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The Effects of AI Overreliance on Student Higher-Order Thinking Skills Development

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تأثيرات الاعتماد المفرط على الذكاء الاصطناعي في تطوير مهارات التفكير العليا لدى الطلاب

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ABSTRACT:

The rise of Artificial Intelligence (AI) has brought about several merits and demerits across multiple life sectors, and education is no exception. AI has recently been an integral part of modern education, offering numerous benefits that enhance accessibility and efficiency in learning. While AI technologies have revolutionised education, they present significant challenges due to students' overuse and excessive reliance. Such overreliance hinders students' critical thinking and problem-solving skills when they excessively depend on automated solutions. The present study investigates the impact of university students' overreliance on AI tools on their higher-order thinking skills development. In this context, an e-questionnaire survey is distributed to Algerian university teachers to investigate students' use of AI in learning and gather insights into their experiences, perceptions, and frequency of AI tool usage in their academic studies. The findings highlight a need to balance AI-assisted learning and the development of essential academic skills.

Keywords: AI tools, cognitive development, critical thinking, higher-order thinking skills, students' dependency.

ملخص البحث

جلبت تقنية الذكاء الاصطناعي العديد من المزايا والعيوب في مختلف القطاعات الحياتية، ولا يُستثنى من ذلك قطاع التعليم. فقد أصبح هذا الأخير جزءًا لا يتجزأ من التعليم الحديث لتعزز الوصول والكفاءة في التعلم. وعلى الرغم من أن تقنيات الذكاء الاصطناعي قد أحدثت ثورة في التعليم، فإنها لا تخلو من التحديات الكبيرة بسبب الإفراط في استخدامها من قبل الطلاب والاعتماد الكبير عليه. هذا الاعتماد المفرط يعوق مهارات التفكير النقدي وحل المشكلات لدى الطلاب عند استخدامه في مواضع لا تتطلب اللجوء إلى تقنيات الذكاء الاصطناعي. تحاول هذه الورقة البحثية إلقاء الضوء على تأثير الاعتماد المفرط لطلاب الجامعات على أدوات الذكاء الاصطناعي على تعلمهم وتطورهم المعرفي. وفي هذا السياق، تم توزيع استبانة إلكترونية على أساتذة الجامعات الجزائرية للتحقق من استخدام الطلاب للذكاء الاصطناعي في التعلم وجمع الآراء حول تجاربهم، تصوراتهم، وتكرار استخدام أدوات الذكاء الاصطناعي في دراستهم الأكاديمية. وتبرز النتائج الحاجة إلى تحقيق التوازن بين التعلم المدعوم بالذكاء الاصطناعي وتطوير المهارات الأكاديمية الأساسية.

الكلمات المفتاحية: أدوات الذكاء الاصطناعي، التطور المعرفي، التفكير النقدي، مهارات التفكير العليا، اعتماد الطلاب.

1. INTRODUCTION

The landscape of education has recently undergone significant changes driven by advancements in technology and pedagogical practices. Among such advancements is the integration of AI technologies into teaching and learning, transforming education's traditional mode into a more modern and innovative framework. AI technologies facilitate individuals learning within communities, enabling them to construct knowledge and learn from one another (Suthers, 1999; Suthers, 2003; Suthers & Hundhausen, 2003; Woolf et al., 2010). The use of digital technologies has led learners to disregard the use of textbooks and manual tools due to the excessive use of portable digital devices nowadays (Beavis, 2010). Such modern tools enable individuals to instantly access a vast range of information, resources, and networks, allowing them to collaborate and learn at a faster pace (Woolf, et.al 2013). Nevertheless, the emergence of AI has raised significant and complex challenges in education due to the students' misuse of these tools.

The rapid and widespread adoption of AI-driven tools puts it at a risky stage of becoming overly dependent upon it. According to Akinwalere and Ivanov (2022), the application of AI technologies in education is both celebrated and scrutinized. The increasing use of AI tools presents a critical issue among educators and scholars. It raises a growing concern that the increasing reliance on AI tools in education leads to a dependency that limits students' creativity. While they have the potential to raise academic standards and improve education quality, AI-driven tools bypass and diminish students' critical thinking and problem-solving skills and thus limit their creativity. They also raise the risk of cheating among students by providing them with easy-to-access websites to generate assignment solutions (Huo, 2023). The overreliance on these technologies makes students fail to strike a balance between using AI as an assistance tool and maintaining traditional learning methods.

