

Relationship Between Artificial Intelligence (AI) Usage and Cognitive Offloading

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Abstract

Artificial intelligence (AI) has become increasingly common in everyday learning, information seeking, and academic activities. Although AI tools can reduce effort and provide quick access to information, frequent dependence on them may encourage users to shift some thinking and problem-solving tasks from their own memory and reasoning to external digital systems. The present study examined the relationship between AI usage and cognitive offloading among 200 respondents. Data were collected through a structured online questionnaire containing demographic questions and Likert-scale statements related to AI usage, emotional dependence, and cognitive or academic offloading. Descriptive statistics were used to summarize participants' responses, while cross-tabulation and chi-square tests of independence were applied to examine associations between categorical variables. Pearson's correlation coefficient was also used to assess relationships among the major study variables. The findings showed a statistically significant association between AI usage and cognitive-offloading categories. The results suggest that higher levels of AI usage were associated with higher levels of reported cognitive offloading in the study population. The findings highlight the importance of understanding how AI can be used as a learning support while maintaining active thinking, evaluation, and independent problem-solving.

Keywords—*Artificial Intelligence, Cognitive Offloading, AI Usage, Academic Learning, Critical Thinking*

I. INTRODUCTION

Artificial intelligence (AI) has rapidly become integrated into education and everyday academic activities. Generative AI tools, particularly ChatGPT (Chat Generative Pre-trained Transformer), can provide explanations, answer questions, summarize information, generate ideas, assist with writing, and support students in completing different academic tasks. Research in higher education shows that the applications of ChatGPT have expanded across learning, writing, information seeking, problem-solving, and other academic activities, making AI an increasingly relevant part of students' learning practices [1][2][3]. The use of external resources to reduce the mental demands of a task is not a new phenomenon. Risko and Gilbert described this process as cognitive offloading, referring to the use of external actions, tools, or resources to reduce the cognitive requirements of a task. Their work suggested that people are more likely to offload when tasks are perceived as demanding and when they believe that external support can reduce the effort required to complete them [4]. With the development of generative AI, this process can occur through systems that actively produce

information and solutions rather than simply storing or retrieving information. Students can therefore use AI not only to access information but also to generate ideas, organize thoughts, solve problems, and produce written responses [1][5].

Research has shown that students use ChatGPT for several forms of academic support. For example, studies of postsecondary learners have reported the use of ChatGPT for brainstorming, generating ideas, writing support, information seeking, and other self-directed learning activities [6][7]. Research on university students has also found that ChatGPT can influence critical, creative, and reflective thinking, although the nature of these effects can vary according to how the technology is incorporated into learning activities [8][9]. Similarly, research involving university students in the United Arab Emirates reported associations between ChatGPT use, student engagement, critical thinking, and academic achievement, demonstrating that AI use can have multiple dimensions within educational settings [10].

The potential benefits of AI-assisted learning are also supported by experimental evidence. A

systematic review and meta-analysis of experimental studies reported that ChatGPT use was associated with improvements in academic performance and higher-order thinking propensities, while also reducing mental effort in some learning situations [11]. Experimental research on creative problem-solving has similarly shown that students using ChatGPT can achieve improvements in the quality, elaboration, and originality of solutions and may perceive tasks as requiring less mental effort [12]. These findings suggest that reducing cognitive effort through AI is not necessarily negative; AI can function as a useful learning support when students remain actively involved in evaluating and developing their responses.

However, concerns have been raised when AI assistance becomes excessive or replaces rather than supports independent cognitive activity. Research examining AI text generators and critical thinking has identified concerns related to reliability, accuracy, ethical use, and the possibility that students may rely on AI for lower-level cognitive tasks rather than developing higher-order thinking skills independently [13]. Studies of ChatGPT-assisted writing have also shown that students may use AI extensively for generating and organizing written content, highlighting the need to understand whether AI is being used as a learning aid or as a substitute for individual effort [6,14]. Reviews of ChatGPT use in higher education similarly emphasize that responsible use requires critical evaluation, fact-checking, AI literacy, and appropriate human involvement [2][3]. Recent research has increasingly connected generative AI with the concept of cognitive offloading. Studies specifically examining AI-based cognitive offloading suggest that students may transfer parts of information processing, idea generation, problem-solving, or decision-making to AI systems. The extent of this offloading may depend on the purpose of AI use and the level of cognitive engagement maintained by the learner [15]. Therefore, AI usage should not be viewed only in terms of frequency or access; it is also important to consider how individuals use AI, how much they depend on it, and whether they continue to engage independently with cognitive tasks.

