ARTIFICIAL INTELLIGENCE IN EDUCATION: IMPLICATIONS FOR THE ACADEMIC QUALITY OF FUTURE EMPLOYEES

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This study investigates the impact of Artificial Intelligence integration in educational environments on academic performance and competency development. Empirical data demonstrated key differences between traditional methodologies and those based on artificial intelligence. Statistical analysis identified critical implementation variables including resource allocation constraints and technological accessibility parameters. The findings demonstrate that optimal integration of artificial intelligence in educational frameworks requires a systematic approach to maintain pedagogical integrity. This research provides quantifiable metrics in combination with a variety of tests, and statistical analysis, which results in offering a proper foundation for establishing further investigations into educational technology integration and workforce preparation optimization.

Keywords: Artificial Intelligence, Education, Employability, Adaptive Learning Systems, Future Skills

1. Introduction

Artificial Intelligence (AI) has emerged as a transformative force in shaping various industries, with the education sector experiencing particularly significant impacts [1]. In educational settings, AI applications range from streamlining administrative processes to personalizing learning experiences and supporting both educators and students [2]. Common implementations include virtual tutors, adaptive learning platforms, automated assessment systems, and curriculum development tools [3], [4].

Forero-Corba and Bennasar [5] highlight many potential applications for AI in education, such as: predicting school abandonment, enhancing accessibility for

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students with disabilities, improving and creating educational resources, bridging educational gaps, encouraging and guiding students, fostering critical thinking, and early academic performance detection.

This research addresses the need to understand what the long-term consequences of the integration of AI in education will mean for the academic preparation and professional development of future employees [6], [7]. While AI indeed offers solutions through which learning can be optimized and enhanced [8], one concern steadily arises: students may not acquire the critical skills that will make them effectively accommodate the rapid evolution of the job market [9].

In the future, employees will need to be ready for complex problem-solving, critical thinking, and constant adjustment to new professional challenges [10]. The more educators depend on AI in education, the more they risk undermining students' development of these key skills since AI might promote a more passive learning environment and reduce possibilities for deep learning and human interaction.

2. Materials and Methods

This study employs a mixed-methods comparative analysis to evaluate the differential impact of AI tools versus traditional research methods on learning processes and outcomes [8], [11]. Following established educational research methodologies [2], the research design incorporates both quantitative metrics for performance assessment and qualitative analysis of learning approaches [6], [8]. This dual approach enables a comprehensive understanding of how AI integration affects both measurable learning outcomes and the broader educational experience.

The comparative framework was specifically designed to examine learning effectiveness and knowledge retention across different methodological approaches, impact on critical thinking and problem-solving capabilities, and variations in student engagement and learning autonomy.

This methodological approach aligns with recent research in educational technology assessment [12], [13], while addressing the specific challenges of evaluating AI-enhanced learning environments [4], [14].

The experiment applied to the participants, which number 118, is represented by a quiz with two types of questions: nine questions with multiple-choice answers and 16 questions with open-ended or free answers. Because the experiment is meant to focus on the learning process of the individuals, the quiz was designed as a Google Form where the participants could select what method of learning they wanted to use to prepare to answer the same set of questions.

For the AI-assisted version, participants will have the opportunity to use any AI tools, such as ChatGPT, Gemini, or ClaudeAI, before starting the quiz to gather more information about the subject of the experiment: Understanding

Procrastination. Once they have acquired the necessary knowledge, they can begin the quiz.

The second version of learning does not involve AI tools. This method is based on traditional learning (books, notes, online sources such as Wikipedia) and provides the participant who chooses it with learning material about the subject of the experiment, that can be read and assimilated before starting the quiz. To analyze the age-specific effects of AI and traditional search methods, participants are grouped by age in three separate categories, namely: under 18, people between 18 and 30, and over 30. The first category is chosen to represent minors in formal education, providing potential insights into how AI and traditional search might impact learning in younger students, accounting for 45.8% of our participants. The second category represents college students, recent graduates, or people who recently entered the workforce, aimed at offering insights into career readiness, comprising 50% of our participants. Lastly, the third category is comprised of what could be considered experienced professionals in the field and aimed at gaining insights into how AI tools impact their careers. The third group is, however, significantly lower in number, comprising only 4.2% of our participants, likely due to the fact that AI usage for learning is less common past a certain age.