While the AI technologies integration in education pros has been widely discussed across different academic discourses, there remains a notable gap in research investigating such tools' long-term implications on students' learning outcomes. AI poses several drawbacks that require thoughtful consideration and must be addressed to maintain a balanced and effective learning environment (Clugston, 2024). The first and foremost trigger to investigating this study is the increasing integration of AI tools into education, which has raised significant concerns about their impact on students' cognitive and academic development. Within the higher education context, university students are increasingly adopting AI technologies to execute and complete their academic assignments and tasks (Power et al., 2025). Despite the growing prevalence of AI in education, students often treat AI technologies, especially ChatGPT, as substitutes for their intellectual efforts. This treatment prevents them from being deeply engaged with the subject matter and hinders their academic competency development.

In light of the growing concerns about the impact of AI on education, the present study aims to investigate the impact of students' overreliance on AI tools on their academic and cognitive development. Within the conceptual framework, the primary objective of this research is to assess students' reliance on AI tools in completing academic tasks. It also aims to analyse the effects of such tools on their critical thinking and problem-solving skills. The study aims to identify the potential negative impacts and drawbacks of AI technologies on

their learning abilities and provide recommendations for the balanced integration of AI in education. To achieve these objectives, the following research question has been formulated:

- How does over-reliance on AI tools hinder students' development of critical thinking and problem-solving skills?

Guided by the main research question, it is hypothesized that excessive reliance on AI technologies negatively impacts the development of critical thinking and problem-solving skills by limiting cognitive engagement and promoting passive learning among students.

2. Literature Review

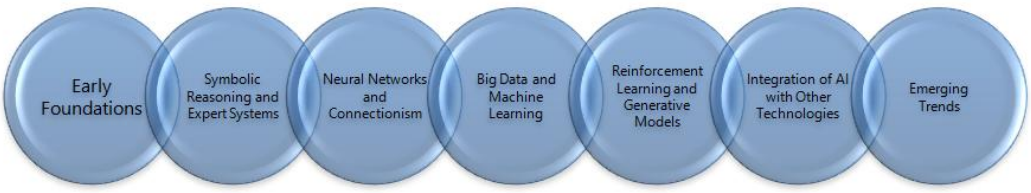
Artificial intelligence has recently witnessed tremendous advancement in transforming industries and reshaping the individual's life, work, and interaction. Driven by breakthroughs in machine learning, deep learning, and natural language processing, AI tools have surpassed human performance in fulfilling various tasks (Chinimilli et al., 2024). Such tools have become transformative across different fields, such as healthcare, finance, and education. Nevertheless, many researchers claim that AI innovations in education still lack rigorous evidence regarding their effectiveness in such contexts (Molina et al., 2024). Still, AI-driven tools have witnessed a rapid integration in education, particularly among university students.

2.1 AI Evolution

The emergence of artificial intelligence can be traced back to the foundational stages of computer science, driven by the fundamental objective of constructing machines capable of simulating human intelligence. AI evolution began in the 1950s with a significant focus on designing machines that could resemble human intelligence. According to Chinimilli et al. (2024), the term "AI" was coined during the Dartmouth Workshop event in 1956, where researchers convened to investigate the potential of machine intelligence. From that event onward, AI has undergone multiple phases of advancement.

During the 1980s, researchers started studying the idea of exploring machine learning that enables computers to learn from data. Dhaswin Kumar et al. (2023) discuss the evolution of AI machines that enable data input to be extracted instead of relying solely on predefined rules. The 2010s witnessed a rise in deep learning as AI powerful approach to analyzing complex data such as image recognition, speech processing, and natural language understanding (Dhaswin Kumar et al., 2023). It has also expanded into robotics, self-driving cars, and autonomous vehicles as greater technologies for efficiency and safety than humans. The following diagram summarizes the evolution of AI:

Fig.1. The Evolution of AI Development



Source: Chinimilli et al., 2024, 2227

As illustrated in the figure above, AI has advanced from basic symbolic reasoning to sophisticated deep learning, driven by extensive data and processing power. Such tools have achieved considerable advancements in natural language processing, decision-making, and content development, along with other technologies.

2.2 AI Integration in Education

AI technologies are not limited to robots and vehicles that facilitate human activities. As they become increasingly sophisticated, AI tools have paved the way for innovative applications that cater to diverse learning styles and preferences (Blikstein & Worsley, 2016; Siemens & Long, 2011). The integration of AI tools in education has been a transformative process, promoting the dynamics of teaching and learning. Such technologies personalize education and offer adaptive learning paths (Jackson, 2019; Luckin et al., 2016; Russel & Norvig, 2010). They include diverse applications such as intelligent tutoring systems, adaptive learning platforms, and immersive simulations. According to Chan (2015), AI tools leverage learning machines to analyze learner performance and provide personalized feedback.

