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The Influence of Artificial Intelligence on Human Cognitive Capacity

Introduction

Artificial intelligence (AI) that has become unavoidable in the world of contemporary life, influences the way people think, learn, and decide. The best feature it has is that it is capable of processing intricate information at a very greater speed than the human brain hence increasing efficiency and productivity to a significant level.

However, dependency is a considerable threat. With the increasing dependence on machines, people will lose the ability to utilize their cognitive ability effectively. Cognitive offloading is encouraged through the usage of AI, as calculators did to the habit of doing arithmetic. This habit has been shown by scientists to decrease flexibility and critical autonomy. Over-reliance on AI services can also undermine the intellect and understanding. This leads to a critical question, which is how can we preserve the important human mental capacities in the AI-enabled world? In the absence of a balance, humans can turn to machines and rely on them for such valuable qualities as the ability to reason and solve hypotheses.

The main aim of the study is to investigate the role of integration of AI in the education sector in relation to the cognitive independence of young adults in advanced learning facilities. In particular, the study will focus on analyzing the question of whether AI can positively address learning efficiency and, at the same time, pose the risk of dependency that can decrease the levels of independent analytical and problem-solving abilities.

The research hypothesized that despite the application of AI as an effective academic resource, its overuse is a factor that leads to cognitive dependency. Students who use AI extensively are predicted to exhibit less autonomy in cognitive functions of reasoning and creativity than students who learn more often independently and do not use AI.

Background

The research was inspired by the desire and urge to learn how Artificial Intelligence (AI) can affect student learning and problem-solving especially in the light of its increased application in academic institutions. Within the last ten years, AI has ceased to be an optional supportive measure and has become a part of human activity. In teaching, it is becoming more popular to offer immediate assistance in writing, problem-solving, research and learning assignments. This high usage has changed how students conduct academic endeavors and cognitive assignments.

This study aims at exploring the association between the application of AI and cognitive independence among students. The research aims at grasping whether the efficiency and convenience of AI is making students more capable of doing better or whether excessive dependency on the technology is lowering critical thinking and ability to solve problems independently. The topicality of this issue is in the fact that there is always a strong side and an opposite side of the issue, with the help of AI as an effective tool or dependence on it as something that can damage cognitive progress in the long term.

Recent research works have dealt with this problem. Even though AI can be effective and can assist in enhancing productivity and accomplishing some of the tasks, overuse of the technology may unintentionally undermine critical thinking and problem-solving without the assistance of the technology. As an example, a study conducted at MIT revealed that students with frequent AI use on writing tasks had 47 percent less neural activity when solving problems, and 83 percent of them could not recreate AI-generated work by themselves (Kosmyna et al., 2025). These results emphasize the reason why this research was conducted, AI has turned into an effective student aid, and its excessive use can result in cognitive dependency. Thus, the paper explores the extent to which cognitive autonomy of young adults in higher education is influenced by the adoption of AI.

Methodology

The sample size used in this research was 15 undergraduate students of BRAC University consisting of both male (40%) and female (60%) students aged 19-26. The respondents were all conversant with AI tools and their applications hence no immature respondents provided responses. The sample was selected on purpose to cover students who use AI in their academic work, which aligns with the fact that the research is focused on cognitive dependence in education The study was a survey-based, cross-sectional study that was conducted to address the association between AI use and cognitive dependence. An online questionnaire was used in data collection with both quantitative and qualitative items. The questionnaire included demographic questions (i.e. age, gender, academic background), and questions that captured the frequency and context of AI use in writing assignments, summarizing readings, solving academic problems, conducting research, and decision-making in coursework.

