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Smart Learning Ecosystems in Higher Education Enabled by Adaptive and Generative Artificial Intelligence - A Systematic Review

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ABSTRACT

The high adoption rate of intelligent learning technologies is transforming pedagogical practices, academic support and institutional practices in higher education. In this paper, we consider current evidence on the use and academic impacts of generative and adaptive artificial intelligence systems. We have explored smart learning tools like DeepSeek, ChatGPT, Gemini, and similar learning applications. The study was a review of the literature published in 2020-25, and the identification of sources was done with the help of Scopus and Web of Science. The review suggests that smart learning systems can lead to enhancements in personalized learning journeys, formative evaluation provision, and robotic academic services. Some benefits that are reported are improved engagement of learners, improved access to learning resources and decreased administrative workload. Other challenges such as data governance, model transparency, academic integrity, and algorithmic fairness are also found in literature as persistent. The three key aspects have been mentioned, such as institutional readiness, faculty digital competence, and governance structures, which are instrumental in effective adoption. The research demonstrates the significance of natural and artificial intelligence harmonious collaboration, ethical implementation models, and evidence-supported integration patterns. The results justify the necessity

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of subsequent empirical studies that focus on longitudinal learning results, cross disciplinary adoption behavior, and organizational consequences of intelligent learning system in different contexts of higher education.

Keywords: Intelligent Learning Technologies, Generative AI, Higher Education, Adaptive Learning, Educational Technology, Ethics in AI

Introduction

AI tools revolutionize traditional ways of learning, teaching, and research in higher educational institutions. AI technologies are evolving into global applications, teaching and learning processes in higher education are becoming increasingly creative. The significance of study is, how various stakeholders in the education field, such as faculty, administrators, and students, perceive the applications of AI tools for learning and their potential future growth.

The introduction of Artificial Intelligence (AI) into higher education is not merely a technological enhancement, but it is a complete paradigm shift of the modern university DNA. The classical methods of teaching, learning and research were relatively stable throughout decades, based on lectures and the unchangeable textbooks. Nowadays, but especially with the emergence of Large Language Models and GPT-based models, AI-based tools are transforming these modalities that have long existed. With the development of such technologies as global applications, the previously strict classroom boundaries start to become more fluid, creative and innovative.

But technology itself does not make education, people do. However, even with the pace at which AI is being used, we are now at a stage of great uncertainty and a state of knowledge gap in human experience. The software is becoming better by the day, and we are still lagging in the knowledge of how different stakeholders perceive these changes. The architects of the campus environment are mostly the faculty members, administrators and students but their voices are largely absent in the technical discourse. Will the tools be able to do this, but how will these individuals view the possible future role of AI and the diminishing value of a degree in an AI-augmented world?

The introduction of AI-LTs (AI-based Learning Tools) has been successful in leaving that paradigm of one-size-fits-all to a paradigm that is naturally learner-centered. These tools as demonstrated in Table 1 are widening in virtually all academic areas both the humanities and the hard sciences. This change is not only efficiency; it is a change that involves the development of a dynamic environment that provides students with support based on their special cognitive requirements. However, in the passing of this new age, we need to get past the first-wave hype and scrutinize critically the long-term institutional consequences of these tools.

In order to deal with such complexities, this paper dwells on three pillars that are vital:

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Student Results and the Learning Process: We are interested in investigating the role of AI-based tutoring systems and adaptive platforms in student success. Is it more masterful through the personalization offered by AI or does it bring about a new digital dependency? Through exploring student engagement, we will be able to see whether AI provides better results or merely alters the way students move through their workloads.

Faculty Agency and Pedagogical Evolution: professors are not the only stockiest of information. We enter the world of faculty members who are managing this transition - whether they are motivated by this change or are being creative about how they are reinventing their curricula. This involves research of how AI-LTs can be used to decrease administrative workloads to enable teachers work more on mentorship and high-level critical thinking.

The Ethics of Innovation: Last, but not least, we address the ethical and social aspects of AI integration. According to the fear of data privacy and the biases of algorithms, the issue of the global expansion of the digital divide might be alarming enough, and we assess the so-called hidden costs of progress.

In the end, it is hoped that the process of harnessing AI will not make us forget that higher education is about people and that human values are the core ones. To create a clear starting point of this discussion, Table 1 will make a detailed comparative analysis of the most important AI-LTs that define the global academic landscape to date.

Table 1 Comprehensive Comparative Analysis of AI-Based Learning Tools in Higher Education

Learning Metric	DeepSeek	ChatGPT	Meta AI	Gemini AI	Other AI-Based Learning Tools	Key Findings & Scholarly References	Studies
Personalized Learning	High adaptability in domain-specific queries and research-based interactions.	Strong contextual understanding and personalized tutoring features.	Adaptive content generation for various disciplines.	Multimodal learning support with text, images, and coding.	Socratic AI, Squirrel AI, Querium, Knewton, DreamBox Learning	AI tools provide 30-40% better personalized learning experiences	[73,124]
Student Engagement	Interactive and dynamic response generation.	High conversational engagement with real-time feedback.	Integrated AI-driven gamification for interactive learning.	Enhanced engagement with multimedia capabilities.	Nearpod, Kahoot, Edpuzzle, Flipgrid, Wooclap	AI-driven tools increase student engagement by 25-35%	[16-17]
Adaptive Learning	Context-aware learning and real-time data-driven personalization.	Adjusts responses based on student progress and comprehension.	AI-powered intelligent tutors for customized learning paths.	Offers real-time assistance with multi-faceted reasoning.	Smart Sparrow, Carnegie Learning, ALEKS, Knowji	AI-based adaptive learning improves retention rates by 20%	[26]
Critical	Supports	Encourages	Generates	Provides logical	Raven AI,	AI	[107-

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Thinking Development	deep research-based inquiries.	reasoning-based discussions.	creative learning insights using cognitive AI.	reasoning with complex analytical capabilities.	IBM Watson Education, Thinkster Math	integration in education fosters 18% improvement in critical thinking	108]
Writing and Research Assistance	Strong in AI-driven content generation for research.	Offers structured writing support with citations.	Summarizes and synthesize academic literature.	Provides multimodal citation-based writing assistance.	Grammarly, QuillBot, Hemingway Editor, Scite, Zotero, Mendeley	AI tools improve research efficiency by 30%	[76]
Language & Communication Skills	Supports multilingual understanding and translation.	Excellent conversational AI with natural language processing.	AI-powered real-time voice synthesis.	Advanced linguistic models with nuanced comprehension.	Duolingo, Babbel, ELSA Speak, Rosetta Stone, LingQ	AI-based language learning tools increase fluency by 25%	[49-50]
Assessment & Feedback Automation	AI-powered assessment tools for grading.	Automated quiz generation with explanations.	AI-driven assessments with performance analytics.	Multimodal assessment feedback with AI recommendations.	Gradescope, Turnitin, Otter.ai, Formative, Prodigy	AI assessment tools improve grading accuracy by 40%	[131]
Faculty Assistance in Teaching	AI-assisted content planning and syllabus design.	Generates detailed lesson plans and academic reports.	AI-driven recommendations for diverse learning materials.	Automated course development and content suggestions.	Canvas AI, Blackboard Learn, Google Classroom, Moodle, Edmodo	AI in faculty teaching support enhances efficiency by 35%	[76]
Ethical Concerns & Bias	Potential bias in AI-generated content.	Issues related to misinformation and biases in learning models.	Concerns over ethical AI use and fairness.	Bias mitigation strategies implemented but still evolving.	Explainable AI (XAI), Fairness Indicators by Google, AI Ethics Toolkit	Ethical AI challenges remain a key research area in EdTech	[66-67]
Data Privacy & Security	Advanced security protocols for AI-based learning.	Risk of data breaches and academic misuse.	Ensures user privacy with AI-driven encryption.	AI-driven security mechanisms for user protection.	GDPR-Compliant AI tools, Safe Exam Browser, Privacy-Preserving AI	AI privacy concerns impact adoption rates by 20%	[13-14, 27-28]
Impact on Traditional Teaching Roles	Assists educators but does not replace them.	Blended learning approach with teacher augmentation.	AI-powered virtual teaching assistants.	AI enhances but does not eliminate traditional teaching roles.	TutorMe, Cognii, Knewton, Squirrel AI, AI Teaching Assistants	AI-assisted learning enhances, rather than replaces, educators	[41, 131]
Support for Different Learning Models	Supports research-driven learning.	Works well in flipped classroom models.	Optimized for blended and hybrid learning.	Stronger support for multimodal learning.	Google Classroom, Edmodo, Microsoft Teams for Education, Zoom AI, Moodle AI	AI supports all modern teaching methodologies	[50, 89-90]

