

Impact of AI Dependency on Students' Academic Self-Efficacy, Academic Procrastination and Critical Thinking



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BAHRIA UNIVERSITY LAHOR CAMPUS

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Dedication

I dedicate this Thesis wholeheartedly to Parents, Siblings, and myself. I am deeply grateful to my parents as I acknowledge that without their guidance and constant love, I would not have become the individual I am today.

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Muhammad Haris Sultan

Abstract

This study aims to explore the relationships between AI dependency, academic procrastination, critical thinking, and academic self-efficacy among university students. A sample of 226 university students participated in the study with data collected through self-reported questionnaires for measuring AI dependency, critical thinking, academic procrastination, and academic self-efficacy. Pearson correlation analysis was used to examine the relationship between these variables, while mediation analysis, utilizing the Process Macro for SPSS, was conducted to test the mediating role of procrastination and critical thinking. The results reveal that AI dependency is positively correlated with academic procrastination and negatively correlated with both critical thinking and academic self-efficacy. Additionally, critical thinking is positively associated with academic self-efficacy and negatively associated with procrastination while procrastination was negatively correlated with academic self-efficacy. Mediation analysis showed that both procrastination and critical thinking mediated the relationship between AI dependency and academic self-efficacy, with AI dependency causing more procrastination and reducing critical thinking, which in turn lowers self-efficacy. These results suggest that AI dependency has negatively impacts academic self-efficacy through its effects on procrastination and critical thinking. The findings highlight the importance of addressing procrastination and developing critical thinking skills to alleviate the negative effects of AI dependency on students' academic outcomes.

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List of Abbreviations

Abbreviations	Full Form
APA	American Psychological Association
SPSS	Statistical Package for the Social Sciences
DAI	Dependency Artificial Intelligence
CThQ	Critical Thinking Questionnaire
TPS	Tuckman Procrastination Scale
GASE	General Academic Self-Efficacy

List of Symbols

Symbol	Full Form
α	Alpha Cronbach's Index of Internal Consistency
β	Standardized Coefficient
f	Frequency
M	Mean
SD	Standard Deviation
%	Percentage
r	Correlation Coefficient

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Chapter 1

1.1 Introduction

The world is facing a phase of deep technological advancement and Artificial Intelligence (AI) has arisen as transformative force of innovation learning and teaching in this present digital era. Where AI tools are rapidly driven into academic environments via intelligent tutoring systems, auto-grading, research assistants and individualized learning platforms. These tools are designed to boost the quality of learning, personalize educational experiences based on individual student requirements and reduce administrative weight for both teachers and students (Smith, 2023). Because of this, AI has advanced from a groundbreaking idea to a common academic tool for college students.

Those who are in support of AI in education, claims that this technology can enhance academic outcomes, personalize learning experience and democratize the power to access quality education, done by providing inevitably handling some repetitive tasks as well as providing immediate feedback. AI tools have a stronge potential to help students and teachers focus on higher-level cognitive activities, creativity, and critical inquiry (Johnson & Lee, 2022). According to this viewpoint, AI tools are seen as an academic assistant for students and teachers that supplements their ability instead of taking its place.

Even though its sifnifiacant advantages, the speed and scale of AI applications in higher education have caused a notable number of concerns. Critics who oppose AI use in education, suggests that over dependencies on AI would risk reducing students' engagement in independent thinking, problem solving, and reflective learning (Chen et

al. 2023). Confounding these issues are ethical challenges that arise in relation to biasing of algorithms, data privacy and unequal access to advanced AI technologies among students from underprivileged backgrounds (Garcia & Rodriguez, 2024). These issues shows that how crucial it is to consider not just the benefit of AI tools but also their significant psychological and academic problems.

From the past few years, studies have introduced concept of AI dependency, which is defined as the extreme and uncritical use of AI systems to complete academic tasks (Al Radaideh et al., 2025; Gómez-Aguilar et al., 2024). When students use AI technologies as learning replacements instead of aids for comprehension, this is known as AI dependency. Students might lack the development of critical academic skills by concentrating just on task completion instead of skill development or enthusiastically participating in cognitive processes. These patterns of behaviors are most likely driven by cognitive overload, time pressure, fear of failure, or low confidence in one's academic abilities (Gómez-Aguilar et al., 2024).

One significant academic behavior is academic procrastination which is heavily influenced by AI dependency. Academic procrastination is the deliberate and unreasonable delay of academic tasks even when one is aware of the possible consequences (Steel, 2007; Steel et al., 2018). In contrast to plain laziness, procrastination is an internal conflict, in which students plan to finish activities but constantly put them off against their better judgment. This self-defeating manner often causes higher levels of stress, guilt, anxiety, and poorer academic performance (Svartdal et al., 2020).

There are three fundamental components of academic procrastination that are identified by scholars. Delay, which involves beginning or finishing work later than

necessary in which disruptions or avoidance behaviors are commonly used in its place (Svartdal et al., 2020). The second one is postponement, which occurs when students purposefully put off work even if they expect unfavorable results. This causes emotional suffering as deadlines draw near (Tice & Baumeister, 1997). The third component is negative consequences, which separates strategic delays from procrastinating. Persistent procrastination is linked to poor academic performance, psychological suffering, and deteriorated well-being (Akpur, 2020; Pychyl, 2024). Most importantly, procrastination is associated with psychological trait as low self-efficacy, aversion to tasks, perfectionism, and fear of failing (Svartdal et al., 2020).

Academic self-efficacy is another critical construct related to this study. Academic self-efficacy is a concept presented by Bandura (1977) within his social cognitive theory. Self-efficacy is the belief that one can plan and carry out the required steps to complete tasks. Self-efficacy is a task and domain-specific thing in contrast to self-esteem. It characterizes overall self-worth. Mastery experiences, vicarious learning, social persuasion, and emotional states are major Bandura's four sources of self-efficacy, all of which influence how people handle difficulties in their daily life.

Self-efficacy plays an important role by impacting motivation, resilience, emotional regulation, and achievement in learning, within educational settings. Students who have higher self-efficacy shall actively engage with their learning, work through tasks, and use suitable coping strategies for academic stress (Lippke, 2020; Visoso, 2024). On the other hand, students who have lower self-efficacy tends to avoid hardworking tasks, procrastinate, and overuse external aids. Due to this overuse of academic means, it lessens their self-assurance and academic independence, creating a negative cycle of avoidance and overreliance.

Equally crucial to achieving success academically critical thinking which described as skill of analyzing, evaluating, and synthesizing information in an information reflective and reasoned manner. Critical thinking permit students to determine the credibility of information and recognize logical patterns, as well as apply knowledge to different situations. In higher education, critical thinking has been regarded as one of the fundamental core cognitive skills necessary for autonomous learning and resolving problems. Over-reliance on content created artificially generated by AI has the potential of weakening students' critical thinking ability due to the diminished active reasoning, evaluation, and intellectual engagement (Chen et al., 2023).

Research suggest that students with strong critical thinking skills are less likely to procrastinate and more likely to exhibit higher academic self-efficacy, as they feel capable of managing complex tasks independently. On the other hand, student who lack self-efficacy and the ability to think critically shall use AI tools and applications and as a result they shall complete the assignments, however their cognitive load and engagement shall be considerably less. This shows that whenever the use and dependency on AI is being studied, one must also include the ability to think critically in the analysis.

Due to significant amount of rising incorporation of AI in education, it becomes most important to understanding the relationships between AI dependency, procrastination, self-efficacy, and critical thinking is essential to understanding the education system in place for university students. By examining all these relationships, it will allow us to provide valuable insights into, that how technology is shaping students' learning behaviors, cognitive development, and academic well-being. Thus, the major aim if this study is to contribute to the developing literature by examining these variable within a combined framework.

Chapter 2

2.1 Literature review

The fast growth of artificial intelligence in higher education has transformed how university students study, complete assignments, and regulate their academic tasks. AI dependency in general defined as frequent or habitual reliance on AI tools such as ChatGPT, Gemini, or automated writing systems, is increasingly discussed as a factor that may influence students' cognitive, motivational, and self-regulatory outcomes. High degrees of AI dependence can also change the learning processes, according to recent international study, especially when students try to outsource fundamental cognitive functions like idea generation, problem solving, and academic writing. According to Vieriu et al. (2025), excessive reliance on AI-assisted learning may restrict possibilities for deep learning and undermine students' participation in higher-order cognitive processes, even though it can boost efficiency and lessen time pressure. Similar results were reported by Tian (2025) who discovered that those students who relied more on AI has worse level of critical thinking skills. This was mostly due to their adoption of AI-generated information without assessing its correctness, logical structure, or trustworthiness.

