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# Impact of Artificial Intelligence on Student Learning Outcomes – Advantages and Pitfalls

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## Abstract

AI is revolutionising education by bringing cutting-edge, individualised solutions that change how instructors and students learn. With the use of adaptive learning technologies, AI-powered solutions allow students to improve their academic performance, target areas that need development, and advance at their own speed. Education becomes more personalised, engaging, and accessible as a result of these developments. But there are also issues with incorporating AI into education, such as an excessive dependence on technology that might impair students' ability to think critically, be creative, and solve problems. In academic settings, concerns are also raised about the digital gap and the moral implications of artificial intelligence. The focus of this research paper is on the advantages and challenges of "Artificial Intelligence (AI)" in the swiftly changing educational landscape, with an emphasis on its influence on student learning outcomes. This study also aims to assess the dual role of AI—whether it serves as a blessing by revolutionizing education or poses risks that hinder holistic student development. To provide a comprehensive understanding, data was collected using secondary sources as well as primary using structured questionnaires distributed via Google Forms, capturing diverse perspectives on AI's impact on learning processes and overall performance. The research also examines whether AI-driven approaches can complement or effectively replace traditional teaching methods. Through this analysis, the paper offers valuable insights into how AI influences educational practices, student engagement, and performance outcomes, ultimately contributing to the broader discourse on the future of technology in education. The findings aim to inform educators, policymakers, and technologists in navigating the advantages and pitfalls of AI to optimize its potential for "student success".

**Keywords;** Artificial Intelligence (AI), Student learning outcomes, AI in education, Overreliance on AI, Future of Education.

## INTRODUCTION

The education sector has recently devoted significant attention to artificial intelligence (AI), a machine-driven technology that is propelled by algorithms proficient of generating predictions, diagnoses, recommendations, and decisions. AI has the potential to improve learning across a variety of contexts. It is profoundly changing education and having an impact on how institutions operate, instructors instruct, and students learn. Universities and schools can offer more engaging, efficient, and personalised learning experiences by incorporating AI into their curriculum. By customising education to accommodate the distinctive requirements of each student, AI functions as a potent instrument that improves the process of learning and teaching. By providing tools that accommodate a wide range of learning requirements, AI fosters inclusivity in the field of education. The combination of AI into education fosters a close relationship between technology and learning processes. The relationship between AI and Education is not without challenges. The relationship reflects a symbiotic progression where education drives the demand for AI innovation, while AI introduces tools and techniques that redefine the educational landscape.

AI and education are dynamic and transformative with processes centered on personalization, automation, collaboration and inclusivity. Artificial intelligence (AI) has the potential to be a boon since it can automate administrative processes, personalise learning, and provide real-time feedback. The possible drawback of AI is its over-reliance, which might impede the growth of social, problem-solving, and critical thinking abilities. AI technologies are enhancing learning outcomes by enabling adaptive learning environments where students can progress at their own pace. However, the increasing dependency on AI presents a number of problems, such as the potential for students' problem-solving and critical thinking abilities to deteriorate as a result of relying too much on technology rather than discovering answers on their own. Ethical concerns about data privacy, fairness and accountability further complicate its adoption and as AI continues to evolve, it presents a dual role in education serving both as an advantage by improving outcomes and a potential pitfall by risking over-dependence on technology. The economy, as well as all other aspects of human society, have been significantly affected by the rapid advancements in AI technologies. AI is changing education by making learning more personalized and engaging. It helps create lessons tailored to each student needs making it easier for them to understand and stay interested. Tools like virtual tutors and adaptive platforms give students' real-time support and unique learning experiences. AI also takes over routine tasks giving teachers more time for creative teaching. AI is poised to revolutionize education by reshaping traditional approaches and enhancing learning experiences. Boosting engagement and comprehension, its capacity to personalise instruction ensures that content is tailored to the unique requirements of each student. Adaptive learning platforms and virtual tutors provide real-time support, fostering independent and dynamic learning. On top of that, AI simplifies administrative responsibilities, allowing educators to concentrate on interactive and innovative teaching methods. Future advancements such as AI-powered virtual labs and immersive simulations promise to make education more engaging and effective. AI-driven assessments will go beyond conventional testing offering a holistic understanding of students' capabilities. This research explores all these dimensions to understand AI's true impact on student learning.

