

The Impact of ChatGPT on Saudi MA Students' Critical Thinking Skills

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Abstract

This study aimed to explore the perceptions of master students in an English Language Institute (ELI) at a Saudi university regarding the effect of ChatGPT on their critical thinking skills. The study sought to identify the challenges, potential risks students can face, and the strategies that can be used to promote critical thinking using ChatGPT. To achieve this, an explanatory-sequential mixed methods design was employed to collect quantitative and qualitative data. Two research instruments were utilized: a questionnaire with a study sample of 50 students and semi-structured interviews with a study sample of five students. The findings revealed that master students have positive perceptions towards ChatGPT. However, there are some factors that contributed to how this tool can affect students' critical thinking, which are the types of tasks performed by ChatGPT, students' level of engagement, and their degree of dependency on it. Furthermore, students reported serious challenges and potential risks they have faced while using ChatGPT. The reliability of the information provided by this tool, overreliance on ChatGPT, and the risk of plagiarism are serious issues that they encounter. Finally, the findings revealed that students believe that questioning what ChatGPT' output and exploring multiple sources are important strategies to promote critical thinking skills. Furthermore, all students agreed that educational institutions must provide clear instructions and guidelines to assist students using ChatGPT ethically and effectively. Based on these findings, this study provides some implications and recommendations that would hopefully improve students' critical thinking by using ChatGPT in educational settings.

Keywords

Master Students, Critical Thinking Skills, ChatGPT, Students' Perceptions

1. Introduction

The advent of artificial intelligence (AI) has significantly altered the educational landscape, with ChatGPT emerging as a prominent tool in this sphere. ChatGPT, developed by OpenAI, stands as a cutting-edge AI language model capable of generating contextually relevant and coherent text responses. Leveraging deep learning techniques, ChatGPT has revolutionized natural language processing (NLP), enabling human-like interactions in various applications [1]. It shows outstanding proficiency in a range of natural language tasks, such as creating coherent essays [2]. Moreover, ChatGPT can engage in interactive conversations, remember previous exchanges, admit errors, question flawed assumptions, and politely refuse inappropriate requests [1]. It offers supplementary inquiries to enrich responses and tackle any obstacles posed by the questioner. Therefore, ChatGPT gained popularity among users in education, especially students. The widespread availability of ChatGPT offers unparalleled accessibility to academic support and resources for students. Whether seeking clarification on complex concepts or assistance with homework assignments, students can easily access ChatGPT-powered tools through web browsers, mobile apps, or integrated learning platforms. This accessibility ensures that students have instant access to assistance anytime, anywhere, eliminating barriers to learning outside of traditional classroom settings. Furthermore, the 21st century is characterized by a surge in globalization and the widespread accessibility of information and technology, leading to significant transformations across various spheres of society. Adaptation to this era demands individuals to cultivate higher order thinking abilities to effectively navigate the challenges of globalization and to be valuable contributors to the workforce of this century. With the emergence of AI tools nowadays, the significance of critical thinking abilities cannot be emphasized enough. Critical thinking is essential for assessing information, resolving issues, and making well-informed choices, whether in academic or real-life situations [3]. The advancement of AI technologies has introduced a new aspect to this conversation. It is argued by researchers that AI is beneficial for problem solving and analytical skills [4], while others are concerned about reinforcing existing biases or hindering the development of critical thinking. It can be referred that these perceptions are varied because of a number of factors like cultural background, prior exposure to technology and the quality of AI tools available [5]. The primary aim of this research is to explore master students' perceptions of the effect of ChatGPT on the development of their critical thinking skills. Also, the study aims to identify the challenges, potential risks students can face, and the strategies that can be used to promote critical thinking using ChatGPT. To achieve these aims, the following research questions were proposed:

RQ1: How can ChatGPT impact the development of MA students' critical thinking skills?

RQ2: What are the challenges and potential risks associated with using ChatGPT on MA students' critical thinking skills?

RQ3: What strategies can MA students use to promote critical thinking when using ChatGPT?

2. Literature Review

2.1. ChatGPT

AI encompasses a multidisciplinary field integrating computer science and linguistics, aiming to develop machines capable of executing tasks typically associated with human intelligence including learning, and decision-making [6] [7]. AI has proven its efficacy in addressing intricate challenges across various domains, including education [7] [8]. Within the realm of NLP, the deployment of AI has led to the development of intelligent chatbots and virtual assistants that exhibit proficiency in comprehending and generating human language [9]. A notable example in the realm of AI technology is ChatGPT which has garnered significant global attention owing to its remarkable ability to generate well-structured, logical, and informative responses, closely resembling human-like interactions [10]. Since its official launch on November 30, 2022, ChatGPT has swiftly emerged as a revolutionary application, experiencing an unprecedented growth rate. Within a mere two-month period, the user base for ChatGPT reached an exceptional milestone of 100 million active users as of January 2023. Its unique capabilities, particularly in providing personalized and interactive assistance, make it a promising tool for supporting students in their educational endeavors. Notably, ChatGPT stands out for its capacity to offer tailored recommendations for educational resources based on individual learning objectives and preferences [11].

ChatGPT is specifically crafted for the purpose of generating human-like text in response to specific requests or dialogues, facilitating natural and open-ended conversations beyond textual content. It demonstrates versatility by being capable of generating essays, research papers, analyzing data and various other forms of output. GPT-3, the model behind ChatGPT, holds the distinction of being the largest language model, exhibiting a commendable proficiency in handling these tasks at a high level [12]. What makes it more popular is its ability to generate sophisticated responses and new ideas, across multiple languages, through the feedback of its users that enhance its learning which can be expressed in real-time conversations [13]. The updated development strategy has empowered ChatGPT to address subsequent queries, recognize errors, decline inaccurate assumptions, and dismiss inappropriate inquiries. In comparison to conventional AI language tools, ChatGPT provides responses that are deemed “more creative” (Vanian, 2022). An essential attribute of ChatGPT is its ability to maintain a “conversational style” and a consistent personality throughout a discussion, contributing to a more authentic and genuine conversational experience instead of arbitrary responses [12].