Although AI can provide academic assistance and reduce mental effort, frequent reliance on AI may be associated with changes in independent learning, critical engagement, and the way individuals

approach demanding tasks. Existing research provides evidence for both supportive and potentially problematic aspects of AI use, but the relationship between general AI usage patterns and cognitive offloading remains an important area for further investigation. Therefore, the present study focuses on the relationship between AI usage and cognitive offloading. By examining respondents' AI-use patterns, dependence-related behaviours, and reported tendency to rely on AI during thinking and academic tasks, this study aims to understand whether differences in AI usage are associated with differences in cognitive offloading.

The objectives of the present study were to assess the pattern and level of artificial intelligence usage among the respondents, examine the extent of reported cognitive and academic offloading associated with AI use, investigate the relationship between AI usage and cognitive offloading, examine whether AI usage differs across selected demographic groups such as age and gender, determine whether there is a statistically significant association between AI usage categories and cognitive-offloading categories using the chi-square test of independence, and examine the relationship among AI usage, emotional dependence on AI, and cognitive/academic offloading using correlation analysis.

II. MATERIALS AND METHODS

A. Research Design

The present study used a quantitative, cross-sectional survey design to examine the relationship between artificial intelligence usage and cognitive offloading.

B. Study Participants

A total of 200 respondents participated in the study. Participants represented different age groups, genders, and occupational backgrounds. The largest proportion of respondents belonged to the 18–24-year age group, while students formed the major occupational group.

C. Data Collection

Primary data were collected using a structured online questionnaire created through Google Forms. The questionnaire was distributed electronically and respondents participated voluntarily. The collected responses were compiled into a spreadsheet for statistical analysis.

D. Research Instrument

The questionnaire consisted of demographic questions followed by 22 main statements related to respondents' interaction with artificial intelligence. The main questionnaire items were assessed using a five-point Likert scale ranging from 1 (Strongly Disagree) to 5 (Strongly Agree). The items were organized into three broad areas: artificial intelligence usage and reliance (8 items), emotional dependence on artificial intelligence (8 items), and cognitive/academic offloading (6 items).

E. Variables Studied

The major independent variable was artificial intelligence usage and reliance, while cognitive/academic offloading was considered the principal outcome variable. Demographic characteristics, including age and gender, were also examined to identify differences between respondent groups.

F. Statistical Analysis

The collected data were summarized using frequencies, percentages, and mean scores. Cross-tabulation was performed to compare categorical variables. Chi-square tests of independence were used to determine whether statistically significant associations existed between demographic/artificial-intelligence-use categories and cognitive-offloading categories. Pearson's correlation coefficient was used to examine relationships between the major study variables. Spearman's rank-order correlation coefficient was also used to examine the relationship between artificial intelligence usage and cognitive offloading. Statistical significance was considered at a p-value (probability value) of less than 0.05.

G. Ethical Consideration

Participation was voluntary, and the questionnaire was completed by respondents through an online form. The collected responses were used for research and statistical analysis, and the study did not require participants to provide personally identifying information for the analysis presented.

III. RESULTS

A. Demographic Characteristics of the Participants

A total of 200 participants were included in the study. The demographic characteristics were summarized using frequency and percentage. Most participants were aged 18–24 years, and students

constituted the largest occupational group, while the gender distribution was almost equal.

The sample was predominantly composed of young adults aged 18–24 years (74.5%) and students (63.5%). Gender distribution was nearly equal, with females accounting for 50.5% and males for 49.0% of the participants.

