real, attentive interlocutor — which is linked to higher student satisfaction and perceived learning (Richardson et al., 2017). These findings are corroborated by studies showing that learners who employed a personalized avatar within a game-based learning environment demonstrated greater motivation and engagement, particularly when the avatar's personality corresponded to their own. Accordingly, it was concluded that students' perceptions of AI instructors depend substantially on implementation quality — specifically natural-sounding speech, an appropriate degree of emotional expressiveness, interactivity, and responsiveness to student input (Fu et al. 2024; Oliveira et al., 2022).

Given this context, we conducted a narrative review to synthesize contemporary experiences with AI in higher education. The goal was to address the following research questions:

— How do students perceive different learning formats (in-person, online, AI-avatar)?

— How does the lecture format affect the class's psychological climate and students' perceptual comfort?

— Does student academic performance change depending on the format?

— Which student traits or skills (e.g., digital literacy, self-regulation, anxiety) moderate success in new learning environments?

— What are the main risks and limitations of integrating AI technologies into higher education, and what strategies can help mitigate these challenges?

## Methods

### *Review design*

This review is conducted in the format of a narrative review (qualitative synthesis without meta-analysis). This signifies that the search and selection of sources were performed systematically and transparently; however, the retrieved data are integrated descriptively, without quantitative pooling of results. This approach is necessitated by the novelty of the topic and the heterogeneity of the included studies. The review focuses on identifying overarching trends and discrepancies within the literature concerning the influence of AI technologies and various learning formats on students' perceptual characteristics.

### *Literature search strategy*

The search covered the period from 2018 to 2025, encompassing publications in both Russian and English. Keywords were selected in both Russian and English, taking into account the terminology of the review topic:

— *Russian language search:* искусственный интеллект, высшее образование, очное обучение, традиционное обучение, онлайн-обучение, дистанционное обучение;

— *English language search:* artificial intelligence, higher education, face-to-face learning, in-person learning, traditional classroom, online learning, distance education, e-learning.

***Sources of search.*** The search covered a range of international and national databases and scholarly platforms to ensure the comprehensiveness and representativeness of the collected literature. Specifically, the following resources were included: the Russian Science Citation Index (eLIBRARY), Scopus, Web of Science, ERIC, and Google Scholar, along with specialized journals and outlets in pedagogy and psychology. To enhance the completeness of the review, relevant reports, analytical briefings, and survey data were also examined, including materials published by the Ministry of Education of the Russian Federation and other institutional sources addressing the use of AI in education. The resulting pool of publications was imported into a bibliographic system to remove duplicates and enable subsequent screening.

***Inclusion Criteria.*** The review incorporated studies meeting the following criteria:

— *Study Design:* Empirical studies (quantitative, qualitative, or mixed-methods), including student surveys, experimental and quasi-experimental designs, longitudinal observations, and meta-analytic reviews;

— *Population:* Higher education students (undergraduate or magistracy). Studies involving faculty samples were included only for comparative analysis of faculty and student perspectives, with the primary focus remaining on learners;

— *Thematic Focus:* Research comparing learning formats (traditional classroom, online distance learning, blended learning, and AI avatar-led instruction) or evaluating the impact of AI tools (generative neural networks, intelligent tutoring systems, chatbots, virtual agents) on psychological and educational aspects of university education. Essentially, studies were required to examine how learning formats or AI technologies affect students;

— *Measures and Variables:* Measured data on students' perception of the learning process (satisfaction, engagement, comfort, motivation), psychological climate or emotional state (e.g., stress, sense of belonging), and academic performance (grades, test scores).

— *Timeframe:* Publications from 2018–2025 predominated, reflecting the current stage of educational digitalization and the recent integration of AI technologies into higher education. To provide a broader analytical perspective, several seminal pre-2018 studies and meta-analyses on online and distance learning were also included, offering historical context and a comparative foundation for interpreting recent findings.

***Exclusion Criteria.*** Studies not meeting the aforementioned requirements were excluded from consideration:

— Research pertaining to preschool or school education, or online learning in general outside the context of higher education (the scope of this review is exclusively higher education);

— Articles focusing solely on the technical aspects of AI system development without data on their pedagogical or psychological impact on students;

— Theoretical works, review articles, and methodological recommendations lacking original data analysis (i.e., without an empirical component);

— Incomplete reports, duplicate publications, conference abstracts, and non-peer-reviewed sources, if they lacked sufficient data for an assessment of research quality and outcomes.

***Stages of literature selection.*** The search and selection procedure was conducted in several phases, with the aforementioned criteria applied sequentially (see Figure for a flowchart):