To evaluate our participants on the open-ended free questions we use four different qualifiers weighed to adjust for various phrasings. The formula for how an open-ended question is marked for evaluation can be seen in Equation 1.

$$S = a * A + b * Cl + c * Cr + d * G, \quad (1)$$

where A represents the overall accuracy of the provided answer, Cl is its clarity, Cr is its creativity, and G is the overall grammar used to formulate said answer. All these intermediate qualifier scores are weighed using four different parameters, $a, b, c,$ and d that exist to emphasize more important parts of an answer for evaluation. In our case, we chose them to be 0.4, 0.3, 0.2, and 0.1 respectively. This is done in part because we believe that the most important part when presenting information is overall accuracy and relevance to the information it presents, as well as how clearly it's formulated, thus making it easier for the person to understand receiving this information. Similarly, we believe that repetitive or uncreative answers, as well as those that don't put a strong emphasis on correct grammar, don't detract from the ability to digest the presented information in a proper manner. As for the four intermediate scores, they are all evaluated manually and attributed a value from 0-100.

3. Results

Even though some participants may have naturally engaged, others may have suspected the true intention of the study and adjusted their behavior, influencing the coherence of the data. We started suspecting this while correcting

the tests given, in which we noticed that the average creativity score was 49.64% and that the average clarity score was 83.33%. Although we thought that the AI gave less coherence, either they touched up the content they received, or they just used it as a reference to their responses.

Some participants may have changed their usual way of solving a test, precisely because of the presence of AI and because they know the fact that they are allowed to use this kind of tool, consciously or not. We believe that participants may have relied too much on AI for tasks that they usually handle themselves, which could have affected the authenticity of their responses.

Moreover, it was possible to observe that, although some participants said that they solved the test using traditional methods, after partially correcting and processing the test, we noticed that they were not entirely honest since some of the answers were given with the AI. For example, from the total of 118 Respondents, 70 of them preferred traditional initially, of whom only 15 switched from traditional to AI, meaning 12% of the total respondents made a switch. We believe this is not a correct estimate because again they might have suspected the true intention of the study or they tried to bypass it. Another relevant factor is that this test was given as a school task for a class of middle school students, respectively one of high school students, both located in suburbs, during normal school hours.

We have noticed that some answers were copied and pasted in markdown format, specific to ChatGPT solutions or other similar Large Language Models (LLMs). These included word-for-word translations from English to Romanian, long texts, repetitions of certain words or phrases that, more often than not, were meaningless. We calculated the average creativity score for the traditional respondents, which numbered 31, obtaining a value of 59.68%, while the average clarity score was 91.13%.

A trend we identified was that a lot of participants tended to give elevated and creative answers in longer formats. Whilst we believe this to be caused by participants having plenty of time and not being rushed to present their answers, Carstens et. al. argue that attention spans are getting shorter, thus making long-length answers more likely to be machine-generated [15]. However, this does not mean that all participants were affected equally. While many relied on AI, some still retained their personal approaches. We noticed that the varying levels of familiarity with digital tools among participants presented notable challenges. We have seen that while some participants lacked the technical skills or experience needed to efficiently navigate search engines or AI tools, others adapted more quickly, though they might have encountered some difficulties. Table 1 highlights these disparities:

Table 1.

Comparison between participants based on experience with AI

Participants	Average creativity score (%)	Average clarity score (%)	Number
Familiar with AI	48	69	49
Not familiar with AI	56	89	16
Who used AI Tools	47	59	36
Who used traditional methods	55	92	29

Participants who used traditional methods consistently achieved higher average scores in both creativity and clarity compared to those who used AI tools.

While the participants generally aligned with the study's expectations, the educational and environmental factors observed here could introduce bias in other research contexts. For instance, participants with less formal education may have encountered challenges in understanding or interpreting the study material, potentially affecting the consistency and accuracy of their answers. The data analysis provides clear evidence of this trend. Table 2 and Table 3 highlight the educational diversity of the participants.

Table 2.

Fields of education of participants

Field of Education	Middle School	Real Sciences	Humanities
Percentage (%)	29.75	34.87	35.38

Table 3.

