



Original Article

Exploring the Impact of Artificial Intelligence on Human Cognitive Abilities: Is it a blessing or a curse?

Shama Gul¹, Farah Batool¹, Fiza A. Rasheed¹ & Wardha Kaleem²¹Malir University of Science and Technology, Karachi-Pakistan, Karachi-Pakistan²Atia General Hospital, Karachi-Pakistan

Abstract

Background: Artificial Intelligence (AI) has become an integral aspect of contemporary society, offering a wide array of applications from voice assistants to autonomous vehicles. This study investigates the effects of AI technology usage on human cognitive abilities.

Methodology: This study utilized a mixed research method, employing semi-structured interviews to gather data from 20 teachers and graduating students of diverse demographics over a 6-month period. A stratified random sample with proportional allocation was selected, and participants completed a pre-tested 21-item questionnaire. Data analysis was conducted using statistical tools, including SPSS version 21.0.

Results: Analysis revealed significant insights into the relationship between AI usage and human cognitive abilities. The majority of participants were aged 25-34, predominantly male and educated, with 48% holding a master's degree. A majority reported regular usage of AI-based technologies, with 67% utilizing them daily. Participants expressed difficulties in problem-solving, critical thinking, concentration, learning, and decision-making when AI use was hindered, alongside heightened anxiety and stress.

Conclusion: The study emphasizes the need for cautious and thorough analysis of ethical implications as AI continues to be integrated into businesses.

Keywords

Artificial Intelligence, Cognition, Human Intelligence, Cognitive Decline



Citation: Gul S, Batool F, Rasheed FA. Exploring the Impact of Artificial Intelligence on Human Cognitive Abilities: Is it a blessing or a curse? *APP*. 2023;10(2): 76-83

Corresponding Author Email: farahbatool97@gmail.com

DOI: 10.29052/2412-3188.v10.i2.2023.76-83

Received 18/10/2023

Accepted 22/11/2023

Published 01/12/2023

Copyright © The Author(s). 2023. This is an open-access article distributed under the terms of the [Creative Commons Attribution 4.0 International License](https://creativecommons.org/licenses/by/4.0/), which permits unrestricted use, distribution, and reproduction in any medium, provided the original author and source are credited.



Funding: The author(s) received no specific funding for this work.

Conflicts of Interests: The authors have declared that no competing interests exist.



Introduction

Artificial intelligence (AI) stands poised at the forefront of transformative advancements in our current industrial era, echoing the profound impact of the digital revolution ushered in by the Internet and digital technologies. Widely recognized as the herald of the next industrial revolution, AI permeates various aspects of modern society, from ubiquitous voice assistants and intricate image recognition systems to sophisticated decision-making algorithms and autonomous vehicles^{1,2}. While AI holds immense promise to positively revolutionize human lives, there are profound concerns regarding its potential impact on human cognitive abilities. This study aims to scrutinize the effects of AI technology utilization on the intricate fabric of human cognition.

In their seminal work "The Second Machine Age," Brynjolfsson and McAfee meticulously dissect the burgeoning landscape of AI, elucidating its profound implications for the economy, the workforce, and the daily experiences of individuals¹. They underscore the awe-inspiring progress precipitated by digital technologies in contemporary society while also cautioning against the multifaceted challenges entailed by the swift proliferation of AI. Indeed, the advent of AI heralds a new epoch characterized by exponential technological growth and profound societal transformations, necessitating astute navigation of the intricate terrain of digitalization.

In recent years, we have witnessed unprecedented strides in AI development across diverse domains, including natural language processing, image recognition, and complex problem-solving. Central to these advancements are deep learning algorithms, drawing inspiration from the intricate architecture of the human brain. Leveraging

vast datasets, deep learning algorithms adeptly traverse the labyrinth of data, continually refining their performance and prowess over time³⁻⁶.

A watershed moment in the annals of AI history was the triumph of AlphaGo, an AI system engineered by Google's DeepMind, over the reigning world champion in the ancient game of Go in 2016. This seminal feat shattered long-held perceptions, demonstrating AI's capacity to rival and even surpass human cognitive capabilities in domains once deemed exclusive to human intellect. Similarly, the advent of OpenAI's GPT-3 in 2020 marked a paradigm shift in natural language processing, epitomizing AI's ability to produce text indistinguishable from human-authored content across an array of linguistic tasks^{7,8}.

However, amidst these groundbreaking achievements, it is imperative to acknowledge the inherent limitations of AI. Despite its prowess, AI grapples with challenges in domains necessitating nuanced human faculties such as common-sense reasoning, creativity, and emotional intelligence. Hence, while AI holds immense promise in augmenting human capabilities, it is unlikely to supplant humans entirely in the realm of cognitive endeavors⁹⁻¹¹.