The field's larger achievements reflect the advancement of AI technologies in education. One of the most significant merits of AI technology adoption in education is personalized learning. According to Shrivastava et al. (2023), the latter advantage can lead to better learner outcomes. Students, in that respect, can learn at their own pace in a way that suits their learning style. Intelligent tutoring and automated assessment systems have the potential to increase efficiency, reduce the time burden on teachers, and provide more accurate and consistent feedback for learners. In the same vein, AI tools present significant demerits in education. For instance, privacy and security concerns around sensitive student data, lack of trust, cost, and potential bias could reinforce stereotypes about them (Jarrah, Wardat, & Gningue, 2022). Despite these drawbacks, the potential of AI in education is still immense.

2.3 Students' Overreliance on AI

AI tools can significantly help students enhance their academic experience by providing more personalized learning support. However, excessive use of these tools can lead to a reduction in critical thinking and creativity among students. As students rely heavily on AI websites and chatbots to provide quick answers and solutions, this diminishes their ability to engage with the target material and lowers their independent thoughts (Balta, 2023). Students then lose their ability to generate original ideas, analyze complex issues, and develop a habit of using AI to perform the easiest tasks.

The use of various AI-powered tools is increasing among university students, especially in academic writing. AI tools such as ChatGPT, Grammarly, Turnitin, QuillBot, and Gemini have been widely adopted by university students to generate given tasks (Ismail, 2024). The use of these platforms can be traced back to several factors, such as time constraints and limited language skills. Roe et al. (2023) discuss that AI tools offer accurate real-time responses, which makes students dependent on them. Although integrating AI tools in educational tasks brings about opportunities for better performance among students, it also poses significant challenges for educators (Kavanagh, 2022). Exploring the merits and demerits of integrating AI tools in education helps leverage the coordinated exploitation of technology-based tools in teaching and learning. Such exploration would not jeopardize students' intellectual and cognitive development.

3. Methodology and Data Analysis

To attain a comprehensive understanding of the AI tools' integration in education, an e-questionnaire survey was opted for via Google Forms. The e-questionnaire was delivered to fifty (50) university teachers across the country, Algeria, with the main objective of understanding their perspectives on how students are relying on AI technologies and how this reliance affects their cognitive and academic development. Such a research tool was chosen to analyse the participants' data in a shorter time frame. Through an online questionnaire survey with fourteen (14) multiple-choice questions, teachers' perspectives about AI's impact on students' progress were obtained and delivered to the target sample via their emails. In response to the study's survey, thirty (30) teachers out of fifty (50) responded to the questionnaire. As stated earlier, the following inquiry serves as the basis for this study: How does over-reliance on AI tools hinder students' development of critical thinking and problem-solving skills?

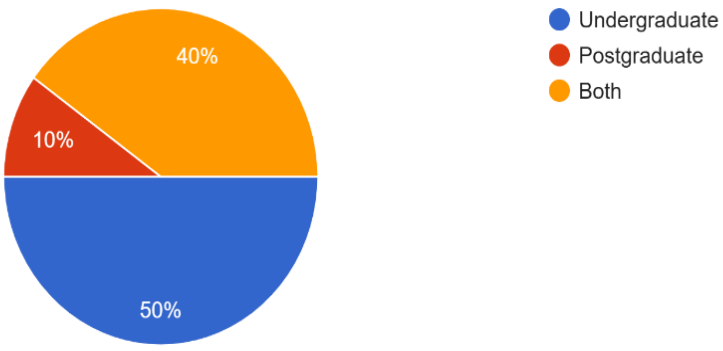
In data analysis vein, the questionnaire's questions are divided into seven (7) themes as follows:

1. Demographics and Context
2. AI Tool Usage and Awareness
3. Impact of AI Tools on Academic Performance
4. Cognitive and Critical Thinking Skills
5. Over-Reliance on AI Tools
6. Strategies for Responsible AI Use
7. Policy and Ethical Concerns

To uphold ethical standards, the participants were explicitly informed that their participation would remain anonymous throughout this research to maintain confidentiality and protect their privacy.