## OBJECTIVES

- To find out the relationship between AI and education
- To find out the importance or advantages of AI in students' learning outcomes

- To find out if AI is a blessing or disguise for students

## LIMITATION

With an emphasis on both its benefits and drawbacks, this study examines how AI affects students' learning results. It is important to note that this study is limited in scope as it primarily considers data from structured questionnaires distributed to a specific targeted groups which may not accurately represent the diverse experiences of students from different socio-economic, cultural and regional backgrounds. The data was collected in December 2024 with a sample size of 104 respondents from various age groups and different courses with different backgrounds. The study also focuses on current AI applications which may become outdated as technologies continue to advance rapidly.

## RESEARCH METHODOLOGY

This study examines how AI affects student learning outcomes using a qualitative research technique. The study particularly focuses on the introduction of the AI in education and its adoption and usage in students of various age groups and pursuing different courses with different cultural and socio-economic backgrounds. The research relies on primary data sources such as data collected through questionnaires which provide insights into the relationship between AI and education and the importance or advantages of AI in students' learning outcomes. Additionally, secondary sources like articles, journals and government reports were also used to provide a broader context.

## ANALYSIS AND DISCUSSION

### Evolution of Artificial Intelligence

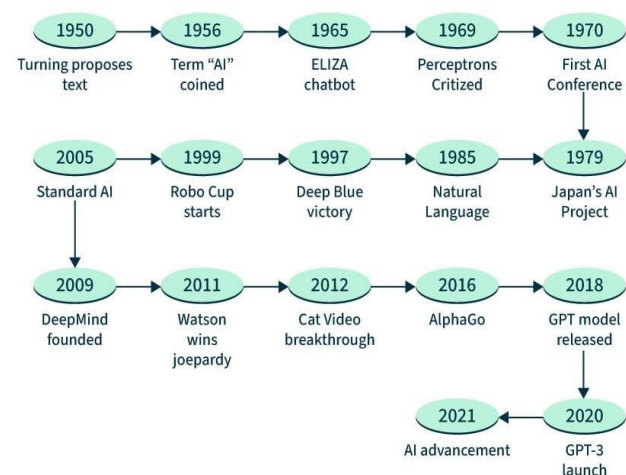


Figure 1 - Evolution of Artificial Intelligence

Source: - <https://www.geeksforgeeks.org/evolution-1>

From a science fiction idea to a potent technology that affects business, healthcare, education, and daily life, "artificial intelligence (AI)" has advanced significantly. The journey of AI can be divided into different stages, each marked by new discoveries and innovations.