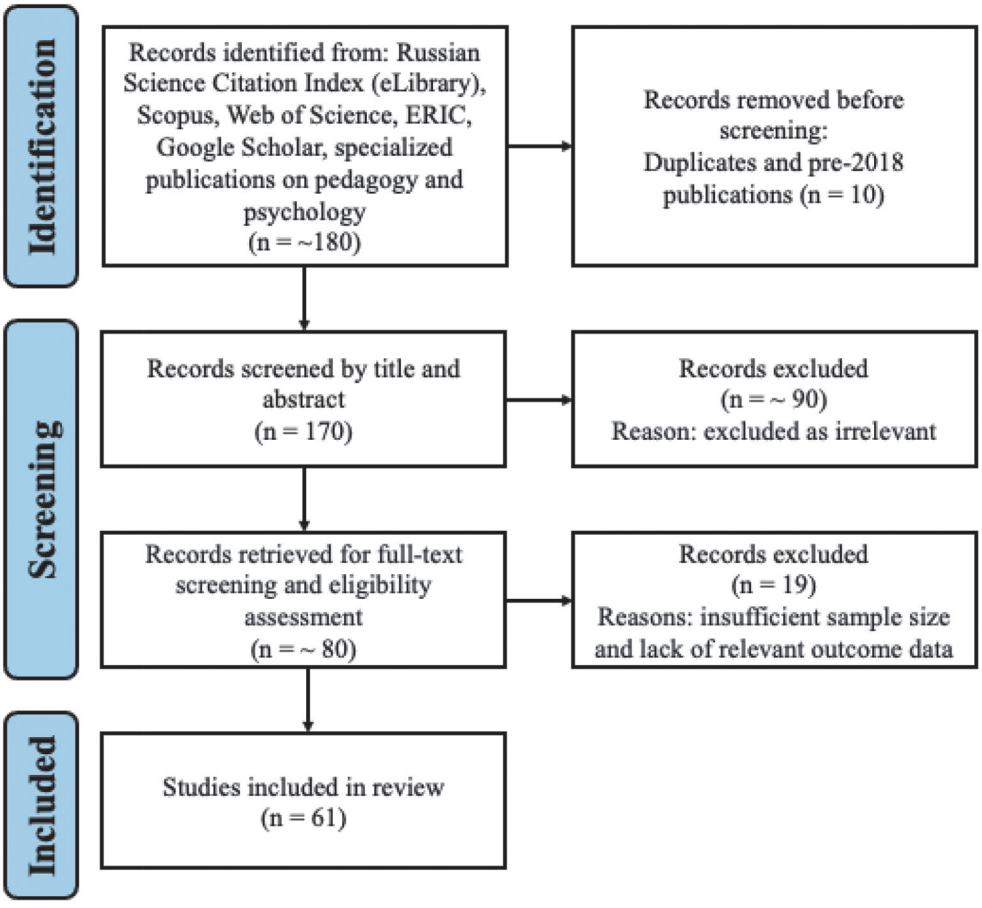
(1) *Identification:* In the initial phase, approximately 180 publications were identified across the specified databases and supplementary sources. At this stage, basic filters were applied based on publication year (excluding works prior to 2018, with the exception of a few seminal studies) and language (excluding non-Russian or non-English sources). Obvious duplicates were also removed immediately. Following the elimination of duplicate entries, approximately 170 unique records remained for further consideration;

(2) *Title and abstract screening:* The subsequent phase involved a rapid assessment of each work's title and abstract for thematic relevance and research type. Approximately 90 publications were excluded as irrelevant to the review's topic. The primary reasons for exclusion at this stage included: the work did not

address the impact of AI or learning formats on students (e.g., focusing on entirely different subject matter), university students were absent from the study population, or it was evident from the title/abstract that the article was theoretical in nature. Upon completion of this screening, approximately 80 publications potentially met the criteria;

(3) *Full-text assessment for eligibility:* In the eligibility phase, the full texts of approximately 80 selected works were thoroughly analyzed. Compliance with all inclusion criteria (as described above) and the absence of exclusion criteria were verified. Additionally, data sufficiency was assessed (e.g., adequate sample size, availability of results enabling the review's questions to be answered). As a result of this phase, an additional 19 studies were excluded, primarily due to a lack of necessary metrics (e.g., an article describing technology implementation without data on student impact), insufficient quality or volume of empirical data, or a lack of alignment with the review's focus;

(4) *Inclusion:* Following the selection process, 61 studies that fully satisfied the criteria were included in the qualitative synthesis. These works formed the basis




Flowchart illustrating the process of selecting studies for the review

*Source*: prepared by Olga A. Ulyanina and Ekaterina N. Vikhrova using PRISMA Flow Diagram (https://www.prisma-statement.org/prisma-2020-flow-diagram)

of the analysis. It should be noted that in addition to these, several supplementary sources (reports, statistical summaries, seminal works predating 2018) are cited within the review's text to justify its relevance and facilitate comparison with prior data. A total of 61 sources are presented in the review and reflected in the bibliography. The geographical distribution and characteristics of the included studies are described in detail within the results section of the review; collectively, they encompass the experiences of universities from Russia, Europe, North America, Asia, and Australia, employing diverse methodologies (e.g., surveys, experiments, meta-analyses). This broad scope enables the narrative review to compare data and identify overarching patterns.

For clarity, the source selection process for this narrative review is illustrated in the flowchart (Figure), encompassing the stages of identification, screening, eligibility assessment, and final inclusion.

### *Data analysis*

From each study, we extracted key findings related to our research questions: how students perceived the different formats (preferences, satisfaction), the impact of format on academic indicators, changes in psychological well-being (stress, motivation, sense of belonging), and any moderating factors (individual traits, digital skills, learning conditions). We grouped results by theme and compared them across studies to identify consistent patterns and notable divergences. Where possible, we report quantitative trends (e.g., percentage increases or decreases in measures) with references to the source studies. In the Discussion, we interpret the aggregated results in context and note study limitations.

## Results

### *Student perceptions of different formats*

Both Russian and international research shows that the instructional format significantly shapes students' subjective learning experiences. Traditional in-person lectures are often considered the "gold standard" due to direct interaction and instructor presence. Remote online instruction, which became widespread during the COVID-19 pandemic, has revealed both advantages (flexibility; improved access to education for geographically remote students) and drawbacks (a deficit of face-to-face contact; difficulties with self-discipline) (Coman et al., 2020; Dhawan, 2020; Hodges et al., 2024; Mishra et al., 2020; Radha et al., 2020).

