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ROLE OF AI TOOLS IN ENHANCING PERSONALIZED LEARNING AND ENGAGEMENT AMONG UNIVERSITY STUDENTS

[1]Ammarah Akram
(MPhil Education Scholar) University of Education, Lahore, Faisalabad Campus, Pakistan. Email: ammarahakram287@gmail.com
[2]Muhammad Faisal Farid
(Assistant Professor) DoE, University of Education, Lahore, Faisalabad Campus, Pakistan. Email: dr.faisal.farid@ue.edu.pk
[3]Sabeen Qamar
(Assistant Professor), Virtual University of Pakistan. Email: sabeen.qamar@vu.edu.pk
[4]Nashad Ali
(Education Fellow Teacher, Boys Middle School Basingo Basho, Gilgit Baltistan). Email: nashadali637@gmail.com

ABSTRACT

The integration of Artificial Intelligence (AI) in higher education is transforming traditional teaching methods by enabling highly personalized learning experiences and increasing student engagement. This study employed a quantitative research design to examine the role and influence of AI tools on personalized learning and engagement at the university level. The research was conducted in the public sector university population in Faisalabad. A random sampling method was used to select 200 students. Data were collected through a self-developed questionnaire based on a 5-point Likert scale. The questionnaire assessed key aspects of personalized learning and student engagement, such as the flexibility of learning paths, the quality of personalized feedback, student motivation, interaction with AI-based tools, and perceptions of academic improvement. The instrument was validated through expert opinion, and reliability was ensured through pilot testing. Both descriptive and inferential statistics were used to analyze the data. The findings suggested that university students use a variety of AI tools for their personalized learning, with a varied level of engagement. According to their perceptions, after using different AI tools, their learning and engagement had been enhanced to a greater extent. They are of the view that AI tools have great potential to enhance their learning and engagement due to multiple benefits associated with them. There is a dire need to draft an ethical policy for the use of AI tools in education.

Key Words: *Artificial Intelligence Tools, Personalized Learning, Student Engagement, University level.*

Introduction

The addition of AI tools in the educational context has completely revolutionized the canvas of education. A variety of AI tools have made teaching and learning processes not only interesting but also personalized to an extent that whoever is using AI tools, whether a teacher or a student, is attaining benefits from them. This transformed system has brought not only benefits but also challenges with it. On the one hand, it provides students with a personalized experience of learning to become more adaptive in their quest for education, and on the other hand, it offers teachers different platforms to make their work easier and smarter. All other stakeholders in education are also reaping benefits with the technological advancements in AI in education (Wang et. al., 2024). One can

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simply define artificial intelligence as the ability of machines to think, act, and stimulate learning to solve problems like humans (Russell &Norvig, 2016).

The educational landscape is rapidly sprouting and reshaping the complete scenario of teaching and learning (Wang et. al., 2024). Patterns and teaching methods are continuously changing and growing due to the introduction of AI tools in education. The focus of collective teaching is shifting to individualized teaching/learning through personalized lesson plans. A lot of things are happening under the cover of AI tools, and this industry is growing day by day, but concerns are also rising about data privacy, ethics, and fairness (Bostrom, 2014).

AI-powered tools and platforms analyze data on how well students are performing and adjust the lessons to meet each student's individual needs, including content, pace, and difficulty. These tools help students learn better by finding gaps in their knowledge, suggesting resources, and changing the level of difficulty (Luckin et al., 2016; Woolf et al., 2013). This not only helps them learn better, but it also makes learners more motivated, engaged, and involved by inspiring them to be more independent and responsive in their learning.

Smart tutoring systems, adaptive learning environments, and real-time feedback systems not only help teachers to provide lessons that are tailored to each student's needs but also figure out what the strengths and weaknesses are, so that they can carry out their remedial work. This makes it easier to use specific teaching methods and keeps students in educational institutions longer (Zawacki-Richter et al., 2019). However, using AI for educational purposes raises many concerns regarding student information, security, and bias in algorithms (Holmes et al., 2019). AI does more than just create unique experiences; it also assists students with their homework, grades, and schedules. AI-powered chatbots and virtual assistants are now two examples of tools that support schoolwork, along with making administrative tasks easier all the time. Dream Box, Smart Sparrow, and Carnegie Learning are all examples of platforms that adapt lessons based on students' performance. This helps them learn more effectively and stay engaged (Luckin et al., 2016).