Levels of education of participants

Level of Education	Middle/High school student	High School Graduate	Bachelor's Degree	Master's Degree
Percentage (%)	60	30	6	4

Table 4 highlights notable differences in performance based on educational diversity. Participants with higher levels of education demonstrated better clarity and creativity scores, reflecting stronger analytical and critical problem-solving skills. However, the majority of respondents (89%) were middle school and high school graduates, which could have limited the depth and complexity of the responses, given their relatively lower levels of education.

Table 4.

Correlation Between Education Level and Scores

Education Level	Average Creativity Score	Average Clarity Score
Bachelor's Degree	56%	100%
High School Graduate	59%	82%
Master's Degree	58%	75%
Middle School Graduate	45%	67%

The urban and rural number of respondents is unbalanced, with everyone coming from an urban environment. Even so, this does not mean that everyone will

necessarily have higher cultural or educational knowledge. This is mostly because living in an urban setting without engaging in its opportunities for growth can still result in a limited worldview, which may bias responses. [16], [17]

The data collected indicates that approximately 80% of young people have experience using AI. Among the tools they mentioned, various LLMs were commonly cited, with ChatGPT being the most frequently mentioned, followed by Gemini, Copilot, and Claude.

During the study phase of our research, those who chose AI assistance primarily used ChatGPT and ChatGPT only. This could be an indicator that such LLMs are powerful enough to fully and independently support studying and research through immediate answers to questions, explanations of complex concepts, and tailored content that targets their areas of difficulty. It also reduces the time spent on irrelevant material and allows for faster progression through the study process. Nevertheless, information provided by LLMs should always be double-checked, although many ignore this to speed up the learning process. The average time taken to complete studying and assessment by people using AI was 22 minutes, 8 minutes less than our estimated duration of the learning process, and 11 minutes less than the time taken by people studying the traditional way, which averaged 33 minutes. On the other hand, individuals who preferred the traditional approach mostly relied on the materials provided, with only a few seeking additional resources from the Internet. For our experiment, this was to be expected, since the materials presented information clearly and covered all the basic aspects necessary to understand the topic. However, the few cases where additional sources were needed suggest that traditional learners must navigate the resources themselves to fully understand a topic. This takes more time and may lead to confusion if relevant or accurate information cannot be found. Considering that the times measured included the assessment phase of the learning process, it could also indicate that people using traditional methods take longer to answer a question, possibly because the information is not as well-structured in their minds since it was not tailored to their needs. Moreover, participants in both AI-assisted and traditional learning groups were asked to rate their confidence in understanding the material after completing their studies. The two groups reported similar confidence levels, with slightly more confidence for the non-AI group.

Table 5 shows the self-evaluated level of knowledge on the topic studied after completing the learning process reported by participants on a scale from 1 to 5.

Table 5.

Level of knowledge reported by participants

Group\Level	1	2	3	4	5
AI	1.8%	5.4%	26.8%	33.9%	32.1%
Traditional	4.6%	34.6%	20%	35.4%	35.4%

Overall, the data suggests it would be fair to say there is a significant difference between the two approaches in both experience and efficiency, from the student's perspective. However, the actual results of the assessment remain to be discussed in the next section.

3.1. The Impact of AI on Academic Quality

The assessment part of our study was based on grading the answers. There were 3 types of questions in our test: multiple-choice questions, free-answer questions, and open-ended questions.

The multiple-choice questions tested the student's ability to distinguish the correct answer from plausible but incorrect alternatives. They were graded in a binary way, with students receiving full credit for selecting the correct option, while no credit was awarded for incorrect answers.

For the free-answer questions and open-ended questions, four key, independent aspects were taken into consideration, as previously mentioned, namely accuracy/relevance, clarity, creativity, and grammar respectively. Fig. 1 illustrates the comparison of the results computed according to equation (1), using the following weights: 0.4, 0.3, 0.2, and 0.1.

