

EXAMINING THE RELATIONSHIP BETWEEN GENERATIVE AI DEPENDENCY AND COGNITIVE FAILURE AMONG UNIVERSITY STUDENTS

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Abstract

In the current digital society, artificial intelligence tools have integrated with the lives of students in academia. While these have been associated with positive learning outcomes and increased productivity, their relevance may also trigger issues of dependence and cognition impairment, which significantly impacts students' psychology. The study adopts a correlational cross-sectional research design to be carried out among university students (N = 100) in the age bracket of 18 years and above from both public and private universities in Punjab, selected through convenient sampling. Data has been collected using the Generative AI Dependence Scale developed by Goh et al., Cognitive Failures Questionnaire 2.0 designed by Goodhew & Edwards, and. This study results shows that AI dependence (cognitive preoccupation, withdrawal, and negative consequence), is significantly ($p = .212^$) positively correlate with cognitive failures and AI Dependence has shown a significant impact ($p = .034^*$) on Cognitive Failure but no significant gender difference ($p = .566^*$) on AI Dependence and cognitive failure. The findings of this study helped in understanding the psychological impact of AI dependence and address the educational and clinical responses to enable students to apply AI appropriately, promote cognitive functioning.*

Chapter I

Introduction

In this modern digital age, technologies (smartphones, social media, and artificial intelligence (AI) tools) are now integrated into our daily lives to an extreme extent. These innovations have increased convenience, speed, and global connectivity which have made life easier and more accessible. Nevertheless, as the reliance on these tools has been growing, there are also significant concerns regarding their effects on human cognition and mental functioning (Shanmugasundaram & Tamilarasu, 2023)

Although AI can support vocational learning, it can also weaken cognitive learning since the students might take submissively the information offered by the AI without critical analysis (Ododo et al., 2024). Although AI can improve individualized learning, overindulgence in it can decrease cognitive and memory encoding (Bai et al., 2023). In the definition of cognitive functions, it includes observation, recall, decision-making, thinking, communication, attentiveness (Al Salmani et al., 2020).

It is important to examine connection between the use of AI, and cognitive failure. Although AI can be beneficial in learning, creativity, and accessibility with a careful approach, its overuse and use without appropriate thought can lead to impaired attention, memory, and independent thinking. If there is balanced, and conscious engagement with AI technologies then there is possibility of optimal cognitive performance and psychological wellbeing in the digital age (Shanmugasundaram & Tamilarasu, 2023).

Cognitive failure, as defined by Broadbent, Cooper, FitzGerald, and Parkes (1982) (Broadbent et al., 1982). It is a human trait to be wrong and we all do so in our ordinary lives. In some cases the effects of these common-day cognitive slips and lapses are relatively minor, like the inconvenience of having forgotten an appointment. However, in other instances, such Cognitive Failure may lead to far reaching effects like missing a road sign that is importance and leading to an accident. Although all human beings have cognitive failure, it is evident that

individual differences exist in the occurrence of these Cognitive Failure (Goodhew & Edwards, 2024).

Cognitive Failure have been investigated in a various of settings and have been related with work-related stress, chronic fatigue syndrome, burnout, and psychiatric illness (Linden et al., 2005; Mahoney et al., 1998). With the constant reliance on and use of digital tools, it is increasingly hard to tell the difference between mere correlations and actual causal relationships as we strive to figure out the role of technology in our mental capacities which lead towards Cognitive Failure (Shanmugasundaram & Tamilarasu, 2023).

Artificial intelligence (AI) is speedily changing learning in terms of personalization, efficiency, and scalability (Govea et al., 2023; Mahmoud & Sørensen, 2024). AI-based technologies like adaptive learning systems and intelligent tutoring systems, transformed the traditional pedagogical paradigm since they personalize the teaching procedure to the requirements of specific students (Alawneh et al., 2024). Although these advances technologies can lead to improvement of learning, besides it also generate queries about how they effect on the cognitive development of the learners especially in critical thinking, recollection and problem solving. Some of the problems are the cognitive dependency, which is the cognitive offloading effect because AI is an enabler of deep learning (Grinschgl & Neubauer, 2022; Kim et al., 2023).

Today's student enrolled in universities facing lots of pressures and multiple challenges related to their academic performance, because this is the era of competitive and demanding responsibilities and commitments from the students that significantly impact their life style. These factors prompt a sense of precarious and fear related to their future academic performance and career success (Moitra et al., 2021).