It was determined that cognitive dependence was measured using Likert-scale questions (1 = strongly disagree to 7 = strongly agree), which measured reliance on AI to perform such tasks as remembering information, managing everyday mental loads, and addressing complex reasoning problems. To be sure, some of the items were reverse-coded. Simple problem-solving tasks were also conducted, one with AI assistance and one with none, so that a Cognitive Dependence Score would be obtained. This hypothetical scale was adapted from previous studies on digital dependency and grounded in cognitive offloading theory. Also, open-ended questions enabled the students to explain their problem solving strategies, learning strategies and their attitude towards AI. This gave qualitative data which supplemented the quantitative results.

Nevertheless, there were certain problems in the process of collecting data. Some of the participants gave partial answers and this lowered the data consistency. There was also a small sample size which limited how far the findings could be generalized. As it was a self-reports survey, a possibility of bias existed, since the students could have either underused or overused their habits of using AI. There are also those who did not manage to finish the cognitive tasks. Technical problems interrupted the submission process in a few cases and this slowed down the analysis.

The research had been done under the normal ethics. It was participatory and informed consent was given before the collection of data. There was strong anonymity and secrecy and individual responses could not be linked back to the participants. The students were made aware that there was no penalty of dropping out of the study at any point. The potential risks or discomfort in the course of participation was minimized, and the overall design was developed in such a way that it reminded integrity and ethical responsibility in accordance with the established standards of academic research.
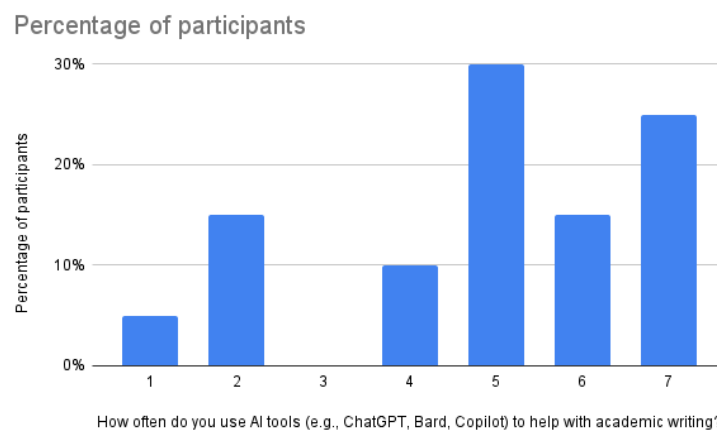
Result

This segment shows the results of the survey of 15 undergraduate students, which was conducted through Google Form, to discuss their dependence on AI in the academic environment. The findings are given in percentages and backed by graphs, indicating how much students rely on AI to perform academic assignments and solve problems.

1. **AI Use in Academic Work**

Among the most significant discoveries, it is possible to mention the fact that most students 70% utilize AI primarily to study, write assignments, or train to pass an exam. This implies that approximately 11/15 students regard AI as a learning and academic resource instead of a tool of fun or free use. This finding in figure 1 demonstrates that AI has become a standard element of the academic life of students. Most students use AI to do work that has direct implications on their grades and learning outcomes rather than as an aid in simple tasks.

Figure 1

The statistical graph on the task AI is most used.

Percentage of participants

How often do you use AI tools (e.g., ChatGPT, Bard, Copilot) to help with academic writing?

Note: The Likert-scale graph (1 = strongly disagree to 7 = strongly agree) shows the percentage of participants who use AI tools for academic writing on a scale of one to seven where one indicates the minimal usage and seven indicates the maximum usage.

2. Hours of AI Use Per Week

In response to the question of the number of hours they spend using AI in an average week, half of the students 50% answered that they spend over 3 hours a week. That equals around 7 to 8 students. The other half was less frequent users of AI, one or two hours or sometimes. This discovery informs us that use of AI is not an occasional activity. It forms part of the routine of many students, such as classes, study etc.

Figure 2

Statistical graph on how many hours per week AI is used for academic purposes.