When formats are directly compared, students often express a preference for in-person instruction, reporting higher levels of engagement during direct contact with instructors. However, well-implemented online learning can achieve similar outcomes. For example, a study at King Saud University (Alarifi & Song, 2024) comparing large cohorts in 2020 (in-person) and 2021 (fully online) found that while raw grades were initially lower online, after controlling for factors like gender, class size, and entry scores, online students outperformed the in-person cohort in three out of five subjects (with one subject favoring in-person and one showing no difference). This illustrates that the effectiveness of online learning depends on

context and subject matter rather than an inherent deficit, echoing earlier findings that format efficacy is implementation-dependent. Nonetheless, many students acknowledge that achieving a high-quality experience online is challenging. In a 2021 Russian survey, only 56% of students felt they adapted well to the sudden shift online, 30% "so-so," and 14% poorly. While 65% found remote learning convenient (e.g. working from home), 38% reported worsened comprehension and 17% noted organizational difficulties. On the other hand, about one-third saw benefits: 35% gained more free time and 18% improved their sleep schedule thanks to flexibility. This ambivalence is echoed elsewhere: for instance, a study in Spain found that students with higher "online learning stress" rated the value of remote materials much lower, suggesting anxiety about the format can undermine the experience.

Newer studies have also begun examining AI-driven lecture formats (Schroeder et al., 2013). Early experiments with AI-generated instructor avatars show student reactions ranging from neutral to moderately positive. In an Australian course with an AI lecturer avatar, interviewed students largely accepted the avatar, citing clear and understandable speech, and none had a strongly negative reaction. Similarly, in a Malaysian study (Tan, 2024), students reacted neutrally to an AI avatar in a learning management system—no one deemed it unacceptable, though enthusiasm was limited. Importantly, a warm and expressive avatar design elicited more trust and engagement than a monotone, mechanical style. In short, students generally view well-designed online courses and even AI-avatar lectures as acceptable, even if face-to-face remains most comfortable for many (Osipova, 2024).

### *Psychological climate and comfort*

The learning format affects not only academic metrics but also the classroom atmosphere and students' emotional comfort. In-person classes typically provide a high level of group dynamics: live communication, nonverbal cues, immediate feedback from the instructor—all these foster a positive psychological climate, a sense of belonging and support. In distance learning, this aspect often suffers: students may feel isolated, less belonging to a group, and an impersonal interaction (Polushko & Saulenko, 2021). This problem was especially acute during the forced remote period—the phenomenon of "Zoom fatigue" describes the emotional exhaustion from constant virtual communication (Bailenson, 2021).

Research shows that deliberate efforts to maintain social interaction online can significantly improve the climate. For example, using cameras (video conferencing) instead of solely audio or text increases the sense of instructor and peer presence (Zhang & Wu, 2024). Creating informal online channels for communication (forums, chat groups) helps students feel a sense of community. Feedback in the learning process is a key factor: timely instructor responses to questions, regular group discussions, interactive assignments—all these reduce feelings of loneliness. As P.R. Lowenthal and C. Snelson (2017) note, it is not only communication per se that matters, but its human tone: support, empathy, and attention to student difficulties. A high level of instructor social presence in an online course is directly correlated with student satisfaction. Thus, psychological climate emerges as a crucial factor in learning effectiveness regardless of format.

If an online environment manages to create an atmosphere of engagement, trust, and mutual support, outcomes are on par with face-to-face classes. Conversely, without deliberate instructional design and support, distance learning carries the risk of student alienation and decreased motivation.

Lectures with AI avatars represent a unique instructional format: formally there is no human instructor physically present, but their virtual image can partially compensate for the absence of a person. Initial experiments suggest that having an on-screen avatar endowed with personality traits noticeably improves the experience compared to faceless text-based materials. In particular, students report feeling that "someone is there with them" — even if that "someone" is not real. A study by S. Richter et al. (2025) on educational chatbots found that virtual assistants with a warm and friendly communication style increased students' sense of psychological support and lowered the barrier to seeking help. An emotionally expressive avatar can smile, joke, address the student by name—these are elements that foster a positive climate. However, it is important to recognize that the avatar's inauthenticity is also perceived. If its facial expressions and voice appear too artificial, monotonous, and lack spontaneity, students tend to perceive such a helper as a "robot," which limits trust. As noted by focus group participants in one study (Vallis et al., 2024), an avatar's speech was "too even, as if edited"— missing the natural liveliness of a human instructor . This observation is important for further technology refinement.

Overall, the review results suggest that to ensure a healthy psychological climate in online and blended learning formats, the lack of live communication must be deliberately compensated. If the instructor (or their digital avatar) actively interacts with students, provides emotional support, and creates a sense of presence, then distance learning becomes comfortable for a large proportion of students (Garris & Fleck, 2022). But if a student is left one-on-one with the material, with no interaction, engagement and satisfaction quickly decline.

### *Academic performance and outcomes*

The influence of learning format on objective performance metrics is mixed. On one hand, evidence points to declines in motivation and achievement for some students in purely remote formats, especially when implemented suddenly without preparation. The emergency remote teaching of 2020 was often criticized: students reported superficial knowledge acquisition, increased cheating, and a more perfunctory approach to assignments (Ferri et al., 2020; Lancaster & Cotarlan, 2021). Lack of regular instructor oversight could lead to procrastination and missed deadlines. On the other hand, a number of studies find no performance difference or even improved outcomes in online groups when the course is well-designed. For example, systematic reviews by B. Means and colleagues (Means et al., 2010; 2013) summarizing 45 empirical studies concluded that online and blended formats are on average as effective as traditional face-to-face instruction, and in some cases even more so, thanks to the possibility of individualizing the pace and timing of learning. A similar conclusion was reached by a meta-analysis by R.M. Bernard et al. (2014): on average, academic performance does not suffer when a course is moved online, provided active learning methods are used and student support is ensured.