According to results of different studies, testing process improved retention and engagement, but prolonged AI usage results towards the memory decline (Akgun & Toker, 2024), which indicate the direct link with the cognitive failure.

Significance of the Study

There are various reasons why this study is important. First, it adds to the accumulating literature on the psychological implications of AI use, which is not yet well-investigated in developing nations such as Pakistan. Second, the target population of this study is university students since it is a highly occupied group prone to cognitive overload. Most importantly, as the AI tools become deeply merged into our everyday routines life, so understanding and calculating their impact on mental functioning is a demanding need. This research helps to define how to preserve optimal cognitive performance and psychological well-being in the digital age.

Rationale of the Study

Although AI tools have become common in higher education, very little empirical research has been conducted to address the side effects that they may have on the cognitive and behavioral well-being of students in higher education. The majority of the available literature has examined the use of general smartphones or social media, but not the interactions of AI specifically. This paper fills that gap as it investigates whether the regular use of AI is associated with increased cognitive failure. In this way, it offers empirical facts on the advantages and possible dangers of the Generative AI Dependency in the academic environment.

Objectives of the Study

Following are the objectives of this study.

1. To examine the relationship between Generative AI Dependency, and Cognitive Failure among university students.

2. To evaluate the impact of Generative AI Dependency on Cognitive Failure among university students.
3. To examine the gender differences regarding the Generative AI Dependency, and Cognitive Failure among university students.

Hypotheses

Following are the hypotheses of this study.

1. Generative AI Dependency (cognitive preoccupation, negative consequences, and withdrawal) has a positively correlates with higher Cognitive Failure among university students.
2. Generative AI Dependency has an impact on Cognitive Failure among university students.
3. There is a significant gender difference regarding Generative AI Dependency, and Cognitive Failure among university students.

Chapter II

Method

Research Design

A quantitative, correlational, and cross-sectional research design has been used to investigate the relationship between AI Dependency and Cognitive Failure among university students. The quantitative research method has been done for the objective measure, statistical analysis and generalization of results of the relationship between the various dimensions of AI Dependency (cognitive preoccupation, withdrawal, and negative consequences) and the Cognitive Failure among the university students.

Sample

The sample has been collected $N=300$ from the university students (male and female) aged 18 years and above which were chosen by applying convenience sampling in public and private universities in Punjab.

Inclusion Criteria

The participants have been included in the study from the university students aged 18 years and above who use AI platforms, including ChatGPT, Google Gemini, AI writing assistants, or other study-related AI applications. The members are engaged in constant communication with AI technologies during their academic or daily routine.

Exclusion Criteria

Students who were not being included are those who have any neurological disorder or diagnosed sleep disorders because these factors can have an independent effect on cognitive failure.

Operational Definitions

Following are the operational definitions of Generative AI Dependency, and Cognitive Failure.

Generative AI Dependency

Generative AI Dependency means, the excessive usage of the generative artificial intelligence systems by the individual, which can be defined as cognitive preoccupation (salience and compulsive use), withdrawal symptoms and adverse effects in the real life (Goh et al., 2025).

Cognitive Failure

The cognitive failure, referring to the daily cognitive errors or slips which can be done normally without causing mistakes, it includes forgetfulness, inattention, and error of action during routine activities (Martin, 1983; Wallace & Chen, 2005).

Instruments

Generative AI Dependency Scale (Goh et al., 2025)

Generative AI Dependency Scale, measures the AI Dependency means in daily task which consists of 11 items which has further 3 subscales: Cognitive Preoccupation (Salience and Compulsive Use), Negative Consequences, and Withdrawal. Developed to assess the frequency, purpose, and dependency level of AI use among adults. Its Items are scored on 5-point Likert scale, 1 refers to strongly disagree and 5 strongly agree.

Cognitive Failure Questionnaire 2.0 (Goodhew & Edwards, 2024)

Cognitive Failure Questionnaire 2.0 measures the frequency of cognitive lapses in daily life. Cognitive Failure Questionnaire 2.0 is an improved version of the first CFQ, shorter in length and better able to describe more variance in objective attentional control performance. CFQ 2.0 is a single-factor and 15-item test. It contains 5-items rated on a 5-point Likert scale (0 = Never to 4 = Very Often).

Procedure

The participants were conducted online using Google Forms after seeking the consent of the powers of the institutes. The aim and confidentiality of the study has been clarified.