3.1 Demographics and Context

Fig.2. Course Type



Source: The Researcher, 2025

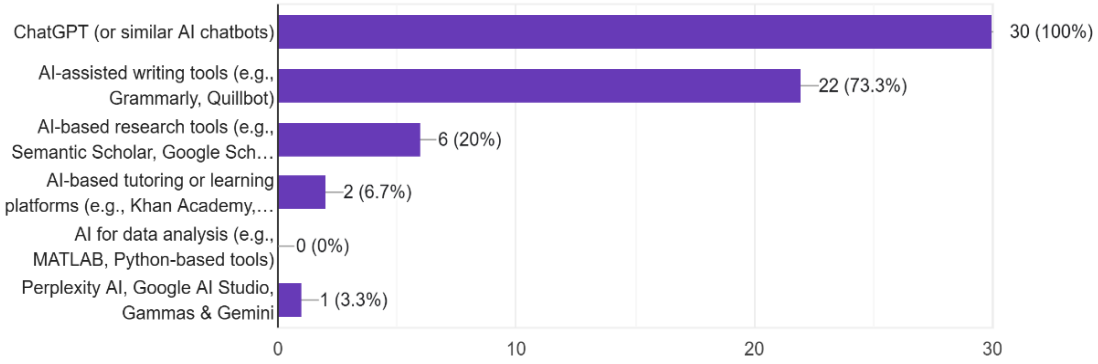
The first theme's data reveals that 50% of teachers are concerned with undergraduate

students. Meanwhile, 10% of the participants teach postgraduate students only. However, 40% of them teach both undergraduate and postgraduate students, providing valuable comparative perspectives on AI tool adoption across different educational levels.

3.2 AI Tool Usage and Awareness

The second theme's data shows that 100% of students use ChatGPT (or similar AI chatbots), making it the most widely adopted tool. AI-assisted writing tools such as Grammarly and QuillBot are also highly popular, with 73.3% of students using them, as claimed by the teachers. In contrast, AI-based research tools (e.g., Semantic Scholar, Google Scholar) are used by only 20% of students. Similarly, only 6.7% of students use AI-based tutoring or learning platforms like Khan Academy and Coursera. Interestingly, AI for data analysis (e.g., MATLAB, Python-based tools) shows no usage among the participants' students. A small percentage of 3.3% use other AI tools, such as Perplexity AI, Google AI Studio, Gammas, and Gemini. In terms of frequency, AI tools have become a regular part of academic workflows among students.

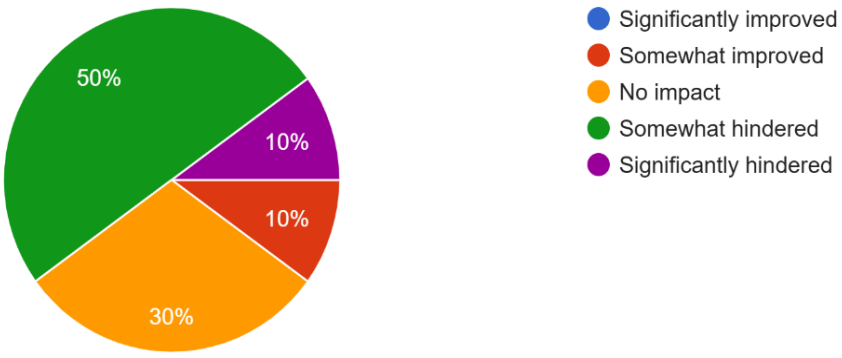
Fig.3. AI Tools Students Use



Source: The Researcher, 2025

3.3 Impact of AI Tools on Academic Performance

Fig.4. AI Tools Impact on Students' Academic Performance

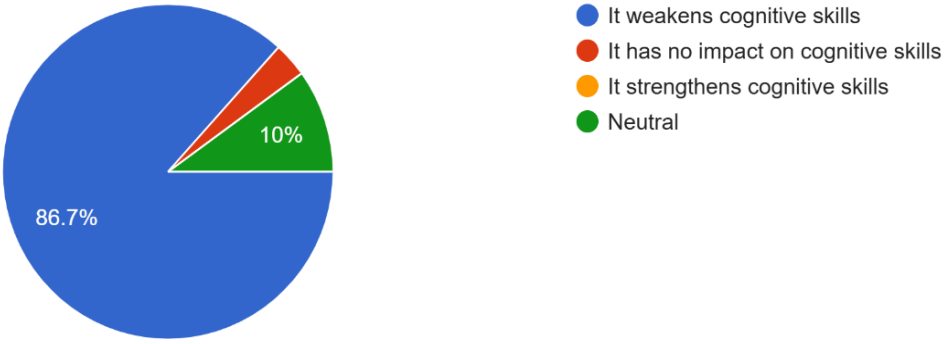


Source: The Researcher, 2025

The third theme indicates that the majority of respondents (60%) believe that AI tools had a negative impact on their students' academic performance. A total of 50% stated that such tools somewhat hindered their performance, while 10% of them significantly hindered students' academic performance. Only 10% believe that AI tools somewhat improved their students' performance in academic contexts. Nevertheless, 30% of the respondents perceive no impact from AI tools for their students.