- **“The Dawn of Artificial Intelligence (1950s-1960s)”**: The 1950s are considered to be the birthplace of AI. The Turing Test, a technique for determining a computer's intelligence, was first presented by Alan Turing in his 1950 book *Computing Machinery and Intelligence*. When John McCarthy invented the phrase "artificial intelligence at the Dartmouth Workshop" a few years next, in 1956, it marked a major advancement in AI research. During the 1950s and 1960s, early AI research aimed to program computers to imitate human reasoning using symbolic logic. However, due to limited resources and low computing power the progress was slow. These early AI systems sought to replicate human knowledge through logic-based reasoning but the lack of advanced technology at the time hindered their development.
- **“AI’s Early Achievements and Setbacks (1970s-1980s)”**:- Notable advancements as well as challenges have occurred during this era. Artificial intelligence experienced the emergence of expert systems in the 1970s, which were intended to harness the expertise of professionals in a variety of disciplines. Rule-based systems were developed by data scientists to address certain issues by using predetermined rules. The actual use of these systems was constrained by their limited capacity to manage ambiguity and complicated circumstances. This era also marked the beginning of the "AI Winter" (1970–1980), a period when interest in AI declined due to unmet expectations and a decline in funding resulting in slower advancements in the field.
- **“Machine Learning and Data-Driven Approaches (1990s)”**:- AI underwent a radical change in the 1990s. A move towards machine learning methodologies occurred in the 1990s, when algorithms used methods including bolster vector machines, decision trees, and neural networks to learn from data. Neural networks, which draw inspiration from the human brain, gained popularity for tasks like movie recommendation, stock market prediction, and voice recognition. The availability of more data and increased processing power further fueled the growth of AI, leading to advancements in data-driven applications. New fields including natural language processing (NLP), picture recognition, and recommendation systems started to appear. Driven by greater computer power and data availability, AI achieved tremendous improvements during this period, which is regarded as the Golden Age of AI. These developments included voice recognition, stock forecasting, and personalised recommendation systems.
- **“The AI Boom: Deep Learning and Neural Networks (2000s-2010s)”**:- Neural systems and deep learning emerged in the twenty-first century. A significant advancement in AI occurred between the 2000s and the 2010s because to deep learning, a subfield of machine learning that draws inspiration from the composition and operations of the human brain. Multi-layered neural systems known as deep neural systems excelled in areas like “image recognition, natural language processing (NLP)” and gaming and technological advancements in deep learning brought major improvements in speech recognition, computer vision and NLP. Leading tech companies like “Facebook, Google and OpenAI” made substantial investments in AI research fostering further innovation. Deep learning advancements relied on complex algorithms inspired by interconnected neurons allowing AI to execute tasks with higher accuracy and efficiency.
- **“Generative Pre-trained Transformers: A New Era (GPT Series)”**:- Generative Pre-trained Transformers are a new development in recent years. The GPT series, developed using extensive text data has a profound global impact. Particularly, GPT-3 transformed language processing by producing human-like text and facilitating language translation. Large volumes of material are absorbed by these models, which helps them understand grammar, context, and even humour. Beyond translation, GPT-3 acts as a powerful writing assistant capable of producing essays, poetry and other forms of creative content. The next generation of AI models including Bard, ChatGPT, Gemini, Bing and Copilot can write,

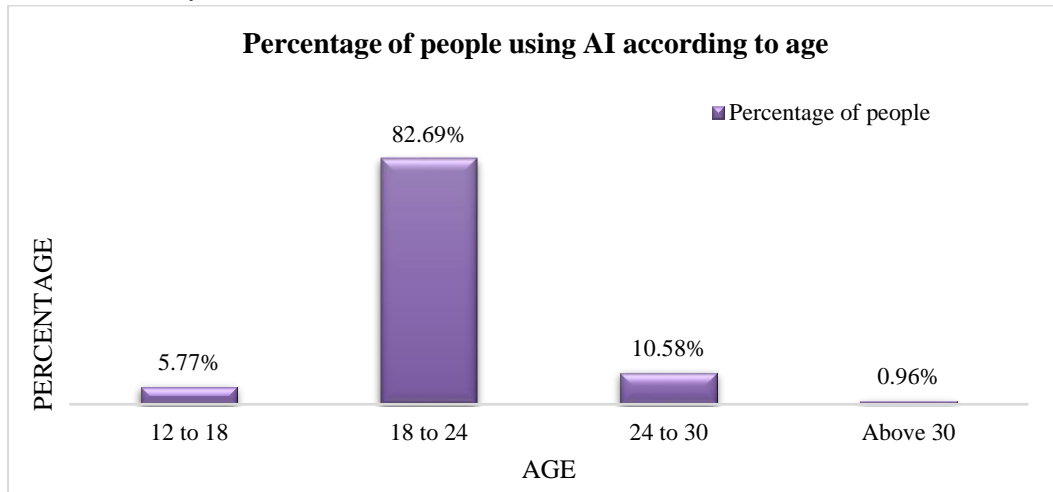
translate and generate original content and also provide insightful responses. These developments have increased AI's potential by demonstrating its ability in language translation, creative endeavours, and content production.

The evolution of AI has moved from simple logic-based programs to highly advanced systems that can understand, learn and interact with humans. As AI develops further, it will have both positive and negative effects on education, particularly on student learning results. Exploring AI's evolution helps us recognize its role in shaping modern learning and our interaction with technology.