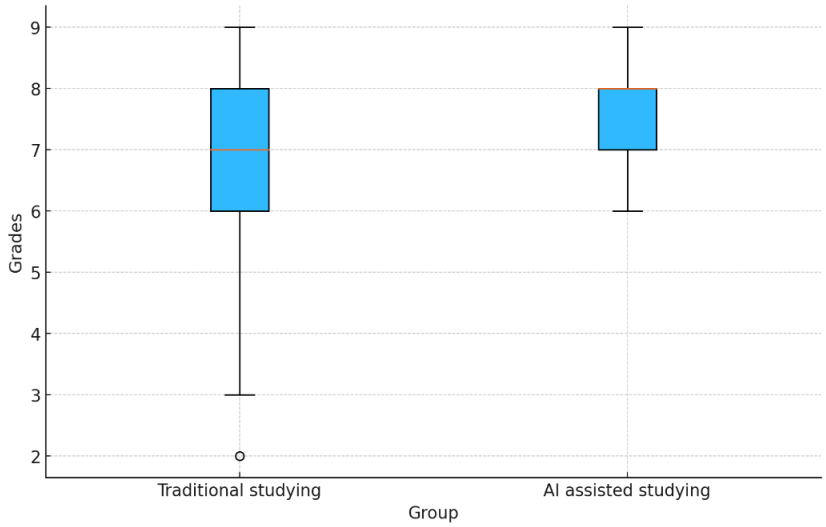

Fig. 1. Comparison Between the Test Results

Fig. 1 indicates that there is a slight difference in how the two groups have answered the questions. A T-test run on the results (P-value~0.082) confirmed there is no significant difference between the groups, as well. Results obtained for the AI-assisted group show relatively less variation and outliers, suggesting that all subjects of this group were conditioned to perform in a similar manner, thereby forming a more consistent cognitive pattern. The grades for the other group are more scattered, which shows greater variability. This indicates more diversity

presented in the way of thinking developed by people who put more effort into learning new information in traditional ways.

The information provided by AI-generated responses tends to be accurate but lacks creativity and expressiveness. While AI answers are grammatically correct and clearly articulated, they often follow a certain structure that results in responses that are similar to one another. This repetitive nature of AI-generated content is one of its inherent limitations. In contrast, when students incorporate their own ideas and creativity into their work with AI assistance, the results exhibit a more personalized touch, although they tend to follow predictable patterns in terms of structure and approach as well. For example, AI can offer a practical example of a concept or relating an experience, but it is always visibly general and impersonal.

On the other hand, in human-generated responses, there is more room for both error and creativity. These two elements are often intertwined, as human creativity is not always bound by the same rules that govern algorithmic processes. This freedom can lead to more diverse and innovative answers, but it also opens the door for subjective biases and mistakes. This can also be observed in our experiment, as students using traditional materials scored both the highest and the lowest grades among all participants.

In Fig. 2, we can observe that the ranges of scores in both groups overlap significantly, indicating that the overall performance of the students in both groups is quite similar. Thus, it is safe to say that both approaches are lucrative when it comes to reaching a goal, in our study, the goal is scoring a high mark on a test. However, their cognitive processes differ, and this divergence is visible in the skills and knowledge individuals acquire and how it expands their perspective, their personal growth, and the psychological impact such as a sense of self-accomplishment and improved confidence.

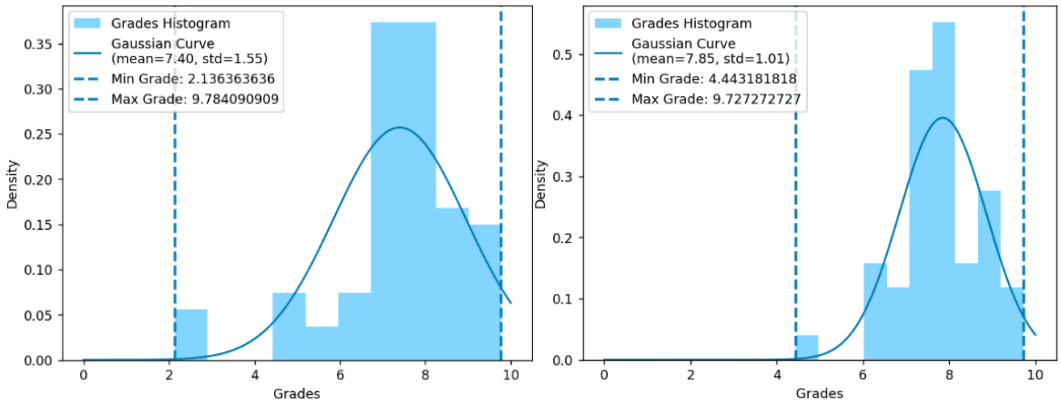

Fig. 2. Gaussian Distribution of Grades for Traditional Studying (left) and AI-Assisted Studying (right)

In both cases, it can be challenging to determine whether students truly understand the material or are just repeating information. To address this, assessments should focus on critical thinking and application, not just recall. In our study, we used open-ended questions, involving problem-solving skills, and case studies to help assess deeper understanding. Another alternative for effective assessment could be oral exams and discussions, which allow instructors to ask follow-up questions. These methods encourage active engagement and better reflect actual comprehension.