2.2. ChatGPT Benefits

Numerous research has reviewed and investigated ChatGPT benefits and how it

can revolutionize education and provide the students with more effective and engaging learning experience. Generally, ChatGPT can provide personalized learning experiences and real-time assessments [14]. Also, it can allow students to learn at their own pace by adapting educational content to suit each student's learning style and needs. Moreover, by providing real-time assessment learners can receive immediate feedback on their work. As a result, understanding and correcting mistakes will be easy, leading to an effective learning process [14]. ChatGPT is also a valuable tool for researchers and students in higher education as it helps in research, writing tasks, and the cultivation of critical thinking and problem-solving abilities. Many studies attempted to identify ChatGPT advantages in academia as a valuable tool [6] [7]. ChatGPT has the ability to summarize research papers and facilitate literature review by providing accessible and understandable information which accelerates in organizing thoughts for writing purposes and allows for increased accuracy and precision in data analysis. ChatGPT assists in academic writing by generating clear and comprehensible texts, generating outlines and improving language. By providing appropriate responses through properly developed constructs. Also, it frees up more time for students to focus on the experimental phase of their research projects. It assists in identifying key insights and trends in research, aiding students in formulating hypotheses and research questions. It generates coherent and well-structured text, that helps in crafting research proposals, reports, and manuscripts. Therefore, ChatGPT can support the development of research skills by furnishing students with pertinent information and resources related to a specific topic, as well as suggesting unexplored facets and current research areas for deeper understanding and analysis of the subject matter. Learners can be prompted by these models to engage in critical thinking by generating questions and prompts that encourage analysis and interpretation of presented information. Also, it offers the capability to identify potential grammatical inconsistencies and propose personalized improvement strategies [6] [7].

2.3. ChatGPT Challenges

While proponents of ChatGPT commend its capacity to enhance education and students learning, there are concerns raised by scholars regarding its weaknesses and how it can be a threat to education. ChatGPT has given rise to ethical concerns, including the promotion of plagiarism and cheating [15]. Also, its susceptibility to errors such as disseminating false information (Tlili *et al.*, 2023). While OpenAI asserts that none of ChatGPT's responses are direct copies of specific texts and are synthesized from training data, recent tests [16], revealed that a 500-word essay generated by ChatGPT exhibited a 45% similarity to existing sources. This raises the concern that ChatGPT "democratizes plagiarism", (Welle, 2023). The promising capabilities of ChatGPT might lead students to utilize it without recognizing the potential for plagiarism. Moreover, there is an elevated risk of increased plagiarism in academic settings, as higher education students might overly

rely on ChatGPT for academic essay writing. This ethical issue becomes more critical considering ChatGPT's tendency to produce inaccurate and nonsensical responses, heightening the risk of misinformation in scientific publications because it does not have internet access and possesses restricted knowledge of global events beyond the year 2021 [17]. Relying excessively on ChatGPT can bring about adverse outcomes for both students and educators. For students, this reliance may contribute to a deterioration in their higher-order cognitive skills, including creativity, critical thinking, reasoning, and problem-solving.

2.4. Critical Thinking

The concept of critical thinking has been highlighted and discussed for centuries, but its formal recognition and systematic exploration began to emerge prominently in the late 20th century. One significant early contributor to the spotlight on critical thinking was John Dewey, an American philosopher, psychologist, and educational reformer. He initiated the first comprehensive deliberations and examinations of critical thinking in 1916, who examined the notion of critical thinking skills within the educational context. He conceptualized critical thinking as a sequential process originating from the identification of a problem, progressing through to its resolution, and culminating in self-interpretation. He insisted that education should focus on developing students' abilities to think critically, solve problems, and apply their learning in practical contexts. Building upon this premise, Bean (2011) further explains that such a problem should trigger innate curiosity among students, fostering both learning and critical reflection. Numerous scholars agree with Dewey's perspective that critical thinking begins with students' active involvement in a problem. For instance, Kurfiss (1988) defined critical thinking as "an inquiry aimed at examining a circumstance, occurrence, inquiry, or issue to formulate a hypothesis or determination that consolidates all accessible data and can thus be convincingly validated" [18]. According to Halpren (2021), critical thinking, from a cognitive psychologist's perspective, is purposeful, rational, and oriented towards specific objectives [19]. It encompasses the type of thinking required for problem-solving, drawing inferences, assessing probabilities, and making decisions. Critical thinkers employ these skills appropriately, often consciously and without external prompting, across diverse contexts. In essence, critical thinking involves individuals evaluating the results of their cognitive processes, determining the quality of decisions, or assessing the effectiveness of problem-solving approaches.

The complexity of critical thinking is considered a multifaceted construct that encompasses various cognitive processes, dispositions, and skills. Despite the varying perspectives and debates surrounding the selection of critical thinking skills it is essential to ground our approach in a coherent framework that aligns with the objectives of this research to provide consistency in defining and specifying critical thinking skills within the context of this study. Dick's taxonomy (1991) was chosen as it seems the most suitable for the objectives and the context of our thesis

[20]. Dick conducted a comprehensive review of critical thinking research spanning four decades, delineating it as encompassing the identification and analysis of arguments, examination of external factors influencing arguments, scientific analytical reasoning, and logical inference. He proposed a taxonomy for critical thinking skills, comprising the following components:

1—**Identification of arguments**, entailing the recognition of themes, conclusions, reasons, and their organizational structure.

2—**Analysis of arguments**, involving scrutiny of assumptions, vagueness, and omissions.

3—**Consideration of external influences**, encompassing evaluation of values, authority, and emotional language.

4—**Scientific analytic reasoning**, encompassing the assessment of causality and statistical reasoning.

5—**Reasoning and logic**, entailing the application of analogy, deduction, and induction.

The important question that can be raised here after discussing the concepts of critical thinking skills is why it is important for students to develop these skills. Experts have mentioned various reasons to understand the significance of critical thinking skills in academic and professional spheres [21]. Critical thinking is crucial to the development of higher order cognitive skills such as self-awareness and reflection which will help the students in the future in their professions to be able to analyze and find solutions to social problems. It works as an intellectual stimulus that enables students to learn.