#### **Relationship between AI and Education**

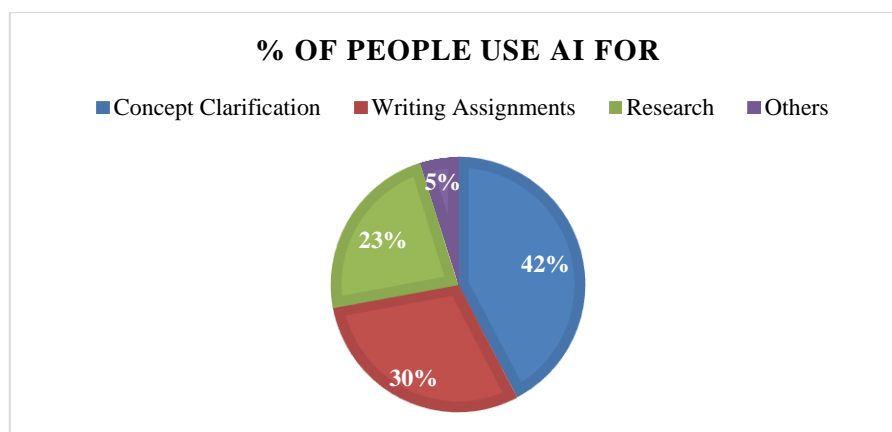
"Traditional teaching and learning approaches" are being reshaped by the revolutionary interaction between AI and

education. By assessing each student's unique requirements and modifying instructional materials appropriately, AI offers individualised learning experiences that improve understanding and engagement. "Dynamic learning environments" that adapt to a student's speed and development are produced by AI-powered adaptive learning systems. Furthermore, AI has the capacity to automate administrative duties, including record-keeping and assessment, thereby enabling educators to concentrate on "interactive teaching and mentoring". AI-driven tools like virtual tutors and intelligent assessment systems foster independent learning by providing instant feedback and support. The future of education might be redefined by the potential for this AI-education synergy to make learning more effective, inclusive, and accessible.



**Figure 2 - Percentage of people using AI according to age**

According to figure 2, out of the total 104 people 5.77% are between the age of 12 and 18, 82.69% are between the age of 18 and 24, 10.58% are between the age of 24 and 30 and 0.96% are above 30.



**Figure 3 - Percentage of people use AI for**

According to figure 3, out of the total 104 people 42% use AI for concept clarification, 30% use AI for writing assignments, 23% use AI for research and 5% use AI for

other purposes like doubt clearing, analysis or interpretation of data, etc.