Another problem in validating answers is fraud detection. Cheating is a potential issue in both AI-assisted and human-generated responses. In AI-generated content, students may use the technology to produce correct but impersonal answers, thus passing the learning process. The uniformity and unnatural polish of AI responses can serve as indicators of cheating and plagiarism detection tools can help identify such cases. In human-generated responses, cheating may involve plagiarism or excessive collaboration. These instances can be detected by inconsistencies in writing style, vocabulary, and knowledge depth.

Human subjectivity is showcased not only in giving free-form answers but in grading them as well. This affects the fairness and accuracy of the assessment. Subjectivity varies based on the perspectives and criteria of the evaluator. As mentioned earlier, we aimed to establish consistent evaluation objectives for all individuals involved in grading the tests. In this context, AI-based correction systems can prove beneficial too. AI has the potential to provide more consistent and objective assessments than humans do, given their algorithmic, less biased way of solving problems. For example, by comparing responses against predefined standards or a vast dataset of examples, AI can ensure a more accurate grading. However, while AI-based correction systems can enhance consistency, they still face challenges in capturing the nuance of human creativity and context. Therefore, a hybrid approach, combining both AI assistance and human evaluation, could be considered as a more optimal approach.

To assess the risks of technology dependence and superficial learning from our test grades, we can analyze patterns in student performance. For example, most AI-assisted students obtained high scores on multiple-choice questions but had worse performance on open-ended tasks. This may suggest reliance on memorization instead of understanding. Additionally, their responses appeared correct but lacked depth, indicating shallow learning. Also, there was a high number of similar answers across responses given by students using AI compared to their traditional learning counterparts, which could indicate the use of technology in answering the questions. These trends suggest that although the AI-assisted group had better results, it may not have fully understood the material.

3.2. Comparative Analysis by Age Group

Fig. 3 shows that AI-assisted studying yields slightly better results than traditional studying for both age groups. However, this might be caused by the fact that the majority of the participants opted for traditional studying (62.96% of under 18 and 57.4% of 18-30).

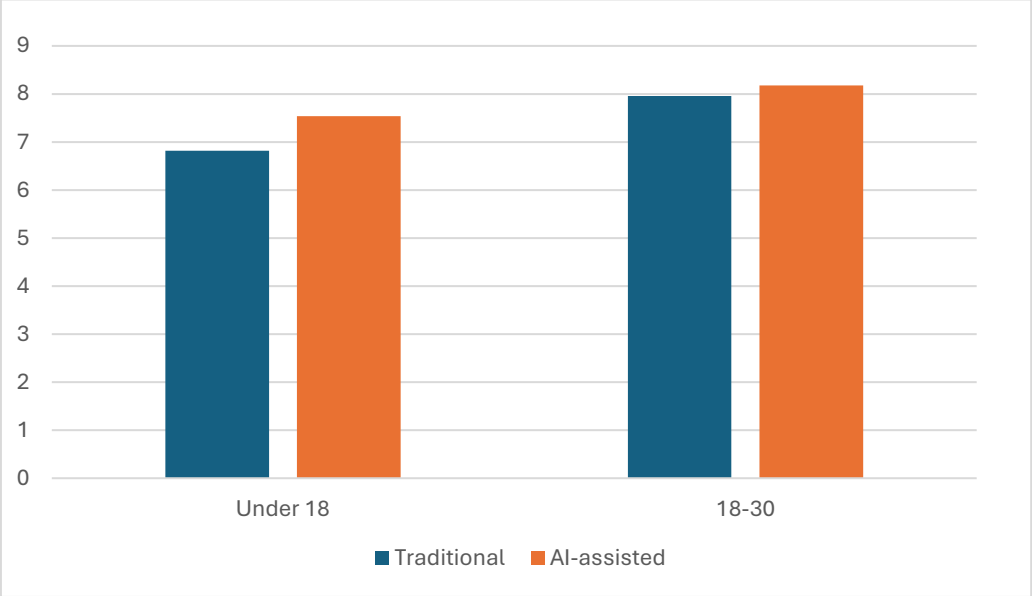

Fig. 3. Average score of participants who used AI tools compared to participants who used traditional methods, by age group