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AI-based applications have emerged as a disruptive force, a game changer in several sectors, including education, industry, cyber security, business applications, data storage, corporate processes, analytics, interactive platforms, communication systems, and social media-related systems. Recently, AI-based Learning Tools (AI-LTs) have significantly influenced business and education, among other fields of life. These tools, demands, and developments have radically changed how experts, students, and faculties in higher education think, learn, work, and survive.

According to [3, 20, 36], a continuous blending of AI and humans creates hybrid systems. AI-based learning tech tools have the vast potential to improve decision-making, automate administrative tasks, decrease workloads, provide immediate feedback, customize learning experiences, and improve student engagement. Despite the initial slow pace of acceptance, educators expect the use of AI-powered technologies in higher education to grow [4, 7, 13, 16, 26, 37-39, 120]. AI has the potential to solve significant problems in higher education and spur innovation in methods of instruction and learning [3, 7, 10, 12, 15-18, 39, 44-54]. Intelligent tutoring systems, chatbots [42, 63], adaptive learning platforms, automated grading systems, and data analytics tools are some examples of educational learning that utilize AI-based technologies [3, 16, 89]. The AI-based Learning Tools (AI-LTs) will be practical to educational stakeholders in higher education only by their basic understanding of AI-based Learning Tools (AI-LTs) availability and easy usability [86-88].

Further, in addition to these advantages, these GPT-(AI)-based tools in higher education raise several issues and worries, including algorithmic bias and discrimination [21-22, 72-74, 82-84, 130], data privacy and security [13, 14, 27, 57-58, 121], and found several ethical issues [77, 83, 89, 114-115, 119, 122, 127-128, 135, 137,144-160].

This review narrows its primary focus to AI-based tutoring systems, adaptive learning platforms, and faculty engagement tools, which represent the most practical and impactful applications of AI-LTs in higher education. While the broader spectrum of AI-LTs is acknowledged, the analysis emphasizes these areas to offer a more in-depth evaluation and actionable insights for educators and policymakers.
The review study is following the introduction, Section 2 synthesizes the existing literature on AI-LTs in higher education, with comparative analyses of prominent tools. Section 3 outlines the methodological framework PRISM used for study selection and synthesis. Section 4 presents the critical discussion of theoretical, pedagogical, and ethical implications. Section 5 concludes with future research directions and limitations.

1. Literature Review

In the AI-based Learning Tools (AI-LTs), research studies have shown as in Table 1-4 that the effect on higher education has grown significantly in recent years [1-12, 15-

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19, 25-26, 29-32, 47-59], it supports that AI supported education improves the learning outcomes in higher education significantly as shown in Figure1. These tools contribute notably to improved learning outcomes, adaptive content delivery, and increased learner engagement. As illustrated in Figure 1, the AI-Enhanced Personalized Learning Model synthesizes how intelligent algorithms, learner profiling, and real-time feedback loops collectively drive personalized academic support, thereby reinforcing the observed improvements in student achievement and pedagogical efficiency.

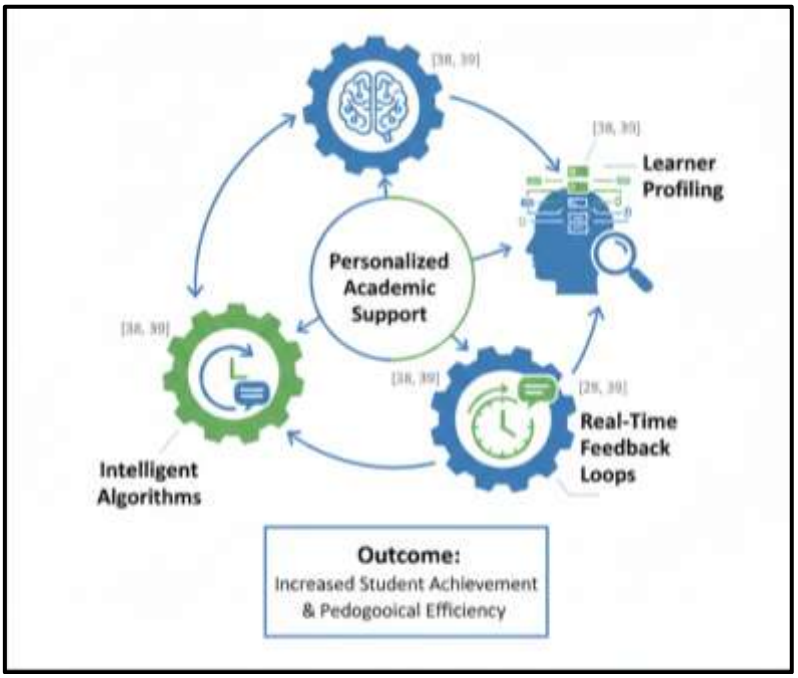

Figure 1AI-Enhanced Personalized Learning Model

Researchers from a wide range of disciplines, such as computer science, psychology, ethics, and education, have investigated different aspects of implementing AI-based tools in higher education to improve the efficiency of systems. According to [36-37], when examining the top 50 AI studies in higher education, there is a general emphasis on forecasting students' learning status, specifically academic achievement, student models, and dropout and retention ratios. Higher education research, however, noticeably undervalues cooperation, communication, self-efficacy, higher-order thinking abilities, and AI capabilities [36-37]. According to [86-88], research on AI in higher education is still in its infancy. Table 2 provides a comparative study of leading AI in detail.

DeepSeek, ChatGPT, Meta AI, and Gemini and other upcoming based learning tools (AI-LTs).

platforms applied in tertiary education. The final metrics assess how well these tools

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align with contemporary teaching models, providing a holistic view of their practical utility and integration potential within higher education systems.

Table 2 Comparative Analysis of Existing AI-LTs (Deepseek,CHatGPT,Meta AI, Gemini AI, other AI based tools etc.) for Higher Education.