In light of these considerations, this study embarks on a multifaceted exploration of the intricate interplay between AI and human cognition, seeking to unravel the implications, challenges, and opportunities posed by the inexorable march of artificial intelligence. Through rigorous inquiry and nuanced analysis, we endeavor to shed light on the evolving dynamics shaping the human-AI symbiosis and chart a course toward a future where AI serves as an enabler of human flourishing rather than a harbinger of obsolescence.



Methodology

Study Design

This study adopted a mixed research method, combining qualitative and quantitative approaches to comprehensively investigate the impact of artificial intelligence (AI) on human cognitive abilities.

Setting

The study was conducted within educational institutions, encompassing both teachers and graduating students from diverse backgrounds in terms of gender, age, and socioeconomic status.

Participants

Participants included teachers and graduate students from various demographic backgrounds, ensuring a diverse representation of perspectives. The inclusion criteria were broad, encompassing individuals of all genders, ages, and socioeconomic backgrounds.

Variables

The primary variable of interest was the impact of AI on human cognitive abilities. Other variables may have included participants' familiarity with AI, their attitudes toward it, and their experiences using AI technologies.

Data Sources/Measurement

Data collection utilized semi-structured interviews and a self-administered questionnaire consisting of 21 items. The questionnaire was pre-tested on a pilot group to ensure clarity and relevance. Data were collected over a period of 6 months, allowing for comprehensive exploration of the research questions.

Bias

Efforts were made to mitigate bias by employing a stratified random sampling technique with proportional allocation,

ensuring representation across different demographics. However, it's acknowledged that there may be biases inherent in self-reported data and participant recruitment.

Study Size

The study included a sample size determined through stratified random sampling, aiming for adequate representation across various demographic categories. Twenty individuals who were either unaware of AI or had not used AI were excluded from the study to focus on participants with relevant experiences.

Quantitative Variables

Quantitative data collected included responses to the 21-item questionnaire, which were then analyzed using descriptive statistics. These statistics provided insights into participants' perceptions, experiences, and attitudes towards AI.

Statistical Methods

Data analysis was conducted using SPSS version 21, employing descriptive statistics to summarize and interpret the quantitative findings. This facilitated a systematic exploration of the collected data, allowing for meaningful insights into the impact of AI on human cognitive abilities.

Result

Participants

The study comprised 150 participants, with a balanced gender distribution: 50% male, 37% female, and 13% opting not to disclose their gender. The age distribution was predominantly in the 25-34 range (36%), with varying proportions across other age groups. Educational backgrounds ranged from matriculation to postgraduate levels, with the highest representation among graduates (48%) and postgraduates (27%). Socio-economic status indicated a majority from middle-class backgrounds (66%),



followed by lower (14%) and higher (20%) strata.

Descriptive Data

Table 1 provides a comprehensive snapshot of the demographic composition of the study participants, detailing frequencies and percentages across various demographic variables such as gender, age, educational background, and socio-economic status. Notably, the sample represents diverse demographics, allowing for a comprehensive analysis of the impact of AI-based technologies across different groups.

Outcome Data

The survey results, as presented in Table 2, shed light on the participants' interactions with AI-based technologies. A significant majority (67%) reported frequent usage of AI tools, with 62% expressing increased reliance on them. Additionally, notable proportions noticed changes in memory (54%) and found it more challenging to recall information

(52%) since using AI. Concerns about declining cognitive abilities were prevalent, with 45% experiencing difficulties in problem-solving and critical thinking. Anxiety related to AI dependency was also evident, as 57% reported feeling stressed when unable to use AI tools.

Main Results

The main findings of the study highlight the pervasive influence of AI-based technologies on various cognitive aspects among participants. Increased usage and reliance on AI tools were widespread, accompanied by observed changes in memory retention and information recall. Moreover, a substantial portion reported difficulties in problem-solving, critical thinking, concentration, and decision-making since engaging with AI technologies. Concerns regarding the potential negative impacts of AI on cognitive abilities were prevalent, with a significant proportion expressing anxiety or stress when unable to access AI tools.

Table 1: Demographic data of the participants (n=150).