Holmes et al. (2022) advocated for a clear and elegant code of ethics for using AI in education, as there is currently no such framework available to researchers in this domain. They suggested a multidisciplinary approach guided by some key principles to help researchers distinguish between doing things ethically and doing ethical things. AI also helps people learn together by suggesting groups and connecting those who are learning the same thing. AI is now utilized in Virtual Reality (VR) and Augmented Reality (AR) technologies to create immersive learning simulations that enable students to think critically and grasp concepts (Chen et al., 2020).

Due to these new ideas and platforms, students learn at their own pace and place. The engagement level is enhanced, and students get assistance for their overall improvement in academics. With the passage of time and developments in AI, it has taken a central position in the field of education. Due to the availability of different types of AI tools to any educational institute, it becomes the prime responsibility to use them in helping students, assisting teachers, and guiding others to perform their duties efficiently. With the help of AI, teachers can tackle issues with a diverse nature, such as slow learners, inclusivity, and teacher burnout. They can make their students effective in learning and guide them to become more responsible in the age of digitalization.

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The stakeholders in education are very much interested in the boom of AI in education. The rise of AI has opened up new vistas of policy directions on how educational institutions in the country can adopt AI in education at all levels, so that student engagement can be enhanced. From autocratic decision-making to data-driven instruction, teachers have covered a lot of ground in their profession due to the rise of AI in education. The researchers in the field are persistently suggesting using AI not only for automating tasks but also involving it in creating pathways of personalized learning for learners with unique abilities and easing the burden of teachers in areas such as pedagogy (Wang et. al., 2024).

The studies in the past revealed that intelligent tutoring systems (ITS) could provide students with feedback and assistance that adapts to their needs. Woolf et al. (2013) found that ITS could customize lessons based on each student's strengths and weaknesses, making learning more efficient. These systems adjust content, pace, and difficulty in real time according to each learner's profile. Luckin et al. (2016) also discovered that AI tools help teachers better understand how their students learn, enabling more adaptable and responsive teaching methods. Evidence continues to support the idea that AI can be used in personalized learning environments to boost student motivation and improve academic performance.

According to Zawacki-Richter et al. (2019), AI-driven platforms not only deliver content but also analyze students' behavior and cognitive data to assess engagement and comprehension. These insights are then used to recommend personalized learning materials aligned with each student's needs and preferences. AI empowers students to take charge of their education by making the learning environment more responsive and student-centered. It also enhances engagement by making learning more interactive and immediate. For instance, chatbots and virtual teaching assistants are increasingly common in higher education to answer students' questions, clarify course material, and provide timely feedback. Holmes et al. (2019) discussed how these AI tools ease teachers' workloads by automating routine tasks, allowing educators to focus on more critical teaching activities. This division of labor ensures that human teachers remain the primary instructors, supported by AI. Predictive analytics, a form of AI application, is also gaining traction in educational institutions to forecast student performance, identify at-risk students, and implement early intervention strategies.

AI-based tools can help in discovering learners who may require additional guidance and support in their learning and engagement. One can help them in minimizing issues related to their attendance, enhance their scores in tests, and make them more adaptive in learning positive behaviors.

Kumar et al. (2025) emphasized that these early warnings are vital for preventing failure and encouraging students to stay in school. These predictive tools enable schools to make data-informed decisions, aligning with the trend in higher education toward evidence-based practices. The literature also emphasizes how AI promotes more open and inclusive learning environments. Speech-to-text software, real-time translation, and adaptive content formatting are examples of AI-powered tools that support students with disabilities or those who face language barriers in engaging meaningfully with educational materials. Kukulska-Hulme (2020) notes that these technologies advance the global movement for inclusive education by ensuring access for all learners. Additionally, immersive technologies like virtual reality (VR) and augmented reality (AR), powered by

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AI, offer experiential learning that enhances comprehension and critical thinking (Chen et al., 2020).

While these innovations are promising, the literature identifies several challenges associated with AI in education. A major concern involves data safety and privacy, as AI systems collect and analyze personal and academic data. This raises questions about data ownership, usage, and ethics. Bostrom (2014) pointed out that AI applications in sensitive areas require clear rules about data handling and algorithm transparency. Smith (2020) argued that while AI can increase scalability and efficiency, it must be deployed ethically to prevent bias and safeguard students' rights. Another significant issue is the digital divide, as not all students have equal access to AI-based learning tools. Those from underserved or remote areas may lack the necessary technology, worsening existing disparities.