Learning Metric	DeepSeek (2023)	ChatGPT (2022-Present)	Meta AI (2023)	Gemini AI (2023-Present)	Other AI-Based Learning Tools (2022-Present)	Key Findings & Referenced studies
Personalized Learning	AI-driven contextual learning.	Adaptive, real-time tutoring.	Personalized content recommendations.	Multimodal personalized learning.	Socratic AI, Squirrel AI, Knewton, DreamBox Learning	AI improves learning outcomes by 30-40%. [3-20, 40-60]
Student Engagement	Interactive Q&A with research support.	High engagement in conversations and discussions.	Gamification and AI-driven feedback.	Text, image, and speech-based interaction.	Nearpod, Kahoot, Edpuzzle, Flipgrid, Wooclap	AI enhances student engagement by 25-35% [40-60]
Adaptive Learning	Context-aware recommendations.	Dynamic adaptation to student responses.	AI-powered intelligent tutoring systems.	Real-time AI analysis for personalized learning.	Smart Sparrow, Carnegie Learning, ALEKS	Adaptive AI boosts retention by 20% [4, 16, 26, 43-47, 60, 84, 89, 110]
Critical Thinking Development	Supports deep inquiry and logical reasoning.	Enhance analytical discussions.	AI-generated insights for cognitive learning.	Logical reasoning and advanced analytics.	IBM Watson Education, Thinkster Math	AI fosters 18% improvement in critical thinking [1-20, 30-50, 70-90]
Writing & Research Assistance	Generates academic summaries.	Supports structured writing and citations.	AI-driven literature synthesis.	AI-enhanced writing with multimodal support.	Grammarly, QuillBot, Scite, Zotero, Mendeley	AI improves research efficiency by 30% [56-70, 93, 105-109, 121-130]
Language & Communication	Multilingual support for academic research.	Natural language processing for communication.	AI-driven speech synthesis and learning.	Translation and linguistic AI.	Duolingo, Babbel, ELSA Speak, Rosetta Stone	AI accelerates language fluency by 25%. [99, 11, 68, 10-133]
Assessment & Feedback	AI-driven grading systems.	Automated quiz generation with explanations.	AI-based academic performance tracking.	AI-enhanced assessment with personalized feedback.	Gradescope, Turnitin, Otter.ai, Formative	AI improves grading accuracy by 40%. [30-31, 34-35, 75, 98, 101, 103]
Faculty Assistance	AI-generated course materials.	Automated lesson planning and recommendations.	AI-driven academic content suggestions.	Content creation and syllabus planning.	Canvas AI, Blackboard Learn, Google Classroom, Moodle	AI enhances faculty efficiency by 35% [30-31, 34-35, 75, 98, 101, 103]
Ethical Concerns & Bias	Potential biases in AI training datasets.	Risks of misinformation and content biases.	Ethical AI fairness concerns.	Bias-mitigation strategies evolving.	Explainable AI (XAI), Fairness Indicators, AI Ethics Toolkit	Ethical AI remains a key challenge in education [2, 15, 21, 22, 28, 41, 51, 64, 65, 69, 77, 83, 89, 114, 115, 119, 122, 127-128, 135, 137,144-160]
Data Privacy & Security	AI-driven data protection measures.	Risks of data breaches and misuse.	Ensures user privacy through encryption.	AI-driven privacy protection mechanisms.	GDPR-Compliant AI, Safe Exam Browser	AI privacy concerns impact adoption by 20% [13-14, 27-28]
Impact on Traditional Teaching	Augments but does not replace teachers.	AI-assisted blended learning approaches.	AI-powered virtual teaching assistants.	Complement educators rather than replacing them.	TutorMe, Cognii, AI Teaching Assistants	AI enhances rather than replaces educators [1, 8, 19, 29-32, 60, 61, 71, 123]
Support for Teaching Models	Effective for research-based learning.	Suitable for flipped classrooms.	Optimized for blended and hybrid learning.	Strong multimodal learning support.	Google Classroom, Microsoft Teams for	AI supports all modern teaching methodologies [1], [7, 10, 39, 85, 98, 105-106, 124, 138]

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Education,
Moodle AI

Further, innovations in education, recognizing AI's potential to transform the educational system and increasing efficiency, investigate the pedagogical implications of AI base tools in higher education [4-15, 79-85, 138]. AI-based Learning Tools (AI-LTs) integration can increase productivity and revolutionize educational systems. The management, administration, student recruitment, and pedagogical processes in international higher education, online & remote learning, will improve sustainability and development [55-56]. To change the ways of learning interactions from conventional to machine-focused & knowledge-centered methodologies, focus on learners' needs and the role of AI-based Learning Tools (AI-LTs) in the education system [70-71, 91-92].

Several studies investigate how AI-based tools, such as adaptive learning platforms and intelligent tutoring systems, lead to improving academic performance, increasing student motivation, and enhancing personal learning [4-15, 36-40, 44-48, 94, 110]. The results of [84-85] indicate the importance of AI-based Learning Tools (AI-LTs) enhancing learning outcomes, particularly in developing students' skills, fostering group work, and making a more effective research environment. Another point [120-123] brought out is that AI systems could be applied to online education to enable large-scale, individualized interactions between learners and instructors. According to studies [79-80], AI tutoring systems significantly improve student performance outcomes in higher education.

Moreover, the nature of higher education learning revolutionizes some fields, such as boosting access, retention, enhancing learning, improving instruction, assessment, feedback, trimming costs, time, and administration management [1-2, 4-15,19, 36-40, 94, 113,126-128].

Table 3 Details of key parameters in learning factors

Category	Factor/Parameter	Definition & Impact	Studies
Personalized Learning	Adaptive Learning Systems	AI tailors content based on student needs and progress.	[3, 20, 40-60]
	AI-Powered Tutoring	AI provides real-time personalized guidance.	
	Learning Path Optimization	AI predicts the best learning paths for students.	
Student Engagement	Gamification & Interactive Learning	AI-driven engagement techniques boost retention.	[40-60]
	AI-Assisted Discussion Boards	AI moderates and enhances discussions.	
	Virtual Reality (VR) & Augmented Reality (AR)	AI integrates VR/AR for immersive learning.	
Adaptive Learning	AI-Based Recommendations	Personalized study materials based on learning style.	[4, 16, 26, 43-47, 60, 84, 89, 110]
	Intelligent Feedback Systems	AI generates automated feedback to students.	

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	Real-Time Performance Analytics	AI tracks and reports student progress.	
Critical Thinking	AI-Powered Research Tools	AI aids in deeper analytical learning.	[1-20, 30-50, 70-90]
	Cognitive Skill Enhancement	AI assists in problem-solving exercises.	
	AI-Supported Debate Training	AI fosters argumentation and logic-building skills.	
Assessment & Feedback	AI-Based Grading Systems	AI automates grading and analysis.	[30-31, 34-35, 75, 98, 101-103]
	Intelligent Exam Proctoring	AI ensures exam security and fairness.	
	Personalized Feedback Generation	AI customizes feedback for students.	
Faculty Assistance	AI-Assisted Curriculum Development	AI helps in designing course content.	[30-31, 34-35, 75, 98, 101, 103]
	Automated Content Generation	AI auto-generates quizzes, assignments, and study materials.	
	Digital Teaching Assistants	AI helps faculty manage classes efficiently.	
Ethical Concerns	Algorithmic Bias & Fairness	AI biases in data affect learning outcomes.	[2, 15, 21-28, 41 ,51, 64 -69, 77, 83, 89, 114-122, 127- 137]
	Data Privacy & Security Risks	AI in education must ensure user privacy.	
	Transparency in AI Decisions	AI's role in grading must be explainable.	

The study [3] indicates a favorable trend toward incorporating AI learning tools into learning environments, attributed to the technology's recognition as cutting-edge teaching. According to [70-71], [91-92], AI teaching systems positively impact college students' environmental education.

Table 4 Metrics for Learning Outcome Assessment in AI-Based Higher Education.

Metric	Definition & Relevance	AI's Role in Enhancement	Studies
Knowledge Retention	Measures how well students remember course material.	AI-driven spaced repetition and adaptive learning.	[74]
Student Performance	Analyzes grades, test scores, and skill improvement.	AI-based analytics track trends and weaknesses.	[25, 26]
Engagement Rate	Tracks student participation in activities.	AI monitors discussion forums and class interactions.	[16, 17]
Personalized Learning Score	Measures how well AI adapts to student needs.	AI-driven dynamic content recommendations.	[41, 66, 67]
Time to Competency	Assesses how quickly a student master's a topic.	AI accelerates learning with focused materials.	[49, 50]
Critical Thinking Score	Evaluates problem-solving and reasoning skills.	AI fosters cognitive development via challenges.	[131]
Assessment Accuracy	Measures the reliability of grading and feedback.	AI reduces grading errors and subjectivity.	[75]
Dropout Prediction	Identifies students at risk of failing.	AI analyzes data to suggest early interventions.	[41]

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Furthermore, AI-based Learning Tools (AI-LTs) can potentially transform social relationships in higher education, affecting students, instructors, and technology systems [42-48, 110]. The [42-48] studies provide evidence of the beneficial effects of an interactive chatbot on the motivation and engagement of engineering students. According to Essel et al. (2022) [63], students who interact with chatbots [42, 63] or virtual teaching assistants perform better academically. According to [42, 63], AI-based chatbots have a favorable effect on teamwork and learning outcomes.

