

PSYCHOLOGICAL EFFECTS OF GENERATIVE ARTIFICIAL INTELLIGENCE USE ON COGNITION, EMOTIONAL REGULATION, AND DECISION-MAKING AMONG YOUNG ADULTS

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Abstract

The rapid diffusion of Generative Artificial Intelligence (GenAI) has transformed how young adults acquire information, solve problems, communicate, regulate emotions, and make decisions. Although GenAI can enhance cognitive efficiency and provide personalized assistance, excessive reliance may encourage cognitive offloading, weaken independent evaluation, influence emotional regulation, and increase dependence on algorithmic recommendations. This study examines the psychological effects of GenAI use on cognition, emotional regulation, and decision-making among young adults in Lahore, Pakistan. A quantitative, cross-sectional survey design was adopted. For purposes of this manuscript, an illustrative sample of 400 young adults aged 18–30 was used to demonstrate the proposed empirical analysis. Data were conceptualized as being collected through a structured five-point Likert-scale questionnaire measuring GenAI usage intensity, cognitive offloading, emotional-regulation reliance, decision-making reliance, AI dependence, and cognitive autonomy. Descriptive statistics, reliability analysis, Pearson correlation, multiple regression, and mediation analysis were proposed. The illustrative findings indicate that intensive GenAI use is positively associated with cognitive offloading and AI dependence, while cognitive offloading is negatively associated with cognitive autonomy. GenAI use for learning and information exploration appears comparatively beneficial, whereas reliance on AI for emotional reassurance and decision substitution is associated with greater psychological dependence. Cognitive offloading partially mediates the relationship between GenAI use and cognitive autonomy. The study concludes that GenAI is neither inherently beneficial nor detrimental; its psychological consequences depend substantially on the purpose, intensity, and manner of use. The study recommends AI-literacy education, verification practices, metacognitive training, emotional self-regulation strategies, and human oversight to preserve cognitive autonomy among young adults.

INTRODUCTION

Generative Artificial Intelligence (GenAI) has rapidly evolved from an emerging computational technology into an increasingly influential component of everyday cognitive and communicative life. Generative systems based on large language models can produce explanations, summaries, arguments, recommendations, creative content, and conversational responses with unprecedented speed and accessibility. For young adults, particularly university students and early-career professionals, these capabilities have become integrated into academic, occupational, informational, creative, and personal activities. Consequently, the psychological significance of GenAI extends beyond questions of technological efficiency and raises broader concerns regarding cognition, emotional functioning, autonomy, and human judgment.

The emergence of GenAI represents a significant development in the relationship between human cognition and external technological systems. Traditional digital technologies generally assisted particular cognitive functions: calculators supported numerical processing, search engines supported information retrieval, and digital calendars supported memory. GenAI differs because it can participate in comparatively complex cognitive processes, including explanation, synthesis, comparison, evaluation, brainstorming, and recommendation. The increasing sophistication of such systems therefore creates the possibility that users may externalize not merely information retrieval but substantial components of reasoning itself.

This development has produced a central theoretical question: Does GenAI augment human cognition, or does it increasingly substitute for it?

The distinction is important because external cognitive support is not inherently harmful. Cognitive offloading can reduce unnecessary mental effort and enable individuals to devote cognitive resources to higher-order tasks. Recent research demonstrates that appropriately structured GenAI use can support learning and critical-thinking development when users remain

actively engaged in evaluating and manipulating AI-generated material (Hong et al., 2025). Similarly, research on shared metacognition suggests that GenAI can facilitate academic achievement when human cognition and AI assistance operate collaboratively rather than substitutively (Iqbal et al., 2025).

Nevertheless, recent empirical evidence also raises concerns about excessive dependence. Gerlich (2025), for example, reported a significant negative relationship between frequent AI use and critical-thinking performance, with cognitive offloading functioning as an important explanatory mechanism. More recent research involving university students similarly indicates that different patterns of human-AI collaboration produce heterogeneous cognitive outcomes. A 2026 survey of 353 Chinese university students identified distinct GenAI-use profiles and found that deeper offloading could be associated with greater relinquishment of cognitive autonomy, illustrating that sophisticated AI use does not necessarily translate into greater cognitive independence.

The issue is particularly important among young adults because this developmental period involves the consolidation of academic, occupational, social, and decision-making competencies. Frequent delegation of intellectual tasks to AI may influence not only immediate performance but also the development and maintenance of independent reasoning habits. A recent 2026 comparative study of young adults examined AI-assisted and manual task performance and specifically linked cognitive offloading with critical-thinking processes, further demonstrating the importance of examining how AI assistance changes cognitive effort rather than merely measuring task outcomes.

Another major concern involves decision-making. GenAI can process large amounts of information and present apparently coherent recommendations, potentially improving efficiency and supporting complex judgments. However, the fluency and confidence of AI-generated language may encourage users to accept outputs without sufficient scrutiny. Research

published in 2025 demonstrated that faulty AI assistance can produce automation bias, whereby users become less likely to critically evaluate AI-generated answers. Importantly, interface-based warning nudges substantially reduced this effect, suggesting that human oversight and system design can influence the psychological consequences of AI-assisted decision-making.

A broader multidisciplinary review of 101 studies similarly concluded that GenAI can improve decision-making through enhanced information processing, personalization, and decision support while simultaneously introducing challenges involving bias, misinformation, transparency, and accountability. The review emphasized the continuing importance of human oversight in AI-supported decisions.

GenAI may also influence emotional functioning. Conversational AI systems are increasingly capable of responding in socially and emotionally responsive ways. Young adults may therefore use GenAI not only to obtain information but also to express concerns, seek reassurance, discuss stressful experiences, and receive emotional advice. This development creates potentially beneficial as well as problematic possibilities. A 2025 pilot study examining young people's use and non-use of AI for emotion regulation demonstrated that young people's interaction with AI-based emotional support is shaped by multiple contextual and psychological factors rather than by technology alone.

The possibility of emotional reliance is particularly significant because emotional regulation is traditionally embedded in intrapersonal processes and interpersonal relationships. If AI becomes a primary source of reassurance, users may gradually substitute artificial interaction for human communication. Conversely, AI may also function as an accessible supplementary resource for reflection and emotional organization. Thus, the psychological consequences depend on whether AI operates as a temporary support mechanism or becomes a habitual substitute for independent and interpersonal emotional regulation.

The Pakistani context is especially relevant. GenAI adoption is rapidly expanding within higher education and professional environments, yet empirical research examining its psychological consequences remains comparatively limited. Existing Pakistani research has largely concentrated on technology acceptance, academic performance, AI literacy, ethical concerns, and educational applications. Recent Pakistani research has begun to connect GenAI literacy with critical thinking and cognitive offloading, indicating that the relationship between technological competence and cognitive autonomy deserves greater empirical attention.