Mufti (2025) found that many Pakistani undergraduates use artificial intelligence to create assignments, compose essays, and summarize readings. This encourages surface-level learning and reduces direct engagement with academic subjects. Further, Shahzadi (2025) studied that Punjabi university students are increasingly using AI-based writing tools, and instructors report noticeable declines in the originality and coherence of student contributions. Khan (2024) asserts that overuse of AI negatively affects

students' capacity to study on their own as they begin to rely more on explanations generated by AI than on their own examination of academic material.

Another important factor in comprehending kids' reliance on AI is procrastination. Academic challenges and emotional stress are closely linked to procrastination, which is typically characterized as deliberate yet unreasonable task delay. According to traditional research by Steel (2007), avoidance motive, impulsivity, and a lack of self-control are the main causes of procrastination. According to recent study, AI dependency may indirectly encourage procrastination by lowering the perceived cost of putting off academic work. For instance, students may feel less pressure to begin their assignments early if they think AI can easily provide summaries or finish assignments later, which increases their propensity to put off work. A study performed among Pakistani university students discovered, those who heavily relied on AI tools report significantly high level of academic procrastination, they felt that AI could fix their assignments at the last moment (Shahzadi, 2025).

Self-efficacy is defined as one important psychological concept that connects to a academic procrastination and AI dependency, which is defined as people's confidence in their capacity to plan and complete activities. According to Bandura's (1997) social-cognitive theory, low self-efficacy leads to task procrastination and high self-efficacy boosts motivation and problem-solving. This relationship is supported by a large body of empirical data. Klassen (2008) showed that whereas students with low self-efficacy find it difficult to start and stay focused on academic work, undergraduates with good self-regulatory self-efficacy are less likely to delay. In a similar vein, Liu et al. (2020) discovered that procrastination tendencies among postgraduate students are significantly predicted by academic self-efficacy. According to Sohail and Hussain (n.d.) higher

academic self-efficacy among college students was linked to improved academic achievement, greater perseverance, and less academic procrastination.

AI dependence and self-efficacy have complex relationship. Research suggests that the regulated and supervised use of AI might increase students' self-efficacy by providing them with learning support, feedback, and examples. However, an over-reliance on AI may undermine students' faith in their own cognitive abilities. Students who rely too much on AI may start to doubt their own skills or feel less capable of finishing homework independently. Acosta-Enéquez (2025) showed that, due to AI reliance, increasing academic stress was an indirect predictor of lower academic self-efficacy. According to Khan (2024), students who use artificial intelligence (AI) regularly for academic work often report feeling less confident when asked to do tasks without AI support, indicating a drop in their trust in their academic ability.

AI dependence particularly impacts critical thinking which is a fundamental skill in education. Skills like assessing evidence, recognizing presumptions, formulating arguments, and resolving challenging issues are all part of critical thinking. Studies show that AI may either support or obstruct critical thinking, depending on how it is used. Tian (2025) found that students who utilized AI tools extensively often forgot to assess AI results which eventually led to a loss in critical evaluation skills. According to Vieriu et al. (2025), AI tends to provide easy answers unless instructors intentionally design projects that require critical interaction with AI-generated material. This limits students' abilities to engage in reflective thinking. According to Mufti (2025), students never challenge the veracity of AI content, even when mistakes or false information are there. This blind acceptance might impair their capacity for critical thought.

High self-efficacy students are more likely to challenge AI outputs, use AI tools strategically, and manage their time well, all of which safeguard their critical thinking abilities. On the other hand, students with poor self-efficacy may avoid challenging cognitive activities, procrastinate, and rely too much on AI, all of which can eventually impair their capacity for critical thought. This concept is supported by Acosta-Enéquez (2025), who demonstrates that when students lacked good self-regulation and self-efficacy, AI reliance predicted worse academic outcomes. These trends are supported by Pakistani research by Khan (2024) and Sohail and Hussain (n.d.), which suggests that boosting self-efficacy may lessen the detrimental effects of AI dependence.

2.2 Theoretical framework

2.2.1 Social Cognitive Theory (Bandura, 1986)

According to Social Cognitive Theory, that every human learning and behavior are influenced by the intervene of personal factors, actions, and the environment, a phenomenon referred to as reciprocal determinism (Bandura, 1986). A major concept in this theory is self-efficacy, is defined as one's confidence in their ability to effectively execute tasks (Bandura, 1997). Students with high self-efficacy are motivated, persistent, and intellectually engaged than those with low self-efficacy, who are inclined to put off or avoid homework. The factors in the research align with this notion that students with Low self-efficacy, frequently put off challenging projects, which can result in procrastination (Steel, 2007). However, since self-assured learners are more likely to use reasoning and analysis, SCT also explains variations in critical thinking (Phan, 2010).

Low self-efficacy students may be more dependent on AI, using it to make up for perceived deficiencies in their academic abilities.

2.2.2 Self-Regulation Theory (Zimmerman, 2000)

According to Self-Regulation Theory that learners actively regulate their ideas, emotions, and actions to attain objectives through processes including planning, monitoring, and self-evaluation (Zimmerman, 2000). While students with poor self-regulation have trouble starting tasks and avoiding distractions. Individuals with strong self-regulation are able to stay motivated, manage their time well, and pay attention. This theory is directly linked to procrastination, which often results from ineffective time management and effort (Duckworth et al., 2019). Because effective goal management builds confidence, self-regulation also increases self-efficacy (Zimmerman & Kitantas, 2014). According to this theory, procrastination and dependence on AI might rise when planning and control failures occur, while self-efficacy and critical thinking are weakened. By forcing students to analyze methods and consider their thought processes, effective regulation fosters critical thinking. Students that struggle with self-control can rely more on AI tools, taking short routes rather than engaging fully.

2.2.3 Cognitive Load Theory (Sweller, 1994)

According to the Cognitive Load Theory, learning is restricted by cognitive excess and working memory has limited abilities. People reduce effort by looking for outside help to reduce cognitive demands. Since students with high cognitive load often rely on AI technology to make difficult work easier, this concept is highly relevant to AI reliance (Mayer, 2010). However, this decrease in cognitive effort may harm critical thinking abilities since youngsters avoid deeper processing. Procrastination is also explained by

CLT, as students are more likely to put off or avoid tasks when faced with challenging cognitive demands (Scherer et al., 2024). Additionally, students' self-efficacy may decline when tasks are perceived as being unduly cognitively taxing, making them feel incapable of completing academic work independently.

2.2.4 Technological Dependency Framework (Griffiths, 2005)

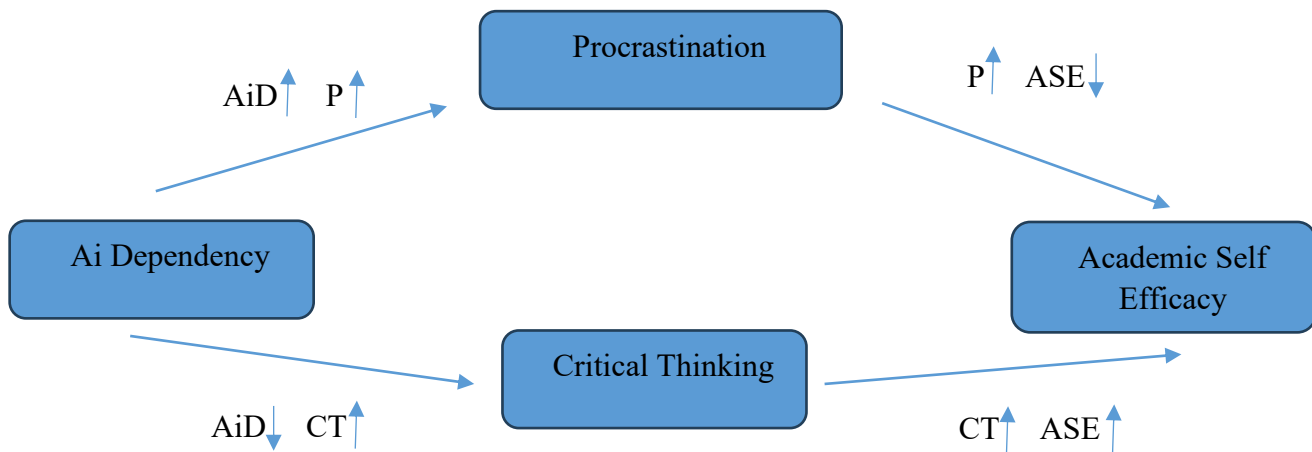
Technological Dependency Framework describes how excessive use of technology may lead to humans relying on technological aids to perform cognitive or behavioral activities (Griffiths, 2005). Over time, such reliance may reduce internal drive and impair skill development. This notion is strongly related to AI reliance, since students may become more reliant on AI for writing, problem solving, and idea development. Excessive dependency inhibits critical thinking by outsourcing cognitive effort to AI rather than the learner. It can also lower self-efficacy since students learn to mistrust their capacity to complete activities without technology assistance (Meshi et al., 2021). Furthermore, technology reliance may add to procrastination, with students putting off chores until they can rely on AI to ease them.