Empirical studies support these conclusions. For instance, in the aforementioned King Saud University study, some online groups outperformed the in-person groups on final grades after adapting to the format. In China, a 2020 study (Bao, 2020) noted that as students and instructors became accustomed to the online environment, their academic outcomes aligned with pre-pandemic in-person benchmarks. The key factor was adaptation of instructional methods: breaking lectures into shorter segments, using interactive quizzes, and incorporating multimedia — all strategies shown to enhance material retention and engagement (Mayer, 2020).

In the case of AI-avatar lecturers, objective performance indicators have been little studied so far, given the novelty of the technology. Nonetheless, initial data are neutral-to-optimistic: a large course taught with an avatar (Vallis et al., 2024) found no drop in average grades compared to the previous year when the course was taught by live instructors. Students successfully completed assessments, though they did note that for full comfort they would have liked a real person in seminars complementing the avatar-led lectures. Another study (Ukenova et al., 2025) focused on technical metrics: it analyzed how improvements in speech synthesis and adding emotional expressions to an avatar affected student participation (lecture viewing time, number of questions asked). It turned out that a more "lifelike" avatar kept students' attention longer and prompted them to interact with the material more (e.g., ask questions in the chat more frequently). This indirectly suggests a potential positive effect on performance, since engagement usually correlates with learning achievement.

It is important to emphasize that individual differences among students significantly modulate the impact of format on learning outcomes. In particular, self-organization and self-regulation skills play a decisive role in online formats (Besser et al., 2022; Yokoyama, 2019). Students who can manage their time, set goals, and monitor progress tend to perform better in distance learning. Conversely, those prone to procrastination struggle without a clear external structure — their results may decline. Likewise, digital literacy influences academic success: students who are proficient with educational technologies are less distracted by technical issues and use resources more effectively, whereas low ICT competence creates additional hurdles (Adnan & Anwar, 2020). Academic motivation is another moderator: highly motivated learners remain active and perform well even when alone at a screen, whereas those with low motivation may disengage entirely in an online environment.

Overall, the quality of knowledge acquisition depends primarily on how well the learning format aligns with the student's needs and characteristics, as well as on the support provided. Properly designed online courses and AI tools can match traditional methods in effectiveness, and with personalized approaches may even surpass them (Apoki et al., 2022). However, negative educational experiences (low engagement, superficial learning) are possible if a student is psychologically unprepared for the format or is left to fend for themselves without adequate structure and guidance.

### *Individual differences and adaptation to technology*

A number of studies focus on the psychological traits that help or hinder students in adapting to new learning formats. One prominent factor is anxiety.

Students with high anxiety and low tolerance for uncertainty experience greater stress online—they miss familiar signals of support, worry more about technical glitches, and are more uneasy due to delayed feedback. According to a survey by R. Bono et al. (2024), students with a high level of "online-learning anxiety" found the remote course significantly less useful. Similar findings are noted in Russian studies: highly anxious students adapt worse to online learning and more frequently suffer emotional burnout (Marinova, 2022; Pobokin et al., 2021; Yarullina, 2020). For such students, transitioning to online or introducing AI tools can be an additional destabilizing factor. In contrast, openness to new experiences and proactiveness facilitate successful adaptation. Students with strong proactive qualities (initiative, independence) tend to find their own ways to learn effectively online; they display positive emotions when working with technology, which boosts engagement. A study by P. Fu et al. (2024) showed that proactive personality, via positive emotions and intrinsic motivation, increases online learning engagement and success. Big Five personality traits also matter: data by É.C. Audet et al. (2021) indicate that students high in conscientiousness adjusted more easily to online mode during the pandemic. Extraverts, in contrast, suffered more from the lack of usual social interaction, though they also participated more actively in video conferences to compensate for the absence of offline communication. Introverts often felt more comfortable in the online environment with fewer random interactions — indeed for them the remote format reduced stress. Thus, there is no one-size-fits-all effect of technology on students: it is mediated by their individual psychological resources.

Notably, the sense of belonging and support plays a role. Moving to remote learning deprives many students of familiar social reinforcements — classroom presence, hallway chats, shared downtime. Students with a strong need for belonging tend to experience greater discomfort in online settings. S. Balkaya and U. Akkucuk (2021) found that sense of community acted as a moderator of satisfaction: with low sense of belonging, satisfaction with online learning plummeted. This implies that universities should strive to maintain elements of the student community even in digital format — through virtual groups, messaging channels, mentorship, virtual "break rooms".

Finally, digital competence — comprising IT skills — is directly tied to successful adaptation (Palvia et al., 2018). Students who are proficient with digital tools — such as office software, video conferencing platforms, and specialized educational applications — experience lower technostress. Those less confident with computers expend much more effort on technical tasks, heightening anxiety. Experience has shown that it is necessary to train students in online learning skills: time management, information search, basics of cybersecurity, handling new content formats (Kizilcec et al., 2017). This will raise overall digital literacy and reduce stress when new technologies are introduced. For example, J. Broadbent, in a review of self-regulated learning strategies, notes that training in time management and autonomous work improves academic outcomes for online students (Broadbent, 2017; Broadbent & Poon, 2015). In sum, psychological and technical preparation of students is an important condition for successful integration of AI technologies (Panigrahi et al., 2018).