3.4 Cognitive and Critical Thinking Skills

Fig.5. Impact of AI Tools on Students' Cognitive Skills

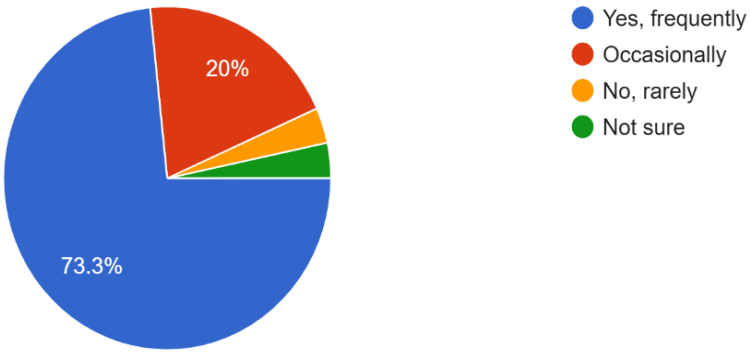


Source: The Researcher, 2025

Within the following theme, the teachers' responses reveal that the great majority (86.7%) believe that the excessive use of AI tools weakens students' cognitive skills, mainly critical thinking and problem-solving skills. A small minority of teachers (3.3%) believe that AI-powered technologies have no impact on students' cognitive development, while 10% remain neutral. Notably, none of the participants believe that such tools strengthen students' cognitive abilities.

3.5 Over-Reliance on AI Tools

Fig.6. Students' Reliance on AI Tools

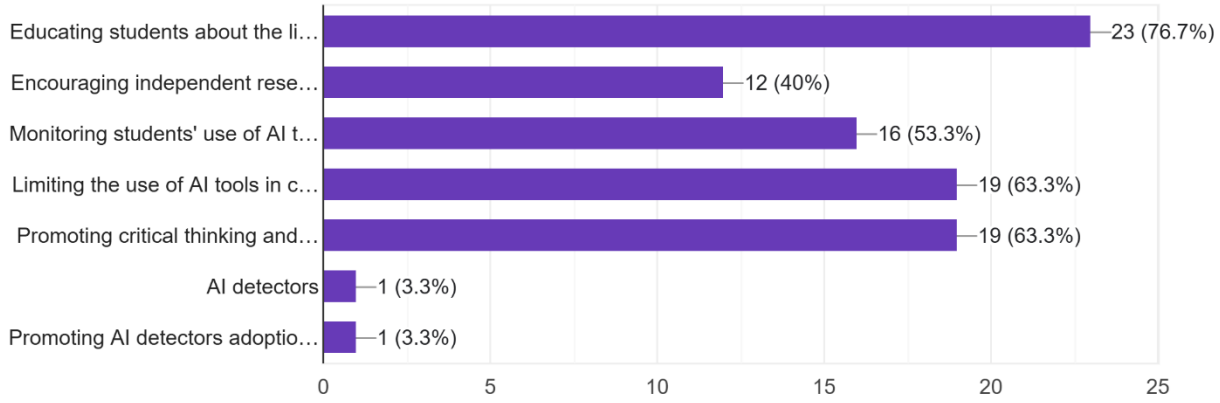


Source: The Researcher, 2025

The fifth theme reveals that a significant majority of teachers (73.3%) frequently observed that students became overly reliant on AI tools. In addition, 20% of them occasionally noticed this reliance, and only 3.3% reported that their students rarely became reliant on AI tools. Another minority of students (3.3%) were unsure about such usage.

3.6 Strategies for Responsible AI Use

Fig.7. Strategies to Prevent Students' Over-Dependence on AI Tools



Source: The Researcher, 2025

The sixth theme of the survey highlights the teaching strategies educators believe are necessary to reduce the students' excessive reliance on AI tools. The most recommended strategy is educating students about the limitations of AI (76.7%). The following strategies include limiting the use of AI tools in certain assignments or exams and promoting critical thinking and cognitive exercises without AI assistance, with 63.3% of students recommending each choice. Monitoring AI use during assessments (53.3%) and encouraging independent research and problem-solving (40%) were also considered important strategies. Only a minority of 6.6% suggested using AI detectors across universities and educational institutions.

3.7 Policy and Ethical Concerns

In response to the last inquiry regarding the main concerns of AI tools in academia, only 12 of the respondents commented as follows:

1 "Ethical breaches."