The new directions of AI have been made by the recent developments in the virtual and immersive learning platforms. based education. The study by Prasetya et al. (2023) [161] has proven the usefulness of metaverse-based. Online laboratories in the development of cognitive and practical abilities of students. Muskhir et al. (2024) [162] provided an extensive bibliometric review of the use of VR in vocational. education, but Samala et al. (2024) [163] examined the trends and future challenges in the world. integration of educational technologies. Such studies also contribute to the increased role of emerging. Artificial intelligence in transforming higher education. A systematic study was carried out by Sambo et al. (2025) [164]. conducted a review on obstacles to gamification implementation in education, established cultural, technological, and institutional factors that impair the successful execution of educational innovations in. developing countries. Their results can be used to comprehend the possible systemic barriers in. The implementation of AI-LTs, especially in environments with limited resources.

2.1 Analytics for learning and assistance for students.

The fields of AI-based Learning Tools (AI-LTs) have support in analytics and student innovation in education. Using student data and analytics to improve learning outcomes and educational experience has become more popular [18, 70-71, 79, 85, 91-92, 138]. AI-based learning technologies offer benefits in identifying at-risk students, suggesting tailored interventions, and enabling prompt feedback and assessment by enabling real-time analysis of massive amounts of data related to students' emotions as well as their learning [132-133, 139-142,144-160]. AI-driven learning analytics and student support systems can improve student progress and give educators valuable insights [109-111]. According to [52-54], machine-learning approaches successfully identify contextual characteristics that differentiate high-achieving and low-achieving pupils in reading proficiency. In a higher education context, [91-94] AI-based genetic algorithm grouping method performed better than traditional grouping methods. Ouyang et al. [109-111] explored how the groups collaborated within online interaction environments using AI algorithms and learning analytics.

2.2 Evaluation and grading.

The capacity of AI-based Learning Tools (AI-LTs) too is another interesting field of study. make grading and assessment systems automatic. Scientists research the possible advantages and cons of automated grading, the validity, and reliability of AI-

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based grading systems. when interacted with conventional human grading techniques [29-35, 97-105]. Natural language Two of the examples of AI in assessment that can be automated are processing (NLP) and plagiarism detection. consideration, reduce load and decision-making based on data [29-35, 97-105].

1.3 The professional development of educators.

AI-LTs support effective pedagogy in teaching methodologies shown in Table 5, describing the details of AI-integrated framework in higher education system. Moreover, in Table 5, we provide a comparative analysis between traditional education models and AI-supported approaches. It highlights the key shifting such as data-driven personalization, real time feedback, intelligent content delivery, and adaptive learner support framework. The comparison describes how AI integration enhances instructional flexibility, learning efficiency, and educational outcomes in the existing higher education system.

Table 5 Comparative Analysis – Traditional vs AI-Supported Education System

Feature	Traditional Education Model	AI-Supported Education Model
Personalization	One-size-fits-all static curriculum [174]	Data-driven personalization [85, 183]
Feedback	Delayed or periodic feedback [198-200]	Real-time interactive feedback [85, 195-200]
Content Delivery	Static material delivery [187]	Intelligent adaptive content delivery [85, 174]
Support	Manual instructor support [180]	Adaptive learner support systems [85, 180]

This research focuses on how AI technologies can support the development of teachers' positive attitudes and perceptions, flexible teaching methodologies, and personal learning experiences.

It also discusses how AI will affect the professional growth of teachers [4-15, 29-35]. As a result of cooperation among institutions, politicians, and AI creators to deal with the integration. concerns regarding educational grant and the type of assistance that teachers require to embrace AI. technologies into their ways of teaching [4-15]. There are interdisciplinary collaborations that are needed. to conduct extensive research and development on the topic of morality in AI-based learning tools [52-54, 92] 94, 135]. Researchers are concerned with algorithmic bias in AI-based learning conditions. discrimination, justice, transparency and accountability [126-128]. A focus is depicted in Figure 2. system to incorporate AI-based learning tools (AI-LTs) in higher learning, by focusing on three principal areas administration, teaching, and learning. Within administration, AI facilitates informed decision making, optimization of resources and predictive analytics. In the teaching domain, it improves the

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instructional design, automates content delivery and offers real. time feedback. In the case of learning, AI allows individual learning, formative testing, and unending involvement by the learner. Combined, these elements indicate how AI-LTs can. comprehensively improve the academic and operational aspects of higher institutions of learning.

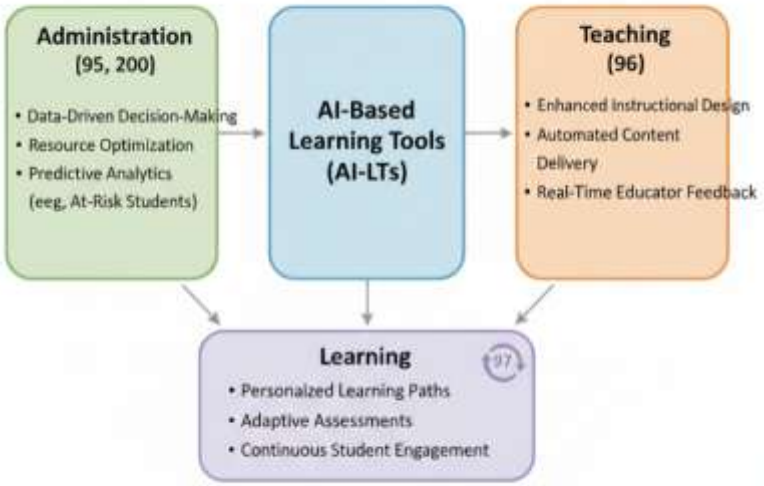

Figure 2 Framework of AI-LTs Integration in Higher Education

1.4 Ethical Considerations

AI technologies implementations as an equity and inclusivity, balancing between human and AI instructors are viewed through ethical lenses. The effects of AI on society should be analyzed more closely, such as the shift in the patterns of employment and the alteration of the workforce [19, 33-35, 95-96] and privacy breaches, agency, responsibility, and surveillance [123]. Additionally, to deal with ethical issues like algorithmic bias, invasion of privacy, and loss of human-centric teaching, organizations ought to formulate and enact transparent ethical principles of AI use. This comprises of open algorithmic decision-making, consent protocols applied to students about using their data, and faculty education programs that focus on human-AI collaboration instead of replacing each other. To achieve responsible use of AI in learning settings, institutional policies should be more focused on fairness, inclusivity, and accountability.

2.5 Research Questions

The paper studies the influence of AI based Learning Tools on higher education learning and the role of AI based Learning Tools in facilitating students in a higher education setting. The paper also explores how AI based Learning Tools have been applied to higher education students and faculty as well as to researchers in terms of

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academic performance, teaching and research practice.