### *Risks and limitations of digitalization in education*

Despite the clear advantages (expanded access to knowledge, individualized learning, new interactive possibilities), the implementation of AI and online technologies carries risks. Based on the analyzed sources, the following key problem areas can be identified:

— Reduced motivation and engagement due to poor use of technology. If an online course is reduced to merely handing out materials with no interaction, student interest plummets — they feel bored and lonely. Absence of external structure leads to procrastination;

— Superficial learning from a reliance on AI-generated answers. The wide availability of GPT systems and other AI tools creates the temptation to get answers without independent thought (Rahman & Watanobe, 2023). There is a risk of students developing a habit of passive consumption of information, weakening critical thinking skills. Cases are already noted where term papers and essays are written almost entirely with neural networks. This entails not only academic dishonesty, but a deeper problem — the underdevelopment of students' own competencies;

— Techno-stress and technological barriers (Baticulon et al., 2021). New systems can cause anxiety in some students: fear of clicking the wrong button, losing data, or not understanding the interface. Moreover, not everyone has access to reliable internet and modern devices — total digitalization can amplify digital inequality (a problem noted by UNESCO and OECD) (OECD, 2021);

— Deficit of live communication and social skills. With excessive shift online, students may get less practice in real interpersonal interaction: public speaking, in-person teamwork, making friends. "Depersonalized" learning can lead to feelings of alienation;

— Ethical issues of AI use. Questions arise around privacy (the collection and storage of student data in intelligent systems), algorithm transparency, and potential bias in AI recommendations (for example, if a system suggests topics or grades assignments). The international community is already discussing the need for ethical frameworks for AI in education. Without such guidelines, there is a risk of misuse — from breaches of confidentiality to adoption of commercial solutions at the expense of pedagogical values;

— Limited authenticity and empathy of AI assistants. Even the most advanced avatar cannot fully replace a human mentor in terms of empathy, flexible thinking, or creative response to unforeseen situations. There is a danger of overestimating the capabilities of technology and leaving students one-on-one with algorithms in situations that require human intervention (for instance, psychological support during a crisis).

It should be noted that all these risks can be minimized with a competent approach. Strategies and recommendations are already emerging: clear academic honesty policies for the AI era are being introduced (for example, requirements to indicate which parts of an assignment were generated by AI, or the use of oral exams to verify authentic understanding). Ethical guidelines for AI use are being developed, for instance, W. Holmes et al. (2022) propose building a community framework around AI ethics in education. Improving the digital literacy of students

and instructors is seen as the primary means of preventing technostress and ineffective tool use (Almazova et al., 2020). In addition, researchers emphasize preserving the role of the live teacher-mentor even with the adoption of advanced technologies. The human factor should remain central, with AI serving as a supplement rather than a replacement.

## Discussion

Our narrative review of Russian and international studies confirmed that the introduction of AI technologies in higher education is a promising yet complex endeavor that requires consideration of numerous psychological and pedagogical factors (Zawacki-Richter et al., 2019). The challenge for research is to ensure these changes benefit students rather than harm them. Based on the body of studies reviewed, several general conclusions can be formulated.

First, no single learning format (in-person, online, AI-avatar) is inherently superior. Each format has strengths and limitations, and effectiveness depends on context and individual characteristics. Traditional face-to-face lectures provide a rich social experience and are usually perceived favorably, but today's students are generally adaptable and willing to accept online formats and even virtual lecturers if implemented well. Most students do not object to the use of AI in education; curiosity and neutrality prevail over distrust. Survey data show that the young generation sees technology as a natural part of life, so its integration into learning is largely a matter of time, and it is important to make that integration as comfortable as possible.

Second, psychological climate and comfort are decisive factors in learning effectiveness regardless of format. In online and blended environments, instructors must put in special effort to maintain a positive atmosphere—by providing continuous feedback, emotional support, and creating a sense of instructor presence (for example, through an AI avatar). If these measures are in place, distance learning can be comfortable and successful for a significant portion of students (Allen & Seaman, 2017). Our review confirms that social presence (Garrison et al., 1999; Garrison, 2011) is the key to student satisfaction in online learning. Digital avatars endowed with personality and emotional expressiveness can improve the class climate by increasing the sense of the instructor's social presence. However, they cannot fully replace live communication — rather, they serve as a tool to emulate it where live interaction is temporarily impossible.

Third, the impact of format and atmosphere on academic performance is ambiguous. We identified instances of reduced motivation and outcomes with poorly implemented online learning, as well as examples where online or blended learning performed no worse than face-to-face (Vo et al., 2017). Thus, the quality of material mastery is determined by how well the format fits student needs and how support is organized. With a well-thought-out course design, interactivity, and attention to audience characteristics, technologies can show effectiveness on par with traditional instruction (Clark & Mayer, 2016). Furthermore, personalized adaptive learning systems (for example, those that recommend supplementary materials to address a student's knowledge gaps) could in the future improve performance by working

with each student individually—something hard to achieve in a large class without AI. That said, the risk of superficial learning remains if a student is not psychologically ready for greater autonomy or abuses the possibility of minimizing effort by delegating work to AI. This presents new challenges for educators—to encourage meaningful learning even when "easy shortcuts" via AI hints are available.

Fourth, personal characteristics significantly modulate the influence of technology. Students with high anxiety, neuroticism, or poor self-organization form a risk group in digital learning: they are prone to lower educational outcomes and overall dissatisfaction. Conversely, students who are open to new experiences, proactive, and self-disciplined adapt successfully and may even prefer digital tools, demonstrating increased engagement. Anxiety is particularly important: it needs to be monitored and addressed—students with elevated anxiety require more support when transitioning to online or working with AI, otherwise they may "shut down" and withdraw from active participation. Additionally, self-regulation skills directly affect success: the ability to learn autonomously is crucial for productive work in an online environment. Therefore, it makes sense for universities to incorporate development of self-regulation and digital literacy into their curricula, preparing students for new learning formats.