TABLE I. DEMOGRAPHIC CHARACTERISTICS OF THE STUDY PARTICIPANTS

Demographic variable	Category	Frequency (n)	Percentage (%)
Age	18–24 years	149	74.5
	25–35 years	26	13.0
	35–45 years	16	8.0
	45–65 years	8	4.0
	Above 65 years	1	0.5
Gender	Female	101	50.5
	Male	98	49.0
	Prefer not to say	1	0.5
Occupation/Status	Student	127	63.5
	Working professional	36	18.0
	Working and studying	29	14.5
	Other	8	4.0

B. Descriptive Analysis and Statistical Analysis

The study included a total of 200 participants who completed the questionnaire examining artificial intelligence usage, dependence on artificial intelligence, and cognitive offloading in academic activities. Responses were recorded using a five-point Likert scale ranging from 1 (Strongly Disagree) to 5 (Strongly Agree). For analysis, the questionnaire items were grouped into three related sections. The first eight statements represented artificial intelligence usage and reliance, the next eight statements assessed emotional dependence on artificial intelligence, and the final six statements represented cognitive and academic offloading.

The mean score for the artificial intelligence usage and reliance section was 3.46, indicating an overall tendency towards agreement with statements describing frequent or dependent use of artificial intelligence. The emotional dependence section had a mean score of 3.38, while the cognitive and academic offloading section had a mean score of 3.29. These values were above the midpoint of the five-point scale (3.00), suggesting that artificial-intelligence-related dependence and offloading

behaviours were reported by a considerable proportion of participants.

TABLE II. MEAN SCORES AND CRONBACH'S ALPHA COEFFICIENTS FOR THE STUDY VARIABLES

Variable	Number of items	Mean score	Cronbach's alpha coefficient (α)
AI Usage & Reliance	8	3.46	0.838
Emotional Dependence on AI	8	3.38	0.888
Cognitive/Academic Offloading	6	3.29	0.835

1) Reliability Analysis

The internal consistency of the questionnaire sections was assessed using Cronbach's alpha coefficient (α). The artificial intelligence usage and reliance section consisting of eight items showed a Cronbach's alpha coefficient of 0.838. The emotional dependence section also demonstrated good internal consistency, with a Cronbach's alpha coefficient of 0.888. The cognitive and academic offloading section, consisting of six items, produced a Cronbach's alpha coefficient of 0.835. These values indicate that the items within each section showed good internal consistency and were sufficiently related to be considered as grouped measures for the present analysis.

2) Relationship Between Artificial Intelligence Usage and Cognitive Offloading

Pearson's correlation analysis was performed to examine the relationship between participants' artificial intelligence usage/reliance scores and their cognitive-offloading scores. A strong positive correlation was observed between the two variables (Pearson's correlation coefficient, $r = 0.872$; p -value, $p < 0.001$; sample size, $N = 200$). This indicates that participants reporting higher levels of artificial intelligence usage and reliance also tended to report higher levels of cognitive-offloading-related behaviours. The correlation was statistically significant at the 0.05 level. Therefore, the observed relationship is unlikely to be explained solely by random variation within this sample. The finding is particularly relevant because several questionnaire items indicated that participants used AI not only for obtaining information but also for tasks that traditionally require independent cognitive effort. These included obtaining immediate solutions, using AI to structure ideas, relying on AI for complex

academic tasks, and accepting AI-generated information without sufficient verification.

3) Emotional Dependence on Artificial Intelligence

The analysis also showed a positive relationship between artificial intelligence usage/reliance and emotional dependence on artificial intelligence (Pearson's correlation coefficient, $r = 0.880$). Participants who reported greater artificial intelligence reliance also tended to report stronger feelings such as frustration, anxiety, mental blockage, or difficulty working without artificial intelligence assistance. The emotional dependence score had a mean of 3.38, which was above the neutral midpoint. This suggests that, for a considerable number of participants, artificial intelligence use was not limited to improving convenience or saving time but was also associated with their perceived ability to manage academic tasks without artificial intelligence support.