Chapter III

Results

Table 1

Independent Samples t-test for Comparing Generative AI Dependency and Cognitive Failure among Female and Male University Students (N=100)

Variables	Males (n=25)		Females (n=75)		Df	t	p	95%CI		Cohen's d
	M	SD	M	SD				LL	UL	
1. Generative AI Dependency	19.1	4.54	19.36	5.26	98	-.180	.566	-2.55	2.12	-0.042
2. Cognitive Failure	24.0	10.7	23.15	12.62	98	.303	.587	-4.73	6.44	0.073

Note. * $p < .05$.

Table one shows that females ($M = 19.36$) scores on Generative AI Dependency compare to the males ($M = 19.1$) among university students. An independent t-test results showed that the difference of Generative AI Dependency on gender is not significant ($p = .566^*$). Findings shows that females ($M = 23.15$) shows slightly higher scores on Cognitive Failure compared to males ($M = 24.0$) among university students. An independent t-test results also showed that the difference of Cognitive Failure is not significant ($p = .587^*$).

Table 2
Correlation Coefficients for Major Study Variables (N=100)

Variables	<i>M</i>	<i>SD</i>	Generative AI Dependency	Cognitive Failure
1. AI Dependency	19.26	5.07	--	
2. Cognitive Failure	23.36	12.12	.212*	--

Note. * $p < .05$.

Table two shows that Generative AI Dependency is significantly positively correlated with Cognitive Failure ($r = .212^*$).

Table 3
Regression Analysis for Generative AI Dependency impact on Cognitive Failure

Variables	<i>B</i>	<i>SE</i>	<i>t</i>	<i>P</i>	95% CI	
					<i>UL</i>	<i>LL</i>
Constant	13.61	4.7	2.9	.034***	4.29	22.94
1. Generative AI Dependency	.51	.24	2.15	.034***	.04	.97

Note. * $p < .05$.

Table four confirmed that R^2 value of .045 showed that the predictors defined 4.5% variance in the final results variable with $F(1,98) = 4.60, p = .034^*$, and the results showed that Generative AI Dependency is significant positive predictor of Cognitive Failure ($\beta = .212, *p < .05^*$).

Chapter IV

Discussion

This study is about the finding the relation between the Generative AI Dependency and Cognitive Failure and seeing that whether Generative AI Dependency shows an impact on the Cognitive Failure of human being. As we know that AI is most demanding feature of this era, we couldn't neglect it so adopting it with proper precautions that would help to leads towards healthy use of AI. The result of first hypothesis is true that there is positive correlation between the Generative AI Dependency and Cognitive Failure which means that if Generative AI Dependency increases than Cognitive Failure will also increase. This study support the fact that regular uses of AI can leads towards impair mental functioning. Too much dependency can damage the cognitive process. Second hypothesis, there is an impact of Generative AI Dependency on the Cognitive Failure and results also tells that it is not the only one which create impacts on Cognitive Failure but it is one of them. Third hypothesis is not true which tells that gender has shown no difference on both Generative AI Dependency and cognitive failure.

Conclusion

The findings show that excessive Generative AI Dependency contributes to higher cognitive failure, which means that Generative AI Dependency is positively correlated to Cognitive Failure and Generative AI Dependency has a significant impact on Cognitive Failure but both variables Generative AI Dependency and Cognitive Failure have shown no difference on gender.

Suggestions

There should be digital wellness workshops to teach balanced Generative AI Dependency in Universities. Students should be motivated to set screen-time boundaries and avoid AI use before bedtime. For future research, one should use longitudinal or experimental

designs to confirm causal relationships. Cross-cultural comparisons could explore whether these effects differ across educational settings.

Implications

This study will contribute to understand that how AI affects students' mental and behavioral functioning. These results can inform: Educational policies promoting responsible AI integration, clinical interventions for students reporting cognitive overload, and public awareness campaigns about digital hygiene and mental health.

Recommendations

Now seeing future with AI is very visible, its use is now one of the major sources of work, can't neglect its contribution, so this study will help to put insight on possible damages AI can cause and help to take precaution to avoid these damages like Cognitive Failure etc. this modern technology should be used in healthy ways to give a productive results. To control these negative aspects AI developers should adopt ethical frameworks considering the cognitive health. Balanced engagement programs should be promoted by introducing "mindful activities" and protocols should be designed to prevent cognitive impairment. Future studies can be done on long term impact of AI on different area and how it is changing our daily life route and work and its positive and negative dimensions.

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