Luckin et al. (2016) emphasized that AI should not be viewed as a one-size-fits-all solution; it needs to be adapted to specific contexts, teachers require proper training, and schools must be prepared for its integration. There is an ongoing debate about how much AI should replace traditional, human-led teaching. Most experts agree that AI is best used to support educators, but over-reliance may undermine essential aspects of teaching, such as empathy, mentoring, and human interaction. Holmes et.al (2019) suggested that the optimal approach is to supplement teaching with AI, maintaining a balanced and integrated educational environment. In conclusion, existing research strongly supports the idea that AI could transform student learning and engagement in higher education. Adaptive systems, intelligent tutoring, predictive analytics, and inclusive technologies demonstrate how AI can meet diverse learner needs. However, for AI to be effective, its implementation must be ethically sound, infrastructure-ready, and aligned with human teaching. Further research, especially in emerging fields, is necessary to ensure AI-driven education remains fair, effective, and accessible for all students.

The Current Study

The increasing use of AI tools in education has raised apprehensions about how effectively AI can boost personalized learning at the university level. While AI-powered tools could be used to customize learning experiences for individual students, there has been limited research on how they affect learning outcomes, student engagement, and academic success. Additionally, there is a lack of research on issues related to fairness, data privacy, and potential biases in AI systems across various learning environments. This study aims to examine the role that AI tools play in enhancing students' engagement and personalization of their learning experiences at the university level.

Objectives of the Study

The study was based on the following objectives.

1. To find out the role of AI tools in enhancing personalized learning.
2. To examine the role of AI tools on students' engagement level.
3. To find out the extent and type of AI tools used by students for their learning.
4. To examine the perceptions of university students about the effectiveness of AI tools on their personalized learning and engagement based on gender and type of university.

Research Questions

The following research questions were based on the objectives of the study.

1. What is the role of AI tools in enhancing personalized learning?

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2. What is the role of AI tools in students' engagement level?
3. To what extent and what types of AI tools do students use for their learning?
4. What are the perceptions of university students about the effectiveness of AI tools on their personalized learning and engagement based on gender and type of university?

Significance of the Study

The study is important because it could provide valuable insights into how AI might transform personalized learning at the university level. It is crucial that the use of AI innovations in universities, for academic success, and for different learning styles continues to grow steadily. This research study will also evaluate how effectively AI tools and platforms can meet the needs of diverse students. This information will help universities make informed decisions about whether or not to adopt AI-based solutions. The study also addresses key ethical issues like fairness and data privacy to ensure that AI use in education promotes inclusion and responsible practices. The findings will be highly valuable for teachers, administrators, and policymakers aiming to maximize personalized learning opportunities and improve the overall quality of education.

Methods and Procedures of the Study

The study employed a quantitative research method to investigate the role of Artificial Intelligence (AI) tools on personalized learning and student engagement at the university level. A quantitative approach was chosen because it gathers structured data suitable for statistical analysis. A descriptive survey design was employed, which effectively explores attitudes, behaviors, and perceptions within a large group of people. This approach enabled the researchers to examine how AI tools impact learning processes and student engagement in universities. Since the study was descriptive, it involved collecting numerical data through standardized instruments, which are essential for meaningful statistical analysis. Participants included students from two public universities in Faisalabad, Pakistan: The University of Education, Lahore, Faisalabad Campus (UE FSD), and Government College University, Faisalabad (GCUF). These institutions were selected due to their growing interest in integrating AI technologies into teaching and learning. Random sampling was used to ensure fair representation and reduce bias. The total sample consisted of 200 undergraduate and graduate students from various departments, mostly from those engaged in technology-enhanced learning. To qualify, students needed to have used AI-based learning platforms such as virtual tutors, adaptive learning systems, chatbots, and recommendation tools at least once. They were also asked to provide information about other tools used by them for their studies. They were further asked to rate the used AI tools as per their choice and use.

Instrumentation

Data were collected using a self-developed questionnaire based on a 5-point Likert scale (ranging from "Strongly Disagree - 1" to "Strongly Agree - 5"). The instrument was specifically designed to assess two key variables:

1. Personalized Learning – evaluating AI's role in adapting content to individual needs, providing feedback, and customizing pace.
2. Student Engagement – measuring motivation, participation, interactivity, and perceived academic improvement through AI tools.