4) Relationship Between Emotional Dependence and Cognitive Offloading

A strong positive association was also observed between emotional dependence on artificial intelligence and cognitive/academic offloading (Pearson's correlation coefficient, $r = 0.926$). This was the strongest correlation observed among the three measured sections. Participants who reported stronger emotional dependence on artificial intelligence also tended to report more behaviours associated with transferring academic or cognitive tasks to artificial intelligence. This pattern provides additional support for examining AI reliance as a multidimensional behaviour involving not only frequency of use but also dependence, emotional responses, and reduced independent engagement with academic tasks.

TABLE III. PEARSON CORRELATION ANALYSIS AMONG ARTIFICIAL INTELLIGENCE USAGE, EMOTIONAL DEPENDENCE, AND COGNITIVE OFFLOADING

Variables	Pearson's correlation coefficient (r)	p -value	Sample size (N)
AI Usage & Cognitive Offloading	0.872	<0.001	200
AI Usage & Emotional Dependence	0.880	<0.001	200
Emotional Dependence & Cognitive Offloading	0.926	<0.001	200

Overall Interpretation of the Statistical Findings

The statistical analysis demonstrates a clear association between artificial intelligence usage/reliance and cognitive offloading within the present sample. The correlation coefficient of 0.872 indicates that the two measures tended to increase together. However, the result should be interpreted carefully. The study was based on self-reported questionnaire responses collected at a single point in time. Therefore, the findings demonstrate an association rather than a causal relationship. The data cannot establish that increased artificial intelligence usage directly causes cognitive offloading.

Instead, the results suggest that participants who reported greater reliance on artificial intelligence also tended to report behaviours consistent with cognitive offloading. This relationship provides a basis for further investigation into how frequent artificial intelligence use may interact with independent thinking, academic decision-making, and learning practices. Overall, the findings support the presence of a substantial relationship between artificial intelligence usage/reliance and cognitive-offloading-related behaviour among the participants included in this study.

C. Cross-Tabulation and Chi-Square Analysis

To examine the relationship between artificial intelligence usage and cognitive offloading, respondents were divided into three categories—low, moderate, and high—based on their mean questionnaire scores. The cross-tabulation showed a noticeable pattern between the two variables.

Among respondents with low AI usage, 14 out of 19 respondents (73.7%) were classified as having low cognitive offloading, while 5 respondents (26.3%) showed moderate cognitive offloading. None of the respondents in this group were classified as having high cognitive offloading. In the moderate AI-usage group, most respondents (88 out of 113; 77.9%) also fell into the moderate cognitive-offloading category. A smaller proportion, 16 respondents (14.2%), showed low cognitive offloading, while 9 respondents (8.0%) showed high cognitive offloading. A different pattern was observed among respondents with high AI usage. Of the 68 respondents in this category, 53 (77.9%) were also classified as having high cognitive offloading, while 15 (22.1%) showed moderate cognitive

offloading. None were classified as having low cognitive offloading.

Overall, the results show that higher artificial-intelligence-usage categories were accompanied by higher cognitive-offloading categories in this sample. The chi-square test of independence confirmed that the association between artificial intelligence usage and cognitive-offloading category was statistically significant (chi-square statistic, $\chi^2 = 154.915$; degrees of freedom, $df = 4$; p-value, $p < 0.001$). This indicates that the distribution of cognitive-offloading levels was significantly different across the artificial-intelligence-usage groups. It should be noted that the chi-square analysis demonstrates an association between the variables and does not establish a cause-and-effect relationship.

TABLE IV. CROSS-TABULATION BETWEEN ARTIFICIAL INTELLIGENCE USAGE AND COGNITIVE OFFLOADING

Artificial intelligence usage category	Low cognitive offloading	Moderate cognitive offloading	High cognitive offloading	Total
Low	14 (73.7%)	5 (26.3%)	0 (0.0%)	19
Moderate	16 (14.2%)	88 (77.9%)	9 (8.0%)	113
High	0 (0.0%)	15 (22.1%)	53 (77.9%)	68
Total	30	108	62	200

Chi-square test of independence: chi-square statistic (χ^2) = 154.915; degrees of freedom (df) = 4; p-value (p) < 0.001.