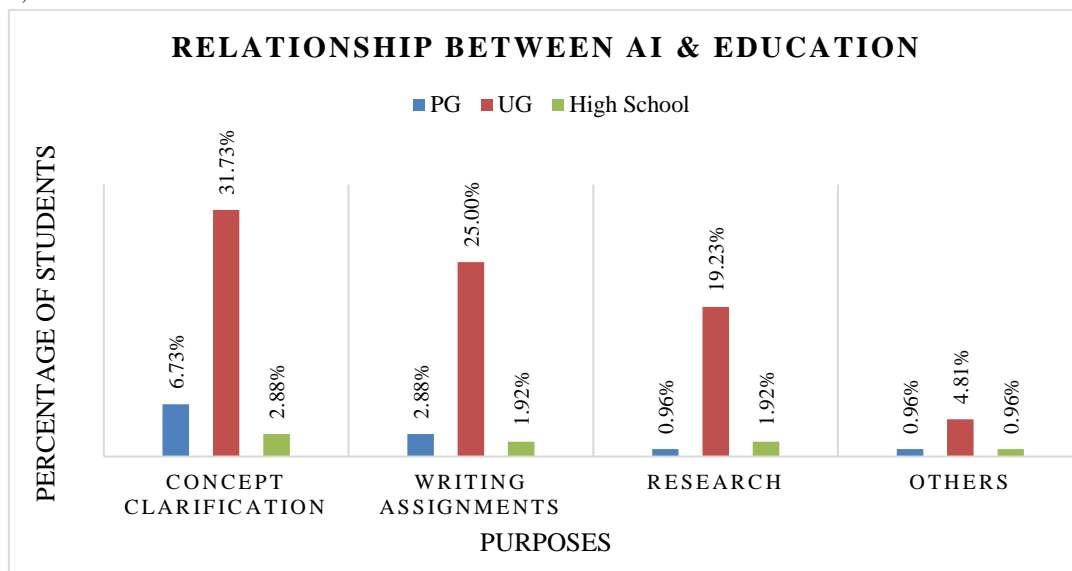


Figure 4 - Relationship between AI and Education

According to figure 4, Out of the total 11 postgraduate students 6.73% use AI for concept clarification, 2.88% use it for writing assignments, 0.96% use it for research purposes and rest 0.96% use it for other purposes like doubt clearing, analysis or interpretation of data, etc. Out of the total 86 undergraduate students 31.73% use AI for concept clarification, 25% use it for writing assignments, 19.23% use it for research purposes and rest 4.81% use it for other purposes. Out of the 7 high school students 2.88% use AI for concept clarification, 1.92% use it for writing assignments, 1.92% use it for research purposes and rest 0.96 use it for other purposes.

#### Advantages of AI in Students' Learning Outcomes

Education is being revolutionised by Artificial Intelligence (AI), which offers personalised learning, immediate feedback, and improved accessibility. AI is helping students learn more efficiently and effectively.

- **Personalized Learning for Every Student:** - AI-driven educational platforms personalize each student's unique learning style by adapting to their individual needs. AI generates personalised study programs to improve comprehension by evaluating a student's learning patterns, assets, and shortcomings. In order to ensure that students study at a comfortable rate, adaptive learning systems like "Khan Academy and Coursera" modify the

complexity of the lessons according on the students' progress. AI facilitates the comprehension of complex subjects by offering alternative explanations, thereby facilitating students' comprehension.

- **Instant Feedback and Assistance:** - Students often struggle with delays in receiving feedback on their assignments and exams, AI helps solve this by instantly grading quizzes, multiple-choice tests and even essays using advanced assessment tools. It also provides detailed explanations for incorrect answers allowing students to learn from their mistakes. AI-powered tutoring assistants like ChatGPT and Socratic offer immediate explanations for difficult topics, giving students the support they need when they need it.
- **Improved Accessibility:** - Through the utilisation of tools such as text-to-speech and speech-to-text, AI enhances the accessibility and inclusivity of education for students with visual or auditory impairments. AI-powered translations help non-native speakers understand lessons in their preferred language. Smart tools offer personalised reading and writing assistance to students who are dyslexic or have other learning disabilities.
- **Increased Engagement and Interactive Learning:** - AI boosts student engagement by creating "interactive and gamified learning



experiences". With "AI-powered virtual reality (VR) and augmented reality (AR)", students can explore immersive learning environments that make education more exciting. AI also enhances motivation through educational games that make learning fun. AI also suggests videos, animations and real-world examples to help students understand complex topics more easily.

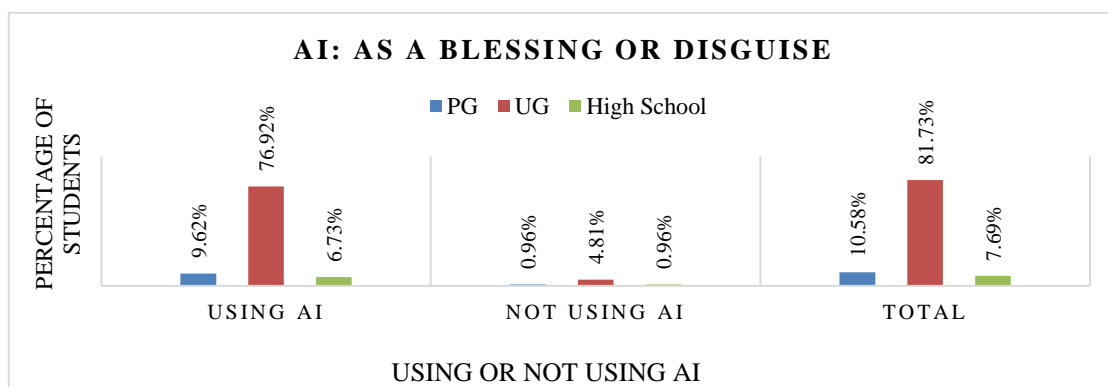
- **Efficient Time Management:** - AI helps students manage their time more effectively by organizing their schedules and study plans. AI tools remind students about deadlines, suggest study breaks and create efficient learning routines. Smart apps analyze performance and offer tips on how to improve time management skills. Automated reminders and progress trackers also help students stay on track and focused on their goals.
- **Enhanced Teacher Support:** - AI supports teachers by helping them deliver quality education more efficiently. It saves instructors time by automating duties such as grading, allowing them to engage in more personalised interactions with students. AI also analyzes student performance data, helping teachers spot learning gaps and offer focused support. With AI-generated insights, teachers can create better lesson plans and improve student learning outcomes.
- **Availability of Learning Anytime, Anywhere:** - AI makes education flexible and accessible beyond traditional classrooms. Students can use AI-powered learning resources anytime, anywhere, allowing them to learn at their own pace. Online AI tutors, educational apps and e-learning platforms offer continuous support. This flexibility is especially useful for students who cannot attend