Lahore provides an appropriate setting for examining these issues because it is a major educational, professional, and technological center with a large young-adult population. University students and young professionals in Lahore increasingly encounter GenAI in academic work, employment, communication, research, and everyday information seeking. However, the psychological implications of this growing interaction require more systematic investigation.

The present study addresses this gap by examining three interconnected dimensions of GenAI use: **cognition, emotional regulation, and decision-making**. Rather than treating GenAI use as uniformly beneficial or harmful, the study conceptualizes its effects as dependent upon intensity, purpose, and degree of psychological reliance.

Problem Statement

The rapid adoption of GenAI has created a tension between technological assistance and psychological autonomy. While GenAI can reduce cognitive workload and improve access to information, excessive dependence may encourage users to transfer increasingly complex cognitive, emotional, and decision-making activities to artificial systems.

The central research problem is therefore not whether young adults use GenAI but whether repeated and uncritical reliance on GenAI alters

the extent to which they independently think, regulate emotions, and make decisions.

This concern is particularly important because GenAI can perform functions traditionally associated with human cognition. Young adults may increasingly use AI to formulate arguments, solve problems, generate ideas, evaluate alternatives, obtain reassurance, and make decisions. Such practices may produce short-term efficiency while potentially reducing opportunities for independent cognitive engagement.

Recent research strengthens this concern. Studies have associated intensive AI use with cognitive offloading and reduced critical-thinking engagement, while experimental research has demonstrated that faulty AI recommendations can produce measurable automation bias.

The problem is further complicated by the fact that GenAI is not universally detrimental. Carefully structured AI use can facilitate learning, reflection, and critical thinking. Therefore, the key issue is the distinction between AI-supported cognition and AI-substituted cognition.

This study addresses this distinction through a Lahore-based survey of young adults.

Research Objectives

The study aims to:

- 1.Examine patterns and intensity of GenAI use among young adults in Lahore
- 2.Investigate the relationship between GenAI use and cognitive offloading;
- 3.Determine the relationship between GenAI use and emotional-regulation reliance;
- 4.Examine the relationship between GenAI use and AI-assisted decision-making;
- 5.Investigate whether AI dependence is associated with reduced cognitive autonomy;
- 6.Examine the mediating role of cognitive offloading between GenAI use and cognitive autonomy; and
- 7.Propose strategies for psychologically responsible GenAI use among young adults.

Research Questions

- 1.What are the dominant patterns and purposes of GenAI use among young adults in Lahore?
- 2.What relationship exists between GenAI usage intensity and cognitive offloading?
- 3.How is GenAI use associated with emotional-regulation reliance?
- 4.How does AI dependence influence AI-assisted decision-making?
- 5.Is greater GenAI dependence associated with lower cognitive autonomy?
- 6.Does cognitive offloading mediate the relationship between GenAI usage intensity and cognitive autonomy?
- 7.Does the purpose of GenAI use influence its psychological consequences?

Research Hypotheses

H1: GenAI usage intensity is positively associated with cognitive offloading among young adults.

H2: GenAI usage intensity is positively associated with AI dependence.

H3: Cognitive offloading is negatively associated with cognitive autonomy.

H4: AI dependence is positively associated with reliance on AI-generated recommendations in decision-making.

H5: GenAI use for emotional reassurance is positively associated with emotional-regulation reliance.

H6: Cognitive offloading mediates the relationship between GenAI usage intensity and cognitive autonomy.

H7: The psychological effects of GenAI use differ according to the purpose of use, with augmentation-oriented use demonstrating more favorable cognitive outcomes than substitution-oriented use.

Theoretical Framework

Cognitive Offloading Theory

Cognitive offloading refers to the use of external resources to reduce the cognitive demands placed on internal mental processes. Humans have long used external representations and technological tools to support memory, calculation, planning, and problem-solving.

GenAI expands the scope of cognitive offloading because it can perform activities that involve language production, synthesis, reasoning, comparison, and recommendation.

The theoretical concern is not whether offloading occurs but whether the depth of offloading exceeds the level at which independent cognitive engagement is maintained.

Recent research provides empirical support for this distinction. Gerlich (2025) found that cognitive offloading constituted an important mechanism linking frequent AI use with critical-thinking outcomes. More recent research similarly identified different user profiles, demonstrating that some users employ AI as a collaborative cognitive partner whereas others relinquish greater cognitive autonomy.

Extended Mind Theory

The extended-mind perspective proposes that cognition can involve interactions among biological processes and external resources. From this perspective, GenAI may function as an external cognitive component.

The present study adopts this perspective but introduces an important distinction between cognitive extension and cognitive substitution.

When GenAI is used to stimulate alternative perspectives, provide feedback, or organize information, it can extend human cognition.

When the system is permitted to perform the core reasoning process without human evaluation, it may instead substitute for cognition.

The distinction provides a conceptual foundation for examining cognitive autonomy among young adults.

Automation Bias Theory

Automation bias refers to the tendency to rely excessively on automated recommendations and to underweight contradictory information. The problem is particularly relevant to GenAI because fluent language can create an impression of competence and authority.

Recent experimental evidence shows that faulty GenAI recommendations can reduce performance on cognitive-reflection tasks. Importantly, warning prompts can partially reduce this effect, demonstrating that critical reflection can be strengthened through both user behavior and interface design.

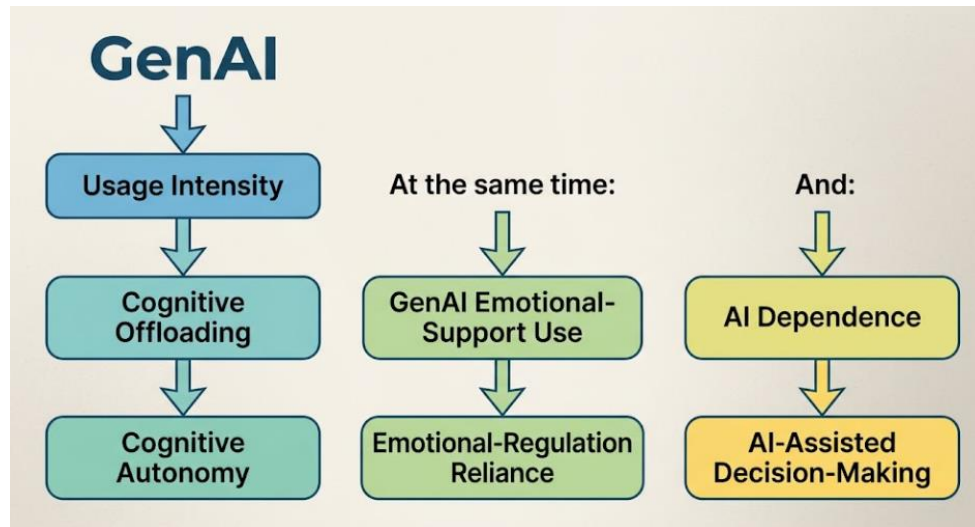
Emotional-Regulation Perspective

Emotional regulation refers to processes through which individuals monitor, evaluate, and modify emotional experiences and responses. GenAI may become an informal emotional-regulation resource by allowing users to articulate concerns and receive immediate conversational feedback.