Fifth, the risks of digitalization are real but manageable. A drop in motivation and engagement from poor use of technology, superficial learning due to AI-provided answers, reduced live communication, technostress, ethical dilemmas — all these require attention, but solutions are already on the horizon. Clear norms and policies for working with AI in academia need to be developed (what is allowed in exams, how to credit AI-derived material, etc.). Investment in digital infrastructure and support is important — high-speed internet and user-friendly platforms reduce student frustration. Training instructors to work with AI tools is also critical: the instructor is responsible for integrating technology into the course in a way that preserves educational value. International organizations (e.g., UNESCO) have released recommendations for universities on integrating generative AI into education, emphasizing ethics and equal access. Thus, the problem of risks is addressed through balance: retain the best of traditional approaches and use AI where it truly enhances learning.

Another insight from this review is the promise of human-centric optimization of AI tools. Experiments show that adding emotional expressiveness and cultural adaptation to an avatar increases student acceptance. Personalization is a key trend: customizing an avatar's appearance and voice for the audience, adapting content to each student's level of preparation. Equally important is integrating avatars into the overall pedagogical system by combining them with live interaction. As researchers note, the human factor remains critical: the best results are achieved when AI and educator work in tandem, complementing each other's strengths. In other words, the future of education lies not in completely displacing the human element, but in close collaboration between humans and AI. An instructor can delegate routine functions (for example, grading standard assignments or initial explanation of simple topics) to an intelligent system, and devote the freed time to individualized work with students, developing their critical thinking, and mentorship. In this symbiosis, AI acts as an amplifier of the teacher's capabilities, not a competitor.

***The limitations*** of this review are that many included studies had relatively small samples or specific conditions (e.g. conducted during the pandemic or within particular departments), which complicates generalization to the entire student population. In addition, the novelty factor is high: today's generation of students may perceive technology differently than the next generation, which will have grown up in an era of ubiquitous AI. Therefore, the findings need regular updating as new data emerge. We also noted a lack of strictly controlled experiments on this topic (it is difficult to randomly assign students to formats in real university settings), so some conclusions are correlational in nature. Nonetheless, the collection of varied studies from different countries provides a sufficiently reliable basis for identifying overall trends.

## Conclusion

The conducted literature review revealed that the integration of artificial intelligence technologies in higher education presents significant opportunities for enhancing learning efficacy yet is also associated with a range of challenges. Teaching formats are undergoing substantial transformation: traditional in-person lectures are now complemented by increasingly prevalent online distance learning courses, while lectures delivered by virtual AI instructor avatars are emerging. No single format can be declared superior, as each offers distinct affordances and limitations. The in-person format provides indispensable live interaction, immediate feedback, and a rich social context. Online learning offers greater flexibility, personalized pacing, and customized learning pathways. Virtual lectures with AI avatars introduce innovative experiences and novel forms of student engagement.

Psychological comfort and a conducive learning environment remain critical for success across all formats. Research indicates that most students perceive in-person lectures as the most comfortable format. The physical presence of instructors and peers fosters a trusting atmosphere, enhances engagement, and facilitates comprehension through instant feedback. In contrast, distance learning requires educators to deliberately cultivate a supportive psychological climate, provide consistent feedback and emotional support, and maintain a sense of instructor presence – for example, through video conferencing or realistic digital avatars. When these conditions are met, online learning can prove comfortable and effective for a substantial student population. Our analysis confirms that the perceived "social presence" of the instructor is a key determinant of both satisfaction and learning depth in remote formats. In this context, digital avatars endowed with personality and emotional expressiveness can enhance the learning atmosphere, thereby boosting engagement and comprehension through more lifelike interaction. Nevertheless, the capabilities of even the most perfected pedagogical agent are limited; they cannot fully supplant live communication and can only offer a partial simulation of human presence in the absence of direct contact.

The impact of instructional formats and the learning environment on students' academic performance is ambiguous. The review identified instances of both decreased motivation and performance in poorly implemented online courses, as

well as examples where distance or blended learning formats demonstrated effectiveness comparable to traditional in-person instruction. The quality of knowledge acquisition is largely determined by the degree to which the format aligns with learners' needs and styles, along with the level of pedagogical support provided. With well-designed online courses, the use of interactive elements, and consideration for audience characteristics, digital technologies can demonstrate effectiveness on par with in-person learning. Furthermore, adaptive AI-based systems capable of recommending materials tailored to individual knowledge gaps can potentially enhance comprehension through a personalized approach — an outcome more difficult to achieve in a mass audience setting without algorithmic assistance. Simultaneously, there is a risk of superficial learning: if a student is psychologically unprepared for greater autonomy or exploits opportunities to minimize effort by delegating work to AI, this can lead to a deterioration of actual knowledge. Educators now face a new challenge: stimulating students' meaningful learning even when technological tools provide "easy pathways" for task completion.

No less significant moderators of the perception of new formats are students' individual psychological characteristics and digital competence. Learners with high anxiety, stress susceptibility, poor self-organization, or limited technical skills constitute an at-risk group that struggles to adapt to online learning and AI-avatar interactions. Such learners more frequently experience discomfort, reduce their learning activity, and ultimately demonstrate lower results and satisfaction. In contrast, students characterized by openness to new experiences, proactivity, strong self-discipline, and a high level of digital literacy typically master digital tools more easily and often even prefer them, noting increased engagement and convenience. The anxiety factor plays a special role: learners with elevated anxiety require additional support during the transition to distance learning or when working with AI; otherwise, they may "drop out" of the educational process due to internal discomfort. Furthermore, self-regulation skills and the ability to learn autonomously directly influence success: a well-developed capacity for independent knowledge acquisition is a prerequisite for productive work in an online environment. The identified dependence on personal characteristics and digital competence implies that the implementation of AI technologies must be accompanied by the development of necessary skills and psychological readiness among students. It is advisable for universities to incorporate training in digital literacy and independent learning into educational programs to prepare students for new forms of instruction and mitigate differences in format perception.