2 "Replacing teachers with AI tools in the future."

3 "Weakens critical thinking and encourages plagiarism."

4 "AI dependency creates lazy students."

5 "Generating essays and academic works through AI-powered tools undermines educational achievements' value and complicates assessing a student's true abilities."

6 "Making the student more reliable can lead him to lose the ability to be a critical thinker. He may just use what's already there, which can also make him lazy."

7 "Being fully dependent on such tools."

8 "Excessive reliance on AI would decrease students' motivation and engagement in the learning process."

9 "Learners' inability to use AI tools ethically and fruitfully."

10 "Excessively relying on these tools would turn students into passive learners."

4. Discussion of the Main Findings

The findings of the present study highlight significant insights into the use of AI tools and their impact on students' cognitive and academic skills. The first theme of the questionnaire reveals that most of the students are undergraduates. While the educational level may not be a primary factor, undergraduate students are more exposed to educational technologies as an integral part of their academic journey. These results highlight that students at an early stage are more familiar with integrating AI tools into learning, as they are exposed to various digital platforms devoted to research, data analysis, and academic writing. They use such tools to assist with various tasks and enhance their academic performance (Chinimilli et al., 2024). The prevalence of AI-powered technology usage among students can also reflect the broader trend of AI integration in modern education.

In terms of usage and awareness, the most adopted AI tools among students are chatbots. As reported by Balta (2023), chatbots are increasingly used due to their accessibility and effectiveness in performing academic tasks and content generation. ChatGPT emerges as the most frequently used website among students due to the growing popularity and accessibility of this tool in educational contexts. In addition to chatbots, AI-powered writing and paraphrasing assistants such as Grammarly and QuillBot are increasingly used by students to assist with quickly correcting and spotting mistakes and enhancing the tone and clarity of writing (Ismail, 2024). However, the least used tools, such as Semantic Scholar, Google Scholar, Khan Academy, and Coursera, indicate that they are seamlessly integrated into students' academic practices due to the limited awareness or unfamiliarity with them. The other suggested AI tools used, such as Perplexity AI, Google AI Studio, Gammas, and Gemini, echo the rising popularity of AI technologies in education.

The survey's findings suggest that the integration of AI-powered tools has a mixed impact on students' academic performance and cognitive skills. On the one hand, the teachers admitted that AI tools hinder students' academic performance due to their overreliance and the lack of human creativity. As they offer real-time responses, students rely heavily on immediate and instant solutions rather than on enhancing their academic skills. According to Roe et al. (2023), the accurate real-time responses provided by AI tools heavily rely on students. On the other hand, teachers reported that the use of AI tools weakens their students' cognitive skills, such as critical thinking and problem-solving skills. This can be the result of excessive use of such tools not only to provide general information or correct mistakes but also to generate essays and long pieces of writing, which in turn limits their ability to think creatively and process information on their own (Huo, 2023). While AI technology can enhance students' cognitive and academic skills, excessive reliance on it diminishes certain aspects of human thinking.

The strategies adopted by educators to ensure that students use AI tools reasonably and without overreliance help cultivate independent learning in an increasingly AI-driven world. Educating students about the limitations of such technologies helps them understand their role and use them as supporting tools rather than substituting human activities. (Chinimilli et al.,

2024). Teachers also believe that encouraging independent research and problem-solving skills fosters students' ability to meet challenges without relying on technology. Moreover, monitoring the use of AI during assessments helps maintain academic integrity while ensuring that these tools are used reasonably. In addition, limiting the use of AI tools in certain assignments and exams helps teachers balance traditional and modern modes of education. A greater proportion of the participants view that promoting critical thinking and engaging students in cognitive exercises without AI assistance strengthens their critical thinking and boosts their creativity. Teachers also suggested that integrating AI detectors into education helps detect plagiarism and thus ensures students use technology responsibly. AI detectors can be used as a safeguard against the false use of these tools.

Teachers are increasingly concerned about the ethical and policy implications of AI integration in education. One of the primary concerns is the potential for AI to replace human teachers. This shift would strip students of the valuable personal connection and mentorship that human educators provide (Chinimilli et al., 2024). While AI-powered tools can facilitate teaching and learning, they can also replicate the emotional intelligence, mentorship, and support that the teacher offers. Moreover, teachers are concerned that over-reliance on AI would undermine students' critical thinking skills. This overreliance can be evident in students' use of AI to generate answers without truly engaging with the teaching material (Huo, 2023). In addition, easy access to AI-generated content raises significant concerns about falling into plagiarism that violates established moral principles. The widespread reliance on AI may further foster intellectual laziness among students, as they may prefer to seek the easiest solutions rather than invest the time and effort needed to grasp complex concepts. This raises the concern that AI would turn students into passive learners with limited motivation and engagement in the learning process.