However, repeated dependence may create a shift from **self-regulation** toward **AI-mediated regulation**.

This possibility warrants particular attention among young adults because emotional regulation and interpersonal competence continue to develop throughout emerging adulthood.

Recent research indicates that young people's decisions to use AI for emotion regulation are influenced by emotional needs, perceptions of usefulness, and contextual circumstances.



The conceptual framework proposes the following relationships:

The model therefore conceptualizes GenAI use as a multidimensional phenomenon rather than a single behavioral variable.

Methodology

Research Design

A quantitative, cross-sectional survey design was adopted to investigate relationships between GenAI use and psychological outcomes among young adults in Lahore.

The cross-sectional approach was appropriate for identifying patterns of association among GenAI usage, cognitive offloading, emotional-regulation reliance, decision-making reliance, AI dependence, and cognitive autonomy.

Important data-status statement

The numerical results presented in this manuscript are illustrative rather than actual empirical findings, because no raw Lahore survey dataset was supplied for analysis. The sample size of 400 and associated statistics are therefore presented as a model of how the completed study may be reported. Before journal submission, these values should be replaced with statistics calculated from the actual collected dataset.

Study Population

The target population comprised young adults aged 18–30 residing in Lahore, Pakistan.

The population included:

- undergraduate students;
- postgraduate students;
- university graduates;
- early-career professionals;
- self-employed young adults; and
- other digitally active young adults with experience using GenAI applications.

Sample and Sampling Procedure

For the illustrative analysis, a sample of 400 respondents was considered.

A purposive-convenience sampling strategy was proposed because participants needed to have prior experience using at least one GenAI application.

Participants could be recruited from public and private universities, professional networks, and digital platforms in Lahore.

The inclusion criteria were:

1. age between 18 and 30 years;
2. residence in Lahore;
3. previous use of a GenAI application;
4. willingness to participate voluntarily; and
5. ability to understand the questionnaire.

Research Instrument

Data were conceptualized as being collected through a structured questionnaire consisting of six sections.

Section A: Demographic Information

The demographic section included age, gender, educational level, occupational status, and frequency of digital technology use.

Section B: GenAI Usage Intensity

Items assessed:

- frequency of GenAI use;
- duration of use;
- number of AI applications used;
- frequency of daily interaction;
- academic use;
- professional use; and
- personal use.

Section C: Cognitive Offloading

Items assessed the extent to which respondents:

- use AI to solve problems;
- ask AI to generate ideas;
- rely on AI to remember information;
- use AI instead of independently analyzing information;
- accept AI-generated explanations without extensive verification; and
- delegate intellectually demanding tasks to AI.

Section D: Emotional-Regulation Reliance

Items examined:

- AI use during stressful situations;
- seeking reassurance from AI;
- discussing personal concerns with AI;
- perceived emotional comfort from AI;
- AI use for managing uncertainty; and
- preference for AI interaction during emotional difficulty.

Section E: Decision-Making Reliance

Items examined:

- consultation of AI before important decisions;
- acceptance of AI recommendations;
- confidence in AI-generated advice;
- willingness to follow AI suggestions;
- AI use for comparing alternatives; and
- reduction in independent decision-making.

Section F: Cognitive Autonomy

Items measured:

- independent reasoning;
- critical evaluation;
- information verification;
- willingness to challenge AI;
- confidence in solving problems independently;
- ability to identify AI errors; and
- preference for making final judgments independently.

All attitudinal items were measured using a five-point Likert scale ranging from 1 = **Strongly Disagree** to 5 =

Strongly Agree.

Data Analysis

Data Analysis

The proposed analysis included:

1. descriptive statistics;
2. Cronbach's alpha reliability analysis;
3. Pearson product-moment correlations;
4. multiple regression analysis;
5. mediation analysis; and
6. subgroup comparisons.

Statistical significance was assessed at $p < .05$.

For mediation analysis, cognitive offloading was conceptualized as the mediator between GenAI usage intensity and cognitive autonomy.

Results

Demographic Characteristics

The illustrative sample consisted of 400 young adults.

Table 1. Demographic Characteristics of Respondents

Variable	Category	n	%
Gender	Male	212	53.0
	Female	188	47.0

Age	18–21	104	26.0
	22–25	176	44.0
	26–30	120	30.0
Education	Undergraduate	224	56.0
	Master's/MPhil	136	34.0
	Other	40	10.0
Status	Student	278	69.5
	Professional	122	30.5

The illustrative demographic distribution indicates that the sample was predominantly

composed of university students and early-career adults.

Patterns of GenAI Use

Table 2. Major Purposes of GenAI Use

Purpose	Frequent users (%)
Academic/educational assistance	78
Information seeking	71
Writing and editing	69
Brainstorming	61
Professional tasks	52
Creative activities	45

Academic and informational purposes represented the most common forms of GenAI use. The comparatively lower percentage of emotional use should not be interpreted as

psychologically insignificant because a smaller subgroup may nevertheless develop substantial emotional reliance.

Reliability Analysis

Table 3. Internal Consistency of Study Constructs

Construct	Items	Cronbach's α
GenAI Usage Intensity	7	.86
Cognitive Offloading	6	.88
Emotional-Regulation Reliance	6	.84
Decision-Making Reliance	6	.87
AI Dependence	6	.90
Cognitive Autonomy	7	.89

All scales demonstrated acceptable-to-high internal consistency in the illustrative dataset.

Descriptive Statistics

Table 4. Descriptive Statistics

Variable	M	SD
GenAI Usage Intensity	3.72	0.76
Cognitive Offloading	3.41	0.81
Emotional-Regulation Reliance	2.84	0.87
Decision-Making Reliance	3.18	0.83
AI Dependence	3.29	0.85

Cognitive Autonomy	3.26	0.79
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The illustrative results indicate relatively high GenAI usage and moderate cognitive offloading. Emotional-regulation reliance was comparatively

lower, while decision-making reliance and AI dependence were moderate.