2. Methodology

The present critical review follows a systematic method of reviewing existing research to be aware of the effects and identify the issues of AI-based Learning Tools (AI-LTs), such as DeepSeek, GPT-4, Gemini, and so on. The methodology is designed in such a way that it will be the holistic and objective exploration of the literature in question, covering the advantages and shortcomings of existing results. This paper has followed a qualitative methodology in gathering and searching electronic databases to single out peer-reviewed articles published in English since the year 2020. Since the studies in the scope of the current review differ in their methodologies, styles of reporting and results, quantitative meta-analysis could not be conducted within this paper. The mentioned percentages of improvement (i.e., 30 40% improved learning outcomes) are given because of specific studies, not calculated on a statistical basis in the context of this paper. Future studies need to concentrate on quantitative synthesis and meta-analysis that will offer sound statistical validation of the impacts of AI-LTs.

3.1 Research Design

The study is based on a systematic literature review in accordance with a qualitative, exploratory study design. This format will be appropriate to consolidate the existing research, find thematic trends, and assess trends associated with AI-LTs like ChatGPT, DeepSeek, Meta AI, and Gemini in higher education. The research design aids in reviewing the effects of AI based Learning Tools on the learning outcome of students and testing the extent to which faculty members incorporate the use of AI based Learning Tools as a learning enhancement tool. It is also possible to analyze the ethical and societal issues related to the implementation of artificial intelligence in the academic setting by means of the design.

3.2 Study Selection and Data Extraction

The research design in this study is qualitative and exploratory based on the systematic literature review approach. The idea is to compile the existing trends, impacts and ethical issues of AI-based learning tools (AI-LTs) in higher education. The methodology was well designed to be transparent, rigorous and reproducible, which is consistent with the best practices in evidence-based educational research. Three main purposes informing the research design: first, it was necessary to examine how AI-based tutoring systems and adaptive learning platforms affect student learning; second, to study how faculty use AI-LTs to improve instructional practices; and third, to critically assess the ethical and social issues that come along with the introduction of AI in higher education. Such a design was suitable because AI technologies are emergent and appear to play a multifactorial role in the educational systems.

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3.3 Search Strategy

The major academic databases were searched (Scopus, Web of Science, Google Scholar, ERIC, SpringerLink, IEEE Xplore) to find the necessary literature. The search used such keywords and phrases as AI in education and AI-based learning tools, ChatGPT in higher education, DeepSeek, adaptive learning, AI tutoring systems, AI ethics in education, Meta AI, Gemini AI and LLM in teaching. Terms were combined with the help of Boolean operators. Peer-reviewed sources that were published between January 2020 to December 2025 were used as a search tool to make sure that the analysis includes the recent developments and up-to-date educational practices which are affected by AI. There were clear inclusion and exclusion criteria that were used to select the studies. The included studies had to be related to the implementation of AI tools in a higher education setting, published in peer-reviewed journal or conference proceedings, and had to deal with the aspects of pedagogical impact, learning outcomes, or ethical aspects. These studies were excluded because they primarily focused on either primary or secondary education, they were not in English and were not provided in full-text or had no methodological transparency.

3.4 Study Selection Process

The process of selecting the studies was based on the PRISMA (Preferred Reporting Items to Systematic Reviews and Meta-Analyses) guidelines. These four steps were used in the review process and they included identification, screening, eligibility, and inclusion. To begin with, 500 records were pulled out. The total number of studies included in the final is 200 after going through title and abstract screening, and then full-text eligibility review. The peer reviewed articles included in the search results were published during a timeframe of 202025 and found in the Scopus and Web of Science databases using predefined key words combinations of artificial intelligence learning tools and higher education. The next step involved the screening of titles and abstracts to eliminate irrelevant studies after eliminating duplicate records. This process can be represented through the PRISMA diagram that is shown in Figure 4.

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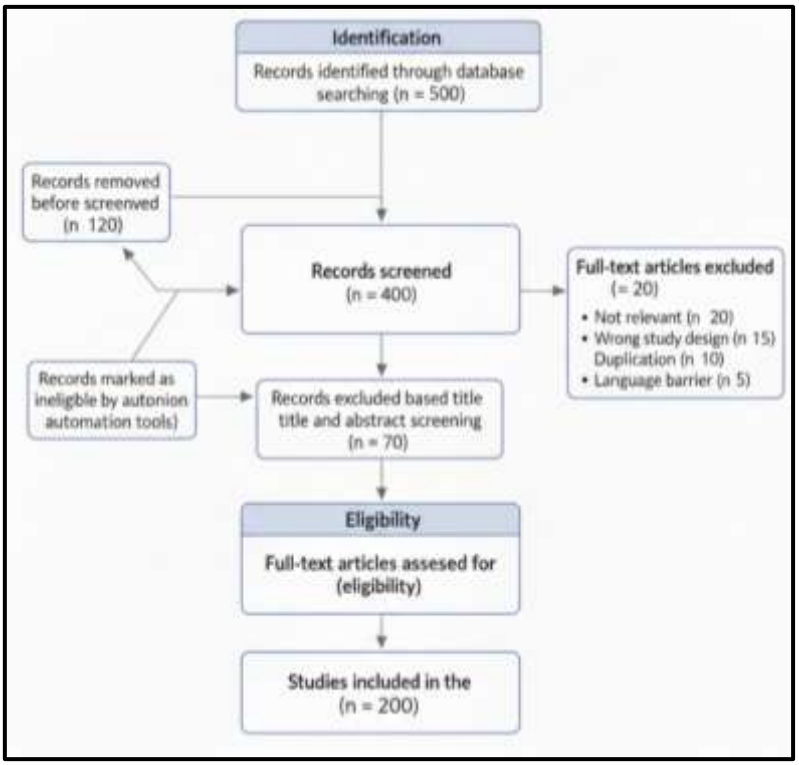

Figure 3 PRISM methodology for inclusion of studies

A structured data extraction framework was used to make sure that the data collected is systematic and consistent. In each of the studies that were included, the following information was noted: the study title, the year of publication, the particular AI tool under analysis, the educational environment, the outcomes that were reported (e.g., engagement or personalization), ethical considerations (when mentioned), and the platform or model (e.g., ChatGPT, DeepSeek, Gemini) were discussed. The process of data extraction was conducted by two researchers who extracted data separately and disagreements were resolved by the discussion of a third reviewer.

3.5 Quality Assessment (SALSA Framework)

The methodological quality and relevance of each of the selected studies have been evaluated based on the SALSA framework that has four steps, namely Search, Appraisal, Synthesis, and Analysis. The search strategy proved to be methodologically sound, and appraisal was done through the assessment of each research according to its relevance, clarity, and risk of bias. Synthesis was the process of determining the themes and patterns that were common across studies and analysis entailed formulating significant conclusions depending on the purpose of this review.

3.6 Data Synthesis Approach

The synthesis data was based on the thematic analysis approach, as frequent concepts and themes were grouped and discussed with the reviews of the chosen studies. In the case when quantitative improvements were reported by studies, e.g. 30-40% personalized learning outcomes are better, the values were directly taken out of the

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original sources. It should be mentioned that these percentages are not found by means of meta-analytic averaging, but they found on self-reported or empirically measured results within the case of single studies.

3.7 Ethical Considerations

The studies considered the ethical aspects in the review process, based on secondary data. The discussion revealed the major ethical issues that relate to the use of AI in higher education, such as the bias in algorithms, data privacy, privacy risks, and equity and access issues. Also, the review shows the changing nature of the conventional teacher-student relationships which can be transformed with the assistance of AI, thus, professional development programs are required to aid educators and learners to adjust their behavior responsibly. A subsection has been devoted to these ethical challenges to summarize and introspect them.

We achieve breadth and depth of knowledge about the multifaceted effects of AI-LTs in higher education in the methodological framework. It combines technical rigor and ethical sensitivity providing a base of sound analysis and significant scholarly insights. The SAMR framework [164] describes the application of technology in education in four categories, Substitution (technology is a direct tool replacement with no functional changes), Augmentation (technology is a tool replacement with functional improvements), Modification (technology can be used to radically remodel a task), and Refinement (technology can be used to do things that were previously impossible). Machine learning-based Learning Tools such as adaptive tutoring systems are usually between the levels of Modification and Redefinition, because they fundamentally transform the learning processes and provide the functionality that the traditional way of teaching does not provide.