2.2.5 Instant Gratification Theory (Lorenz, 1950s; modern behavioral psychology)

In accordance to the Instant Gratification Theory, people choose instant benefits over long-term consequences, even if the latter are more important (Mischel et al., 1989). This inclination is associated with impulsive conduct, short-term pleasure seeking, and avoidance of effort. This hypothesis is critical for understanding procrastination since students frequently prefer quickly rewarding activities (e.g., amusement, relaxation) over difficult academic assignments. AI gives rapid solutions with little effort, satisfying the

urge for instant results. However, this dependency avoids students taking part in critical thinking by avoiding the slow, laborious cognitive processes necessary for analytical reasoning. Instant gratification also affects self-efficacy because kids rely on rapid external solutions rather than developing competence through consistent work.

2.3 Conceptual Framework



2.4 Problem statement

The wild use of artificial intelligence (AI) systems in academic settings has changed how university students access to knowledge, complete assignments, and manage their overall learning tasks. While AI technologies can significantly improve academic performance by delivering instant feedback, creating ideas, and simplifying complicated assignments, on the other hands their widespread and uncontrolled usage has incited worries about students' psychological functioning (Dwivedi et al., 2023). Students are getting more reliant on AI systems to do regular academic tasks, which may impair their capacity to think independently, manage their emotions during academic problems, and maintain consistent study habits. This dependence has the potential to create a reliance pattern where students choose AI-generated solutions instead of

engaging in active learning or problem solving, ultimately undermining the development of essential academic and cognitive skills (Kasneci et al., 2023).

AI dependence may also lead to procrastination, a common problem among university students across the world. Students that rely heavily on AI sometimes postpone starting academic activities, believing that AI technologies would finish or simplify the tasks for them at the last minute. Such activities is linked to avoidance tendencies, low motivation, and difficulty maintaining long-term academic goals (Steel & Klingsieck, 2016). Students who procrastinate incur increased academic stress, worse work quality, and poor time management, all of which lead to academic inefficiency and psychological strain (Svartdal et al., 2020). In Pakistani culture, where academic pressure and competitiveness are strong, procrastination is widely seen as a key impediment to academic performance, particularly among undergraduate students who struggle with self-regulation and task management.

Another significant problem is Critical Thinking, due to impact of AI's. Critical thinking requires analyzing information, evaluating evidence, and drawing reasonable conclusions—all of which are necessary for academic and professional success. However, students' participation in higher-order cognitive processes may be reduced if they rely on AI systems to answer questions, generate ideas, or complete projects on a regular basis. Researches show that abandoning cognitive activities to AI may result in a decline in rational reasoning and logical argument abilities since the cognitive effort essential for such tasks are reduced. This pattern of cognitive abandoning promotes passive learning while limiting the development of independent intellectual capacities.

Academic self-efficacy, or students' confidence in their ability to do academic activities successfully, is also be impacted by growing AI deployment. High levels of

self-efficacy are linked to increased motivation, and academic accomplishment (Bandura, 1997). But, as students become more rely on AI, they lose confidence in their own abilities, considering that academic accomplishment can only be achieved with AI support. Reseraches shows external dependency weakens internal confidence, lowering the perceived capacity to handle academic obstacles independently (Usher & Pajares, 2008). Academic self-efficacy among Pakistani university students is already impacted by cultural beliefs, social pressures, and a competitive academic environment, putting it at risk of further deprivation owing to AI dependency (Shamim & Ahmad, 2022).

All these issues show a gap in our understanding of how AI dependence affects procrastination, critical thinking, and academic self-efficacy among university students. Researches has explored the impacts of AI on learning, there is little empirical evidence from poor countries like Pakistan, where digital literacy, cultural norms, and academic constraints are quite different from Western contexts (Qureshi et al., 2021). As a result, a comprehensive study is required to better understand how AI reliance affects psychological variables and academic performance among Pakistani university students.

2.5 Rationale of the study

The growing use of artificial intelligence (AI) in higher education in Pakistan has created both opportunities and challenges for university students which is making it critical to understand the effects of all of these variables on academic and psychological functioning (Qureshi et al., 2021). While AI tools can aid learning by providing immediate access to information and fast assistance with assignment tasks, over-dependence on them may reduce students' engagement in critical thinking, bound students' independent creativity, and weaken their academic self-efficacy, especially

when confronted with difficult educational assignments (Long & Magerko, 2020; Gross, 2015). Furthermore, AI dependency may lead to procrastination among students, as they delay starting tasks because they believe AI will simplify or complete the work for them, and it may undermine academic self-efficacy by developing the awareness that success is only dependent on technological support instead of personal effort (Steel & Klingsieck, 2016; Bandura, 1997; Usher & Pajares, 2008). In Pakistan, wherein students typically experience high academic pressure, extreme contexts, and variable amounts of access to digital resources, these consequences may become more pronounced in the future. Despite the widespread usage of AI, there has been little study on how AI reliance relates with procrastination, critical thinking, and self-efficacy in the Pakistani setting. Thus, this study is necessary to explore these relationships among Pakistani university students which will provide insight that can guide educator, policymaker and institution promoting balanced and operative, effective and efficient AI usage to develop better learning outcomes and students' well-being.

2.6 Research gap

With the increasing use of artificial intelligence (AI) technologies in Pakistani institutions, research into the psychological and academic implications of AI reliance on students remains scarce. The majority of previous research on AI usage and academic behavior has been undertaken in Western or technologically advanced settings, which may not accurately reflect Pakistan's unique cultural, educational, and technical realities (Qureshi et al., 2021; Kasneci et al., 2023). There is little research on how AI reliance interacts with essential academic and cognitive characteristics such as procrastination, critical thinking, emotional control, and self-efficacy in Pakistani university students. Some study has found links between procrastination and self-efficacy in Pakistan (Rafiq

et al., 2022; Shamim & Ahmad, 2022), these studies have not considered the function of AI as a mediating or moderating factor in these results. The rapid dependency of AI tools such as ChatGPT, automated assignment generators, and virtual learning platforms creates new challenges that may impair procrastination, reduce independent critical thinking, and undermine students' confidence in their academic abilities; these issues are underexplored in the Pakistani context. So, a study is required to bridge this gap by giving culturally appropriate perspectives on how AI reliance impacts students' cognitive and behavioral patterns, as well as helpful methods for well-adjusted AI integration in Pakistani higher education.

2.7 Hypotheses

1. **H1:** AI dependency is positively associated with academic procrastination and negatively associated with critical thinking and self-efficacy among university students.
2. **H2:** Critical thinking is positively associated with academic self-efficacy and is negatively associated with academic procrastination among university students.
3. **H3:** Academic self-efficacy is negatively associated with procrastination.
4. **H4:** Procrastination mediates the relationship between AI dependency and academic self-efficacy.
5. **H5:** Critical thinking mediates the relationship between AI dependency and academic self-efficacy.