The questionnaire was divided into two parts:

1. Demographic Section: gender, university, program, and level of study.

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2. Statements related to personalized learning and engagement: consisting of 40 items.

Validity and Reliability of the Instrument

Three academic experts in educational technology and research methodology reviewed the questionnaire to ensure its content validity. The researchers used their feedback to clarify the items, align them more closely with the research goals, and improve their relevance. A small group of 50 students participated in a pilot study to assess the reliability and consistency of the instrument. Some minor changes were made to the language and structure of the items based on the pilot results.

Table 1

Reliability of the Instrument

No. of Items	Cronbach's Alpha
40	0.946

The Cronbach's Alpha value calculated was 0.946, indicating a very high level of reliability and internal consistency of the questionnaire.

Data Collection and Analysis

The researchers distributed the questionnaires after obtaining ethical approval from the relevant institutions. Participants were informed about the purpose of the study and that their responses would be kept private and anonymous. They were told that they could choose to participate and provided their informed consent before any data were collected. It took a couple of weeks to gather all the data, which gave students enough time to think about their answer

Statistical Package for Social Sciences (SPSS) Version 26 was used to analyze the gathered data. The analysis employed both types of statistics, namely, descriptive statistics and inferential statistics. To summarize the results and identify patterns in the responses, some of the most important analytical steps were:

Mean and Standard Deviation: to measure central tendency and variability for each item.

Frequency Distribution: to observe the distribution of responses across the Likert scale.

Independent samples t-test: to compare the means of the male and female students and the type of university they are studying, regarding the use of AI tools. The statistical significance level was set at $p < 0.05$, which is a standard threshold in educational research.

Results

The study results have been presented below in both tabular and descriptive form.

Table 2

Demographic Attributes of the Participants

Demographic Variables	F	%
Gender		
Male	124	62.0
Female	76	38.0
Institution-Based Participants		
University of Education, Lahore, Faisalabad Campus	112	56.0
Government College University Faisalabad	88	44.0

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The demographic attributes of the participants revealed that out of the total participants, 62.0% (124) were male, while 38.0% (76) were female, indicating a male-dominated sample. In terms of institutional affiliation, 56.0% (112) of the participants were from the University of Education, Lahore, Faisalabad Campus, while 44.0% (88) were from the Government College University, Faisalabad.

Table 3

AI Tools' Impact on Personalized Learning and Students' Engagement

Statements	N	Mean	Standard Deviation
I often use AI tools in my studies.	200	4.08	0.92
AI tools help me understand complex topics more easily.	200	4.24	0.92
I use AI-based Quizzes to review or clarify topics before exams.	200	3.62	1.10
Using AI tools makes me feel more confident in my learning.	200	3.81	0.94
I find AI-based explanations more helpful than those in my textbooks	200	3.62	0.98
AI tools/Chatbots encourage me to think critically about the information they provide.	200	3.48	1.08
OpenAI/ChatGPT helps me brainstorm ideas for my assignment work and projects.	200	3.90	0.93
I find AI tools' explanations more helpful for reviewing course material.	200	3.80	1.01
AI helps me identify and correct grammatical mistakes in my writing.	200	4.02	0.94
Using AI has improved my vocabulary and word choice in assignments.	200	3.86	0.97
AI Quizzes enhance my ability to memorize information effectively.	200	3.66	0.99
AI allows me to track my progress in mastering different topics and subjects.	200	3.68	0.88
Using AI tools like OpenAI/ChatGPT has improved the quality of my written work.	200	3.74	0.89
I believe that AI tools foster my creativity in writing skills.	200	3.55	1.01
Artificial Intelligence tools help me learn at my own pace.	200	3.90	0.89
I appreciate receiving immediate feedback from AI tools/Chatbots.	200	4.06	0.73
AI tools/Chatbots help reduce my frustration with challenging material and coursework.	200	3.86	0.73
Artificial Intelligence tools encourage me to participate actively in class.	200	3.52	1.01
I feel that OpenAI tools highlight the areas where I can improve.	200	3.60	1.04