2.5. The Impact of ChatGPT on Critical Thinking

Essel *et al.* (2024) investigated the effects of utilizing ChatGPT on the critical, creative and reflective thinking skills of university students [1]. By incorporating quantitative and qualitative methods the results demonstrated that the quantitative results indicated that incorporating ChatGPT in in-class tasks effectively improved students' critical thinking skills. The technology facilitated dialogues with ChatGPT, encouraging students to think critically. The personalized feedback and guidance provided by ChatGPT contributed to a deeper understanding of the topics. The study noted improvements not only in the overall critical thinking score but also in its two dimensions: critical openness and reflective skepticism. These dimensions reflect the willingness to consider alternative perspectives, exposure to novel ideas, and the ability to question assumptions, pursue evidence, and evaluate arguments. The initial aspect, critical openness, involves a readiness to entertain alternative viewpoints and embrace innovative ideas. The subsequent aspect, reflective skepticism, pertains to the capacity to challenge assumptions, seek evidence, and assess arguments. The enhancement observed in these dimensions within the Experimental Group suggests that ChatGPT plays a role in fostering critical thinking skills. It achieves this by serving as a platform that enables students to engage with a variety of perspectives and ideas. However, it should be

noted that this study proved the ability of ChatGPT to enhance students' critical thinking skills because the technology here was used with direct instruction. Another study proved using AI tools with direct instruction can foster critical thinking skills, Ibna Seraj and Oteir (2022) investigated the educational potential of RALL (robot-assisted language learner) including an AI companion in the context of EFL instruction, this study seeks to explore its efficacy in fostering conversational skills, role-playing abilities, and open discussions within the domain of English language teaching. A robotics-infused TEFL curriculum was created, employing the RALL framework, with the objective of enhancing higher-order thinking skills pertinent to the 21st century focusing on developing critical thinking by surveying university students. The study used mixed methods by employing online survey and classrooms' observation with 453 participants. The study revealed that AI friends had a positive impact on critical thinking abilities among the participants. It also showed that AI based instruction boosted student trust self-confidence, open mindedness, and maturity in English that led to improving their critical thinking skills. Therefore, AI based instruction helps students learn critical thinking skills as they are the foundation of 21st century skills.

Guo and Lee (2023) investigated how to use ChatGPT to foster critical thinking in higher education [22]. The results indicate a notable enhancement in students' self-perception regarding their critical thinking abilities, particularly in areas such as formulating insightful questions, assessing information and reaching logical conclusions, and grasping complex subject matter. Additionally, students recognized ChatGPT as a valuable tool for gaining diverse perspectives, although its impact on fostering creativity or generating original ideas was not deemed substantial. The suggestion by students to utilize ChatGPT as a resource for improving critical thinking skills among their peers emphasizes its potential role in fostering the development and improvement of students' critical thinking skills. This study proved that ChatGPT can foster critical thinking when it's integrated into the curriculum, yet we should note that according to this study this tool should be integrated with clear guidelines for students to benefit from its features.

2.6. Theoretical Framework

The IDEE framework (as shown in **Figure 1**) focuses on identifying desired outcomes, determining appropriate levels of automation, ensuring ethical considerations, and evaluating effectiveness in educative AI. It is originated in 2023 by Su and Yang who propose this framework to guide the use of ChatGPT and AI tools in educational settings. This framework serves as a cornerstone for this research study to explore students' perceptions regarding the impact of ChatGPT on CT.

Firstly, according to the IDEE framework we must identify the desired outcomes of incorporating ChatGPT into educational contexts. In this study, the primary objective is to comprehend how the utilization of ChatGPT influences students' critical thinking. Critical thinking encompasses the ability to analyze information, evaluate arguments, and synthesize knowledge. Specific outcomes may

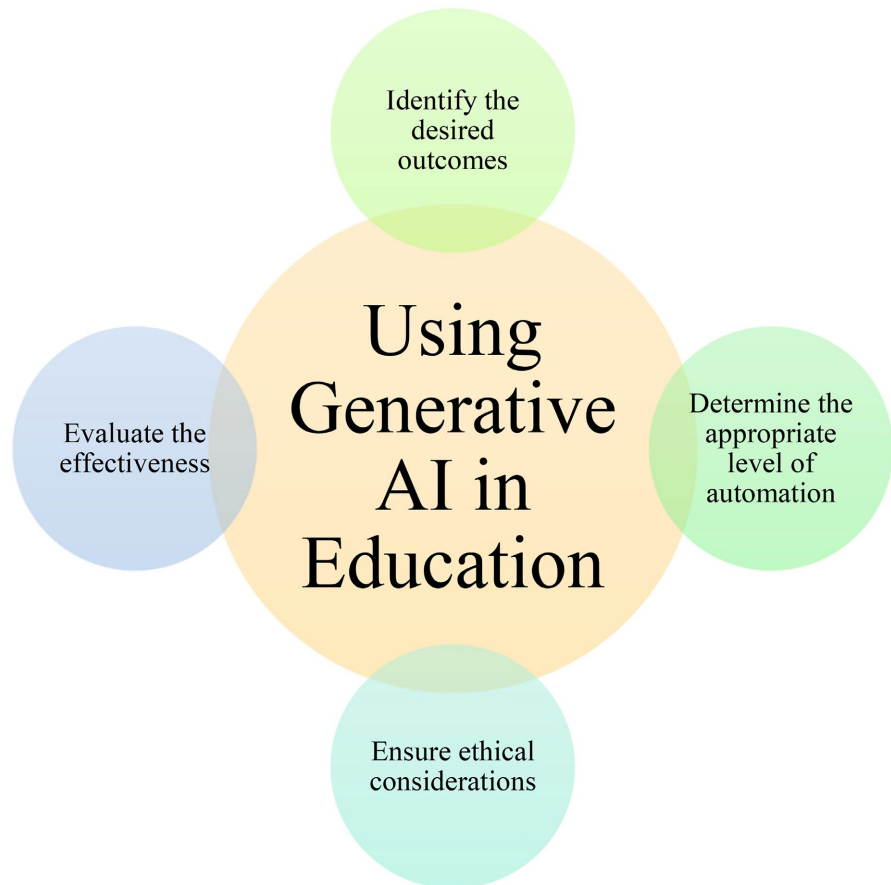


Figure 1. Theoretical framework for using generative AI in education [23].

include assessing whether students perceive ChatGPT as a helpful tool for developing critical thinking skills, whether it enhances their ability to ask probing questions, and whether it improves their capacity to evaluate the validity of information.

Secondly, determining the appropriate level of automation is essential. It is pertinent to acknowledge that ChatGPT is utilized by students without integration into the existing curricula. Given this context, the focus will be on understanding the extent to which students independently engage with ChatGPT and its impact on their critical thinking skills. Therefore, in this study, the level of automation is characterized by ChatGPT operating as an additional tool outside the structured curriculum framework. Students have the autonomy to utilize ChatGPT according to their individual needs and preferences, without prescribed directives from educators. Consequently, the research aims to investigate the implications of this informal integration of ChatGPT on students' critical thinking abilities, exploring how self-directed interaction with the tool influences their cognitive processes and analytical skills.

Thirdly, ethical considerations must be carefully addressed. The study acknowledges the ethical complexities inherent in students' autonomous use of ChatGPT, which is not formally integrated into the curriculum. Key concerns include ensur-

ing the quality and reliability of information provided by ChatGPT, as well as addressing potential biases and misinformation. Transparency in disclosing the use of AI-generated content is emphasized to foster trust and empower students to critically evaluate information. Additionally, broader societal implications, such as impacts on cognitive development and reliance on technology, are considered.