Overall, how many hours per week do you use AI tools for academic purposes?
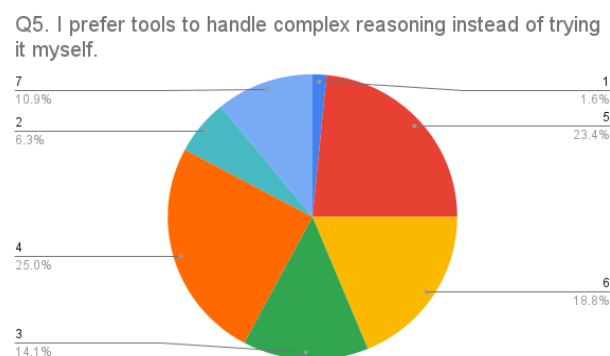
- 1–3
- 3–5
- 5–10
- 10+

20%
15%
15%
50%
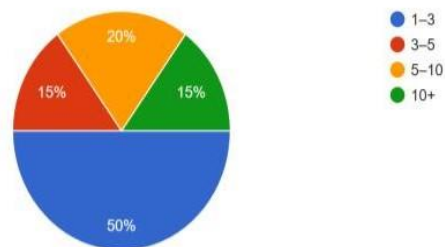
Note: The pie chart indicates the frequency of AI use where each color represents the amount of time participants use AI per week and the percentage indicates the number of participants in that particular time frame.

3. AI for Complex Reasoning

In this segment, Students were asked whether they like to use AI to solve complex reasoning tasks like logical or difficult questions, 78 % said they do. It is an extremely positive outcome as it indicates that the majority of students not only use AI frequently but also rely on it more when the assignments become more challenging. This choice indicates that students view AI as the means of overcoming issues that they might be unable to deal with independently as represented in figure 3.

Figure 3

Pie chart indicating the AI preference for complex reasoning.

Q5. I prefer tools to handle complex reasoning instead of trying it myself.

7
10.9%

2
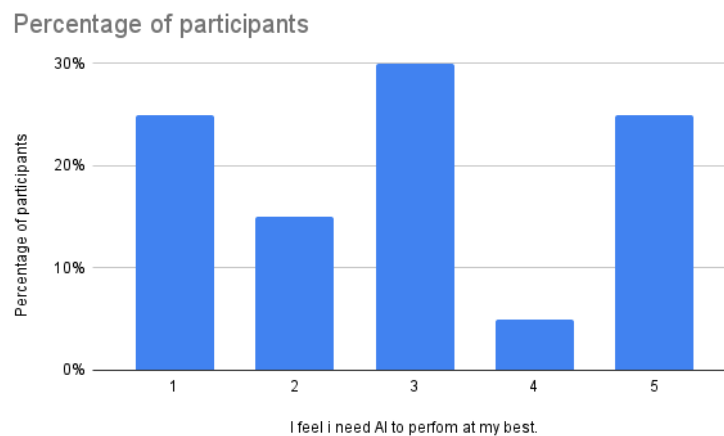6.3%

4
25.0%

3
14.1%

1
1.6%

5
23.4%

6
18.8%

Note: The pie chart indicates the preference of AI use for complex reasoning where each color represents the scale of preference and the percentage shows the number of participants.

4. **Belief About Best Performance**

Figure 4

Statistical graph on their belief about best performance.

Percentage of participants

Note: The Likert-scale graph shows the percentage of participants who feel AI tools are for performing better on a scale of one to five where one indicates the least and five the most.

The other main finding is that 60% of students (9 out of 15) claimed they do their best only with the help of AI. This implies that over 50 %t of the group feel that they cannot achieve their optimum performance without AI. The remaining 40% believed that they were still capable of doing well without AI although they were less in number. The fact that the majority of students rely on AI to give their optimistic results proves that such dependency is not only a question of convenience, but a direct connection to their skills and self-esteem.

5. **Reflections on Cognitive Test (With vs Without AI)**

Figure 5

Statistical graph on reflections on cognitive Test.