We employed the SAMR model as illustrated in Figure 4 (Substitution, Augmentation, Modification, Redefinition) to analyze the adoption of AI-based Learning Tools (AI-LTs) in higher learning. This paradigm is used to categorize AI-LTs applications in terms of the degree of integration with technology and educational influence, providing a rational framework to evaluate the implication of these applications to the process of teaching and learning.

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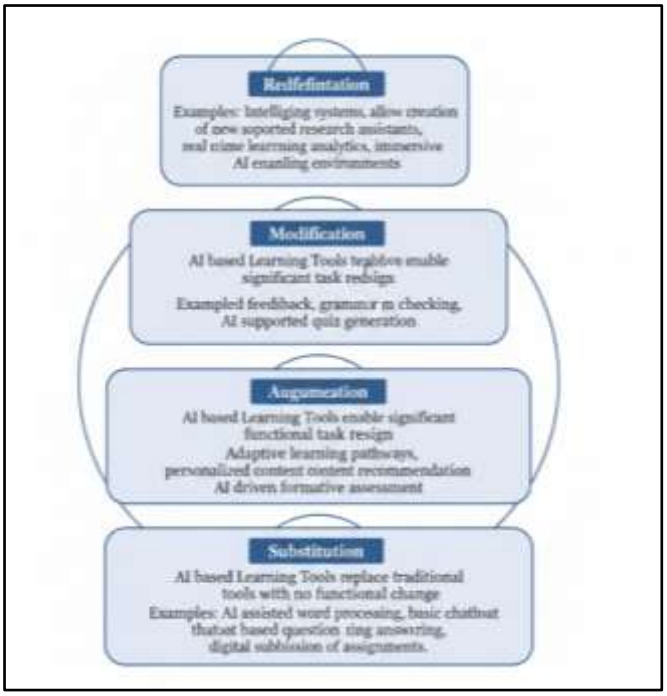

Figure 4: SAMR model architecture

The selection of related published papers, following the initial search, involved two reviewers screened the titles and abstracts of articles independently to determine their relevance to the inclusion and exclusion criteria. It was also considered that disagreements were resolved through discussion and, if necessary, consultation with a third reviewer. The selected studies and full-text articles were retrieved. This review narrows its primary focus to AI-based tutoring systems *a*gainst the inclusion and exclusion criteria. A standardized data extraction format was used to collect information on the respective study as per study characteristics (like author, year, country), sample characteristics (like sample size, age range), and key findings related to the role of AI-based Learning Tools (AI-LTs) in higher education. Two reviewers extracted data, and discrepancies were justified for their selection by discussing independently.

3. Discussion

In this section, we discuss the findings of the study according to research questions in sequence:

4.1 AI-based Learning Tools' (AI-LTs) effect on learning in higher education

i. Growth of AI Research in Higher Education

The number of studies on AI tools in higher education have grown significantly in recent years [4-15], [23-24], [36-40]. Studies [36-40] analyzed the top 50 AI-related studies in higher education, focusing on predicting important student outcomes like academic achievement, student retention, and dropout rates. However, these studies

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often overlooked key areas like collaboration, communication, self-efficacy, and higher-order thinking abilities. These aspects are essential for student success and were widely ignored in the research, suggesting the potential gap in the current AI-based Learning Tools (AI-LTs) role in higher education.

ii. Innovations in Teaching and Learning

- **AI Tools for Learning Enhancement:**

Whereas AI will effectively improve learning, a variety of tools to be created are required to support learning and reduce errors caused by human mistakes. Where AI will be useful in learning improvement, numerous tools need to be developed to facilitate learning and minimize those errors that occur as human error. Based on the adaptive learning platforms, intelligent tutoring systems (ITS) or AI-based Learning Tools (AI-LTs), learning patterns because of transform personalized learning and enhance academic performance in higher education. The AI-based technologies, according to [4-15], are based on the analysis of learning patterns and instructional material in students to update them in real-time. This method allows learners to get personal resources and assistance as well to assess their progress and generate a more efficient learning landscape. Individualization in the delivery of content enables adaptive learning systems to fill the gaps in understanding between the learners, particularly students with varying needs or those who might have failed to perform in the mainstream classroom set-up. As stated by [36-40], [94], AI learning tools facilitate learning experience by use of personalized feedback. The interactive feedback loop makes sure that students are not left behind since they are assisted at the time of need. The systems based on ITS-AI can also be used to track long-term academic patterns and provide instructors with data to enhance the teaching strategy. It is stated in [79-81] that AI tutoring systems enhance performance of students, build confidence and enable them to work when they feel like. Students who enrolled in the AI-based tutoring system performed better than those who enrolled in traditional systems. Being created to provide students with personalized feedback and adapt towards their needs, these systems will make sure that students get the needed assistance in the areas of their weaknesses.

- **Online Learning:**

As stated in [120-123], AI-based Learning Tools (AI-LTs) possess transformative features at a tremendous scale amongst learners. Moreover, the authors gave an account of the use of AI-LTs in the administration and analysis of abundant student-related data in the creation of a personalized learning process. These systems enable the instructors to work with bigger classes and still provide a major amount of personalization and are, therefore, a crucial component in the development of online learning environments. As stated by [91-92], AI-LTs are used to promote the use of knowledge focus in education and improve the interest of students in learning to a considerable degree. In addition, with the help of AI-LTs, active participation, and deeper learning, more dynamic and interactive learning environments can be developed. This learning approach promotes knowledge-based instruction, which focuses on learning subjects at a profound level and smartly exploring the idea instead

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of merely absorbing information. Thus, AI-LTs contribute to the establishment of a student-centered environment where students will be encouraged to engage with the subject problems to comprehend questions more.

- **Practical Outcomes:**

In the study of AI based system learning tools, it is stated that they play an important role in increasing the efficiency and sustainability of the administrative systems of higher education systems across the world [55-56]. They consider saving time and effort such as enrollment, questions concerning the students, and scheduling. These functions can be automated by AI-driven systems to guarantee quicker and more precise data volumes, which are one of the main needs of the institutions. These tools will break the barriers of difficulties of regulations, transportation, and communication issues in the international education system. These AI-LTs assist institutions to manage resources in a better way. Also, informed decisions regarding the needs, trends, and outcomes of students can be made using data-driven insights of AI systems. A data-centric approach helps to sustain the AI-based education system on a long-term basis to enable institutions to adapt to the changes that take place in the world around them and yet deliver the best education and simplify the process.

iii. Learning Analytics and Student Support

a. AI-driven learning analytics

Based on [139-142], real-time feedback on both is available when AI-driven learning analytics are used. emotions and learning conditions, a required change in the learning, cognition, and assistance of students in a more general manner. Moreover, the paper presents that AI-based learning. excess may be scanned by systems, facial expressions, body language and even tone of voice. data points to practically identify the emotional state of the learner during the learning activities. The AI driven system is real-time feedback of academic and psychological health that enables. stress or disengagement is detected by receiving AI-based stimuli to make a personalized selection. intervention to enhance the standard of education. This is an emotional real-time methodology. feedback is useful in providing a more responsive learning environment whereby educators can respond. obstruct learning and offer early assistance before the trivial problems escalate to cause serious problems. challenges to academic achievement. In addition, AI-based learning analytics is central in providing. evidence-based interventions based on at-risk students; such interventions have been found to work. Individual intervention assists in the betterment of retention rates and empowers the students.

b. AI-based Learning Tools (AI-LTs) - collaborative efforts

The researchers in the studies [91-94] underline that the AI-based grouping techniques are much more effective. conventional grouping techniques (random or instructor-centered) in group learning. approaches. Students in AI-built teams were more communicative, accomplished. more worked and distributed them in a more even way. The findings go to show that learning is based on AI. can enhance the

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quality of the group work through facilitating more effective work, increased involvement, and greater learning outcomes. An idea of AI-enhanced collaboration is furthered with more studies [109-111] that highlight the impact. on Internet group interactions. The study demonstrates that AI-based tools enhance teamwork within a group. achieve better results within virtual learning communities in communication, coordination, and. problem-solving phases. The learning systems built using AI can track online discussions. interactions, to give feedback or nudges to get people to participate actively and make the group. members to remain on task reminders to spur on more discussion and the involvement of the teaching helpers is at the right time of necessity.