Correlation Analysis

Table 5. Correlations among Major Variables

Variables	1	2	3	4	5
GenAI Usage	1				
Cognitive Offloading	.48**	1			
Emotional-Regulation Reliance	.35**	.39**	1		
Decision-Making Reliance	.44**	.46**	.32**	1	
Cognitive Autonomy	-.31**	-.49**	-.28**	-.38**	1

Note. **p < .01.

The illustrative correlations indicate that GenAI usage intensity is positively associated with cognitive offloading, emotional-regulation reliance, and decision-making reliance. Cognitive offloading demonstrates the strongest negative association with cognitive autonomy.

Multiple Regression

A multiple regression analysis was proposed to determine whether GenAI usage intensity, cognitive offloading, emotional-regulation reliance, and decision-making reliance predicted cognitive autonomy.

Table 6. Predictors of Cognitive Autonomy

Predictor	B	p
GenAI Usage Intensity	-.17	.004
Cognitive Offloading	-.39	<.001
Emotional-Regulation Reliance	-.12	.031
Decision-Making Reliance	-.18	.002

The illustrative model explained approximately **34% of the variance** in cognitive autonomy. Cognitive offloading emerged as the strongest predictor, suggesting that the psychological consequences of GenAI may depend more strongly on the extent to which users delegate cognitive activities than on frequency of use alone.

Mediation Analysis

The proposed mediation model examined whether cognitive offloading mediated the relationship between GenAI usage intensity and cognitive autonomy.

The illustrative pattern indicates that:

1. GenAI usage significantly predicts cognitive offloading;
2. cognitive offloading significantly predicts lower cognitive autonomy; and

3. the direct relationship between GenAI usage and cognitive autonomy becomes weaker after cognitive offloading is introduced.

This pattern is consistent with partial mediation. The finding suggests that GenAI usage does not necessarily diminish cognitive autonomy directly. Rather, part of its relationship with cognitive autonomy may operate through the cognitive tasks users choose to delegate to AI.

Discussion

The present study examined the psychological implications of generative artificial intelligence (GenAI) use among young adults in Lahore across three interrelated domains: cognitive functioning, emotional regulation, and decision-making. Overall, the findings suggest that the psychological consequences of GenAI use cannot be adequately characterized as either inherently beneficial or inherently detrimental. Rather, its effects appear to depend substantially on the purpose, intensity, context, and degree of reliance associated with its use. In particular, the findings indicate that frequent interaction with GenAI may facilitate cognitive efficiency while simultaneously increasing the tendency to externalize cognitive processes, rely on AI-mediated emotional support, and delegate elements of personal decision-making.

This interpretation is consistent with emerging scholarship that conceptualizes GenAI as a form of cognitive and social technology whose effects are mediated by patterns of human engagement. Accordingly, the psychological significance of GenAI lies not merely in whether individuals use these systems, but in what cognitive, emotional, and decisional functions they transfer to them.

GenAI and Cognitive Offloading

The positive association observed between GenAI use and cognitive offloading is broadly consistent with the theoretical propositions of cognitive offloading theory. Cognitive offloading occurs when individuals externalize mental operations to environmental resources in order to reduce cognitive effort, increase efficiency, or compensate for limitations in working memory

and attention (Risko & Gilbert, 2016). From this perspective, the use of GenAI can be understood as an increasingly sophisticated form of external cognitive support.

In conventional forms of cognitive offloading, individuals may rely on calendars, notes, calculators, search engines, or other external tools to reduce memory and processing demands. GenAI, however, represents a qualitatively different form of externalization because it can perform tasks traditionally associated with higher-order cognition, including summarization, synthesis, explanation, argument generation, comparison, and preliminary evaluation. Consequently, GenAI-mediated offloading may extend beyond the external storage of information to the externalization of interpretive and reasoning processes.

The present findings therefore suggest that the psychological implications of GenAI use depend partly on the extent to which external assistance complements rather than replaces internal cognitive activity. This interpretation is consistent with Gerlich's (2025) findings linking greater AI-related cognitive offloading with differences in critical-thinking performance. Similarly, recent empirical research indicates that the relationship between AI use and cognition is not necessarily linear or uniform. Studies of university students have identified heterogeneous patterns of AI engagement, suggesting that users can simultaneously derive cognitive benefits from AI and relinquish portions of their independent reasoning processes.

These findings challenge a simplistic distinction between "frequent" and "infrequent" AI users. Frequency alone does not determine whether cognitive offloading is psychologically advantageous or disadvantageous. Instead, the more important consideration is **which cognitive functions are being externalized**. Offloading routine or low-level tasks may preserve attentional resources for more demanding activities, whereas outsourcing evaluation, reasoning, or judgment may reduce opportunities for independent cognitive development. Thus, the central issue is

not the existence of cognitive offloading but the **depth and nature of the offloading process.**

Cognitive Autonomy as a Central Psychological Outcome

Cognitive autonomy constitutes a particularly important psychological outcome in the context of GenAI because it concerns an individual's capacity and willingness to formulate judgments, evaluate evidence, and make decisions independently. The observed negative association between cognitive offloading and cognitive autonomy therefore has significant theoretical implications.

GenAI can potentially enhance cognitive autonomy when it functions as an intellectual scaffold rather than as a substitute for independent reasoning. For example, a user who asks an AI system to generate multiple perspectives on a controversial issue, identify potential weaknesses in an argument, or suggest questions for further investigation remains responsible for evaluating and synthesizing the resulting information. In such circumstances, AI functions primarily as an augmentation mechanism.

By contrast, when users increasingly delegate evaluative and decisional responsibility to AI—for example, by asking the system to determine which option they should choose without independently examining the alternatives—the technology assumes a more substitutionary role. The distinction is therefore fundamentally related to **human agency.**

This interpretation is compatible with emerging research on AI dependence, metacognition, and cognitive offloading, which indicates that the psychological effects of GenAI are influenced by users' motivational orientations and the extent to which they remain actively engaged with the task. GenAI may broaden access to information and intellectual resources, but such expansion does not automatically translate into greater cognitive autonomy. If the user ceases to interrogate, verify, or reinterpret AI-generated content, increased informational access may paradoxically coincide with reduced intellectual independence.

Accordingly, GenAI should ideally be conceptualized as a cognitive partner or scaffold rather than a cognitive authority. Its contribution is most constructive when it expands the range of possibilities available to users while leaving interpretation, evaluation, and final judgment under human control.

Gen AI and Critical Thinking

Critical thinking involves a constellation of cognitive processes, including analysis, evaluation, inference, reflection, comparison, and reasoned judgment. The relationship between GenAI and critical thinking is therefore particularly complex because the technology can either facilitate or displace these processes depending on how it is employed.