Chapter 3

METHODS

3.1 Operational Definitions

- **AI Dependency:** The level to which students exceptionally and uncritically rely on AI tools to complete academic tasks, measured through the AI Dependency Scale.
- **Academic Procrastination:** The unreasonable and deliberate delay of academic tasks even though anticipated negative outcomes, measured using an academic procrastination questionnaire.
- **Academic Self-Efficacy:** Students' beliefs in their ability to effectively perform academic tasks and achieve learning goals, measured through the General Academic Self-Efficacy Scale.
- **Critical Thinking:** The ability to analyze, evaluate, and integrate information reflectively and reasonably in academic contexts, measured using the Critical Thinking Questionnaire.

3.2 Research Design

The quantitative, correlational research design is employed to examine the relationships among AI dependency, procrastination, critical thinking, and academic self-efficacy among university students in Pakistan. This design is appropriate to measure the natural associations and predictive effects among them within an academic context. A cross-sectional survey method is used, allowing data to be collected from a large sample at a single point in time, which is suitable for identifying patterns, trends, and statistically significant relationships.

3.3 Participants

The population for this study is consisted of university students (from 3rd semester) aged 18 year above, enrolled in both private and public universities in Pakistan. The sample size included 226 participants. These individuals are pertinent to the study as they are active of AI tools (like Chat GPT, Gemini, etc) specifically for educational purposes.

Purposive sampling, non probability sampling method is employed to select participants. This technique enabled to choose individual who meet specific criteria relevant to the study's objectives. In this case participants are selected based on their age (above 18 years), university affiliation (private or public), semester and exposure to Ai tools for educational purposes.

3.4 Inclusion criteria

Participants shall be included on the basis of currently enrolled as a student in university (Semester 3 or above), using Ai tools (Chat GPT, Gemini, etc) for educational purposes for approximately 6 months or more, have regular access with devices and internet, efficient in English language and shalling to consent for the part of the study.

3.5 Exclusion criteria

Individuals with backlogs, doesn't user of any AI tool, presented with any psychological distress, using AI less than 6 months are not selected for this study

3.6 Measures

3.6.1 Dependence on Artificial Intelligence Scale (DAI)

The Dependence on Artificial Intelligence Scale (DAI) (Morales-García et al., 2024) is a free to use scale which shall be used to evaluate the extent of dependence that university students exhibit towards artificial intelligence. Internal consistency is assessed using Cronbach's alpha (α) and McDonald's omega (ω). Both coefficients are 0.87, indicating good reliability and internal consistency. The instrument is comprised of five items and formatted in a Likert-type manner, offering five distinct response alternatives that range from "Completely false for me" to "Describes me perfectly."

3.6.2 The Critical Thinking Questionnaire (CThQ)

The Critical Thinking Questionnaire (CThQ) is a critical thinking test tool designed for adolescent and adult. The basis for creating the questionnaire is classifying the educational goals proposed by Benjamin Bloom and spread by critical thinking practitioners. The independent rater system used in the construction of the test, while the psychometric properties of the test are tested on a sample of 198 people, calculating the inter-correlation and the Cronbach's Alpha reliability coefficient. Both assessments of the independent rater system and research checking the psychometric properties of the test indicate high reliability of the tool. Cronbach's Alpha coefficient of internal consistency is 0.87. In its final version, the test consists of 25 items, the results of which allow assessing critical thinking in 6 scales: remembering, understanding, applying, analysing, evaluating, and creating. The tool also allows checking the overall score.

3.6.3 Tuckman Procrastination Scale (TPS),

The Tuckman Procrastination Scale (TPS), developed by Bruce Tuckman (1991) free to use scale, is a widely used tool for assessing academic procrastination. The original version consists of 35 items measured on a 5-point Likert scale, while a shorter 16-item version also been validated for research use, which is also used in this research. Studies consistently report strong internal consistency with Cronbach's alpha values ranging between .86 and .90 for the full scale and around .85 for the short form, indicating high reliability. Test-retest analyses further support its stability over time. In terms of validity, the TPS demonstrates sound content validity, as its items are based on core procrastination behavior such as delay, avoidance, and failure to complete tasks. Construct validity is proven through factor analyses that confirm one-dimensional structure as well as significant correlation with related constructs like self-regulation, self-efficacy, and academic performance. Criterion validity is also determined by higher TPS scores predicting poorer academic outcomes, including lower GPA and increased task delay.

3.6.4 General Academic Self-Efficacy Scale (GASE)

The General Academic Self-Efficacy Scale (GASE) is a short, self-report measure designed to assess university students' belief in their ability to manage academic challenges. It consists of 5 items that are rated on a five-point Likert scale ranging from strongly disagree to strongly agree. In the 2022 validation study by Van Zyl et al., the scale shows standard internal consistency with Cronbach's alpha ranging from 0.74 to 0.78 and McDonald's omega between 0.74 and 0.78 across two time points. Factorial validity is also supported through confirmatory factor analysis which shows a good

model fit (CFI = 0.99, TLI = 0.98, RMSEA = 0.05, SRMR = 0.02). Criterion validity is established with a significant positive correlation between academic self-efficacy and task performance which is indicating both concurrent validity ($\beta = 0.54-0.58$) and predictive validity ($\beta = 0.39$). These findings confirm that the GASE (Van Zyl et al., 2022) is a reliable and valid instrument for measuring academic self-efficacy across time and cultural contexts.

3.6.5 Procedure

This study follows a quantitative, survey-based approach, collecting data through self-reported questionnaires, either in paper form or online form. Participants are informed about the study's purpose, and their confidentiality is strictly maintained. Ethical approval is obtained before initiating data collection. Data for this study is collected through surveys utilizing a standardized questionnaire. The questionnaire is designed to gather information on participants' dependency on AI for educational purposes, Critical Thinking, Academic Self-Efficacy and Procrastination.

3.7 Statistical Analysis

To test the hypotheses in SPSS, For H1 that AI dependency is positively associated with academic procrastination and negatively associated with critical thinking and self-efficacy Pearson Correlation Analysis shall be executed to examine the strength and direction. H2, critical thinking is positively associated with academic self-efficacy and negatively associated with academic procrastination, tested using Pearson Correlation Analysis to assess the correlations between critical thinking, procrastination, and self-efficacy. For H3 academic self-efficacy is negatively associated with

procrastination, a Pearson Correlation Analysis would again be suitable to test the relationship between these two variables. To test H4, which proposes that procrastination mediates the relationship between AI dependency and academic self-efficacy Mediation Analysis using the Process Macro for SPSS is employed to determine the indirect effects of procrastination on the relationship between AI dependency and self-efficacy. Similarly, H5 which suggest that critical thinking mediate the relationship between AI dependency and academic self-efficacy is tested using Mediation Analysis via the Process Macro for SPSS, allowing for the examination of the indirect effect of critical thinking on this relationship.

3.8 Ethical Considerations

Ethical considerations are prioritized during the whole research process. Informed consent is obtained from all participants before data collection, which ensured that they understood the study purpose, the nature of questions and the right to withdraw at any time without any concerns. To maintain confidentiality, responses are remain anonymized, and data is securely stored. Participants shall be assured that their response would only be used for academic purposes, with no personal identifiers being linked to data.