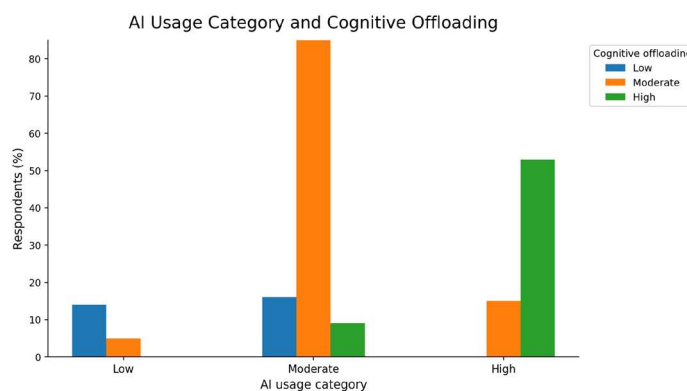


Fig. 1. Relationship between artificial intelligence usage and cognitive offloading

The bar graph illustrates the distribution of cognitive-offloading levels within each artificial-intelligence-usage category. The graph shows that respondents in the low artificial-intelligence-usage group were predominantly classified as having low cognitive offloading, whereas the high artificial-intelligence-usage group was predominantly associated with high cognitive offloading.

D. Spearman Rank-Order Correlation Analysis

A Spearman rank-order correlation was performed to determine the relationship between artificial intelligence usage and cognitive offloading among the respondents. The analysis included 200 respondents. A strong positive correlation was observed between artificial intelligence usage and cognitive offloading scores (Spearman's rank correlation coefficient, $\rho = 0.794$; p-value, $p < 0.001$).

The result indicates that respondents reporting higher levels of artificial intelligence usage and reliance also tended to report higher levels of cognitive offloading. The association was statistically significant, indicating a statistically significant relationship between the two variables in the study sample. However, since the present study used a cross-sectional survey design, this correlation represents an association and does not establish a causal relationship between artificial intelligence usage and cognitive offloading.

TABLE V. SPEARMAN RANK-ORDER CORRELATION ANALYSIS

Statistical measure	Result
Sample size (N)	200
Spearman rank correlation coefficient (ρ)	0.794
p-value (probability value)	< 0.001
Direction	Positive
Strength	Strong

IV. DISCUSSION

The present study was conducted to examine the relationship between artificial intelligence usage and cognitive offloading among 200 respondents. The findings indicate a clear association between the level of artificial intelligence usage and the level of reported cognitive offloading. The mean score for artificial intelligence usage and reliance was 3.46, while the mean score for cognitive and academic

offloading was 3.29. These values suggest that artificial intelligence was being used to a moderate extent by the participants and that the respondents also reported a noticeable tendency to depend on artificial intelligence for certain thinking and academic activities.

The cross-tabulation provided a more detailed picture of this relationship. Among respondents with low AI usage, 73.7% were classified as having low cognitive offloading, and none were classified in the high cognitive-offloading category. In contrast, among respondents with high AI usage, 77.9% were classified as having high cognitive offloading, while none were placed in the low cognitive-offloading category. This pattern suggests that respondents who reported greater use of AI were also more likely to report greater reliance on AI-related support for cognitive and academic tasks.

The chi-square analysis further supported this pattern. A statistically significant association was observed between artificial intelligence usage and cognitive-offloading category (chi-square statistic, $\chi^2 = 154.915$; degrees of freedom, $df = 4$; p-value, $p < 0.001$). Therefore, the distribution of cognitive-offloading levels was not the same across the different artificial-intelligence-usage groups. However, this result should be interpreted as an association rather than evidence that increased artificial intelligence usage directly causes cognitive offloading, since the present study used a cross-sectional survey design.