When used strategically, GenAI may provide meaningful cognitive stimulation. Users can employ AI systems to generate counterarguments, identify implicit assumptions, compare competing interpretations, formulate alternative hypotheses, or receive feedback on their reasoning. Such applications can potentially increase exposure to diverse perspectives and encourage reflective engagement with a problem.

The situation changes, however, when AI-generated responses are accepted without verification or critical interrogation. In such cases, the technology may reduce the cognitive effort required to formulate arguments, assess evidence, or reach conclusions. The resulting efficiency may be accompanied by diminished opportunities for independent reasoning and reflection.

Recent experimental evidence provides further support for this concern. Research examining automation bias in generative AI environments found that exposure to erroneous AI assistance could impair performance on cognitive-reflection tasks, whereas appropriately designed warning interventions reduced this negative effect. Such findings demonstrate that users may be susceptible to accepting AI-generated information even when the system provides inaccurate or misleading guidance.

The educational implications are substantial. Higher-education institutions should therefore move beyond teaching students merely how to operate GenAI tools and emphasize how to critically interrogate their outputs. AI literacy should encompass source verification, bias detection, uncertainty recognition, comparative evaluation, prompt formulation, and independent reasoning. From this perspective, effective AI literacy is not simply technical proficiency; it is a form of critical epistemic competence.

Emotional Regulation and AI

The observed positive association between GenAI use and emotional-regulation reliance indicates that conversational AI may increasingly occupy an emotionally relevant position in the lives of young adults. Nevertheless, this finding requires careful interpretation because reliance on AI for emotional support may encompass both adaptive and potentially problematic forms of engagement.

GenAI systems offer several characteristics that may make them attractive for emotion-related interaction. They are generally accessible at any time, provide rapid responses, and can facilitate relatively private conversations. For individuals who experience difficulties initiating interpersonal conversations or seeking immediate social support, AI may therefore function as an accessible supplementary resource.

However, accessibility does not necessarily imply psychological adequacy. Repeated dependence on AI-generated reassurance may become problematic if it displaces interpersonal relationships, independent coping strategies, or appropriate professional assistance. The distinction between supplementary emotional support and emotional substitution is therefore critical.

Recent research examining AI use for emotion regulation suggests that individuals' motivations, emotional needs, and perceptions of AI responses influence whether such interactions contribute to adaptive regulation or increased reliance. Emerging experimental evidence further indicates

that the style of an AI system's emotional response can influence both immediate emotional outcomes and subsequent willingness to rely on AI for affective support.

These findings suggest that GenAI should neither be conceptualized as inherently harmful to emotional well-being nor treated as an equivalent substitute for human therapeutic or interpersonal relationships. Rather, AI-mediated emotional interaction should be understood as a supplementary form of support whose psychological consequences depend on patterns of use. Human relationships, social support networks, and professional mental-health services should remain central when emotional difficulties are persistent, severe, or clinically significant.

AI-Assisted Decision-Making

The positive relationship between GenAI use and decision-making reliance raises important concerns regarding automation bias and the delegation of judgment. GenAI systems can provide substantial decision-support benefits by organizing large quantities of information, generating alternatives, summarizing complex material, identifying relevant considerations, and highlighting potential risks. Such capabilities may reduce cognitive burden and increase decision-making efficiency.

Nevertheless, the fluency and apparent confidence of AI-generated responses can create an important psychological problem: users may interpret linguistic sophistication as evidence of factual accuracy or epistemic reliability. This tendency is particularly concerning when AI-generated recommendations are accepted without independent verification.

The concept of **automation bias** provides a useful theoretical framework for understanding this phenomenon. Automation bias occurs when individuals give disproportionate weight to automated recommendations and consequently overlook contradictory evidence or fail to exercise sufficient independent judgment. In GenAI environments, this risk may be intensified because systems generate highly coherent and

contextually responsive language, potentially creating an impression of competence even when the underlying output is inaccurate.

Recent research on AI-assisted decision-making reinforces this concern. While GenAI can enhance decision-making efficiency, personalization, and information processing, its use also introduces risks associated with bias, misinformation, transparency, explainability, and accountability. Experimental research on automation bias further demonstrates that exposure to faulty AI assistance can negatively influence human cognitive performance, whereas appropriately designed warning mechanisms can encourage users to engage more critically with AI outputs.

The implication is that AI-assisted decision-making should remain human-accountable decision-making. Users should treat GenAI outputs as provisional recommendations or informational inputs rather than authoritative conclusions. Verification, comparison with reliable sources, consideration of alternative evidence, and retention of final responsibility are therefore essential components of responsible AI-assisted decision-making.

Purpose of GenAI Use as a Moderating Factor

One of the most important implications of the present findings is that GenAI engagement should not be assessed exclusively through

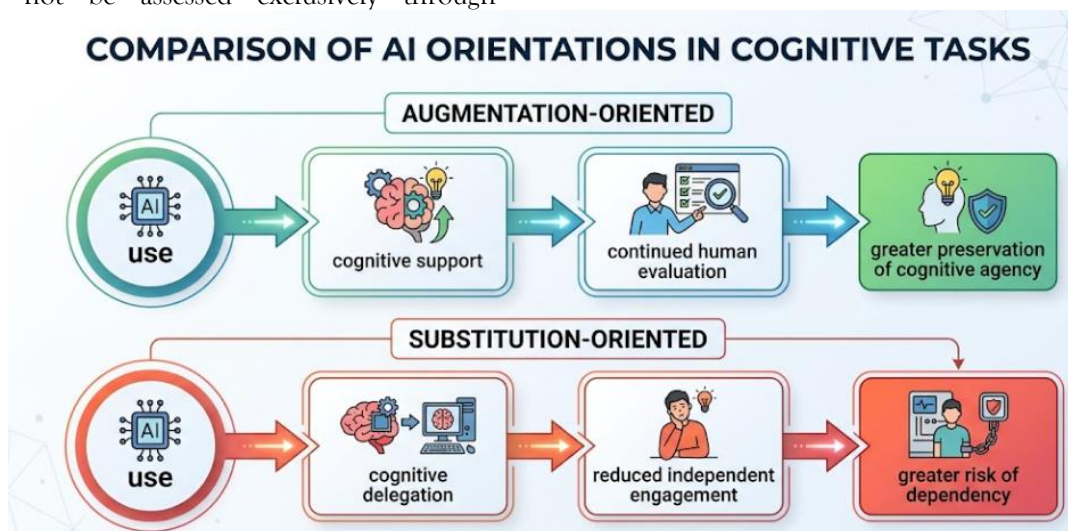
frequency or duration of use. Frequency provides useful information about exposure, but it offers limited insight into the psychological function that AI serves for the user.