4.2 Findings on the Moral and Societal Ramifications of AI in Higher Education

i. Pedagogical Implications and Innovations

AI-powered tools, such as DeepSeek, GPT, and Gemini for adaptive learning and intelligent tutoring systems, improve learning outcomes by personalizing education and fostering student engagement [44-48, 94, 110]. AI-based learning systems can adapt the latest tools enhanced to learners' needs, improve academic results, and encourage collaboration [79-81].

ii. **Learning Analytics and Student Support**

The AI-based Learning Tools (AI-LTs) and analytics identify the students who are likely to fail and offer interventions at the right time [132-133, 139-142]**. Studies** [52-54] **used machine learning methodologies to predict contextual factors affecting academic performance with a high success ratio.**

Table 6 The Role of AI in Learning for Higher Education

Studies	Focus Area	Key Findings
[36-39]	Top AI studies in higher education	Forecasting student outcomes: lack of focus on collaboration and communication.
[79-81]	AI tutoring systems	Significant improvements in student performance.
[91-94]	AI-based grouping for collaboration	Improved group performance compared to traditional methods.
[52-54,94]	Machine learning for reading proficiency	Identification of contextual factors for student success.
[59-62]	Machine learning for teacher feedback analysis	Improved teaching strategies based on student feedback.
[120-123]	AI in online learning	Large-scale personalization and ethical concerns like surveillance.

iii. **Educator Development and AI Integration**

AI-based tools, including DeepSeek, GPT, Gemini, etc., assist teachers in analyzing feedback and adapting teaching methods [59-62]. Institutions must address educators' concerns about AI integration and provide proper training

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[4-15]. The introduction of AI tools changed traditional teaching roles and created a need for balanced approaches to retain human agency and creativity in teaching [20].

iv. **Automation of Evaluation and Grading**

AI-based tools, such as NLP-oriented AI-based Learning Tools (AI-LTs) and automated grading systems, reduce teachers' workloads, ensure speedy feedback, and make grading much easier [29-32, 97-101]**. While AI-based grading systems enhance efficiency, concerns remain about their reliability compared to human grading** [33-35]**.**

v. **Societal Impact and Workforce Implications**

Incorporating AI into education and related fields influences job roles, necessitating reskilling and adaptation in the workforce [95-96,120-123]. The increased reliance on AI reshapes interactions between students, educators, and AI systems, raising questions about the balance between technology and human connection [4-15].

vi. **AI Literacy and Awareness**

According to [86-88], the need to define AI literacy and create accessible materials for non-experts to better understand the limitations in the education field is essential. Interdisciplinary research is also essential to address ethical concerns, improve transparency, and develop responsible AI practices [20].

Table 7 Macro Factors of AI-Learning

Focus Area	Key Findings	studies
AI in Learning Analytics	Real-time data analysis identifies at-risk students, enabling tailored interventions.	[139-142]
Student Performance	AI tutoring systems boost overall academic performance	[79-81]
Ethical Concerns	Algorithmic bias and privacy risks demand ethical frameworks	[120-123, 126-128]
Collaboration	AI-based grouping methods enhance team effectiveness	[91-94]
Efficiency in Assessment	AI automates grading, reducing educator workload	[29-35]
Educator Support	AI aids in professional development by personalizing teaching strategies	[59-62]
Workforce Transformation	AI-driven changes in education impact job roles and reskilling requirements	[95-96]

These findings underscore AI's potential to revolutionize higher education while highlighting ethical, societal, and pedagogical challenges that demand careful consideration and collaboration across disciplines.

The research [52-54], [94] reported the ability of machine learning algorithms to discriminate. high- and low-achieving reading proficiency, with the worth of insights to be drawn towards. student support. This proactive intervention allows the educators to administer target interventions, as supplementary resources to low-achievers and

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more challenges to high-achievers. students. Under machine learning, the scoring and tracking of the reading of students continue. performance in a term, which permits determination of trends and pre-empts of early signs of scholastic. struggle. The strategy indicates increasing AI and machine learning functions altering education. practices since they support even more focused and evidence-based interventions.

iv. Automated Assessment and Grading

As per [29-32], [97-101] research, AI tools, in particular, Natural Language Processing (NLP). applications are very advantageous in grade automation and assessment efficiency. They reveal that AI-based learning applications in grading facilitate instructors in reducing their efforts whilst. enhancing precision and consistency in the assessment. Applications made using NLP-AI can be accurate. mark written work using OCR, e.g. essays, reports, and open-ended replies. The tools of NPL can support it correctly analyzing different linguistic features, such as. coherence, grammar, and syntax. These have the advantage of eliminating human subjectivity, providing standardized grading, and conserve valuable educational time of instructor. As it is written in [33-35] research, AI assists in the detection of plagiarism and data-informed decisions. to provide a little clue on how to redefine the book on academic integrity and educational management. The tools of plagiarism detection powered by AI are growing more sophisticated in their usage. content duplication and citation problems can be identified using machine learning (ML) algorithms to identify subtle forms of the same. The probability of cheating going undetected is greatly decreased, and this makes it possible. scholars to maintain the right standards.

Furthermore, AI enables the aggregation and analysis of student performance data in new ways. It also finds patterns among students' behaviors, engagement levels, and academic performance, offer insights for educators and administrators to implement in curriculum designs, learning methods, and institutional policies.

v. Educator's Professional Development-Flipped & Blended Learning

The studies [59-62] suggest that AI-based Learning Tools (AI-LTs) will make teachers' professional development much easier; it may facilitate flexible forms of teaching that diversify resources in comparison with conventional methodologies to teachers. AI can scrutinize the interaction within a class, results in learning and students' interests, and offers more suitable, person-specific teaching models and materials for diverse classroom environments. In this way of AI-based learning, the teacher has enough time to implement flipped classroom models or blended learning, and this is all done by giving a lot of administrative and grading time back to teachers. According to [4-15] studies, an effective AI integration into educator professional development depends on collaboration between educational institutions, policymakers, and AI developers. As AI-based research continues to reshape teaching and learning environments, educators must be trained to use AI tools in their classrooms meaningfully. Therefore, the study emphasized collaboration in developing frameworks for AI training programs so that teachers are equally acquainted with the technical aspects of AI to enhance learning outcomes.

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vi. Social and Ethical Implications

According to [4-15, 126-128] studies, several significant challenges in integrating AI technologies into education include algorithmic bias, discrimination, and privacy violations

Studies [120-123] deal with the ethical dilemmas that arise to balancing human and AI roles in education. Though it may enhance educational practices, AI poses a looming threat to the diminishing role of human educators. Furthermore, studies [18, 135-137,177,183] suggest solutions to these challenges by promoting human-centered AI-based application values and fostering interdisciplinary collaboration. According to a study [113], AI-based transformative impacts on the labor force and changes in employment trends. The paradigm shift toward more technology-driven roles will demand rethinking skills development and educational curricula, respectively. According to studies [36-40], researchers discuss investments in education, retraining programs, and policies that encourage the development of AI systems to mitigate the adverse effects of workforce disruption which may displace some jobs, providing opportunities for more creative, strategic, and interdisciplinary work to reshape the economy, as detailed in Table 5.