Lastly, it is important to evaluate the effectiveness of ChatGPT in fostering critical thinking. This evaluation provides valuable insights into the impact of ChatGPT on educational outcomes and ethical considerations. Understanding how ChatGPT influences students' critical thinking skills contributes to the broader understanding of AI integration in education. This evaluation not only informs the design of future research studies but also guides educators and policymakers in making informed decisions regarding the integration of AI technologies into educational practices.

3. Research Methodology

3.1. Research Paradigm

The term paradigm in social research can be identified as a framework or a set of beliefs and assumptions that guide how researchers perceive, understand, and conduct their research [24]. Research paradigms influence how researchers formulate research questions, gather and assess data, and interpret research outcomes [25]. According to Scotland (2012) there are four elements of paradigm that have an essential role in guiding research, namely, ontology, epistemology, methodology, and methods [26]. Ontology refers to the assumption that constitutes reality, and epistemology is the methods that is obtained to know the reality. Methodology refers to the underlying strategy or approach that informs the selection and application of specific methods, and methods are the specific techniques and procedures used to collect and analyze data. This study follows the pragmatism paradigm based on this philosophy it emphasizes human experience over abstract knowledge [27]. Moreover, this philosophy highlights experience as a fundamental concept that involves the interaction between beliefs and actions [28]. Additionally, this approach suggests various methods to thoroughly understand and accurately address the research problem [29]. As a result, we integrated multiple perspectives utilizing mixed methods.

3.2. Research Design

This study aims to explore master students' perceptions on the impact of ChatGPT on the development of their critical thinking. Also, the study aims to identify the challenges, potential risks students might face, and the strategies that can be used to promote critical thinking using ChatGPT. To accomplish the study's purpose, an explanatory sequential mixed-method design was adopted to gather the needed data from the participants. This design involved two distinguishing stages: firstly, a quantitative phase was conducted to gather and analyze data, providing a broad overview of the phenomenon. Subsequently, guided by the findings from the

quantitative phase, a qualitative phase was undertaken to delve deeper into the phenomenon, examining participants' perceptions and viewpoints in more detail [29]. Employing different research methodologies added substantial significance and improved the credibility of the research investigation. The reason for selecting this design is its capability to offer a comprehensive comprehension of the research issue [30].

3.3. Participants and Context

This research study was conducted at King Abdulaziz University (KAU) in the city of Jeddah, Saudi Arabia, where the participants were master students in TESOL who study at the English language Institute (ELI). The rationale for selecting this context was the accessibility of the participants to the researcher, facilitating the administration of research instruments and data collection. Also, master students are well-suited for this research due to their capacity to delve into complex topics and provide in-depth analyses, enriching the study with comprehensive insights. Furthermore, their familiarity with ChatGPT empowers them to effectively navigate and leverage its capabilities. The study was conducted at the second semester of the academic year 2023 - 2024 and continued to the first semester of the academic year 2024 - 2025. The sample size for the quantitative phase of the current study was 50 master students in TESOL at the ELI, KAU. The participants were from different ages, and they were all female. **Table 1** below summarizes the demographic data of the participants in the quantitative phase.

Table 1. Master students in TESOL' demographic data in the quantitative phase.

Demographic		N	%
Gender	Female	50	100%
Age	Under 25	10	20%
	25 - 30	25	50%
	31 - 35	12	24%
	36 - 40	2	4%
	Over 40	1	2%
Total		50	100%

3.4. Research Instruments

3.4.1. Questionnaire

For the quantitative stage, a questionnaire was designed by the researcher depending on the literature review and the IDEE framework to serve the purpose of the study. It included the following elements: an introduction to explain the purpose of the study, the consent form for the participants, demographic questions, and three sections, namely, perceived impact on critical thinking, challenges and risks, and strategies for promoting critical thinking. **Table 2** below describes each section what is intended to measure. The validity of the questionnaire was checked

by an expert in the field. Also, the reliability was verified, using Cronbach's alpha using SPSS and the value was (0). The questionnaire included 26 items that were measured on five-point Likert scale, ranging from Strongly Disagree (1), Disagree (2), Neutral (3), Agree (4), to Strongly Agree (5). **Table 3** illustrates the weighted means for five-point Likert scales.

Table 2. Questionnaire sections and what they measures.

Sections	Description	Items
Perceived impact on critical thinking	Items that measure the impact of ChatGPT on CT	1 - 13
Challenges and risks	Items that identify challenges and potential risks students might face	14 - 22
Strategies for promoting critical thinking	Items that determine strategies to promote CT using ChatGPT	23 - 26

Table 3. The weighted means for five-point Likert scales.

Answer	Scale	Weighted means
Strongly Agree	5	4.20 to 5
Agree	4	3.40 ≤ 4.20
Neutral	3	2.60 ≤ 3.40
Disagree	2	1.80 ≤ 2.60
Strongly Disagree	1	1 ≤ 1.80

3.4.2. Semi-Structured Interviews

To gain a deeper insight into the participants' perceptions and have more details about the phenomena, a second instrument was utilized which is semi-structured interviews. Interviews provide researchers with the opportunity to explore phenomena that may not be directly observable, such as self-reported perceptions [31]. Also, they suggested that interviews can yield more comprehensive responses compared to questionnaires, allowing for a deeper understanding of the subject matter. The selection of this tool was based on its superior capability in ordering questions with flexibility and giving the opportunity to the researcher to ask additional questions, if necessary [32]. Based on the questionnaire results and previous literature an interview guide was designed by the researcher. It consisted of eleven questions to explore the perceptions of the participants regarding the impact of ChatGPT on their critical thinking development in greater depth. To validate the interviews, an expert in the field revised the questions to ensure they were credible. The interview protocol was comprised of three sections. First, the introductory section gave background information about the interviewer and explained the role and the purpose of the interview. Also, briefly outline the structure of the interview and its importance in the research. Second, the participants were asked about their perceptions of the impact of ChatGPT on their critical thinking, the challenges and risks they faced, and the strategies for promoting critical thinking. Finally, the concluding part of the section provided participants

with the chance to offer further comments or provide additional information. Five students were interviewed individually using Zoom. **Table 4** below gives a summary of participants' demographic data in the qualitative phase in terms of gender, age, and educational qualification.

Table 4. Participants' demographic data in the qualitative phase.