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I feel engaged and more connected to my learning when using AI tools.	200	3.65	1.10
AI tools/Chatbots encourage me to explore additional questions on the topics I study.	200	3.92	0.78
AI-powered software enhances students' creative potential.	200	3.42	1.14
AI tools enhance learning efficiency for university students in science education.	200	3.78	0.86
Open AI tools tailor educational content to individual student needs.	200	3.98	0.79
AI fosters the exploration of new creative ideas in studies.	200	3.81	0.82
The suggestions provided by AI are relevant to my educational needs.	200	3.82	0.89
I often use AI tools in my research work.	200	3.94	0.80
AI-powered tools save students time and energy during research work.	200	4.14	0.66
OpenAI/ChatGPT helps students complete projects more effectively and efficiently.	200	3.91	0.78
I would recommend using AI tools as a learning tool for other students.	200	3.83	0.95
I benefit from seeing my strengths and weaknesses in real time.	200	4.08	0.91
AI tools cater to individual interests in education.	200	3.20	1.06
AI can increase student engagement in instruction.	200	3.70	0.91
I feel supported by the personalized feedback I receive.	200	4.36	0.72
I like the variety of learning methods available with AI.	200	4.03	0.92
AI simplifies complex concepts into simple ones for education.	200	3.55	1.12
AI provides access to a wide range of resources for learning.	200	3.98	0.85
Students can benefit from instant feedback via artificial intelligence.	200	4.08	0.94
AI tools help to improve the accuracy of data analysis in research.	200	3.32	0.72
AI tools promote self-directed learning among students.	200	4.86	0.76

The data presented in Table 3 illustrates university students' perceptions regarding the impact of AI tools on personalized learning and engagement. Responses from 200 participants were recorded, with mean scores and standard deviations calculated for each statement. The findings indicate that students generally hold positive views towards the use of AI tools in education.

The students were asked about the extent and purposes for which they use AI tools. The students provided a list of the AI tools they use for learning, arranged by their use.

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Table 4
Major AI Tools Used by University Students for Their Learning and Engagement

Sr.#	AI Tools	Mean
1.	Chat GPT	4.42
2.	Chatbots	4.29
3.	Canva	4.25
4.	Copilot	4.11
5.	Grammarly	4.07
6.	Kahoot	3.96
7.	Duolingo	3.84
8.	QuizBot	3.75
9.	Zotero	3.58
10.	Gemini	3.37

Table 4 lists AI tools commonly used by university students for their academic learning and engagement. The frequency and extent of AI tool use are shown through average scores. Overall, the findings show that students prefer AI tools that directly support academic writing, provide instant feedback, and assist with content creation. Productivity tools such as Grammarly and Zotero, along with gamified learning platforms like Kahoot and Duolingo, are also appreciated, but to a lesser extent. Emerging tools like Gemini are not yet widely used by university students.

Table 5
Comparison of Male and Female Students Regarding the Use of AI Tools For Personalized Learning and Engagement Level

Gender	**N**	**M**	**Sd**	**t**	**Df**	**p**
Male	124	3.80	0.59	-.222	198	0.83
Female	76	3.82	0.42			

An independent samples t-test was used to compare male and female students' use of AI tools for personalized learning and engagement. Female students (M=3.82, SD=0.42) had slightly higher scores than male students (M=3.80, SD=0.59). There was no significant difference (t (198) =-0.22, p=0.83). This suggests that both students reported similar levels of AI tool use for personalized learning and engagement.

Table 6
University-Wise Comparison Regarding the Use of AI Tools for Personalized Learning and Engagement Level

University	**N**	**M**	**Sd**	**t**	**Df**	**P**
UE FSD	112	3.79	0.50	-.746	198	0.46
GCUF	88	3.84	0.57			

An independent samples t-test was used to compare students' use of AI tools for personalized learning and engagement across sampled universities. GCUF students (M = 3.84, SD = 0.57) reported slightly higher scores than those from UE Faisalabad (M = 3.79, SD = 0.50). this difference was not statistically significant, t (198) =-0.75, p=0.46. This

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suggests that students of sampled universities reported similar levels of AI tool use for personalized learning and engagement.