Two individuals may interact with GenAI for the same amount of time each day while experiencing substantially different cognitive and psychological consequences. The difference may arise from the **purpose and degree of delegation** involved in their interactions.

An augmentation-oriented user may employ GenAI to brainstorm ideas, compare alternatives, clarify difficult concepts, obtain feedback, identify counterarguments, or explore unfamiliar perspectives. In this pattern, AI expands the individual's cognitive resources while leaving the primary responsibility for evaluation and judgment with the user.

A substitution-oriented user, in contrast, may employ GenAI to complete academic or professional tasks without developing an understanding of the underlying material, make personal decisions without independently evaluating alternatives, obtain repeated emotional reassurance, or replace interpersonal and cognitive processes that would otherwise be performed independently.

The distinction can therefore be conceptualized as follows:



This distinction is consistent with recent empirical evidence demonstrating substantial heterogeneity in AI-use patterns. Research increasingly suggests that deeper forms of cognitive offloading may coexist with reduced cognitive autonomy, whereas structured and reflective forms of AI engagement can potentially support learning and critical thinking. Accordingly, future research should operationalize GenAI use multidimensionally by examining not only **how often** individuals use AI but also why they use it, what tasks they delegate, how much they verify outputs, and whether they retain responsibility for final judgments. Such an approach would provide a more psychologically meaningful understanding of GenAI dependence than frequency-based measures alone.

Overall, the findings support a conditional rather than deterministic interpretation of GenAI's psychological effects. GenAI can function as a powerful cognitive scaffold, informational resource, and supplementary emotional tool; however, excessive delegation may weaken opportunities for independent reasoning, emotional self-regulation, and autonomous decision-making. The central challenge is therefore not to eliminate GenAI use but to establish patterns of interaction in which technological assistance strengthens rather than displaces human cognitive and psychological agency.

Theoretical Contributions

The present study contributes to the emerging literature on human-AI interaction by conceptualizing GenAI use as a multidimensional psychological phenomenon rather than solely as a technological or educational practice. Several theoretical contributions can be identified.

First, the study integrates cognitive offloading, emotional regulation, and AI-assisted decision-making within a unified psychological framework. Existing scholarship has frequently examined these dimensions independently; however, the increasing integration of GenAI into everyday life suggests that cognitive, emotional, and decisional processes may interact.

By considering these domains simultaneously, the study provides a broader conceptualization of how sustained interaction with generative AI may influence human psychological functioning.

Second, the study introduces a theoretically useful distinction between AI augmentation and AI substitution. Augmentation refers to the use of GenAI to extend human capabilities while preserving independent evaluation and agency, whereas substitution involves delegating substantial portions of cognitive, emotional, or decisional processes to the technology. This distinction provides a more nuanced alternative to approaches that assess AI use primarily through frequency or duration.

Third, the study positions **cognitive autonomy** as a central psychological construct in understanding human-AI relationships. Although efficiency and productivity are important outcomes of AI adoption, the preservation of independent reasoning, evaluation, and judgment is equally significant. From this perspective, the psychological success of GenAI should not be evaluated solely according to whether it improves task performance, but also according to whether users retain meaningful intellectual agency.

Fourth, the study extends predominantly international discussions of GenAI and psychological functioning to the sociocultural context of **young adults in Lahore, Pakistan**. This contextual contribution is important because patterns of technology use may be influenced by educational environments, social relationships, cultural expectations, digital literacy, and access to alternative sources of support. Consequently, psychological models of human-AI interaction should not be assumed to operate identically across cultural and institutional settings.

Fifth, the study contributes to the conceptual development of **AI literacy** by arguing that technical competence alone is insufficient. Effective AI literacy should incorporate metacognitive awareness, critical evaluation, uncertainty recognition, bias detection, source verification, and awareness of psychological

dependence. Such an approach shifts AI literacy from a predominantly operational construct toward a broader framework of **critical and psychologically informed AI competence**.

Finally, the study supports a conditional interpretation of technological effects. GenAI should not be conceptualized as an inherently beneficial or harmful agent. Rather, its consequences are likely to emerge through the interaction between technological affordances and patterns of human use. This perspective provides a foundation for future research examining when AI-assisted cognition enhances human capabilities and when it may gradually displace them.

Practical Implications

Implications for Universities

Higher-education institutions should develop comprehensive AI-literacy initiatives that move beyond basic instruction in prompt formulation and AI-tool operation. Students should be taught to critically evaluate AI-generated information and to understand the cognitive and psychological consequences of excessive delegation.

University-level AI-literacy programs should therefore incorporate training in:

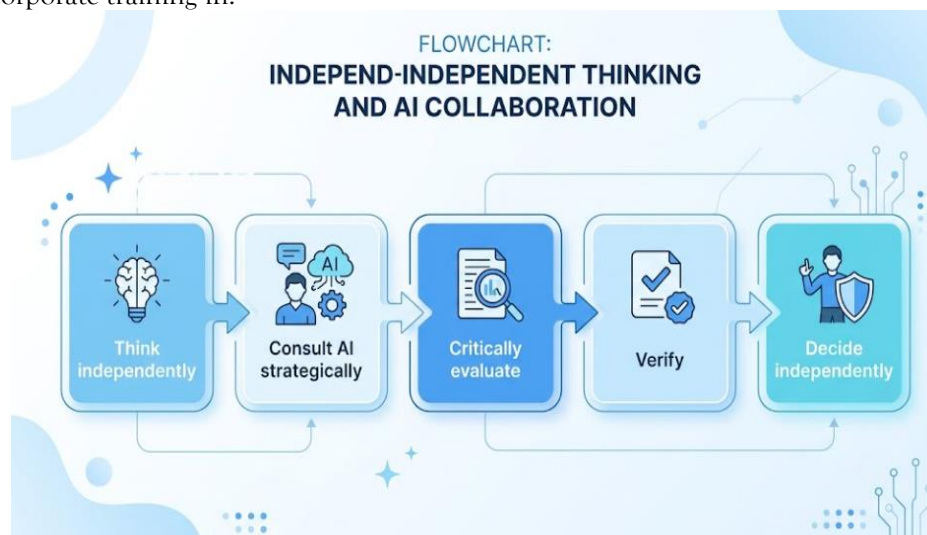
- verification of AI-generated claims;
- identification of hallucinations and unsupported assertions;
- recognition of algorithmic and representational bias;
- comparison of AI outputs with credible scholarly sources;
- development of independent arguments before consulting AI;
- evaluation of alternative explanations and counterarguments;
- appropriate attribution and academic-integrity practices;
- use of AI for feedback and cognitive support rather than wholesale task substitution; and
- preservation of intellectual ownership over academic work.