By analyzing the results of participants under the age of 18, we identified a difference in scores between those who used AI tools to solve the "Understanding Procrastination" quiz and those who chose the traditional learning method. A significant difference observed in the participants' results is that those who used AI tools scored significantly higher on the multiple-choice questions in the quiz, while those who relied on traditional learning methods demonstrated a slightly stronger overall approach to creativity to the open-ended questions. These statistics show that using AI tools in the learning process can help individuals retain precise information and data, providing more accurate answers to factual questions that do not require personal involvement. However, the absence of traditional learning may affect how people respond to questions that test emotional depth and creativity, without significantly affecting their overall understanding of the situation.

The age category of 18-30 is very important as it involves people who are moving from finding themselves in the academic environment to the working life. Their learning inclinations as well as performance trends during this stage also reveal the amount of employment preparedness that these individuals have. Our research shows that despite the growing relevance of technology in today's

workplaces, the majority of participants in this age group prefer learning in the 'old-school' way, rather than using AI tools to answer the quiz during the test. This preference indicates that many people within this group still want to learn things the old-fashioned way, where the focus is more on the creative process, critical thinking, and relying on personal experiences. These competencies are very important when dealing with real-life problems that have multiple dimensions and where the person is required to be adaptable. Nevertheless, the close average scores between AI-assisted learning and traditional learning highlight that individuals using either method are effective at performing tasks requiring the retention of facts and concepts. Those who used AI tools scored particularly high on accuracy in fact-based questions, demonstrating their ability to leverage technology efficiently to address specific problems. This competence underscores the increasing importance of digital literacy and data-driven decision-making in a vast majority of industries.

From the experiment, it can be observed that the average scores are very similar for both AI-assisted learning and traditional learning methods. However, this time we can note some variations in the scores for questions that require creativity and personal experience. The slightly higher scores for the open-ended questions suggest that those who chose traditional learning methods tend to rely more on their creativity, critical thinking, and personal experience when answering, to relate their solutions to real-life situations. On the other hand, those who use AI tools in the learning process often tend to rely exclusively on the information provided and are reluctant to incorporate their personal experiences or beliefs when formulating their answers.

These results indicate that if we compare the outcomes of traditional educational methods and those assisted by AI tools, the level of performance remains similar, yet there are noticeable differences in how the participants tackle the various questions. The standard classroom or textbook learning is more powerful for tasks that require creativity, critical thinking, and drawing on one's own experience because it is oriented towards more real-life problem-solving. On the other hand, AI-based learning is highly competent and accurate in learning facts, but this seems to hinder a more comprehensive approach to problem-solving from developing. However, this difference in approach also emphasizes a potential gap. The reliance on AI tools may reflect a reduced willingness or ability to answer open-ended questions, which are often critical in roles requiring creativity, leadership, and emotional intelligence. It is essential to know that to remain competitive in the job market, professionals must integrate technological skills with creativity and strong communication abilities. This mixture ensures they can successfully address both well-defined and ambiguous challenges.

In summary, the openness of individuals to use AI for learning indicates a preparedness for specific career paths that emphasize technical precision and efficiency. However, to ensure long-term success across diverse professional

environments, it is essential to foster a mindset that combines creativity, critical thinking, and personal experiences with technological expertise.

4. Discussion

The long-term effects of AI on academic performance and employability are closely related to how these tools are utilized.

When AI is used as a complementary resource, such as an add-on to traditional learning methods, students can benefit from its ability to create personal study routines, provide personalized feedback, and enhance engagement without diminishing cognitive effort. [7] In this case, AI acts as a facilitator, allowing students to refine their understanding and boost performance through personalized guidance. AI has the potential to significantly enhance academic performance and improve employability by accelerating the learning process and making skill development more accessible. Moreover, the ability to use AI tools has become a desired skill by many employers, encouraging proper usage of such tools in different tasks. [18]

However, if students become overly reliant on AI to complete tasks without engaging their own cognitive abilities, it could undermine their development of critical thinking and problem-solving skills. Over time, this could negatively impact employability, as employers value not only technical knowledge but also cognitive flexibility and creativity. [19]

In conclusion, the long-term benefits of AI in education depend on how it is integrated into the learning process, ensuring that students not only gain technical proficiency but also develop critical thinking necessary for their future careers. The key to maximizing AI's potential is to use it as a tool for reinforcement, while still focusing on developing essential skills through active learning.