CDS vs. Overall, how many hours per week do you use AI tools for academic purposes?
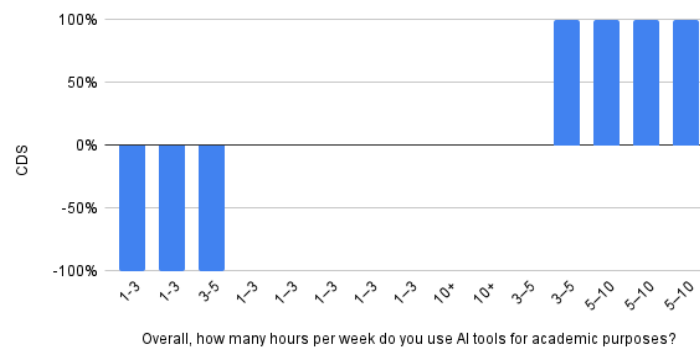
In order to obtain a clearer picture of the role of AI, a short cognitive test was done in the presence of AI assistance and with it off. The Cognitive Dependence Scale is a hypothesized scale that measures reliance on AI by computing the difference between performance in AI-assisted and non-AI conditions, (CDS = Performance with AI - Performance without AI) with higher scores showing dependence on AI. Here, the CDS score was compared with their frequency of AI use to determine how much dependence on AI has already been established in the participants.

The results were ambiguous as some of the participants had more correct answers without AI use than with AI. On the other hand, seven participants were more capable in answering the questions. Among these two participants, some responded with blank answers and the remaining participants responded with wrong answers to the questions without AI use. When we compared these results against their usage of time, we found that the students that had dependence on AI for their academic performance, were using AI frequently. But the students who had control on their AI use, performed better than them.

Qualitative data analysis

The reflection given by the participants on the cognitive test showed that there was a difference in experiences. Other participants mentioned the test to be challenging without the help of AI and it is likely that they are relying on external assistance to cope with cognitive load. Their reactions show that AI could have entered their problem-solving pattern and made their performance without AI more difficult. Conversely, other participants said the test was manageable, which also demonstrated confidence in their own abilities and resistance to being unable to use technology. Such distinction implies the different levels of reliance on AI,

where in some cases that can be a life-sustaining cerebral scaffold, in other cases, it is an optional meter, not an imperative.

Discussion

Throughout history, people have invented devices to lessen their work load and AI is part of it. In recent years, artificial intelligence has become an integral part of our day to day life. According to Ryan and Deci (2000) motivation can be intrinsic which is driven by curiosity and extrinsic which is driven by either rewards or deadlines. In university students, overthinking is a big problem. They have a tendency to delay difficult tasks without considering the consequences. The pressure from this becomes the driving force for them to use AI. In this study aimed to explore the effect of frequent AI use in cognitive capabilities and determine if frequent use of AI is able to create a prolonged dependence for our cognitive processes. Extensive research has been conducted on this which highlights that individuals rely on external tools to lessen the mental effort required problem-solving tasks (Risko & Gilbert, 2016). Moreover, Frequent reliance encourages cognitive offloading which reduces attention span and leads to originality decline in individuals (Thaker et al., 2025). Again, another study by MIT showed that people who used AI for writing showed lower brain activity and continued to perform worse even later without AI (Kos'myna et al., 2025).

In this study, we evaluated the participants' cause and motivation to use AI, their frequency of AI use, their cognitive functions and how they justify their over reliance on it. The results that were obtained mostly aligned with the results we hypothesized, which is that individuals are dependent on AI for their cognitive capabilities with frequent use and it is creating a huge impact on society.

The results derived from our survey showed that the participants consisted of undergraduate university students and adults who had previous knowledge about artificial intelligence and were comfortable using it. The majority of them were using it for academic work like writing, analysis and research but mostly writing. This suggests that AI is used as academic support and students rely on it to reduce effort and increase efficiency which aligns with cognitive offloading theory (Risko & Gilbert, 2016). This aligns with Zhai, Wibowo, and Li (2024), they observed that excessive use of AI dialogue systems can adversely impact cognitive capacities, such as critical thinking and analytical reasoning, in students. These conclusions point to the possible cognitive price of overuse of AI in academics.