Variables		Frequency	Percentage
Gender	Male	75	50
	Female	56	37
	Prefer not to say	20	13
Age	18-24	30	20
	25-34	54	36
	35-44	47	31
	45-54	18	12
	55 and above	2	1
Educational Background	Matric	5	3
	Intermediate	21	14
	Graduate	72	48
	Postgraduate	41	27
	Others	12	8
Socio-economic Status	Lower	21	14
	Middle	99	66
	High	30	20

**Table 2: The survey results of the study participants.**

Questions		Frequency	Percentage
AI tools usage	Frequently	101	67
	Sometimes	33	22
	Rarely/Never	17	11
Increased Reliance on AI tools	Yes	93	62
	No	17	11
	Not Sure	41	27
Noticed any changes in your memory since using AI-based technologies	Yes	81	54
	No	17	11
	Not Sure	53	35
Find it more challenging to recall information since using AI-based technologies.	Yes	78	52
	No	23	15
	Not Sure	50	33
Experienced difficulties in problem-solving or critical thinking skills since using AI	Yes	68	45
	No	29	19
	Not Sure	54	36
AI-based technologies have impacted your ability to concentrate or focus	Yes	75	50
	No	18	12
	Not Sure	57	38
Have you noticed any decline in your ability to learn new things since using AI?	Yes	72	48
	No	21	14
	Not Sure	57	38
Find it harder to make decisions independently since using AI	Yes	72	48
	No	26	17
	Not Sure	53	35
Concerned about the potential negative effects of AI on your cognitive abilities	Yes	83	55
	No	21	14
	Not Sure	47	31
Feel anxious or stressed when you are unable to use AI-based technologies	Yes	86	57
	No	56	37
	Not Sure	8	5

Discussion

The pervasive integration of AI into various facets of daily life has prompted considerable debate regarding its impact on human cognition, decision-making, and productivity. This study sought to elucidate the nuanced relationship between AI utilization and potential declines in these cognitive abilities¹².

The findings reveal a notable trend wherein graduate students exhibit a higher frequency of AI tool usage compared to undergraduate and master's degree holders. This suggests a differential adoption pattern among individuals with varying levels of educational attainment, warranting further exploration into the underlying factors influencing this discrepancy.

An overarching theme emerging from the study is the perceived correlation between



increased reliance on AI and a potential decline in cognitive engagement and decision-making autonomy. The results indicate a propensity for individuals heavily dependent on AI to exhibit tendencies towards laziness, as AI-enabled products and services streamline tasks, potentially reducing the need for cognitive effort¹³⁻¹⁵. While this aspect remains relatively underexplored in prior research, it aligns with existing literature highlighting the impact of automation on human behavior and cognition^{13,14}.

The implications of AI integration in education are particularly noteworthy, as the study suggests a concerning trend toward diminished cognitive engagement among students and educators. AI's ability to automate routine tasks may inadvertently discourage independent thinking and problem-solving skills, leading to a reliance on technology at the expense of cognitive development^{16,17}. This phenomenon underscores the importance of fostering a balance between AI integration and the preservation of essential cognitive faculties in educational settings¹⁸⁻²⁰.

Moreover, the findings underscore the notion that AI's expanding role in decision-making processes may exert a profound influence on human cognition. While AI offers undeniable benefits in processing vast amounts of data and optimizing decision outcomes, there exists a potential downside wherein human decision-makers may become overly reliant on AI-driven insights, leading to an atrophy of critical thinking and intuitive analysis skills^{21,22}. This echoes concerns raised by previous research regarding the erosion of human agency in decision-making processes due to the increasing dominance of AI technologies²³.

Ultimately, the study highlights the complex interplay between AI utilization and human

cognition, pointing towards a need for cautious integration and proactive measures to mitigate potential negative consequences. As AI continues to evolve and permeate diverse domains, it is imperative to prioritize the preservation and enhancement of human cognitive abilities, ensuring a symbiotic relationship between AI and human intelligence. Further interdisciplinary research is warranted to deepen our understanding of the multifaceted impacts of AI on cognition and decision-making, paving the way for informed strategies to harness its transformative potential while safeguarding human cognitive resilience.

Conclusion

In conclusion, the emergence of AI presents a complex scenario for human cognition, offering both opportunities for advancement and potential hazards. While AI has the capacity to enhance efficiency and decision-making, its unchecked proliferation may lead to risks such as cognitive decline and excessive reliance. Therefore, a cautious and ethically mindful approach to AI development and integration is crucial. This entails prioritizing ethical considerations, implementing regulatory oversight, and fostering interdisciplinary collaboration and transparent dialogue. By doing so, we can aim to harness AI's transformative potential while safeguarding human cognitive resilience, steering toward a future where AI empowers rather than diminishes, maximizing benefits while minimizing risks to human cognitive abilities.

Acknowledgment

The authors extend heartfelt gratitude to all the respondents for dedicating their time to participate in the survey.