The main objective of this research was to investigate the impact of students' overreliance on AI-powered tools, as the research question stated:

- How does over-reliance on AI tools hinder students’ development of critical thinking and problem-solving skills?

In light of this research question, the findings suggest that the excessive use of AI tools can hinder students' critical thinking and problem-solving skills by reducing their motivation and engagement with the material. When leaning heavily on such tools, students bypass their cognitive and academic skills by reducing creativity and human thinking, which is an essential key to academic and professional development. This dependence turns students into passive learners, which limits their opportunities for skill-building and creative thinking.

5. CONCLUSION

In a nutshell, the widespread use of AI-powered tools has unveiled a complex integration into education. The teachers’ questionnaire findings have revealed that while such tools facilitate active learning and offer valuable support in enhancing education, students’ overreliance and dependency on AI hinder their critical thinking skills and reduce creativity. This dependency raises a critical concern about the potential for diminishing academic skills development. In that vein, educators need to guide students and provide them with alternative approaches to using AI in a leveraged and responsible way to maximize its potential and mitigate its use. Students, thus, need to strike a balance between traditional and modern techniques for learning. By doing this, AI-powered tools will no longer substitute for students’ development of essential cognitive and academic skills.

Building on the findings of the present study, the following pedagogical recommendations are put forward to further provide a deeper and more comprehensive exploration and understanding of the reasonable use of AI in education.

- ✓ It is crucial to raise awareness and educate students, teachers, and all education stakeholders about the merits and demerits of AI-powered technologies by devoting workshops and academic events that stress the importance of using such tools and avoiding them when necessary.
- ✓ Encouraging process rather than product is an essential step towards enhancing students' critical thinking and problem-solving skills. This can be practiced through structured seminars and debates on controversial topics as well as analyzing real-world problems or case studies creatively and critically.
- ✓ Education stakeholders need to integrate AI tools that only enhance personalized learning instead of banning them. Such AI-powered tools can be used to present content based on the students' needs, provide instant feedback, and identify learning gaps.
- ✓ Setting clear guidelines for AI-powered tools' use can help ensure that students use them ethically. Institutions, in that vein, need to warn students about the ethical use of such tools and educate them about the importance of academic integrity. They can also provide guidelines for the reasonable use of AI to prevent misuse and dependency on technology. In addition, incorporating AI detectors can serve as an effective solution to ensure academic integrity.
- ✓ Helping students build confidence in their abilities, where they focus on the learning journey rather than the result, is an effective way to limit AI dependency. This can be achieved through praising their efforts and providing constructive feedback, encouraging self-learning resources, and fostering collaboration in the classroom.
- ✓ Emphasizing the importance of traditional learning methods, such as note-taking, reading, and active participation, can help students develop self-reliance in learning. Such a process reduces their dependency on AI and strengthens their academic and cognitive skills.

Combining these pedagogical recommendations helps educators reduce AI dependency on students and foster independent learning, which in turn helps them develop academic and cognitive skills. As the study addressed some AI challenges in education, other pedagogical issues such as technical limitations, privacy and policy concerns, and algorithm and data bias need further consideration. Future research should focus on addressing such issues and conduct further investigation from different users' perspectives.

Bibliography List:

Akinwalere, S. N., & Ivanov, V. (2022). Artificial intelligence in higher education: Challenges and opportunities. *British Journal of Computing, 12*(1), 1-15. https://doi.org/10.33182/bc.v12i1.2015

Balta, N. (2023). Ethical considerations in using AI in educational research. *Journal of Research in Didactical Sciences, 2*(1). https://doi.org/10.51853/jorids/14204

Beavis, C. (2010). Literacy, learning, and online games: Challenge and possibility in the digital age. In *Proceedings of the IEEE 3rd International Conference on Digital Game and Intelligent Toy Enhanced Learning* (pp. 33–40). Institute of Electrical and Electronics Engineers.

Blikstein, P., & Worsley, M. (2016). Multimodal learning analytics and education data mining: Using computational technologies to measure complex learning tasks. *Journal of Learning Analytics, 3*(2), 220-238. https://doi.org/10.18608/jla.2016.32.9

Chan, T. F. I. (2015). *Predicting the probability for adopting an audience response system in higher education* (Doctoral dissertation).