In response to inquiry about their frequency of AI use, a substantial portion of participants replied that they used it more than three hours per week. This evidence supports the previous outcome which is the integration of AI in academic activities. It also indicated that using AI to generate ideas is also affecting their brains' engagement in critical thinking and complex problem solving. In the survey, the participants reported that they prefer to offload complex cognitive skills. This reduces opportunities to practice creative thinking and complex language use which leads to reduced engagement and performance even when AI is not used. Similarly we can observe that many children in Generation Alpha are experiencing speech formation difficulties that highlights potential early challenges in language development.It is implying a more generalized issue of the impact of diminished mental activity during young age. To support this issue, the recent study done by MIT showcased that ChatGPT users had markedly lower neural activity and worse executive control and creativity in neurocognitive areas critical to thinking and language processing compared to those who wrote alone (Kos'myna et al., 2025).

The survey also inquired if the participants felt they needed Al to perform better. More than half of the participants reported that they felt the need to use AI to enhance their performance. According to cognitive appraisal theory, we can interpret that they perceive AI usage as a way for them to manage the pressure of academic tasks. The students constantly need to do their assignments and meet deadlines. Sometimes, they are not able to solve all the problems. But as they need to finish it within time, they appraise the task as a challenge and evaluate AI use as a better option to complete the tasks. This shows that their reliance is not random. Rather, their perception on how hard the task is and how confident they feel in their abilities is what influences their AI usage (Lazarus & Folkman, 1984).

In comparison with this, a recent mixed methods study conducted by Coyle & McCarthy (2022) explored the effects of AI-based tools in learning on the levels of stress and academic performance of university students. According to our survey, students mainly resort to AI as a form of coping with academic pressure, but that study concluded that those students who mainly used AI to complete routine and low-cognitive tasks were much less stressed, as well as more confident in their deadlines performance. Conversely, the present research indicates that students view AI as a necessary tool to deal with difficult assignments, which means that they would use it more strategically and performance-oriented than as a stress-relief measure. These contrasting views show the subtle importance of AI in

educational situations whether it is considered as a workload management tool or an approach to master competence in challenging tasks.

As this study wanted to measure how much frequent use will affect their cognitive skills, it created a hypothetical scale based on cognitive offloading theory. The results obtained from that cognitive skills test were ambiguous. The participants were given two sets of questions to solve with and without AI use. Some of the participants showed no dependence on AI as they were able to solve all the questions. Some of them were not able to solve the questions that were meant to be solved without AI and some of them did not verify if the answers given by AI were correct. The unclear findings indicate that the regular AI usage might not have similar impacts on all users. While some maintain cognitive independence, others exhibit partial or over- reliance on AI. In terms of cognitive theory, these results suggest that regular AI use may affect cognitive engagement in different ways among the individuals (Risko & Gilbert, 2016). To compare and contrast, a recent study by Wang, Kim, and Patel (2023) tested the impact of AI assistance on age-specific problem-solving and reported that the older cohort actually experienced greater benefits of AI compared to younger subjects, who tended to over-trust the technology which is a different pattern of cognitive dependence that would not congruent with these mixed results.

Upon completion of the survey, participants were requested to provide feedback on their experience in solving the presented problems. 50% of the participants reported that they are able to solve the task without any help from AI tools. And another 50% of the participants reported that they thought using AI was more effective for them. This evidence did not support the previous outcome that was obtained from measuring their cognitive dependence. Because some of the participants who reported that they were able to solve it by themselves, could not solve the problem. This creates an inconsistency in the outcomes. But overall results were mostly consistent. We can interpret these results using Bem (1972) who explained how individuals' previous experiences, expectations, and cognitive biases can influence their understanding and interpretation of tasks. In this study, participants who considered themselves able to solve problems and failed to demonstrate a discrepancy between perceived and actual performance revealed the effect of the perceived on competence and tool efficacy judgments.