regular classes due to personal reasons or geographic limitations.

AI is transforming education by personalizing, engaging, and making learning more accessible. It boosts student engagement, provides immediate feedback, and helps teachers enhance learning outcomes. With AI, students can learn more efficiently and effectively, improving their academic performance and skill development. Nevertheless, though AI offers a plethora of benefits, it should be employed as an adjunct to conventional education rather than as a substitute.

#### *AI: A Blessing or a Disguise for Students?*

AI is both a blessing and a potential disguise for students depending on how it is utilized. On one hand, AI serves as a powerful tool that enhances learning by personalizing education, offering virtual tutors, automating administrative tasks and providing instant feedbacks. It enables students to access diverse resources, engage in immersive learning experiences and overcome traditional barriers to education. AI-powered adaptive learning platforms, for example, enhance academic outcomes and comprehension by adapting to the unique learning styles of each individual. Conversely, AI may serve as a guise if it is misused, as an excessive reliance on AI tools may impede critical thinking, creativity, and problem-solving abilities. It can lead to academic dishonesty with students relying on AI-generated answers instead of understanding concepts. In addition, the educational disparity among privileged and underprivileged pupils may be exacerbated by the asymmetrical access to AI technology. Ultimately, whether AI is a blessing or a disguise depends on its integration into education. When used responsibly, it has the potential to revolutionize learning. However, safeguards must be in place to ensure its support and complements student development rather than replacing essential skills.



**Figure 5 - AI: As a Blessing or a Disguise**

According to figure 5, out of the total 10.58% of postgraduate students 9.62% use AI and rest 0.96% do not use AI. Out of the total 81.73% of undergraduate students 76.92% use AI and rest 4.81% do not use AI. Out of the total 7.69% of high school students 6.73% use AI and rest 0.96% do not use AI. This indicates that the students who use AI consider AI as a blessing as it provides personalized learning for all and also helps them for various purposes like concept clarification, writing assignments, doubt clearing, research, etc and also it is easy to use, always accessible and time saving. But, the other students who do not use AI consider it as a disguise because they think that AI can increase overdependency on AI and can hinder the critical thinking capacity of students. Also, they think it has several disadvantages like lack of human interaction, privacy concerns, lack of personalization, etc.

### ***Ethical and Practical Considerations***

As AI becomes more integrated into education it brings both ethical and practical challenges that must be carefully considered. While AI enhances learning outcomes its widespread use raises concerns about data privacy, fairness, accessibility and the overall impact on student development.

- “Proportionality and Do No Harm”:- AI systems should be used only to the extent necessary to achieve a legitimate purpose. It is essential to conduct risk assessments to identify and prevent potential harms that may arise from their implementation.
- Safety and Security:- AI systems in education must be designed to prevent potential risks, ensure data privacy and protect students from misinformation or over-reliance. Strong security protocols must be implemented to safeguard student information from cyber threats and unauthorized access.
- “Right to Privacy and Data Protection”:- Student privacy must be safeguarded at every stage of AI integration in education. Strong data protection measures should be established to prevent unauthorized access, ensure secure storage, data handling and promote ethical use of personal information.
- Responsibility and Accountability:- AI systems in student learning must be transparent and accountable. There should be mechanisms for oversight, impact assessment, and regular audits to ensure that AI tools align with ethical standards. These processes help safeguard student rights, promote fairness and prevent any potential negative

effects on their educational experience or wellbeing.