Chapter 4

Results

Table 4.1

Demographics Profile (N=226)

Respondent's Characteristics		<i>f (%)</i>
Gender	Male	122 (54)
	Female	104 (46)
Age	18-20 Years	95 (42.0)
	21-23 Years	81 (35.8)
	24-26 Years	38 (16.8)
	27-Above	12 (5.3)
Education	2nd Year (BS hon.)	66 (29.2)
	3rd Year (BS hon.)	62 (27.2)
	4th Year (BS hon.)	83 (36.7)
	Master's Level	15 (6.6)

	Social Sciences (e.g., Psy, Socio)	55 (24.3)
	Natural Sciences (e.g., Bio, Chem, Phy)	32 (14.2)
Field of Study	Engineering / Technology (CS, IT, SE)	73 (32.3)
	Business / Management	37 (16.4)
	Arts / Humanities	24 (10.6)
	Other:	3 (1.3)
University	Private	98 (43.4)
	Public	128 (56.6)
	Less than 50,000 PKR	51 (22.6)
	50,000-100,000 PKR	62 (27.4)
Socioeconomic Status	100,000-200,000 PKR	57 (25.2)
	More than 200,000 PKR	30 (13.3)
	Prefer not to say	26 (11.5)

		38 (16.8)
	Personal smart phone	142 (62.8)
Access to Technology	Personal smart phone, Personal laptop/Computer	
	Personal smart phone, Personal laptop/Computer, Shared Devices	46 (20.3)
	Less than 2 hours	14 (6.2)
	2-4 hours	58 (25.7)
Internet Usage	5-7 hours	75 (33.1)
	More than 7 hours	79 (35.0)
	Rarely	28 (12.4)
Frequency of Ai	Sometimes	67 (29.6)
	Often	87 (38.5)
	Very Often	44 (19.5)

		55 (24.3)
	Academic Purpose	50 (22.1)
Purpose of Ai	Academic Purpose, Creative work	10 (4.4)
	Academic Purpose, Entertainment or Chatting	
	Academic Purpose, Personal Learning development	111 (49.1)
	Less than 6 months	14 (6.2)
Duration of Ai Use	6-12 months	38 (16.8)
	1-2 years	66 (29.2)
	More than 2 years	108 (47.8)
Resident Type	Day Scholars	149(65.9)
	Hostilities	77 (34.1)

Table 4.1 presents the demographic profile of the 226 university students who participated in the study. A significant number of males (122, 54%) and females (104, 46%) were the part of that study. With regard to age, most respondents are between 18–20 years (n = 95, 42.0%) and 21–23 years (n = 81, 35.8%), indicating that most

participants are in the early years of their university education. A smaller proportion of students fell within the 24–26 years age group ($n = 38$, 16.8%), while only a limited number are 27 years and above ($n = 12$, 5.3%). This distribution suggests that the sample primarily represents young adult undergraduate students.

In terms of educational level, the largest proportion of respondents are enrolled in the 4th year of BS (Honors) programs ($n = 83$, 36.7%), followed by 2nd year students ($n = 66$, 29.2%) and 3rd year students ($n = 62$, 27.2%). Small percentage of participants are studying at the Master's level ($n = 15$, 6.6%). Regarding field of study, students from Engineering and Technology disciplines (e.g., Computer Science, Information Technology, Software Engineering) constituted the largest group ($n = 73$, 32.3%). This is followed by participants from Social Sciences ($n = 55$, 24.3%) and Business and Management ($n = 37$, 16.4%) only fewer respondents are in Natural Sciences ($n = 32$, 14.2%) and Arts and Humanities ($n = 24$, 10.6%), only a small number reported other fields of study ($n = 3$, 1.3%). With respect to the type of university, more than half of the participants are enrolled in public universities ($n = 128$, 56.6%), whereas private university students accounted for 43.4% ($n = 98$). In terms of socioeconomic status, the largest proportion of respondents reported a monthly family income between 50,000–100,000 PKR ($n = 62$, 27.4%), followed by 100,000–200,000 PKR ($n = 57$, 25.2%). Students with a family income of less than 50,000 PKR comprised 22.6% ($n = 51$) of the sample, while 13.3% ($n = 30$) reported an income of more than 200,000 PKR. Moreover 11.5% ($n = 26$) preferred not to disclose their income. Concerning access to technology the most of students reported having access to both a personal smartphone and a personal laptop/computer. In terms of internet usage, respondents reported using the internet for

more than 7 hours daily ($n = 79$, 35.0%) or 5–7 hours ($n = 75$, 33.1%). Concerning the frequency of AI tool usage most participants reports using AI tools often ($n = 87$, 38.5%) and rarely ($n = 28$, 12.4%), while 19.5% ($n = 44$) reported very frequent use. In terms of purpose nearly half of the respondents reported using AI tools primarily for academic and personal learning development purposes ($n = 111$, 49.1%). With respect to the duration of AI tool usage, almost half of the participants had been using AI tools for more than two years ($n = 108$, 47.8%) followed by those with 1–2 years of usage ($n = 66$, 29.2%). Regarding residence type, the majority of respondents are day scholars ($n = 149$, 65.9%), while hostel residents constituted 34.1% ($n = 77$).

Table 4.2

Reliability Analysis of DAI, TPS, CThQ and GASE (N= 226)

Variables	Variable		α	Range		Skew	Kurto
	M	SD		Potential	Actual		
DAI	17.67	3.30	0.73	5-25	5-25	-1.49	2.95
TPS	40.35	5.2	0.79	16-64	17-59	-0.97	2.85
CThQ	83.9	10.7	0.83	25-125	47-110	-.56	.54
GASE	15.1	2.9	0.78	5-25	5-23	-.45	1.43

α = Cronbach's alpha; Skew = Skewness; Kurto = Kurtosis

Table 4.3 presents the reliability analysis for Dependency AI, Academic Procrastination, Critical Thinking, and General Academic Self-Efficacy of 226 participants, with their means (M), standard deviations (SD), and ranges listed.

For the Dependency AI variable mean score is 17.67 with a SD of 3.30. The Cronbach's alpha for this variable is 0.73. The skewness of -1.49 show that the data is negatively skewed. The kurtosis value of 2.95 show a leptokurtic distribution show that the data has sharp peak.

For Academic Procrastination, the mean is 40.35, with a standard deviation of 5.2. The scores range from 16 to 64, and the Cronbach's alpha value is 0.79, which is acceptable. The skewness of -0.97 indicates a slight negative skew, and the kurtosis value of 2.85 show that the distribution is also leptokurtic.

The Critical Thinking variable had a mean of 83.9 and a standard deviation of 10.7, with a range between 25 and 125. The Cronbach's alpha of 0.83 reflects strong internal consistency. The skewness value of -0.56 shows a mild negative skew, and the kurtosis of 0.54 is close to 0 show that is relatively close to normal.

For General Academic Self-Efficacy the mean score is 15.1 and the standard deviation was 2.9 with a range from 5 to 23. The Cronbach's alpha value is 0.78. The skewness value of -0.45 indicates a slight negative skew, and the kurtosis value of 1.43 show that the distribution is mildly leptokurtic.

Table 4.3

Correlation Analysis of DAI, CThQ, TPS and GASE (N= 226)

Variables	M	SD	DAI	CThQ	TPS	GASE
DAI	17.67	3.30	-	-.296**	.419**	-.153**
CThQ	83.9	10.7		-	-.436**	.442**
TPS	40.35	5.2			-	-.308**
GASE	15.1	2.9				

** $p < .01$ DAI (*Dependency AI*), CThQ (*Critical Thinking*), TPS (*Academic Procrastination*) GASE (*Academic Self-Efficacy*)

Table 4.3 show correlation analysis results of relationships between AI dependency (DAI), critical thinking (CThQ), academic procrastination (TPS), and academic self-efficacy (GASE).

Analysis show a significant negative correlation between AI dependency and critical thinking (CThQ) with coefficient of -0.296 ($p < 0.01$) indicate that as AI dependency increases, critical thinking decreases. There is also a significant positive relationship between AI dependency and academic procrastination (TPS) (0.419, $p < 0.01$), means that higher AI dependency is associated with higher levels of procrastination. AI dependency is negatively correlated with academic self-efficacy (GASE) (-0.153, $p < 0.01$), indicating that those having increased AI dependency has lower academic self-efficacy,

Critical thinking has a significant negative correlation with academic procrastination (TPS) (-0.436, $p < 0.01$). This suggests that higher critical thinking abilities are associated with less procrastination. Critical thinking show a significant positive correlation with academic self-efficacy (GASE) (0.442, $p < 0.01$). This indicates that higher scores on critical thinking skills are associated with higher self-efficacy.

Academic procrastination is negatively correlated with academic self-efficacy (-0.308, $p < 0.01$) suggesting that the more a person procrastinates, the lower their academic self-efficacy is.

Table 4.4

Mediation Analysis: Procrastination as a Mediator of the Relationship Between AI Dependency and Academic Self-Efficacy

Path	B	SE	t	p	95% CI
DAI → AP	0.66	0.09	6.90	<.001	[0.47, 0.84]
AP → GASE	-0.16	0.04	-4.22	<.001	[-0.24, -0.09]
Direct Effect of DAI → GASE	-0.02	0.06	-0.41	0.6841	[-0.15, 0.09]
Indirect Effect (DAI → AP → GASE)	-0.1117	0.042		<.001	[-0.19, -0.03]

Note. Bootstrapping based on 5,000 samples. CI = confidence interval.