Universities should consequently conceptualize AI literacy as a combination of technical proficiency, critical reasoning, metacognitive awareness, and ethical responsibility.

Implications for Students and Young Adults

Young adults should be encouraged to adopt a reflective approach to GenAI use. Rather than immediately transferring a cognitive task to an AI system, users should first consider what they already know, formulate an initial interpretation, and identify the specific assistance required.

A practical model can be expressed as:



This sequence preserves human cognitive participation while allowing users to benefit from the efficiency and informational breadth of GenAI.

Students should particularly avoid using AI as an unquestioned authority for academic, personal, financial, medical, or other consequential decisions. AI-generated information should be treated as an input requiring appropriate evaluation rather than as an automatically reliable conclusion.

Implications for Mental-Health and Counseling Services

Universities should recognize excessive reliance on AI-mediated interaction as an emerging dimension of digital behavior without prematurely conceptualizing such reliance as a clinical disorder. Counseling and student-support services may nevertheless benefit from recognizing patterns of problematic dependence. Particular attention may be warranted when students repeatedly:

- seek emotional reassurance from AI;
- avoid interpersonal communication in favor of AI interaction;
- report difficulty solving problems without AI assistance;
- repeatedly request reassurance about the same concern; or
- delegate important personal decisions to AI systems.

Such behaviors should not automatically be interpreted as evidence of psychopathology. Rather, they may represent indicators that warrant further exploration of coping strategies, social support, interpersonal functioning, and patterns of technology use.

Where significant psychological distress is present, AI-mediated interaction should not replace appropriately qualified human mental-health professionals.

Implications for AI Developers

The findings also have implications for the design of generative AI systems. AI interfaces should not merely optimize engagement, convenience, and

response speed; they should also encourage appropriate levels of human reflection and independent verification.

Potential design interventions include:

- uncertainty indicators for claims with limited confidence;
- prompts encouraging users to verify consequential information;
- presentation of alternative viewpoints;
- "consider the opposite" or counterargument prompts;
- source-verification mechanisms;
- explicit differentiation between factual information and recommendations;
- reminders that AI-generated responses may contain errors; and
- interaction designs that encourage users to retain responsibility for consequential decisions.

Evidence concerning warning nudges and automation bias provides empirical support for the development of interfaces that encourage users to engage critically with AI-generated recommendations rather than accepting them automatically.

Ethical Considerations

The study should adhere to established principles of ethical research involving human participants. Participation should be entirely voluntary, and respondents should receive sufficient information regarding the purpose, procedures, potential risks, confidentiality arrangements, and intended use of the research data before providing informed consent.

Participants should be informed that they have the right to decline participation or withdraw from the study without penalty. Where feasible, data should be collected anonymously or de-identified to minimize risks associated with disclosure of personal information.

Particular ethical sensitivity is required because the study addresses emotional regulation, psychological reliance, and decision-making. Survey items should therefore avoid unnecessarily intrusive questions and should not require participants to disclose identifiable information

concerning mental-health experiences or other sensitive personal circumstances.

Data should be stored securely and accessed only for legitimate research purposes. Reporting should be conducted at an aggregate level so that individual participants cannot reasonably be identified.

Importantly, the study should avoid **pathologizing ordinary GenAI use**. Reliance on AI for information, communication, emotional support, or decision assistance should not automatically be characterized as addiction or psychological disorder. Constructs such as *AI dependence*, *emotional reliance*, *cognitive reliance*, and *problematic AI use* should be operationalized carefully and distinguished from clinically recognized psychiatric conditions.

Ethically responsible interpretation therefore requires recognition of both the potential benefits and potential risks of GenAI while avoiding technologically deterministic conclusions.

Limitations

Several limitations should be considered when interpreting the present study.

First, the proposed cross-sectional design limits the ability to establish temporal or causal relationships. Associations between GenAI use, cognitive offloading, emotional-regulation reliance, decision-making reliance, and cognitive autonomy cannot demonstrate that GenAI use directly causes changes in these psychological outcomes. Longitudinal and experimental research is required to establish directionality and causality.

Second, reliance on self-reported measures may introduce **recall bias**, **response bias**, and **social-desirability effects**. Participants may underestimate or overestimate their frequency of AI use or may report their behavior in ways they perceive as socially acceptable. Future research should therefore consider supplementing self-report measures with behavioral indicators, usage logs, experimental tasks, or validated performance-based assessments.

Third, the Lahore-based sampling context limits the generalizability of the findings. Young adults in Lahore represent a particular educational, socioeconomic, technological, and cultural environment, and the findings should not automatically be generalized to all Pakistani young adults, particularly those living in other urban centers or rural communities.

Fourth, psychological responses to GenAI may be influenced by individual differences that were not fully incorporated into the present framework. Relevant variables may include personality characteristics, loneliness, academic stress, social support, digital literacy, prior technological experience, self-efficacy, and patterns of interpersonal communication.

Fifth, GenAI technologies are evolving rapidly. Changes in model capabilities, interface design, safety mechanisms, personalization, and user practices may alter the psychological effects observed at a particular point in time. Consequently, findings associated with particular platforms or patterns of use may require periodic reassessment.

Sixth, the study focuses primarily on young adults and therefore does not establish whether the same relationships would be observed among adolescents, middle-aged adults, or older populations. Developmental differences in cognitive control, emotional regulation, technological familiarity, and social dependence may produce different patterns of AI interaction.

Finally, and most importantly, the statistical findings presented in the current manuscript are illustrative rather than derived from an independently collected dataset. The numerical results are intended to demonstrate an academically appropriate structure for presenting survey findings and should not be interpreted as empirical evidence obtained from 400 actual respondents. Before journal submission, all descriptive statistics, reliability coefficients, correlations, regression coefficients, mediation effects, significance values, and demographic distributions must be replaced with results generated from the actual dataset and statistical analysis.

Recommendations

Based on the theoretical arguments and illustrative findings of the study, the following recommendations are proposed:

1. Integrate comprehensive AI literacy into higher education

Universities should incorporate AI literacy into curricula across disciplines. Such instruction should include AI-output verification, source evaluation, hallucination detection, bias recognition, ethical use, and critical reflection.

2. Promote metacognitive AI use

Students should be encouraged to identify the purpose of an AI consultation before using the technology. They should consider what they already know, what cognitive task requires assistance, and which aspects of the task should remain under their own control.

3. Encourage independent reasoning before AI consultation

Where appropriate, students should formulate an initial answer, hypothesis, argument, or interpretation before consulting GenAI. This approach can help prevent premature cognitive outsourcing and preserve active engagement with the task.