Drawbacks and complications of the study

The findings can be more clearly explained by the limitations and challenges that we experienced in this study. This study had many limitations that should be considered before interpreting the results. Firstly, the scale for measuring cognitive abilities which was newly created for this research based on cognitive offloading theory and has not been validated as a psychological scale. Additionally the survey was done from a subjective perspective. It means the data was biased as the participants self assessed their capabilities and behavior. Unlike subjective data, objective data gives us accurate and unbiased information.

Secondly, the sample size was too small for accurate assessment. The greater the sample size, the greater statistical power and, therefore, the less difficult it is to identify actual effects, and the more varied the sample in terms of age, background, and experience, the lower the level of sampling bias and the broader the scope of behaviors and worldviews. Again, the sample was limited to undergraduate students from a single university which reduced the generalizability of the findings.

Lastly, the data was collected only one time which was only the participants immediate responses. So it showed the short term effects on cognitive abilities but it does not allow for observation of changes or trends over time. As a result, it is not possible to determine whether frequent AI use leads to lasting cognitive dependence or other long-term impacts on learning and cognitive development.

The main obstacle in this study was to ensure that participants were completing the tasks honestly and as per instruction because the study was conducted online and there was no possibility for us to monitor them.Moreover, some participants submitted responses which were very inconsistent and ambiguous. So, the data demanded quite an extensive cleaning and validation.

Recommended strategies for future research

For future research on AI use and cognitive dependence, there are several recommendations that can be made to improve reliability. Firstly, the samples should include a larger and diverse sample which should include multiple universities, age, gender, professional groups, and cultural backgrounds. Sampling bias can be reduced in this way and it will create a wider range of patterns which will ensure that the identified patterns are applicable to a wide range of population.

Secondly, a standardized scale should be developed and validated by the American Psychological Association to measure cognitive dependence on AI. It would create a more accurate and consistent result. Lastly, the study should be conducted in a controlled

environment that would help them to ensure the instructions are followed accurately. All of this will help in creating a more accurate study on this.

Frequent use of AI in academics has many psychological implications which influence cognitive development. Dependence on AI means that students can offload mental burden as they outsource more demanding cognitive capabilities that can make them more efficient but decrease the ability to think and be creative in the long run (Risko & Gilbert, 2016; Thaker et al., 2025). This behavior is shaped by how students perceive tasks and their ability to manage them. When tasks seem challenging, AI is seen as a necessary aid to complete work on time. Overall we can conclude this discussion by saying that although AI can make tasks easier and save mental effort, frequent dependence may reduce active engagement and creative thinking. Over time, this routine offloading of cognitive load can reduce the possibilities of independent learning and acquisition of skills that are complex, indicating that overuse of AI can bring long-term consequences on cognitive development.

Conclusion

Artificial Intelligence (AI) is now in the center of academic life of students and increases efficiency and productivity, but also poses the threat of cognitive dependence. This work validated the two-fold impact, 3/5 of the students applied AI primarily to study and assignments, 50% more than three hours per week, and 78% to find solutions to challenging problems. Approximately 60% stated they did it better with AI and 80% said faster, more accurate and confident when assisted. Most of them became less confident and less performing without AI. These results imply that AI enhances short-term performance, but it produces dependence that undermines autonomy in problem-solving, memory and critical thinking, although not all learners are equally vulnerable.

Further research ought to explore the long term impacts of AI on creativity, and independent thinking and intercultural aspects of dependency. More detailed insights could be in the form of experimental comparisons of AI-assisted and traditional learning. To be implemented, educational institutions must bear a responsibility of combining AI with independent learning, and policy-makers should create guidelines to facilitate a responsible utilization of AI and digital resilience. So AI is a friendly companion but a cognitive danger, it can be utilized as a tactical assist that can help to maintain memory, flexibility, and critical thinking without substitution.

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