DAI = AI Dependency; GASE = General Academic Self-Efficacy ; AP= Academic Procrastination

The result of the mediation analysis reveal key relationships between AI dependency, procrastination, and academic self-efficacy. First, the analysis show AI dependency significantly influence procrastination. The coefficient of 0.66 indicate positive relationship between AI dependency and procrastination meaning that AI dependency increases procrastination also increases. This relationship is highly significant as the p-value is less than 0.001 and the confidence interval does not include zero confirming the strength of this finding.

Direct effect of AI dependency on academic self-efficacy is not significant, coefficient for this path is -0.02 with a p-value of 0.68 which is not statistically significant, suggests that AI dependency itself does not have a direct impact on academic self-efficacy.

The analysis also show a significant negative relationship between procrastination and academic self-efficacy. The coefficient of -0.16 indicate that as procrastination increase, academic self-efficacy decrease, with a p-value of less than 0.001.

The direct effect of AI dependency on self-efficacy is not significant the indirect effect through procrastination is. The indirect effect is significant with a coefficient of -0.11 and a p-value of less than 0.001. confidence interval for this indirect effect does not contain zero indicating that procrastination significantly mediate the relationship between AI dependency and academic self-efficacy. This means that AI dependency lead to more procrastination which in turn reduce academic self-efficacy.

Table 4.5

Mediation Analysis of Critical Thinking as a Mediator in the Relationship Between AI Dependency and Academic Self-Efficacy

Path	B	SE	t	p	95% CI
DAI → CTHQ	-0.96	0.21	4.64	<0.001	[-1.37, -0.55]
CTHQ → GASE	0.12	0.02	6.92	<0.001	[0.08, 0.15]
Direct Effect of DAI → GASE	-0.02	0.05	0.37	0.71	[-0.13, 0.09]
Indirect Effect (DAI → CTHQ → GASE)	-0.11	0.04		<0.001	[-0.21, -0.04]

Note. Bootstrapping based on 5,000 samples. CI = confidence interval.

DAI = AI Dependency; GASE = General Academic Self-Efficacy; CTHQ = Critical Thinking.

Table 4.5 show a significant negative relationship between AI dependency (DAI) and critical thinking (CTHQ). The coefficient of -0.96 ($p < 0.001$) indicate that AI dependency increase critical thinking decreases. This relationship statistically significant and the confidence interval ([-1.37, -0.55]) does not contain zero confirming the strength of this effect.

When examining the direct effect of AI dependency on academic self-efficacy (GASE), the analysis shows this relationship is not significant. The coefficient of -0.02 with a p-value of 0.70 suggests that AI dependency does not directly influence academic self-efficacy.

The relationship between critical thinking and academic self-efficacy is highly significant. The coefficient of 0.12 ($p < 0.001$) shows that increased critical thinking is associated with higher academic self-efficacy.

Indirect effect of AI dependency on academic self-efficacy through critical thinking is significant. The coefficient for the indirect effect is -0.11, with a p-value less than 0.001 and a confidence interval $([-0.21, -0.04])$ that does not include zero. This indicates that critical thinking significantly mediates the relationship between AI dependency and academic self-efficacy. Specifically, higher AI dependency leads to lower critical thinking, which in turn reduces academic self-efficacy.

Chapter 5

5.1 Discussion

This study was conducted to investigate the impact of AI dependency on Academic procrastination, Critical Thinking and Academic self-efficacy among university students. The main purpose of the study was to investigate how much the over dependency on AI tools lead to lower critical thinking, increased procrastination and reduce the overall academic self-efficacy. The sample was primarily male (122, 56%), with a significant proportion of age falls into 18-20 age range (95, 42%) and 21-23 age range (81, 35.8%). Most of the participants were undergraduates (211, 93.3%). Most of the students was from Engineering/Technology department (73, 32.3%) and were from Public sector universities (128, 58.6%). Regarding socioeconomic status, the largest group (62, 27.4%) fall between 50,000-100,000 PKR. Access to technology was high (142, 62.8%), owning both a personal smartphone and a personal laptop/computer. Internet usage was high (35%) spending more than 7 hours. AI usage was frequent with 38.5% of participants using AI "often," primarily for academic purposes as indicated by 49.1% of respondents. A considerable portion (47.8%) had been using AI for more than two years. Most of respondents (65.9%) were day scholars.

The results of this study discover significant relationships between AI dependency, academic procrastination, critical thinking, and academic self-efficacy. AI dependency was found to be positively correlated with academic procrastination and negatively correlated with critical thinking and self-efficacy, which shows that AI dependency increases procrastination also increase while critical thinking and self-efficacy decrease. These results are aligned with the notion that over-dependence on AI

can affect students' abilities. This align with Kuss and Griffiths (2017) who investigated that, the instant gratification provided by AI tools cause higher dependencies on digital technologies like AI impacts to procrastination as students may become preoccupied to it. Carr (2018) suggest that AI while providing rapid solutions might reduce students' engagement in deep thinking processes which leads to a decline in critical thinking skills. Schunk and DiBenedetto (2020) have shown that an over-dependance on external aids like AI, significantly lowers self-efficacy. These findings also supported by Imtiaz et al. (2020) which highlighted that over-dependance on technology among Pakistani students developed in increased procrastination and decreased academic confidence. These results indicate that AI dependency has adverse impact on students' academic habits, cognitive abilities, and self-confidence.

Critical thinking was found to be positively correlated with academic self-efficacy and negatively correlated with academic procrastination which indicates that students with higher levels of critical thinking have stronger academic self-efficacy and lower procrastination. This supports Bandura's (1997) self-efficacy theory. According to this theory, those individuals who possesses stronger sense of expertise in their abilities are more likely to engage in task proactively and effectively, as compared to those with lower sense of expertise. The correlation between critical thinking and reduced procrastination reflects McCrea's (2014) research which showed that students who think critically are more likely to complete tasks before deadlines. There is a Positive relationship between critical thinking and academic self-efficacy, indicating that students who engage in higher-order thinking feel more confident in academic abilities. These findings are aligned with a study conduct by Zafar et al. (2018) which found that student

with higher critical thinking abilities showed more academic self-efficacy and were less expected to procrastinate.

The negative correlation between academic self-efficacy and academic procrastination was also examined, indicating students who have higher self-efficacy procrastinate less. This findings are supported by Steel's (2007) work on procrastination which show that student with higher levels of self-confidence in their academic abilities avoid procrastination and approach tasks timely. Procrastination negatively impacts self-efficacy which indicates that the more students procrastinate the less confident they are to complete academic tasks.. These results are confirmed by Haider et al. (2021) where procrastination was found to be inversely related to academic self-efficacy among university students further confirming the negative impact of procrastination on students' academic confidence.

Although Academic self-efficacy is not directly influenced by AI dependency, the mediation analysis has proven that procrastination plays significant mediating role between AI dependency and self-efficacy. Results show that AI dependency lead to increased procrastination which in turn reduces academic self-efficacy. Mediation effect is consistent with Rosen et al. (2020) who found that procrastination is a vital factor in explaining the negative effect of digital distractions on academic performance. While Academic self-efficacy is not directly effected by AI dependency, procrastination plays a significant role in it. Identical finding was also reported by Hussain and Shams (2020) in which, they found that procrastination mediated the relationship between technology addiction and academic performance in students.

Critical thinking was also found to mediate the relationship between AI dependency and academic self-efficacy. Means that higher the AI dependency cause reduced critical thinking which in turn leads to lower academic self-efficacy. These results are also identical to Kato's (2020) declaration that the over reliance on technology weakens students' ability to engage in critical thoughts, hence negatively changing their confidence in academic abilities.

5.2 Conclusion

Findings of this study explores in-depth correlations between AI dependency, academic procrastination, critical thinking, and academic self-efficacy among university students. The results shows that AI dependency is positively correlated with academic procrastination and negatively correlated with both critical thinking and self-efficacy. Additionally, critical thinking and academic self-efficacy were found to be inversely related to procrastination. The study also explore mediating roles of procrastination and critical thinking in the relationship between AI dependency and academic self-efficacy. The findings of this academic study highlight the necessity for therapies targeted at reducing procrastination and improving critical thinking abilities, particularly in an era of rising AI dependence. These findings provide us the sanitizing students' self-efficacy and critical thinking abilities can help reduce the negative effects of AI dependency on their academic outcomes, providing valuable insights for educational practices and strategies to improve students' academic performance and wellbeing.