Pseudonym	Gender	Age	Qualification
T1	Female	Under 25	MA
T2	Female	25 - 30	MA
T3	Female	25 - 30	MA
T4	Female	25 - 30	MA
T5	Female	31 - 35	MA

3.5. Procedures

As previously stated, this study followed a mixed methods research design that started with a questionnaire to collect the quantitative data followed by semi-structured interviews to collect the qualitative data. For the questionnaire it was administered electronically through Google Forms. Prior to administering the questionnaire to the intended population, it underwent a pilot test with a comparable group of participants to verify the clarity of both the questionnaire instructions and items. Then, to ensure the reliability of the questionnaire, Cronbach's alpha coefficient test in SPSS software was run. As shown in **Table 5** below, the result of the Cronbach's alpha coefficient test was 0.77, which is considered to be within the acceptable range of reliability [30]. Finally, the questionnaire was distributed to the participants via WhatsApp and their official emails.

Table 5. Reliability Statistics.

Cronbach's alpha	No. of Items
0.77	23

3.6. Data Analysis

To analyze the quantitative data, participants' responses were first organized using Excel software and then coded using SPSS software version 26.0. After coding the data in SPSS, the distribution's normality was assessed, and descriptive statistics were calculated to determine the frequencies, percentages, mean and standard deviation of the questionnaire responses. In addition, inferential statistics such as Tukey HSD test to identify significant differences in perceptions of the impact of ChatGPT on critical thinking skills among students with varying frequencies of usage. To analyze the qualitative data, the interview's recordings were first transcribed using Read AI app in which the recordings were converted into written transcripts. Then, the written transcripts were carefully read and re-

read to generate relevant patterns, themes, and insights were identified and listed into initial codes. Next, the similar codes were put together to generate meaningful themes. Finally, the themes were refined and then interpreted in the result chapter. The use of semi-structured interviews allowed the participants to expound upon their perspectives and emotions, offering researchers significant and detailed insights.

3.7. Ethical Consideration

Ethical considerations were addressed in the data collection process of this study. First, permission to collect data was obtained from the administration of KAU. Second, all participants were asked to sign a consent form agreeing to answer the questionnaire and participate in the semi-structured interview, and they were informed about the study's purpose, objectives, and procedures. Participants were assured of their anonymity during data collection and were informed that they could withdraw from the research at any time without any consequences. Pseudonyms were used in reporting qualitative data instead of participants' real names. Finally, the interview recordings were deleted after being transcribed and analyzed.

4. Data Analysis & Discussion

4.1. Quantitative Phase

This study aims to explore master students' perceptions regarding the impact of ChatGPT on their critical thinking skills. Also, it tries to identify the challenges and potential risks they face, and the strategies that can be used to promote critical thinking using such a tool. This part shows the analysis and results of the quantitative data that were acquired from the questionnaire.

Descriptive Statistics

Table 6. Frequencies, percentages for the frequency of using ChatGPT by MA students.

	Frequency	Percent
Rarely	5	10%
Occasionally	10	20%
Frequently	12	24%
Very frequently	23	46%

Table 6 shows the frequencies and percentages for the frequency use of ChatGPT. The table indicates that most students use this tool very frequently, demonstrating a high level of engagement and reliance on ChatGPT for their academic tasks. This result suggests a strong dependence on such a platform for generating content for academic purposes. This reliance might indicate that students view it as a fundamental resource, which could affect the development of their critical thinking skills. Whether this impact is positive or negative depends on how students engage

with ChatGPT, either as a means to enhance their reasoning or as a shortcut that limits deeper cognitive process.

This section shows the descriptive statistics of the study's variable. The items in the questionnaire were analyzed by calculating the means and standard deviation. The results are as follows:

Table 7. Means and standard deviation of students' answers to PICT

Items	Mean	Std. Deviation	Estimates
1.ChatGPT has positively influenced my critical thinking skills.	3.88	1.081	Agree
2.Using ChatGPT has expanded my perspective on complex topics.	4.36	0.802	Strongly Agree
3.ChatGPT has helped me analyze information more critically.	4.08	0.966	Agree
4.ChatGPT has improved my ability to evaluate and assess arguments.	3.86	0.948	Agree
5.ChatGPT has enhanced my problem-solving skills.	3.84	1.017	Agree
6. I believe ChatGPT has contributed to the development of my research skills.	4.18	0.800	Agree
7.ChatGPT has encouraged me to question assumptions and consider alternative viewpoints.	3.84	1.196	Agree
8.I feel more intellectually engaged when using ChatGPT.	3.92	0.986	Agree
9.ChatGPT has improved my ability to articulate and express my thoughts critically.	3.96	1.068	Agree
10. ChatGPT has enhanced my ability to generate innovative ideas and solutions.	4.10	1.015	Agree
11.I use ChatGPT to get answers instead of my own investigation because it is easier.	3.04	1.399	Neutral
12.I use ChatGPT when uncertain about how to tackle complex problems.	4.40	0.700	Strongly Agree
13. I depend on ChatGPT for generating ideas or solutions when facing challenges in problem solving or critical analysis.	3.94	1.316	Agree
Average Perceived Impact on Critical Thinking	3.95	0.622	Agree

This table measures the impact of ChatGPT on students' critical thinking skills. **Table 7** displays the mean scores and standard deviations of responses to each item in this dimension. In general, the total mean score for the perceived impact on critical thinking dimension is 3.95, which indicates that students generally agree that ChatGPT has positively influenced their critical thinking skills.

According to the mean value of each item, item 12 has the highest mean at 4.40, with the level of response being "Strongly Agree", indicating that most students strongly agree that they use ChatGPT when uncertain about how to tackle complex problems. Conversely, item 11 has the lowest mean at 3.04, with the level of response being "Neutral", suggesting that students are neutral about using ChatGPT to get answers instead of conducting their own investigations. This suggests that students might not fully process the extent to which this tool is influencing their own investigative skills. It could indicate that even though they value ChatGPT, they might not see it as a replacement for their critical thinking skills but rather as an assistant.

Table 8. Mean and standard deviation for information overload and reliability concerns.

Items	Mean	Std. Deviation	Estimates
1. Using ChatGPT sometimes leads to information overload.	3.64	0.875	Agree
2. I am concerned about the reliability of information generated by ChatGPT.	4.36	0.749	Strongly Agree
3. There is a risk of misinterpretation or misunderstanding due to the limitations of ChatGPT.	4.22	0.840	Strongly Agree
Average Information Overload and Reliability Concerns	4.07	0.654	Agree

The results regarding information overload and reliability concerns related to ChatGPT are presented in the previous **Table 8**. This table shows the means and standard deviations of respondents' concerns about the use of ChatGPT. Overall, the average mean score for information overload and reliability concerns is 4.07 with a standard deviation of 0.654, indicating that the respondents generally agree with these concerns.