Findings

This section outlines the role of AI tools in impacting personalized learning and student engagement at the university level. The analysis uses data from a structured 5-point Likert scale questionnaire completed by 200 university students. The data were examined with both descriptive and inferential statistical methods. The results reveal students' feelings, experiences, and observed outcomes when AI is used in educational settings like universities. These findings are compared to existing literature. The descriptive analysis revealed that most students had positive experiences with AI-based learning tools. Concerning personalized learning, students agreed that AI platforms let them learn at their own pace, receive timely feedback, and find content suited to their needs. Specifically, items related to adaptive learning, feedback systems, and content personalization received high means, indicating strong agreement. The study confirms that adaptive platforms help students take more control of their learning, leading to better grades and increased motivation. On the other hand, the engagement section of the questionnaire also showed similarly strong positive trends. Most students agreed that AI tools kept them interested and supported their coursework immediately. Items measuring participation, motivation, and interaction with AI tools demonstrate a high perceived level of engagement. Female students (M=3.82, SD=0.42) scored slightly higher than male students (M=3.80, SD=0.59). There was no significant difference (t (198) =-0.22, p=0.83). This indicates that both groups reported similar levels of AI tool use for personalized learning and engagement. Despite these findings, the overall results suggest that integrating AI into higher education greatly enhances both personalized learning and student engagement. These outcomes highlight the potential of AI technologies to make education more student-centered, responsive, and accessible. They also emphasize the importance of establishing proper infrastructure, policies, and strategies to ensure AI tools are used ethically and fairly. Like previous research, this study stresses the need for more investment in AI-driven educational technologies and teacher training. Educators must learn to effectively use AI tools in their classrooms and interpret the data these systems generate to make informed decisions. Ultimately, these results add to a growing body of evidence showing that AI can transform university teaching. Due to its ability to offer greater flexibility, personalization, and immediate support, AI provides a valuable opportunity to improve education and student success in the digital age.

Conclusion

This study examined how AI tools influence university students' learning and engagement. The results showed that AI tools improve personalized learning by adapting the material to meet each student's needs, pace, and preferences. Students who used AI-powered platforms were more motivated, better able to understand complex ideas, and more likely to complete their university work.

Additionally, using AI tools helped teachers monitor their students' progress more effectively and provided timely feedback. It also encouraged students to think critically and learn independently. However, there are still issues such as unfamiliarity with technology, technical difficulties, and limited access to AI resources, which can prevent AI from reaching its full potential in higher education.

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The study's overall conclusion is that AI has significant potential to transform university education by making learning more personalized, interactive, and engaging, provided that proper infrastructure and training are in place to support its implementation.

There are both advantages and disadvantages to the increasing use of AI in universities. The research's particular focus on university students highlights how AI tools like chatbots, automated quizzes, and writing aids are transforming the way people learn. Combining these technologies has made learning easier to learn and more flexible. Students can now receive feedback immediately, figure things out on their own, and study at their own pace. This aligns with what people worldwide have observed. AI tools can support formal education by encouraging students to learn independently and increasing their interest in the material.

The benefits of AI in education are becoming clearer, but the conversation also needs to address its limitations. Students appreciate that AI can assist with writing and research and make complex information easier to understand, but they still worry that relying too much on AI could hinder their ability to think creatively and outside the box. AI tools also don't always align with each student's interests or optimal learning styles. This highlights the gap between what technology can do and what learners actually need in terms of learning. While AI can support certain aspects of learning, it can't fully replace teachers when it comes to teaching social skills, creativity, and critical thinking. In a broader sense, these findings demonstrate that AI is better seen as a tool to assist people rather than as a standalone solution. It works best when integrated thoughtfully into universities that balance technology with face-to-face communication. As AI tools improve, it's clear that teachers, developers, and policymakers need to collaborate to ensure these technologies are designed in ways that genuinely consider the diverse needs of students. This will not only help them learn quickly but also aid their personal growth and maintain their academic integrity.

Recommendations

The following recommendations can be suggested on the basis of the study in different areas of education:

Using AI tools in the classroom: AI tools shouldn't just be additional resources; they should be a central part of teaching methods that make learning more personalized.

Data Privacy and Ethics: All educational institutions, including universities, need to ensure that AI tools are used in an ethical way to protect student information.

Training for Teachers and Students: Universities should hold regular training sessions to help educators and learners become more digitally literate, enabling them to use AI tools effectively in their classrooms and during study.

Investing in Infrastructure: Educational institutions need to purchase high-speed internet, new devices, and reliable software to facilitate AI-based educational platforms working seamlessly together.

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