Implications

- Educational institutions should spotlight incorporating critical thinking exercises and activities within the core curriculum, to alleviate the adverse effects of AI dependency. These applications can help in development of independent thought, analytical reasoning, and problem-solving skills. On the other hand universities can help students reduce their dependence on AI tools for quick solutions by engaging students in activities that require deep thinking and reflection.
- As procrastination is strongly correlated with academic underperformance, universities should apply targeted interventions to help students cope with this. To overcome procrastination, time management workshops, personalized counselling sessions, and productivity tools could be offered to guide students in which help students develop healthier study habit and reduce tendencies to delay tasks.
- Educators should adopt a balanced approach to use AI tools in academic settings. While AI can be an effective tool for learning, students should be encouraged to view it as an extra resource rather than a primary one. By using AI as a tool for improving research or clarifying concepts which helps students can develop better cognitive skills. This approach should help them prevent becoming overly dependent on AI for tasks that require critical thinking.
- To improve students' confidence, universities should organize mentorship programs and academic success coaching, which can be intended to help students navigate challenges, set academic goals, and build self-efficacy.
- Universities should consider modifying their core curriculum to focus more on independent learning and problem-solving to avoid overuse of AI tools for tasks

that students could complete on their own., students will be encouraged to rely on their own cognitive abilities by designing projects and activities that require critical analysis, creative thinking, and independent research.

- Educational institutions should create clear SOPs for the productive and ethical use of AI tools, encourage students to use AI in ways that support their critical thinking and independent learning, rather than hindering it.
- Universities should provide training on how to efficiently incorporate AI into studies while sustaining academic integrity and improving learning outcomes.

5.3 Limitations

- The generalizability for this study to other areas or countries is limited because it was limited to selected public and private universities in Pakistan.
- This study is focused on AI dependency solely. There are several other factors, including social media use, personal habits, or environmental influences, that could also affect academic procrastination and self-efficacy. The study's narrow focus on AI may limit its ability to capture the full range of technological and psychological factors impacting students' academic behaviors.
- This study is it cross-sectional design which mainly focus only on students' behaviors and attitudes at a single point in time. As a result, causal relationships between AI dependency, procrastination, critical thinking, and academic self-efficacy cannot be establish. Longitudinal studies would be needed to look up changes over time and provide strong evidences of cause and effect relationships.
- The study utilize self-reported data from participants, which may can cause biases such as social desirability or wrong self-assessments. Students may overrate their

academic self-efficacy or underreport procrastination tendencies which may affect the accuracy of the results.

- This study used standardized questionnaires to measure critical thinking, procrastination, and self-efficacy to collect data. While these tools are widely used, they may not gather all the distinctions of these constructs, particularly in the context of rapidly evolving technology use.
- The study did not account for other potential contradictory variables which might be students' prior academic performance, motivation levels, or mental health status, which may influence their academic self-efficacy and procrastination behaviors.

5.4 Recommendations

- Universities should offer digital literacy-based programs, particularly focusing on teaching students how to use AI tools responsibly without becoming overly dependent. These programs should encourage students to use AI as an extra resource for enhancing learning, while emphasizing the importance of independent thinking and problem-solving skills.
- Educational institutes should spotlight active learning methods that require students to take part in critical thinking and independent problem-solving. This could include project-based learning, case studies, and collaborative activities that promote deeper cognitive engagement and discourage over-reliance on AI for answers.
- Universities should offer mentorship programs where students can take personalized guidance and support. Academic counselors or coaches can help students set realistic academic goals, build self-efficacy, and provide strategies for

overcoming procrastination which in returns ultimately enhancing students' academic self-efficacy.

- Universities should offer workshops focused on procrastination management. These workshops could present students to methods such as cognitive behavioral strategies, mindfulness, and goal-setting to help them to overcome procrastination and improve their academic performance.
- Future studies should study long-term effects of AI dependency on students, particularly exploring how these behaviors progress over time. Furthermore, more researches are needed to identify effective strategies and interventions that can moderate the negative impacts of AI dependency while endorsing positive learning outcomes.

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Appendices

Appendix A
Permission Letter



Bahria University
Discovering Knowledge

BULC/PSY/2025/327

11th November 2025

Permission Letter

Subject: Request for Cooperation for Collecting Research Data

To Whom It May Concern

Respected Sir/Ma'am,

Bahria University is a Federally Chartered Public Sector University. Bahria University was established by the Pakistan Navy in 2000. Since then, it has steadily grown into one of Pakistan's leading higher education institutions with campuses in Islamabad, Karachi, and Lahore.

The Department of Professional Psychology (DPP) was established in 2018. The Department offers both BS Psychology and MS Clinical Psychology Programs, aims to give quality education, and promotes ethical and competent psychology practice in Pakistan.

Mr. Muhammad Haris Sultan, a student of Bahria University Lahore Campus, currently enrolled in BS Psychology, VIII Semester. He is conducting final year research entitled "*AI Dependency, Academic Procrastination, Critical Thinking and Academic Self Efficacy among University Students.*"

For this purpose, he needs to collect data from your institute/organization. The information provided will remain confidential, and we will ensure the ethical responsibility of all our participants. The results concluded from the collected data will be used only for educational purposes. The identity of any participant will not be disclosed at any time.

We would like to seek your cooperation in conducting this research. Your assistance in our scientific pursuit will be highly appreciated and acknowledged.

Thanking you in anticipation.

Supervisor

A handwritten signature in black ink, appearing to read "Lubna".

Ms. Lubna Kanwal Dar
Sr. Lecturer

A handwritten signature in black ink, appearing to read "Khawer".

Dr. Khawer Bilal Baig
Senior Associate Professor/ HOD
Department of Professional Psychology
Bahria University Lahore Campus

Appendix B**Consent Form**

I, **Muhammad Haris Sultan**, a **BS Psychology 8th semester** student under the supervision of **Ms. Lubna Kanwal Dar**, am conducting a research study titled “AI Dependency, Critical Thinking, Self efficacy, Academic Procrastination and Emotional Regulation among university students” The purpose of this study is to explore how students’ dependence on Artificial Intelligence relates to their psychological and academic functioning. Participation involves completing questionnaires that shall take approximately 20–25 minutes. There are no foreseeable risks, your contribution shall help expand research knowledge in psychology and AI. All responses shall remain confidential and anonymous, used only for academic purposes. Participation is voluntary, and you may withdraw at any time without penalty or skip any question you are not comfortable with. By agreeing to participate, you acknowledge that you have read and understood the information provided and voluntarily consent to take part in this study. **Email:** harrissultan084@gmail.com

I consent to participate in this study.

Signature: _____ **Date:** _____ **Email/Mobile No:** _____

Appendix C

Demographics

1. Age

- 18–20 years 21–23 years 24–26 years 27 years and above

2. Gender

- Male Female Other: _____

3. Year of Study

- 2nd Year (BS hon.) 3rd Year (BS hon.)
 4th Year (BS hon.) Graduate
 Master's Level

4. Field of Study

- Social Sciences (e.g., Psychology, Sociology, Education) Natural Sciences (e.g., Bio, Chem, Phy)
 Engineering / Technology (CS, IT, SE) Business / Management Arts / Humanities
 Other: _____

5. Type of University

- Public Private

6. Socioeconomic Status (Approximate Monthly Family Income)

- less than 50,000 PKR / equivalent 50,000–100,000 PKR / equivalent
 100,000–200,000 PKR / equivalent above 200,000 PKR / equivalent Prefer not to say

7. Access to Technology (choose all that applies to you)

- Personal smartphone Personal laptop/computer Shared device No personal device

8. Daily Internet Usage

- Less than 2 hours 2–4 hours 5–6 hours 7 hours or more

9. Frequency of AI Tool Use (e.g., ChatGPT, Grammarly, Perplexity, etc.)

- Never Rarely Sometimes Often Very Often

10. Main Purpose of Using AI Tools (choose all that applies to you)

- Academic purposes (assignments, studying, research)
 Personal learning / skill development
 Creative work (writing, art, design)
 Entertainment or chatting
 Other: _____

11. Duration of AI Tool Use

- Less than 6 months 6–12 months 1–2 years More than 2 years

12. Residence Type

- Hostilities Days scholars

Section II

Please read each statement carefully and select the option that best represents how true it is for you. There are no right or wrong answers—your honest responses will help provide an accurate understanding of your experience with AI use.