According to the mean value of each item, item two, "I am concerned about the reliability of information generated by ChatGPT," has the highest mean at 4.36 and a standard deviation of 0.749. The level of response is "Strongly Agree," suggesting that most respondents are significantly concerned about the reliability of the information provided by ChatGPT. This reveals that the students are aware of the importance of evaluating sources and the accuracy of the content they utilize reflecting a developing sense of critical thinking as they are questioning whether the information is trustworthy and credible. Item one, "Using ChatGPT sometimes leads to information overload," has a mean of 3.64 and a standard deviation of 0.875, with the response level being "Agree," reflecting that respondents generally agree with the notion that ChatGPT can sometimes lead to information overload. This means that students are concerned about receiving too much information from ChatGPT as it can make it difficult to evaluate, analyze, and synthesize the material they encounter.

Table 9. Mean and standard deviation for dependency on ChatGPT.

Items	Mean	Std. Deviation	Estimates
1. ChatGPT may lead to a dependency on automated assistance, affecting independent critical thinking.	3.82	1.063	Agree
2. The use of ChatGPT may hinder the development of my critical thinking skills.	3.16	1.218	Neutral
3. Using ChatGPT can lead to over-dependence on AI for basic tasks.	4.16	1.017	Agree
4. Using ChatGPT to complete assignments undermines developing my critical thinking skills.	3.06	1.185	Neutral
5. ChatGPT will hinder my development of analysis and evaluation skills such as problem-solving.	2.88	1.172	Neutral
6. ChatGPT makes me less likely to think for myself.	2.94	1.331	Neutral
Average Dependency	3.34	0.900	Neutral

Table 9 includes the means and standard deviations of respondents' views on dependency concerns. The dependency dimension assesses the impact of ChatGPT on users' independent critical thinking skills. In general, the total mean

score for the dependency dimension is 3.34 and lies in the range of $2.60 \leq 3.40$, which indicates that the majority of respondents have a neutral stance on the dependency concerns associated with ChatGPT.

According to the mean value of each item, item three, “Using ChatGPT can lead to over-dependence on AI for basic tasks”, has the highest mean at 4.16, and the level of response is “Agree”, indicating that most respondents agree that ChatGPT can lead to over-dependence on AI for basic tasks. On the other hand, item five, “ChatGPT will hinder my development of analysis and evaluation skills such as problem-solving”, has the lowest mean at 2.88 and a response level of “Neutral”, suggesting that respondents are unsure if ChatGPT hinders the development of their analysis and evaluation skills. Overall, in this section most of the students chose neutral, suggesting that they are not necessarily dependent strongly on ChatGPT. They may view it as a useful tool that assist them on their academic works, but they do not rely on it completely which reflect a balanced perspective.

Table 10. Means and started deviation for strategies for effective use of ChatGPT.

Items	Mean	Std. Deviation	Estimates
1. MA students should receive training on how to use ChatGPT effectively to promote critical thinking.	4.52	0.735	Strongly Agree
2. Encouraging MA students to explore multiple sources in addition to ChatGPT is essential for critical thinking development.	4.58	0.575	Strongly Agree
3. Providing guidelines on how to validate information obtained from ChatGPT can improve critical thinking.	4.66	0.519	Strongly Agree
4. MA students should be encouraged to challenge and question ChatGPT-generated content.	4.74	0.487	Strongly Agree
Average Strategies for Effective Use of ChatGPT	4.63	0.447	Strongly Agree

The strategies for the effective use of ChatGPT dimension assesses the measures that can be implemented to promote critical thinking among MA students. **Table 10** shows the means and standard deviations of respondents’ views on various strategies. In general, the total mean score for this dimension is 4.63 and falls in the range of $4.21 \leq 5.00$, which indicates that the majority of respondents strongly agree with the proposed strategies for effective use of ChatGPT to enhance critical thinking.

According to the mean value of each item, item four, “MA students should be encouraged to challenge and question ChatGPT-generated content”, has the highest mean at 4.74, and the level of response is “Strongly Agree”, indicating that most respondents strongly agree that encouraging students to question and challenge ChatGPT content is crucial for developing critical thinking skills. Item one, “MA students should receive training on how to use ChatGPT effectively to promote critical thinking”, has the lowest mean at 4.52, with the response level being “Strongly Agree”, indicating that most respondents believe training on the effective use of ChatGPT is essential for promoting critical thinking.

4.2. Inferential Statistics

Table 11. Pearson correlation coefficient results to reveal the relationship between frequent use of ChatGPT and PICT.

Correlations		PICT
Frequent use of ChatGPT	Pearson Correlation	0.368**
	Sig. (2-tailed)	0.009
	N	50

The Pearson correlation analysis, as shown in **Table 11** indicates varying degrees of relationships between the frequency of ChatGPT use in academic pursuits and the four key dimensions: PICT, Information Overload and Reliability Concerns, Dependency, and Strategies for Effective Use of ChatGPT. The correlation with Perceived Impact on Critical Thinking is moderate and significant ($r = 0.368$, $p = 0.009$), suggesting that frequent use of ChatGPT is positively associated with the perceived impact on critical thinking. The correlation with Strategies for effective use of ChatGPT is weak to moderate positive ($r = 0.247$, $p = 0.83$) suggesting that the more frequent users of ChatGPT might improve strategies for using this tool effectively. The other dimensions (Information Overload, and Dependency) do not show significant correlations which means that these factors are not strongly affected by how often students engage with this tool.

Table 12. Tukey HSD test for PICT by frequency of Use.

	Frequently	N	Mean Rank	Chi-Square	df	Sig.
PICT	Rarely	5	17.60	8.785	4	0.032
	Occasionally	10	15.60			
	Frequently	12	28.50			
	Very frequently	23	29.96			
	Total	50				

The Tukey HSD test reveals that the p-value (0.032) is less than 0.05, and it can be concluded that there is a significant difference in how students with different frequencies of ChatGPT usage perceive the impact of ChatGPT on their critical thinking (as shown in **Table 12**). The “Very frequently” and “Frequently” groups have higher mean ranks (29.96 and 28.50, respectively), indicating that students in these groups perceive a higher impact on their critical thinking compared to those who use ChatGPT “Rarely” or “Occasionally”. In general, this finding suggests that more frequent interaction with ChatGPT can lead students to recognize its importance role in shaping their critical thinking whether that influence is seen as positive or negative. Students who use ChatGPT regularly may find it helpful to stimulate their critical thinking by exposing them to new ideas, promoting them to ask more questions, or offering different perspectives to consider. On the other

hand, frequent users might also recognize that overreliance on this tool could affect their ability to think independently, making them more conscious of its ability to hinder critical thinking if it is not used carefully.