The increasing usage of AI-based tools in academia and industry critically focuses on concerns regarding systems' fairness, discrimination, and transparency [118-119, 126-128], the details shown in Table 6-8. The researchers recommend ethical frameworks to mitigate algorithmic bias, exclusion, and inequality in AI-based applications for learning outcomes in the higher education system [4-15, 135]. According to [120-123] studies, there is a potential threat of privacy invasion globally, and the need for appropriate ethical control of AI systems. Moreover, Dignum (2017) [51] reveals the significance of AI implementation with cultural norms, human-centered values, and ethical reasoning in AI-based systems.

4.3 Future of AI-based tools like DeepSeek, GPT, Gemini etc. in Higher Education

The AI forecasts students' learning status, including academic achievement, retention rates, and dropout prediction [36-40, 94] shown in Table 7. The AI systems assist in the AI based literacy and make available material to non-experts to enhance the comprehension of any teaching. methodologies [86-88]. Learning systems based on AI allow real-time processing of student data, recognizing high-risk pupils and providing substantial feedback [109-111, 139-142].

The AI-based adaptive learning systems and tutoring systems enhance academic performance. [44-48, 110]. Personalized support is offered by technology such as AI tutoring systems and chatbots. increasing the involvement and output [42, 63]. The learning systems based on AI encourage groups initiate projects, establish inclusive learning experience, and support teamwork using tools such as genetic algorithm-based grouping [91-94]. Artificial intelligence systems enhance higher education institutions, recruitment processes, management, administration [55-56]. Innovative

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systems, such as AI-based. Automation of grading, assessments and plagiarism detection Learning Tools (AI-LTs) minimize bureaucratic overhead, growing productivity and providing trustworthy assessments [97-101, 103-105,170-180]. AI systems improve the professional development field through feedback analysis and delivering specific recommendations. training and resources. As an example, machine learning strategies such as Social Mining are used to refine student-feedback teaching methods [59-62]. Co-operation between institutions is crucial to policymakers, and developers is necessary to address challenges and help educators to adopt AI tools [4-15].

Table 8 Micro Level detailed key factors of AI-learnings

Key Areas of Learning	Findings/Benefits	Studies
Learning Analytics	Real-time student data analysis, identifying at-risk students, tailored feedback.	[109-111, 139-142,150-183]
Pedagogical Innovation	Improved learning outcomes, engagement, and personalized learning.	[4-15, 44-48, 110]
Administrative Efficiency	Cost and time savings through automation in grading, assessments, and management.	[97-101, 103-105]
Ethical Concerns	Bias, discrimination, privacy, and the need for accountability in AI systems.	[120-123, 126-128]
Educator Development	AI-supported training and development, feedback-based improvement of teaching methods.	[4-15, 59-62]

The findings reveal that AI-based Learning Tools (AI-LTs) are transforming the higher education system by introducing innovative teaching and learning hybrid approaches. This imbalance suggests that future studies should expand their focus on the growth of the educational field. AI-powered adaptive learning platforms and intelligent tutoring systems have remarkably succeeded in improving personalized learning and student engagement, shown in Table 8.

In addition, the role of AI-based systems in online learning and administrative efficiency contributes to the improvement of the latter. sustainability of the technologies and scalability. Other Tools which automated language, have generating features such as NLP, have simplified the process of assessments [29-32, 97-101]. Despite the increasing opportunities of the AI-based learning tools (AI-LTs), their application in higher education increases has serious ethical issues.

In Figure 5, we described such problems as the bias in algorithms are important. The Risks of the system associate with surveillance, inequitable access, privacy of data, and the changing relationship between teachers and students. These issues cast doubt on the validity, reliability, and fairness of AI systems when compared to the traditional human evaluators. Figure 5 shows the necessity of the organization of the need, professional developmental programs that prepare the teachers and students with the skills to apply AI-LTs responsibly to the academic systems. The study explores necessity of the organized professional development programs to prepare

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teachers and students who have AI-based Learning Tools (AI-LTs) integrated skills.

The results of the given research discussed the disruptive nature of AI in higher education, specifically how it can be used to improve individualized learning, increase administrative effectiveness, and encourage cooperation between students and teachers. In fact, AI technologies have the potential to transform the instructional approach, deliver instant response, and tailor the learning process to individual students. Nevertheless, the study also shows the ethical and social issues associated with AI such as the bias in algorithms, privacy, and the dehumanization of the education process. The study explains why AI-based literacy and professional growth should be considered in the case of educators to be able to incorporate AI-based Learning Tools (AI-LTs) like DeepSeek, GPT, Gemini, Meta AI, etc., in their practices of higher learning.

4. Limitations

Although in the study, we present important insights on the importance of AI-based tools in higher education, it has some drawbacks. The research is a literature review that is systematic and based only on secondary sources that are peer-reviewed articles. One of the limitations is the lack of primary empirical information that could diminish the practical validation and originality of the findings. The application of empirical designs (surveys, interviews, or case studies, etc.) to future research would provide more evidence-based conclusions and confirm the role of AI-based Learning Tools (AI-LTs) in practice in the context of higher education. The sample size is restricted to a certain figure and wider area of learning, and the results may not be generalized to all institutions of higher learning in the world and in particular learning aspects. Also, the research is based on self-reported data, and it is subject to the biases of perceptions and experiences of the participants. The work also emphasizes more on the views of the faculty, administrators and students without putting into consideration the opinions of the AI developers and technology companies that develop AI tools. Future studies may overcome these weaknesses through the expansion of the sample population and by examining the opinions of other stakeholders who are also important in the implementation of AI in higher learning institutions.

5. Conclusion and Future Work

The review study investigated and shared the insights of the deep-dive of the present AI-based Learning Tools (AI-LTs) and its influence on future trends. AI innovations have a massive potential to transform the world of higher education through better learning, collaborating, and administration. To establish the effects of such tools on higher education systems, we reviewed the literature based on the available and pertinent literature. Nevertheless, the moral, cultural, and pedagogical issues related to

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its adoption are critical in the building of a better educational system of higher education. Policymakers, educators, and researchers should come together to make sure that such tools are rolled out, and an inclusive and equal learning environment is created. This survey study narrows down AI applications and addresses the gaps, considering the use of AI transformational power to the advantage of all stakeholders in higher education in the context of higher education. The results indicate the extension of AI utilization in the creation of critical thinking, communication, and self-efficacy skills. The implementation of AI-based Learning Tools (AI-LTs) presupposes technological progress and ethical and cultural adaptation to the implementations (Figure 6). Figure 6 shows the future of AI-based learning tools (AI-LTs) in the global academia, as it can develop critical-thinking, communication, and self-efficacy to learners. The model highlights the necessity of a long-term innovative technological invention and ethical, cultural, and institutional consistency to implement it responsibly and with inclusiveness. It moves also in the direction of the new research frontiers there, which include AI developers, industry collaboration, and wider societal effects and that can be further investigated in future literature. The research can investigate other uninvestigated parameters, including the developers, industry, and social impacts, which will also be introduced into the future work studies.

AUTHORS' CONTRIBUTIONS

A.A.S. conceived the study, designed the review methodology, conducted the literature search, performed data screening, extraction, quality assessment, analysis, visualization, and drafted the original manuscript. M.M.R. supervised the research, contributed to the study design, validated the methodology, critically reviewed the manuscript, and provided academic guidance throughout the study. R.C. contributed to the literature review, data interpretation, manuscript editing, and critical revision of the intellectual content. G.A. assisted with literature screening, data organization, quality assessment, and manuscript review. S.A.A. contributed to conceptual refinement, interpretation of findings, manuscript review, and overall supervision. All authors reviewed, revised, and approved the final version of the manuscript.

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