I feel unprotected when I do not have access to AI	Completely untrue for me	Mostly untrue for me	Neither true nor untrue for me	True for me	Describes me perfectly
I'm concerned about the idea of being left behind in my tasks or projects if I do not use AI.	Completely untrue for me	Mostly untrue for me	Neither true nor untrue for me	True for me	Describes me perfectly
I do everything possible to stay updated with AI to impress or remain relevant in my field.	Completely untrue for me	Mostly untrue for me	Neither true nor untrue for me	True for me	Describes me perfectly
I constantly need validation or feedback from AI systems to feel confident in my decisions	Completely untrue for me	Mostly untrue for me	Neither true nor untrue for me	True for me	Describes me perfectly
I fear that AI might replace my current skills or abilities	Completely untrue for me	Mostly untrue for me	Neither true nor untrue for me	True for me	Describes me perfectly

Section III

The following is a list of 25 statements. Please rate on a scale of 1 to 5 to what extent you agree with the given statement that applies to you (**from 1 – strongly Disagree to 5 – strongly agree**). There are no good or wrong answers. Do not spend too much time on individual statements, and mark the answer that first seemed closest to what you think about yourself. The research is completely anonymous, and the results will only be used for research purposes

After reading it, I check important information, even if it seems to be true	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
I like combining information from different texts	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
I am willing to share the newly gained information	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
In-depth analyses of reality are a waste of life	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
After reading it, I am able to repeat important threads from the text	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
The same content can be expressed in many different ways	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
I can understand texts from various fields	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree

I form my impression on the basis of various information that I combine with each other	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
Everything already exists, so nothing completely new can be created	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
When I talk, I give many examples	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
In the discussion, I care about justifying my stance on the matter and understanding the other party at the same time	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
I like finding dependencies between seemingly different phenomena	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
I can see the structure of the text, and I could change it	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
When discussing, I try to use practical examples to justify my stance on the matter	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
If necessary, I can recall information about which I once read	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree

When I am interested in some information, I try to check if it is true	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
I can extract the most relevant parts of a text	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
To evaluate the information, I check many sources	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
I do not remember much from what I was learning at school	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
I like discussing new meanings in texts that I already know	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
I like to collate different opinions and compare them with each other	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
I have difficulties with paraphrasing	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
I try to use the information I have learned in everyday life	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
When I read the text, I am researching for a relationship between the information it contains and other texts that I have read	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree

I pay attention to the contexts, nuances and overtones of the statements	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree

SECTION IV

Please read each statement carefully and choose the option that best describes how true it is for you. There are no right or wrong answers—respond honestly according to your usual habits and behavior.

Items	That's me for sure 1	That's my tendency 2	That's not my tendency 3	That's not me for sure 4
I needlessly delay finishing jobs, even when they're important	1	2	3	4
I postpone starting in on things I don't like to do	1	2	3	4
I delay making tough decisions	1	2	3	4
I keep putting off improving my work habits	1	2	3	4
I get right to work, even on life's unpleasant chores	1	2	3	4

I manage to find an excuse for not doing something	1	2	3	4
I put the necessary time into even boring tasks, like studying	1	2	3	4
When something's not worth the trouble, I stop	1	2	3	4
I am an incurable time waster	1	2	3	4
I am a time waster now but I can't seem to do anything about it	1	2	3	4
I wish I could find an easy way to get myself moving	1	2	3	4
I always finish important jobs with time to spare	1	2	3	4
I look for a loophole or shortcut to get through a tough task	1	2	3	4
When I'm done with my work, I check it over	1	2	3	4
I still get stuck in neutral even though I know how important it is to get started	1	2	3	4
Putting something off until tomorrow is not the way I do it	1	2	3	4

SECTION V

Please read each statement carefully and choose the option that best describes how much you agree or disagree with it. There are no right or wrong answers—respond honestly based on how you usually feel about your academic abilities.

Items	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
I generally manage to solve difficult academic problems if I try hard enough	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
I know I can stick to my aims and accomplish my goals in my field of study	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
I will remain calm in my exam because I know I will have the knowledge to solve the problems	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
I know I can pass the exam if I put in enough work during the semester	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
The motto ‘if other people can, I can too’ applies to me when it comes to my field of study	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree

Appendix D Tool Permission

Request for Critical Thinking Questionnaire (CThQ) Permission Inbox x



Harris Sultan

Thu, Nov 20, 2025, 3:40 PM ☆

Respected Sir/Madam, I hope this message finds you well. My name is M. Haris, and...



Aleksander Kobylarek <ale... Mon, Nov 24, 2025, 1:28 AM

☆ 😊 ↩ ⋮

to me ▾

Hi,
no problem.

Here you have the questionnaire and instructions how to use it

<https://andragogy.pl/index.php/andragogy/article/view/1427>

everything is published by CC-by licence, so it means that you can use it without permission- you have only indicate authors of the questionnaire, if the research results would be published

best regards

a.k.

...

—

<https://wroc.academia.edu/AleksanderKobylarek>

www.researchgate.net/profile/Aleksander_Kobylarek

<http://www.jecs.pl>

<http://ogrodynauk.pl>

<https://andragogy.pl>

www.aleksanderkobylarek.pl

Request for General Academic Self-Efficacy Scale Permissoin Inbox x



Harris Sultan

Thu, Nov 20, 2025, 3:36 PM

Respected Sir/Madam, I hope this message finds you well. My name is M. Haris, and...



Llewellyn van Zyl <llewellyn1... Thu, Nov 20, 2025, 5:57 PM



to me ▾

You're more than welcome to use the scale for your study!
Best of luck

L



Appendix E Plagiarism Report

AID,AP

ORIGINALITY REPORT

13%

SIMILARITY INDEX

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AI detection includes the possibility of false positives. Although some text in this submission is likely AI generated, scores below the 20% threshold are not surfaced because they have a higher likelihood of false positives.

Caution: Review required.

It is essential to understand the limitations of AI detection before making decisions about a student's work. We encourage you to learn more about Turnitin's AI detection capabilities before using the tool.

Disclaimer

Our AI writing assessment is designed to help educators identify text that might be prepared by a generative AI tool. Our AI writing assessment may not always be accurate (i.e., our AI models may produce either false positive results or false negative results), so it should not be used as the sole basis for adverse actions against a student. It takes further scrutiny and human judgment in conjunction with an organization's application of its specific academic policies to determine whether any academic misconduct has occurred.

Frequently Asked Questions

How should I interpret Turnitin's AI writing percentage and false positives?

The percentage shown in the AI writing report is the amount of qualifying text within the submission that Turnitin's AI writing detection model determines was either likely AI-generated text from a large-language model or likely AI-generated text that was likely revised using an AI paraphrase tool or word spinner.

False positives (incorrectly flagging human-written text as AI-generated) are a possibility in AI models.

AI detection scores under 20%, which we do not surface in new reports, have a higher likelihood of false positives. To reduce the likelihood of misinterpretation, no score or highlights are attributed and are indicated with an asterisk in the report (*%).

The AI writing percentage should not be the sole basis to determine whether misconduct has occurred. The reviewer/instructor should use the percentage as a means to start a formative conversation with their student and/or use it to examine the submitted assignment in accordance with their school's policies.

What does 'qualifying text' mean?

Our model only processes qualifying text in the form of long-form writing. Long-form writing means individual sentences contained in paragraphs that make up a longer piece of written work, such as an essay, a dissertation, or an article, etc. Qualifying text that has been determined to be likely AI-generated will be highlighted in cyan in the submission, and likely AI-generated and then likely AI-paraphrased will be highlighted purple.

Non-qualifying text, such as bullet points, annotated bibliographies, etc., will not be processed and can create disparity between the submission highlights and the percentage shown.