4.3. Qualitative Phase

The second phase of this study involves gathering data through semi-structured interviews to deeply explore the master students' perception about the impact of ChatGPT on their critical thinking skills. Also, to identify the challenges and potential risks students might face, and the strategies that they employ to promote critical thinking skills using ChatGPT. **Table 13** presents the major themes, and subthemes generated from the semi-structured interviews data.

Table 13. Themes, subthemes, and excerpts of master students' perceptions of ChatGPT effect on critical thinking skills.

Major themes	Subthemes	Excerpts
Perceived impact on critical thinking	-ChatGPT Hinder CT skills	<i>"I think that when I was using it excessively, I felt that it reduced my critical thinking"</i> (Student5)
	-ChatGPT Facilitate CT skills	<i>"Analyzing what ChatGPT is generating. This is a different set of critical thinking skills that I acquired"</i> (Student 3)
Challenges faced in utilizing ChatGPT regarding critical thinking skills	-Over-reliance	<i>"Over-dependence on ChatGPT is a problem right now that I am trying to avoid"</i> (Student4)
	-Passive learner	<i>"This was a challenge I faced when I'm using ChatGPT because it made me less productive. I'm not writing as I used to be because of that dependence."</i> (Student 2)
	-Losing creativity	
Potential risks associated with relying on ChatGPT for academic tasks	-Misinformation	<i>"Sometimes it will provide me with false information"</i> (Student 2)
	-Plagiarism	<i>"Sometimes I would use something from ChatGPT, and I would forget to cite or look for other sources. And then it will be plagiarized work"</i> (Student 2)
Strategies employed in using ChatGPT to promote critical thinking skills	-Monitoring ChatGPT use	<i>"I try not to ask ChatGPT for new ideas or analyzing my work, especially with my thesis. I want to give my brain the chance to be creative. Because of that, I don't use it for things that need higher-order skills"</i> (Student 1)
	-Self-reliance	
Seeking guidance in how to use ChatGPT effectively	-Independent learning	<i>"I do seek help and guidance through online platforms and technicians who use ChatGPT"</i> (Student 3)
	-Resources utilizing	<i>"There should be a manual or ethical rules that universities and teachers also utilize in their classrooms and explain to the students how to use AI appropriately and ethically."</i> (Student 3)
	-Institutional responsibility	

Theme 1: Perceived Impact on Critical Thinking

Generally, the interviewees stated after using ChatGPT for a long time they noticed that it did influence their critical thinking skills. Most of them agreed that ChatGPT can hinder critical thinking skills as they noticed that their abilities have changed after utilizing this tool. Three out of five students explained that they asked ChatGPT to perform tasks that need critical thinking skills instead of thinking by themselves. The students explained that after using this tool there were a change in some of their skills such as their ability to evaluate, synthesize, critique, analyze, and decision making, as one student reported that *"I felt that it reduced*

my critical thinking. Whenever I have anything, I always go to it. I don't think" (Student 5). Another student stated that *"I would say it's slightly affected me in regard to evaluating and synthesizing information"* (Student 2). However, two students explained that using ChatGPT did not hinder their critical thinking skills as they do not use it for tasks that need critical thinking skills *"I don't use it for example for analyzing comparing uh critiquing, but I use it for the small tasks that can save time for you."* (Student 1). The other student asserted that her critical thinking skills enhanced by performing critical thinking tasks like analyzing and critiquing what ChatGPT provides and check the accuracy of its output *"Analyzing what ChatGPT providing or generating. This is a different set of critical thinking skills that I acquired through using it."* (Student 3). Therefore, it can be concluded that students' critical thinking skills can be influenced both positively and negatively depending on the type of tasks they ask ChatGPT to perform and their engagement with it. Students who completely depend on it for generating ideas and solving problems may experience a decline in independent thinking and reduced ability to tackle problems on their own. However, students who actively engage with ChatGPT by analyzing and critiquing its output tend to develop and enhance their critical thinking skills.

Theme 2: Challenges Faced in Utilizing ChatGPT Regarding Critical Thinking Skills

During the interviews the students were asked about the challenges they faced while using ChatGPT regarding their critical thinking skills. All the students acknowledged that after using this tool they became overly dependent on it because it saves their time and effort. The interviewees reported that ChatGPT is a smart and fast tool that can provide solutions to any complicated issues they face in their academic work. As one of the students stated *"ChatGPT helped explain complicated tables of analysis for my thesis. You just can copy and paste the tables"* (Student 1). However, as a result of overly-relying on ChatGPT most of the students expressed that they could not think by themselves anymore because of its accessibility they immediately turn to ChatGPT when required to engage in critical thinking tasks *"because of the accessibility of ChatGPT, it made it easier for me to go and search, especially to analyze or evaluate something. Over-dependence on ChatGPT is a problem right now that I am trying to avoid."* (Student 2). Nevertheless, one student reported that over-relying on ChatGPT is not a problem as it will not affect the user's critical thinking skills if they utilized properly *"People nowadays are overusing ChatGPT. So, I do not see it as a problem. On the other hand, I see it as an advantage. It's a very important tool that we should utilize, but we should know how to utilize it appropriately"* (Student 3).

Moreover, some students mentioned that after utilizing ChatGPT for an extended period, they became passive learners, who rely on this tool without questioning, analyzing, or applying the information. This can lead to surface-level understanding rather than deep comprehension and critical thinking *"It made me a slower writer and lazy to think and to write on my own. Instead of writing, I would*

say, let's see what ChatGPT says" (Student 2). Other student commented "I reached a stage that I can't even write simple text...even if I want to reply to an email, I always go to it and I say, how can I say this" (Student 5). Losing creativity is another challenge the students have faced while using ChatGPT due to overreliance, as their brain will not have the chance to be creative "It hinders creativity because ChatGPT can generate words, but it cannot generate new ideas. So, after using it for a long time, the creative part of your brain isn't trained anymore to try to get new ideas." (Student 4). Other student asserted that "The over-reliance on it to organize, create and provide some solutions might kill the creativity of the human brain." (Student 1).