- Fairness and Non-Discrimination:- AI in student learning should uphold fairness, inclusivity and non-discrimination, ensuring equal access to educational benefits for all students. AI tools must be designed to eliminate biasness, promote social justice and provide personalized learning experiences that accommodate diverse needs fostering an equitable learning environment.
- “Awareness and Literacy”:- In order to improve comprehension of the ethical implications, data utilisation, and function of AI, it is imperative to provide accessible and open education that promotes public understanding of data and AI. This involves fostering digital skills, critical thinking and media literacy, enabling students to use AI-powered educational tools responsibly and make informed choices in a technology-driven world.
- Integration with Traditional Teaching Methods:- Traditional instructional methods should be supplemented by AI, not replaced. Teachers play a critical role in mentoring and guiding students and AI should be used to enhance, rather than substitute human interaction in education.
- Teacher Training and Adaptation:- Educators need proper training to effectively use AI tools in classrooms. AI's potential benefits for students may be restricted by the difficulty that instructors may experience in incorporating "AI into their teaching strategies" in the absence of sufficient knowledge.
- Cost and Infrastructure:- Integrating AI into education demands substantial investment in technology, software, and infrastructure. Schools and universities especially in developing regions may find it challenging to afford AI-based learning solutions. Policymakers must ensure cost-effective ways to integrate AI into education systems.
- Monitoring and Ethical Use Policies:- In order to regulate the use of AI in education, it is imperative to establish explicit policies and guidelines. Regular monitoring is essential to prevent misuse and ensure that AI applications align with ethical standards and educational objectives.

As AI continues to shape education, it is crucial to balance its benefits with ethical and practical considerations. It must be used ethically and responsibly, ensuring fairness, privacy and accountability. With proper policies, investment and oversight, AI can create an inclusive and innovative learning

environment that enhances student outcomes while upholding ethical standards.

## CONCLUSION

“Artificial Intelligence (AI)” has become a powerful force in education by bringing significant changes in student learning outcomes. The addition of AI-powered tools enables the student’s access to personalized learning experiences, receive instant feedback and benefit from improved accessibility to academic resources. However, our research has highlighted that the implementation of AI in education has both positive and negative implications offering both advantages and challenges.

The data collected from 104 respondents indicates that 82.69% of students in the age group of 18-24 actively use AI for various academic purposes, with 42% relying on it for concept clarification, 30% for writing assignments and 23% for research. This indicates that AI is becoming an integral part of modern education complementing traditional learning methods and enriching academic engagement. Furthermore, the findings show that 93.27% of students believe AI has positively impacted their academic performance, mainly due to benefits like personalized learning, instant feedback, time efficiency and access to large amount of information or knowledge.

However, the study also reveals concerns regarding AI’s influence on students’ independent thinking and critical reasoning skills. 66.3% of respondents agree that AI can hinder a student's ability to think independently, highlighting risks such as over-reliance on AI-generated answers, reduced creativity and problem-solving abilities. Additionally, 52.9% of students agree that they have become increasingly dependent on AI for academic tasks, indicating that while AI improves efficiency, it can also reduce human effort in critical thinking, problem-solving and research.

One of the main discussion in this study is whether AI serves as a blessing or a disguise in education. The findings highlight that students who use AI view it as a blessing, recognizing its role in making education more accessible, efficient and engaging. On the other hand, students who do not use AI view it as a disguise, highlighting concerns such as lack of human interaction, privacy issues, over-dependency and potential biases in AI-generated content. This difference in the viewpoints suggests that AI’s impact on education largely depends on how it is integrated and used by students and educators.

Another significant finding from the study is the concern regarding AI’s ability to replace traditional teaching. 30.8% of respondents believe that AI can replace traditional teaching methods while 31.7% disagree and 37.5% remain uncertain. This suggests that while AI offers various innovative solutions to enhance learning, human educators still play an irreplaceable role in mentoring, emotional intelligence development and fostering creativity in students. Thus, AI ought to be seen as an adjunct to conventional teaching techniques rather than as a substitute for them.

Careful thought must also be given to the practical and ethical implications of AI in education. To guarantee that AI serves all students equally, important concerns including data protection, justice, accessibility, and responsibility must be addressed. Additionally, concerns about bias in AI algorithms, lack of transparency in AI decision-making and the risk of academic dishonesty must be managed through proper policies and regulations.

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