The application of AI technologies in education is also associated with risks that must be anticipated. The primary risk is the reduction of live human interaction: an overabundance of remote and automated formats threatens to create a deficit of interpersonal contact, a weakening of communication skills, and a sense of alienation among students. Furthermore, poor pedagogical design of digital courses can lead to superficial knowledge acquisition and diminished learning motivation, while the widespread availability of AI tools calls academic integrity into question. Ethical challenges also emerge, including algorithmic opacity, potential bias in AI systems, and unequal access to digital technologies, which may exacerbate existing disparities

in educational opportunities. Finally, some learners experience "technostress" when adapting to complex digital services. However, with a responsible approach, these risks can be mitigated. Many universities are already introducing regulations and policies governing the fair use of AI. International guidelines (e.g., from UNESCO) emphasize preserving the leading role of the instructor-mentor and ensuring equal opportunities for students when implementing AI. Enhancing the digital literacy of all participants in the educational process is also critical for reducing technostress and preventing the ineffective use of technology. Overall, a balanced approach is necessary: preserving the best elements of traditional in-person education while deploying AI in areas where it genuinely enhances the learning process.

Based on the findings, practical recommendations can be formulated for various stakeholders in the educational process. University administrators should implement AI technologies progressively and on a scientifically grounded basis: developing institutional regulations for AI use (including academic integrity guidelines), investing in digital infrastructure, and establishing digital competence programs for students and faculty. It is advisable to conduct pilot projects with virtual avatars and online courses while collecting student feedback to ensure a comfortable adaptation process and sustain audience engagement. Educators are encouraged to master new digital tools and reconceptualize their role towards mentorship and moderation of the learning process. With the growing prevalence of online learning and AI systems, the educator's role expands from knowledge transmitter to include learning coordinator, motivator, and guarantor of educational quality. By leveraging AI as an assistant – for instance, to automate routine tasks and personalize instruction — educators can dedicate more time to individual student interaction, developing critical thinking skills, and maintaining personal contact. Developers of educational AI environments and virtual avatars should adhere to pedagogical principles and address real user needs. Collaborative development with experts in education and psychology is highly recommended. A pedagogical agent should be intuitive, empathetic, and capable of adapting to learners' proficiency levels and responses. Incorporating emotional expressiveness, varied presentation styles, and cultural adaptation enhances student acceptance and implementation effectiveness. Thus, AI tools should be designed to complement and extend the lecturer's capabilities, not to replace them.

In essence, higher education's task is not to reject AI, but to learn to coexist with it effectively. A scientific, data-driven approach can guide the judicious implementation of innovations, preserving the best aspects of traditional education while unlocking new opportunities for every learner. This review, by comparing in-person, online, and AI-avatar lecture formats and their impacts on student perception, class climate, and academic outcomes, provides a foundation for further research and practical guidance. Future studies should build on these findings by conducting more controlled experiments (e.g. comparing AI instructors with human instructors under similar conditions) to obtain rigorous evidence of format impacts, and by examining long-term effects — whether the identified advantages or disadvantages persist after an adaptation period, and how a mix of formats over the course of an entire degree program might affect graduates' competencies. Additionally,

incorporating physiological measures of student stress or engagement (such as biometric data) could help validate self-reported experiences.

From a practical standpoint, our findings can inform evidence-based guidance for universities on implementing AI. For instance, institutions should consider how to design digital avatars that are appropriate for the student audience, how to integrate them with live teaching, and how to sustain students' psychological comfort when introducing new technologies. AI in education is here to stay, and it is incumbent on the educational community to steer it toward enhancing the quality of learning without losing humanistic values, keeping the focus on each student's development.

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**Article history:**
Received 10 March, 2025
Revised 12 April, 2025
Accepted 14 April, 2025

**For citation:**
Ulyanina, O.A., & Vikhrova, E.N. (2025). Artificial intelligence technologies, in-person and online learning in higher education: A review of the impact on students' perceptual features, psychological climate and academic performance. *RUDN Journal of Psychology and Pedagogics, 22*(2), 337–360. http://doi.org/10.22363/2313-1683-2025-22-2-337-360

**Authors' contribution:**
*Olga A. Ulyanina* – concept and design of the research, supervision, data collection and analysis, text writing and editing. *Ekaterina N. Vikhrova* – data analysis, text writing and editing.

**Conflicts of interest:**
The authors declare that there is no conflict of interest.

**Bio notes:**

*Olga A. Ulyanina,* Doctor of Psychology, Associate Professor, Head of the Federal Coordination Center for the Development of Psychological and Pedagogical Assistance in the Education System of the Russian Federation, Moscow State University of Psychology & Education (29 Sretenka St, Moscow, 127051, Russian Federation), Chief Research Fellow of the Center for Applied Linguistic Research and Testing "ISTOK", Moscow Institute of Physics and Technology (National Research University) (9/3 Institutsky lane, Dolgoprudny, 141701, Russian Federation). ORCID: 0000-0001-9300-4825, eLibrary SPIN-code: 9283-7824, Scopus ID: 57207950411, ResearcherID: AAF-2050-2020. E-mail: ulyaninaoa@mgppu.ru

*Ekaterina N. Vikhrova,* Ph.D. in Philology, Associate Professor, Associate Professor of the Department of Foreign Languages, Moscow Institute of Physics and Technology (National Research University) (9/3 Institutsky lane, Dolgoprudny, 141701, Russian Federation). ORCID: 0009-0006-9233-8894, ResearcherID: MTF-7487-2025. E-mail: vikhrova.en@mipt.ru