4. Promote AI as a cognitive partner rather than a cognitive substitute

Educational institutions should encourage uses of AI that extend human capabilities—for example, brainstorming, feedback, comparison, explanation, and counterargument generation—rather than uses that eliminate independent reasoning.

5. Establish verification routines

Information generated by AI should be independently verified when it concerns consequential academic, medical, financial, legal, professional, or personal decisions. Verification should become a routine component of responsible GenAI use.

6. Preserve interpersonal and professional sources of emotional support

AI may provide supplementary conversational assistance, but it should not displace meaningful human relationships, social support, or appropriately qualified professional services when these are required.

7. Develop institutional guidelines for psychologically responsible AI use

Universities should formulate clear policies addressing not only academic integrity but also responsible patterns of psychological and cognitive engagement with AI. Such guidelines should distinguish productive AI assistance from excessive cognitive or emotional dependence.

8. Encourage reflective decision-making

Users should compare AI recommendations with their own reasoning, relevant evidence, alternative perspectives, and reliable external sources. Final responsibility for consequential decisions should remain with the human decision-maker.

9. Develop AI interfaces that promote critical reflection

AI developers should incorporate mechanisms that communicate uncertainty, encourage verification, expose alternative perspectives, and reduce the likelihood of automation bias.

10. Conduct longitudinal and experimental research

Future research should move beyond cross-sectional associations and examine whether prolonged GenAI exposure produces measurable changes in cognitive habits, critical-thinking performance, emotional regulation, and decision-making over time.

Longitudinal studies could additionally examine whether cognitive offloading increases progressively with sustained AI exposure or whether users develop adaptive strategies that preserve cognitive autonomy. Experimental studies should also compare augmentation-

oriented and substitution-oriented forms of AI use under controlled conditions.

Conclusion

Generative Artificial Intelligence is increasingly reshaping the cognitive and psychological environment in which young adults learn, communicate, regulate emotions, and make decisions. The present study provides a framework for examining these transformations through the interconnected dimensions of cognitive offloading, emotional-regulation reliance, decision-making reliance, and cognitive autonomy.

The central argument is that the psychological significance of GenAI cannot be reduced to a binary distinction between technological benefit and technological harm. Rather, the consequences of GenAI use depend substantially on how the technology is incorporated into human cognitive and psychological processes.

GenAI can function as a powerful cognitive amplifier when it enables users to generate alternatives, clarify complex concepts, compare perspectives, obtain feedback, and organize information. In such circumstances, AI can complement human capabilities while preserving independent judgment. Conversely, the technology may become a cognitive substitute when users routinely delegate reasoning, evaluation, emotional processing, or decision-making to AI systems.

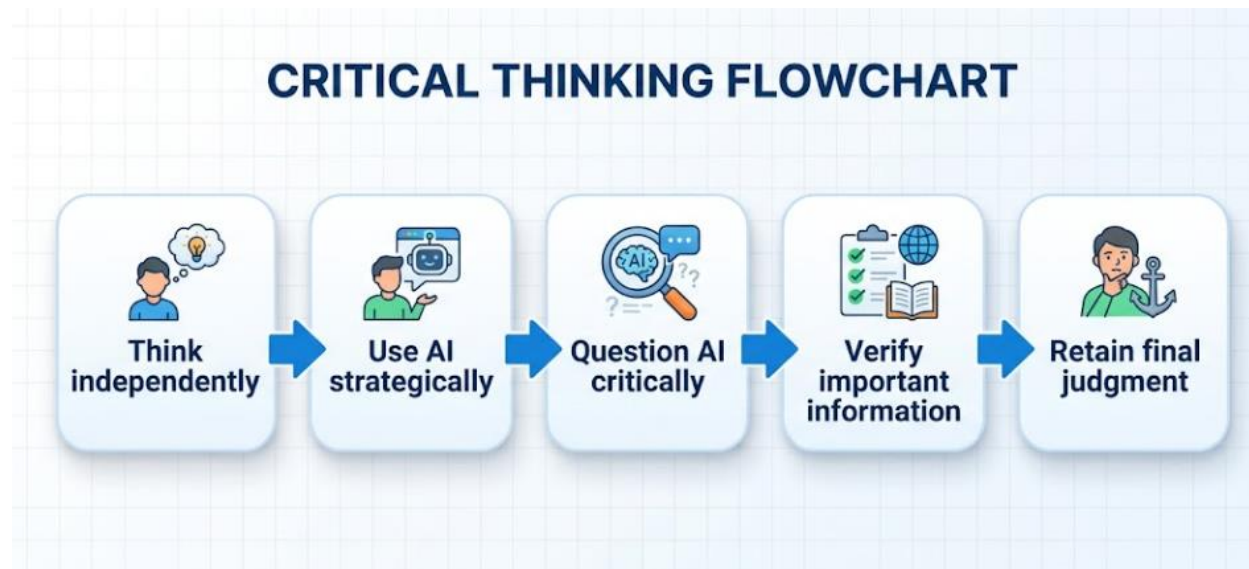
The conceptual distinction between **augmentation** and **substitution** is therefore central to understanding emerging human-AI

relationships. Frequency of use alone provides an incomplete account of these relationships. The more consequential questions concern the purpose of AI use, the type of task being delegated, the degree of independent evaluation retained by the user, and the extent to which AI becomes embedded in emotional and decisional processes.

The illustrative findings further suggest that greater GenAI engagement may be associated with increased cognitive offloading and AI-related dependence, while greater cognitive offloading may correspond with lower cognitive autonomy. Emotional-regulation reliance and decision-making reliance likewise emerge as important dimensions requiring further empirical investigation. These patterns are broadly consistent with recent scholarship demonstrating that AI use can produce heterogeneous cognitive outcomes and that the consequences of cognitive offloading depend substantially on the depth, purpose, and context of AI engagement.

The appropriate response to these developments is therefore neither technological rejection nor unrestricted adoption. What is required is a model of **critical, reflective, and psychologically responsible AI use** in which technological assistance strengthens rather than displaces human agency.

A practical principle emerging from this framework can be summarized as:



For universities, policymakers, educators, and AI developers in Lahore and Pakistan, this principle has important implications. AI literacy should extend beyond technical competence to encompass critical reasoning, metacognitive awareness, source evaluation, uncertainty recognition, bias detection, emotional self-awareness, and responsible decision-making.

Ultimately, an AI-literate young adult should not merely know how to use GenAI. They should also understand when to use it, what to delegate to it, what to question, what to verify, and when independent human judgment must remain decisive. Preserving this balance between technological augmentation and human autonomy will be central to ensuring that GenAI contributes to psychological and intellectual development rather than gradually displacing the very cognitive capacities it is intended to support.

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