Chinimilli, V. R. P., Sadasivuni, L. N., Anga, G. L., & Bhansali, P. K. (2024). The rise of artificial intelligence: A concise review. *IAES International Journal of Artificial Intelligence (IJ-AI*), *13*(2), 2226–2235. https://doi.org/10.11591/ijai.v13.i2.pp2226-2235

Clugston, B. (2024, July 19). Advantages and disadvantages of AI in education. University Canada West. https://www.ucanwest.ca/blog/education-careers-tips/advantages-and-disadvantages-of-ai-in-education

Dhaswin Kumar, S. K., Vikash, R., Mohith, S. M., & Ajayaganesh, V. (2023). **Evolution of** artificial intelligence (AI). *International Journal of Research Publication and Reviews*, *4*(5), 678–686.

Jackson, E. A. (2019). *Use of WhatsApp for flexible learning: Its effectiveness in supporting teaching and learning in Sierra Leone's higher education institutions*. *Sage Preprint, 1*-18. https://doi.org/10.31124/advance.8947415.v1

Jarrah, A. M., Wardat, Y., & Gningue, S. (2022). Misconception on addition and subtraction of fractions in seventh-grade middle school students. *Eurasia Journal of Mathematics, Science and Technology Education, 18*(6), em2115.

Huo, J. (2023). The rise of artificial intelligence: Challenges and reflections on humanism. *Proceedings of the 2023 8th International Conference on Modern Management and Education Technology (MMET 2023)*. https://doi.org/10.2991/978-2-38476-146-3_15

Ismail, A. A. M. (2024). Over-reliance of AI tools in academic writing tasks: The Malaysian tertiary level context. *E-Prosiding Persidangan Antarabangsa Sains Sosial & Kemanusiaan kali ke-9 (PASAK9 2024), 17-18 Julai 2024*.

Kavanagh, B. (2022). Assessing AI-based Summarizing and Paraphrasing Tools for a CLIL Intercultural Communication Academic Writing Class. *Intercultural Communication Studies, 31*(2).

Luckin, R., Holmes, W., Griffiths, M., & Forcier, L. B. (2016). *Intelligence unleashed: An argument for AI in education*. Pearson.

Molina, E., Cobo, C., Pineda, J., & Rovner, H. (2024). *AI revolution in education: What you need to know*. In *Digital innovations in education*. World Bank.

Power, R., Hambrock, H., Ferreira-Meyers, K., Abd Karim, R., Ossiannilsson, E., & Ștefan, I. (2025). *Artificial intelligence for seamless education*. ISBN 978-1-7390190-3-7.

Roe, J., Renandya, W. A., & Jacobs, G. M. (2023). A review of AI-powered writing tools and their implications for academic integrity in the language classroom. *Journal of English and Applied Linguistics, 2*(1), 3.

Russell, S., & Norvig, P. (2010). *Artificial intelligence: A modern approach*. Prentice Hall.

Siemens, G., & Long, P. (2011). Penetrating the fog: Analytics in learning and education. *EDUCAUSE Review, 46*(5), 30-32.

Shrivastava, A., Suji Prasad, S. J., Yeruva, A. R., Mani, P., Nagpal, P., & Chaturvedi, A. (2023). IoT-based RFID attendance monitoring system of students using Arduino ESP8266 & Adafruit.io on defined area. *Cybernetics and Systems*, 1–12.

Suthers, D. (1999). Representational support for collaborative inquiry. In *Proceedings of the 32nd Annual Hawaii International Conference on System Sciences* (Vol. 14, pp. 1-10). Institute of Electrical and Electronics Engineers.

Suthers, D. D. (2003). Representational guidance for collaborative inquiry. In J. Andriessen, M. J. Baker, & D. D. Suthers (Eds.), *Arguing to learn: Confronting cognitions in computer-supported collaborative learning environments* (pp. 27–46). Kluwer Academic.

Suthers, D. D., & Hundhausen, C. (2003). An experimental study of the effects of representational guidance on collaborative learning processes. *Journal of the Learning Sciences, 12*(2), 183–219. https://doi.org/10.1207/S15327809JLS1202_3

Woolf, B. P., Shute, V., VanLehn, K., Burleson, W., King, J. L., Suthers, D., Bredeweg, B., Luckin, R., Baker, R. S. J. d., & Tonkin, E. (2010). *A roadmap for education technology*. Computing Research Association.

Woolf, B. P., Lane, H. C., Chaudhri, V. K., & Kolodner, J. L. (2013). AI grand challenges for education. *AI Magazine, 34*(4), 36-46. https://doi.org/10.1609/aimag.v34i4.2490