DOI: 10.22363/2313-1683-2025-22-2-337-360
EDN: VDDJBF
УДК 159.923

Обзорная статья

# Технологии искусственного интеллекта, очное и онлайн-обучение в высшем образовании: обзор влияния на особенности восприятия студентов, академическую успеваемость и психологический климат занятия

**О.А. Ульянина[1,2], Е.Н. Вихрова[2]**

[1]Московский государственный психолого-педагогический университет, *Москва, Российская Федерация*
[2]Московский физико-технический институт (национальный исследовательский университет), Долгопрудный, *Российская Федерация*
ulyaninaoa@mgppu.ru

**Аннотация.** Стремительная цифровизация высшего образования и рост использования искусственного интеллекта (ИИ) в обучении требуют тщательной оценки их влияния на студентов. Традиционные очные, дистанционные онлайн и лекции с ИИ-аватарами создают различные условия, формирующие психологический климат и комфорт на занятиях. Ранее проведенные исследования показывают, что интеграция ИИ повышает вовлеченность студентов, но сравнительные данные о комфорте, эффективности и восприятии разных форматов обучения остаются ограниченными. Цель данного обзора — изучить восприятие студентами трех форматов обучения (очные, онлайн, лекции

с ИИ-аватарами), их влияние на психологический климат занятий и академическую успеваемость, а также риски и перспективы использования ИИ в вузах. Нарративный обзор литературы за последние ~7 лет по теме применения ИИ в высшем образовании включил публикации из российских (РИНЦ, eLIBRARY) и международных баз данных (Scopus, Web of Science и др.), а также отчеты и результаты опросов, соответствующие критериям включения (эмпирические исследования, сравнивающие форматы обучения или оценивающие влияние ИИ-инструментов на студентов; публикации 2018–2025 гг. на русском или английском языках) и исключения (неполные отчеты, дубли, работы вне сферы высшего образования). В результате установлено, что большинство студентов оценивают очное обучение как наиболее комфортное, хотя хорошо разработанные онлайн-курсы и реалистичные лекции с аватарами дали сопоставимый уровень удовлетворенности. Ни один формат не оказался универсально лучшим; эффективность зависела от контекста. Результаты оценки онлайн-обучения варьируются: в некоторых случаях они сравнимы или превосходят оценки очных занятий. Исследования лекций с ИИ-аватарами показали нейтрально-позитивное восприятие студентами, отметившими четкую речь и доступность. Виртуальное присутствие преподавателя повышало удовлетворенность и вовлеченность студентов, а визуальная обратная связь оказалась эффективнее текстовой. Цифровая грамотность студентов способствовала их адаптации к новым форматам, тогда как недостаток навыков и низкий уровень доверия к технологиям вызывали тревогу. Риски применения ИИ в высшем образовании включают сокращение живого общения, ограниченную аутентичность аватаров, академическую нечестность и этические вопросы. Таким образом, ИИ-аватары и цифровые технологии могут повысить интерактивность и гибкость обучения, но не способны заменить живой человеческий контакт. Поэтому требуется сбалансированное, ориентированное на человека внедрение ИИ в высшее образование с учетом психологических факторов.

**Ключевые слова:** искусственный интеллект, высшее образование, цифровой аватар, онлайн-обучение, очное обучение, психологический климат, восприятие, успеваемость, образовательный опыт

**Финансирование.** Исследование проведено в рамках соглашения с Минобрнауки России от 17.01.2025 № 075-03-2025-662 (шифр FSMG-2025-0086, тема проекта: «Прикладные исследования по внедрению технологий искусственного интеллекта в высшем образовании»).

**История статьи:**
Поступила в редакцию 10 марта 2025 г.
Доработана после рецензирования 12 апреля 2025 г.
Принята к печати 14 апреля 2025 г.

**Для цитирования:**
*Ulyanina O.A., Vikhrova E.N.* Artificial intelligence technologies, in-person and online learning in higher education: A review of the impact on perceptual features, psychological climate and academic performance // Вестник Российского университета дружбы народов. Серия: Психология и педагогика. 2025. Т. 22. № 2. С. 337–360. http://doi.org/10.22363/2313-1683-2025-22-2-337-360

**Вклад авторов:**
*О.А. Ульянина* – концепция и дизайн исследования, руководство проектом, сбор и анализ данных, написание и редактирование текста. *Е.Н. Вихрова* – анализ данных, написание и редактирование текста.

**Заявление о конфликте интересов:**
Авторы заявляют об отсутствии конфликта интересов.

**Сведения об авторах:**

*Ульянина Ольга Александровна,* доктор психологических наук, доцент, руководитель Федерального координационного центра по обеспечению развития психолого-педагогической помощи в системе образования Российской Федерации, Московский государственный психолого-педагогический университет (Российская Федерация, 127051, Москва, ул. Сретенка, д. 29), главный научный сотрудник Центра прикладных лингвистических исследований и тестирования «ИСТОК», Московский физико-технический институт (национальный исследовательский университет) (Российская Федерация, 141701, Долгопрудный, Институтский пер., 9, стр. 3). ORCID: 0000-0001-9300-4825, eLibrary SPIN-код: 9283-7824, Scopus ID: 57207950411, ResearcherID: AAF-2050-2020. E-mail: ulyaninaoa@mgppu.ru

*Вихрова Екатерина Николаевна,* кандидат филологических наук, доцент, доцент департамента иностранных языков, Московский физико-технический институт (национальный исследовательский университет) (Российская Федерация, 141701, Долгопрудный, Институтский пер., 9, стр. 3). ORCID: 0009-0006-9233-8894, ResearcherID: MTF-7487-2025. E-mail: vikhrova.en@mipt.ru