Theme 3: Potential Risks Associated with Relying on ChatGPT for Academic Tasks

In the interview the students were asked about the potential risks in using ChatGPT for academic tasks. The most reported risk among the interviewees was plagiarism as master students are fully aware of this issue. They explained that using what ChatGPT provides as it is, consider plagiarism. ChatGPT generates responses based on a large dataset such as books, websites, and research papers which are derived from a wide variety of publicly available information sources. One student emphasized that users should not use the responses generated by ChatGPT word-for-word; rather, they have to paraphrase the material in their own words. "You cannot take the text as it is, like you have to explain it in your own words." (Student 1). Another student said "The major one is always plagiarism. Sometimes I would use something from ChatGPT, and I would forget to cite or look for other sources. And then it will be plagiarized work." (Student 2). This indicates that ethical consideration is a major issue that needs to be tackled. Misinformation was another risk that students faced as they claimed that ChatGPT can provide false information which can lead to spread inaccurate information in their academic work "it is not accurate in giving references it provides me with fake references" (Student 5). This suggests that students recognize ChatGPT's limitations and understand the importance of critically evaluating its output. Moreover, this awareness highlights broader ethical considerations regarding trust in ChatGPT, suggesting that educational institutions should provide guidelines on the ethical use of ChatGPT emphasizing the necessity of cross-referencing sources and understanding the limitations of this tool generated content.

Theme 4: Strategies employed in using ChatGPT to promote critical thinking skills

During the interview the students were asked about the strategies they employ while utilizing ChatGPT to promote their critical thinking skills. Most of the interviewees stated that they do not use any specific strategies to enhance their critical thinking abilities, as they have not consciously considered using such approaches. Instead, they rely on this tool mainly to tackle the challenges they face in their academic work due to its ability to save time and effort while they are swamped with too many assignments at hand. One student said, "I'm not using

any strategies at all." (Student 4). However, other students claimed that monitoring their use of this tool and self-reliance can prevent the decline of critical thinking abilities *"I try not to ask ChatGPT for new ideas or analyzing my work, especially with my thesis. I want to give my brain the chance to be creative. I don't use it for things that need higher-order skills. I think monitoring its use can protect you from the drawbacks of over-reliance"* (Student 1).

Theme 5: Seeking guidance in how to use ChatGPT effectively

In the interview the students were asked if they seek guidance on how to use ChatGPT effectively. After reviewing their answers, it appears that all the students seem to prefer independent learning. They search for new solutions on how to utilize ChatGPT effectively to solve any issues they face in their academic work by using the resources that are available online such as reading other experiences, asking technicians and searching through online platforms. One student explained *"I do seek help and guidance through online platforms and technicians who use ChatGPT and other AI tools because not only I'm using it through my research and my studying"* (Student 3). Moreover, All the interviewees agreed that they institutions like universities should set guidelines for the students to help them learn how to use not only ChatGPT but also other AI tools appropriately and ethically to promote critical thinking and to avoid over reliance. One of the students stated *"In the higher education system. I think we need like guidelines, official ones that tell us which is good, and which can be regarded as cheating or plagiarism"* (Student 2). Another student said, *"There should be a manual or ethical rules that universities and teachers also utilize in their classrooms and explain to the students how to use AI appropriately and ethically"* (Student 3). However, one student argued that master's students possess sufficient awareness to use this tool appropriately without guidance, whereas younger and less experience students who are still developing their critical thinking abilities require scaffolded support from their institutions *"I don't think I necessarily need guidance to teach me how not to depend on ChatGPT. But for the ones who are starting their journey with the existence of AI and ChatGPT, they must learn those strategies because otherwise they won't have critical thinking skills."* (Student 4).

5. Conclusion and Recommendations

This research sought to explore the effect of ChatGPT on master students' critical thinking skills, the challenges, potential risks students might face, and the strategies that can be used to promote critical thinking using such technological platform. Based on the analysis of the quantitative and qualitative data that were obtained from the questionnaire and semi-structured interviews, it was found that master students have positive perceptions towards ChatGPT. However, there are some factors that contributed to how this tool can affect students' critical thinking, which are the types of tasks performed by ChatGPT, students' level of engagement with the tool, and their degree of dependency on it. Furthermore, students reported serious challenges and potential risks they have faced while using ChatGPT.

The reliability of the information provided by this tool, overreliance on ChatGPT, and the risk of plagiarism are serious issues that they encounter. Finally, the findings reveal that master students believe that questioning ChatGPT' output and exploring multiple sources are important strategies to promote critical thinking skills. However, the findings showed that students did not implement any specific strategies deliberately to promote critical thinking skills. This finding can be attributed to the fact that master students use ChatGPT to overcome any challenges they face in their academic assignment and to save their time and effort. On the other hand, master students believe that monitoring ChatGPT use, and self-reliance are strategies that can prevent them from being dependent on this tool and hinder critical thinking. Furthermore, all students agreed that educational institutions must provide clear instructions and guidelines to assist students using ChatGPT ethically and effectively to prevent them from spreading false information in their academic work or producing plagiarized assignments.

5.1. Implications

Based on the study findings, the following implications are put forward to foster critical thinking skills using ChatGPT:

- 1) The quantitative findings indicated that ChatGPT can foster master students' critical thinking skills. Therefore, educational institutions should integrate AI tools like ChatGPT into the curriculum to improve students' critical thinking and problem-solving skills.
- 2) Although master students use ChatGPT regularly to assist them in their academic assignments, they never thought of using it to foster their critical thinking skills intentionally. Therefore, students should be encouraged to use strategies that can help them enhance their critical thinking abilities instead of depending on this tool.
- 3) Institutions should stress the need to develop AI literacy among students to ensure that they understand how to engage critically with AI output like ChatGPT instead of passively accepting its output. For example, students should be encouraged to reflect more on the use of such tool.
- 4) Ethical considerations is an important issue that students face while using ChatGPT, such as plagiarism and spreading false information. Therefore, educational institutions should set guidelines on the ethical use of AI tools in academic environments and how AI might affect students' cognition, originality, and critical analysis.

5.2. Limitations

Even though this study generated several promising findings and practical implications for master students and other policy makers, some limitations exist which must be acknowledged to provide opportunities for future research or replication. First, the scope of this research was limited to female master students who study in a Saudi university and did not explore other contexts. Second, the size of the

study sample was relatively small, which makes it difficult to generalize the data to other contexts. Finally, the research field of this study is very new and there are limited research regarding the scope of this study.

5.3. Recommendations for Future Research

By keeping all the limitations and implications mentioned so far, this study sets forth several recommendations for future research. Although ChatGPT is commonly used among students to assist them in their academic assignments, there has been relatively few studies that examined its effect on critical thinking skills, specifically in the Saudi context. Therefore, further research in this direction is recommended. Moreover, to investigate the influence of ChatGPT on students' critical thinking on a larger scale, the replication of the current study would be encouraged, with a significant sample of participants from a wider geographical area.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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