The development of this technology is not recent [20], but AI solutions only started gaining mainstream momentum in 2020 through image generation, with an apex in 2022 through the official launch of ChatGPT which is in continuous development, expansion, astonishing by the increasing speed and acuity of solving the proposed tasks. This type of software still does not equal the human mind and thinking and is still subject to certain failures. Any bias present in AI systems could have influenced the results of the study, especially because some participants depended on AI for important decisions. Participants may find it difficult to understand or critically evaluate AI results due to the opaque nature of the AI decision-making process. Differences in AI performance in different tasks could have influenced the coherence of the results.

However, this does not mean that the study is without value; on the contrary, it highlights important ideas for improvement. As artificial intelligence continues to transform the educational landscape, it becomes increasingly essential to

examine how these tools can be effectively integrated without compromising the development of critical cognitive and social skills.

The results from the "Understanding Procrastination" quiz highlighted both the potential benefits and challenges associated with utilizing AI in learning environments. After conducting subsequent analysis on this, we found the potential and challenges of AI in learning environments, such as risks of over-reliance and varied educational and cultural contexts. We agree that these factors demand a thoughtful approach to curriculum design, educator training, and collaboration with the tech industry.

Designing a curriculum that integrates AI effectively necessitates intentional planning rather than replacing traditional learning approaches. However, we feel that educators must consider various factors, such as student engagement and technological accessibility because these elements play a crucial role in the success of such initiatives.

The responses from the quiz revealed both potential benefits of using AI: faster access to information and enhanced personalization; however, challenges also emerged, such as reduced critical thinking and dependency on technology. To validate this, we reiterate that the quiz results underscore disparities in creativity and clarity scores based on participants' educational levels and familiarity with AI. For example, participants using traditional methods achieved higher creativity (55%) and clarity (92%) scores than those relying on AI tools (47% creativity and 59% clarity).

5. Conclusions

Our research has revealed several key findings regarding the impact of AI integration in education and its implications for future workforce preparation. AI-assisted learning demonstrated faster completion times (22.33 minutes vs. 33.30 minutes for traditional methods). Traditional learning methods showed higher creativity scores (55%) and clarity scores (92%) compared to AI-assisted approaches (47% and 59% respectively). While AI tools provide efficient access to information, they may potentially limit deep learning and critical thinking development. Students with higher education levels demonstrated better analytical and critical problem-solving skills, with bachelor’s degree holders achieving 100% clarity scores. Participants using traditional methods showed greater variability in responses, indicating more diverse thinking patterns. The research revealed significant disparities in AI tool familiarity and effectiveness across different educational backgrounds, and identified key barriers to AI adoption, including resource constraints and technological accessibility. Educational institutions require structured frameworks for balancing AI integration with traditional teaching

methods [21]. Cultural and demographic factors significantly influence AI tool effectiveness in education [22].

The research findings suggest several important implications. Educational institutions must develop comprehensive strategies for AI integration that preserve critical thinking and creativity [23], [24]. Teacher training programs need updating to include AI literacy and technical competency development. Collaboration between educational institutions and technology providers is crucial for sustainable implementation [25], [26]. These findings suggest that successful AI integration in education requires a carefully balanced approach that preserves human elements of learning while leveraging technological advantages, addresses educational accessibility and equity concerns [28], and prepares students for a technology-driven future [29] while developing essential cognitive skills [4].

Future employees need balanced skill development combining AI proficiency with human-centric capabilities [11], [14]. The job market increasingly demands workers who can effectively leverage AI while maintaining critical thinking skills [1]. Educational programs must evolve to address the growing gap between traditional education and workplace requirements [27]. Long-term studies are needed to assess the impact of AI-assisted learning on career success. Further investigation into the optimal balance of AI and traditional learning methods. Development of standardized frameworks for measuring AI effectiveness in education [2].

Future work could include continuing the study with more participants, adding control questions to make sure the participants give coherent answers and defining a less subjective scoring system for the open-ended questions.

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