The findings are relevant to previous research on cognitive offloading. Cognitive offloading has traditionally been described as the use of external resources to reduce the mental demands involved in completing a task. With generative AI, this process can extend beyond simply storing or retrieving information because AI systems can also assist with explanation, summarization, problem-solving, idea generation, and written responses. Risko and Gilbert's work on cognitive offloading provides a theoretical basis for understanding why individuals may transfer some cognitive demands to external resources [4]. Recent research has also shown that the relationship between artificial intelligence use and cognitive performance is not necessarily simple. A study of undergraduate students in Ghana reported that ChatGPT use was associated with changes in critical, creative, and reflective thinking skills. The authors emphasized that AI-supported activities can influence different dimensions of cognition rather

than producing a single uniform effect [16]. Similarly, a systematic review and meta-analysis by Deng et al. found that ChatGPT-based educational interventions could improve academic performance and higher-order thinking propensities while also reducing mental effort. However, the authors highlighted methodological limitations and recommended the use of objective measures and longer-term assessments when studying the effects of AI on learning. This is important when interpreting the present findings because cognitive offloading may sometimes represent useful reduction of unnecessary mental effort rather than a complete loss of independent thinking [8].

Recent experimental evidence also demonstrates why the issue requires careful interpretation. One randomized controlled study reported lower long-term knowledge retention among students who used ChatGPT as a study aid compared with students who used traditional study methods. The authors linked this finding to reduced cognitive effort during learning. On the other hand, other experimental research has found that ChatGPT can improve performance on some complex problem-solving tasks while reducing perceived mental effort. These findings indicate that the effect of artificial intelligence may depend on how the technology is used, rather than simply on whether it is used [11]. The present study therefore suggests that artificial intelligence usage and cognitive offloading should be considered together. Using artificial intelligence does not automatically mean that a person is unable to think independently. Artificial intelligence may function as a useful support when users question its responses, verify information, compare different sources, and use the generated material as a starting point for their own reasoning. The concern arises when artificial intelligence becomes the primary source of answers and replaces rather than supports personal thinking. Recent research similarly suggests that the manner of artificial intelligence engagement, including whether users actively evaluate artificial-intelligence-generated information or simply accept it, can influence cognitive outcomes [17].

Overall, the findings of the present study support the existence of a significant relationship between AI usage and reported cognitive offloading among the respondents. The results highlight the need for balanced AI use in academic settings, where AI can be treated as a supporting tool while maintaining

independent reasoning, evaluation, and active participation in the learning process.

V. CONCLUSION

The present study examined the relationship between artificial intelligence usage and cognitive offloading among 200 respondents. The findings showed that respondents with higher levels of artificial intelligence usage were more frequently classified in the higher cognitive-offloading category. The chi-square analysis demonstrated a statistically significant association between artificial intelligence usage and cognitive offloading (chi-square statistic, $\chi^2 = 154.915$; degrees of freedom, $df = 4$; p-value, $p < 0.001$).

The study therefore indicates that greater AI usage was associated with greater reported cognitive offloading within the present sample. However, this finding should not be interpreted as proof that AI usage directly causes cognitive offloading. AI can serve as a useful academic support by reducing routine effort, providing explanations, and helping users organize information. At the same time, excessive dependence may reduce opportunities for individuals to independently analyse, evaluate, remember, and solve problems. The findings emphasize the importance of developing a balanced approach to AI use. Students and other users can benefit from AI while still maintaining responsibility for understanding, checking, and evaluating the information they receive. Instead of completely replacing human thinking, AI may be more beneficial when used as a supplementary tool that supports learning and encourages further reasoning.

In conclusion, the study highlights the growing importance of understanding how people interact with AI and how these interactions may influence cognitive behaviour. Further research using experimental designs and objective measures of cognitive performance would help provide a clearer understanding of the long-term effects of AI-assisted cognitive offloading.

VI. LIMITATIONS OF THE STUDY

1. The cross-sectional and self-reported nature of the study allows identification of associations between AI usage and cognitive offloading but does not establish a cause-and-effect relationship.
2. The sample was predominantly composed of young adults and students, which may limit the

generalizability of the findings to other age groups and populations.

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