References

1. Brynjolfsson E, McAfee A. The second machine age: Work, progress, and prosperity



- in a time of brilliant technologies. New York (NY): WW Norton & Company; 2014.
2. Dejoux C, Léon E. *Metamorphose des managers*. 1st ed. France: Pearson; 2018.
 3. Jungwirth D, Haluza D. Artificial Intelligence and Public Health: An Exploratory Study. *Int J Environ Res Public Health*. 2023;20(5):4541.
 4. European Parliamentary Research Service. *Artificial intelligence act*. 2021. [Accessed on 21 February 2023]. Available at: https://www.univiu.org/images/aauniviu2017/GP/co-curr/Artificial_intelligence_act.pdf
 5. Knight W. Tech Companies Want AI to Solve Global Warming. *MIT Technology Review*. 2016. [Accessed 15 Aug. 2016]. Available at: <https://www.technologyreview.com/s/545416/couldai-solve-the-worlds-biggest-problems/>
 6. Zhang MC, Liu KY, Dong YY. E-hotspot dynamics and development tendency of artificial intelligence research—mirror scanning of mapping knowledge domain based on Chinese and foreign journal papers recent 10 years. *J Shandong Normal University*. 2019;34(1):1-12.
 7. Garg A. What is ChatGPT, and its possible use cases? 2022. [Accessed: July 15, 2023]. Available at: <https://www.netsolutions.com/insights/what-is-chatgpt/>
 8. Jeyaraman M, K SP, Jeyaraman N, Nallakumarasamy A, Yadav S, Bondili SK. ChatGPT in Medical Education and Research: A Boon or a Bane? *Cureus*. 2023;15(8):e44316.
 9. Silver D, Huang A, Maddison CJ, Guez A, Sifre L, van den Driessche G, et al. Mastering the game of Go with deep neural networks and tree search. *Nature*. 2016;529(7587):484-9.
 10. Brown T, Mann B, Ryder N, Subbiah M, Kaplan JD, Dhariwal P, Neelakantan A, Shyam P, Sastry G, Askell A, Agarwal S. Language models are few-shot learners. *Advances in neural information processing systems*. 2020;33:1877-901.
 11. Ahmad SF, Han H, Alam MM, Rehmat M, Irshad M, Arraño-Muñoz M, Ariza-Montes A. Impact of artificial intelligence on human loss in decision making, laziness and safety in education. *Humanit. soc. sci.* 2023;10(1):1-4
 12. Farrow E. Determining the human to AI workforce ratio—exploring future organisational scenarios and the implications for anticipatory workforce planning. *Technol Soc*. 2022;68(101879):101879.
 13. Bartoletti I. AI in healthcare: ethical and privacy challenges. In: *Artificial Intelligence in Medicine: 17th Conference on Artificial Intelligence in Medicine, AIME 2019*. Springer International Publishing, Poznan, Poland; 2019. pp. 7-10.
 14. Nikita. Advantages and Disadvantages of Artificial Intelligence. *Simplilearn*. 2023. Available at: <https://www.simplilearn.com/advantages-and-disadvantages-of-artificialintelligence-article>
 15. Baron NS. Even kids are worried ChatGPT will make them lazy plagiarists, says a linguist who studies tech's effect on reading, writing and thinking. *Fortune*. 2023. Available at: <https://fortune.com/2023/01/19/what-is-chatgpt-ai-effectcheating-plagiarism-laziness-education-kids-students/>
 16. Posner T, Fei-Fei L. AI will change the world, so it's time to change A. *Nature*. 2020;588(7837):S118-118.
 17. Pomerol J-C. Artificial intelligence and human decision making. *Eur J Oper Res*. 1997;99(1):3.
 18. Duan Y, Edwards JS, Dwivedi YK. Artificial intelligence for decision making in the era of Big Data—evolution, challenges and research agenda. *Int J Inf Manage*. 2019;48:63-71.
 19. Cukurova M, Kent C, Luckin R. Artificial intelligence and multimodal data in the service of human decision-making: a case study in debate tutoring. *Br J Educ Technol*. 2019;50(6):3032-3046.
 20. Ahmad. Knowledge management as a source of innovation in public sector. *Indian J Nat Sci*. 2019;9(52):16908-16922.
 21. Jarrahi MH. Artificial intelligence and the future of work: human-AI symbiosis in organizational decision making. *Bus Horiz*. 2018;61(4):1-15.



22. Ghosh B, Daugherty PR, Wilson HJ. Taking a systems approach to adopting AI. *Harv Bus Rev.* 2019.
23. Sebastian R, Sebastian K. Artificial intelligence and management: the automation–augmentation paradox. *Acad Manage Rev.* 2021;46(1):192–210.
24. Mohamed AA, Marques O. Diagnostic Efficacy and Clinical Relevance of Artificial Intelligence in Detecting Cognitive Decline. *Cureus.* 2023;15(10):e47004.

