Research Article

AI Dependency Among Health Care Professional Students And Its Impact On Their Academic Performance & Critical Thinking –A Cross-Sectional Study

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Abstract

Objective: The adoption of Artificial Intelligence (AI) tools, including platforms like ChatGPT, in educational environments has garnered growing attention, especially among students in healthcare-related programs. While AI presents opportunities to enhance learning efficiency, concerns remain about its influence on students' academic performance and critical thinking capabilities. This study seeks to evaluate the level of dependence on AI among young healthcare professional students and explore its impact on both their academic achievements and critical thinking skills.

Materials and Methods: A cross-sectional survey was administered to undergraduate healthcare students. Total 395 students participated in the study. AI- Health Professionals & Students Dependency Index, academic performance scale and critical thinking evaluation scale was used. The questionnaire covered the frequency and manner of AI tool usage, self-reported academic outcomes, and measures of critical thinking. Data were analyzed using descriptive statistics and correlation techniques to explore the associations between AI use and academic metrics.

Results: Initial findings reveal that many students frequently use AI tools for academic purposes. Which may impair critical thinking, problem-solving abilities, academic performance and professional skills with the p- value of 0.05 of Pearson correlation coefficient.

Conclusion: This study highlights the importance of balanced AI integration in academic settings. It advocates for the establishment of structured guidelines to ensure AI tools complement, rather than replace, traditional educational practices—thereby maintaining and promoting critical thinking among healthcare students.

Keywords: Artificial Intelligence, Healthcare Education, Academic Performance, Critical Thinking, Student Dependence.

Introduction

Across the globe, healthcare expenses are rapidly rising. And AI frequently appears as clinical decision support systems (CDSS), which help healthcare providers diagnose illnesses and make treatment choices. [1] Traditional CDSS align patient characteristics with an established knowledge base, whereas AI-driven CDSS utilize models trained on patient data tailored to the specific case. However, despite its significant promise, AI is not a one-size-fits-all solution. [2] To tackle the regulatory, safety, and quality issues, with the use of AI in healthcare. A framework is developed that called the Governance Model for AI in Healthcare (GMAIH). The model is built around four key pillars: fairness, transparency, trustworthiness, and accountability. [3,4]
Artificial intelligence has had a major impact on different areas of education. One of the most significant changes can be seen in teaching and learning approaches, where AI-driven methods have emerged as a promising way to improve educational practices. [5] AI-powered technologies, including tools like ChatGPT, have greatly impacted fields such as writing, research, and programming by offering substantial support. [6] Nevertheless, there are growing concerns about possible downsides, including a decline in critical thinking abilities and an overreliance on these technologies. Although AI brings many advantages, it is not flawless and demands skilled human oversight to address unforeseen errors and biases. [6,7] As AI continues to move beyond research settings, the necessity for appropriate regulations governing its role in society and government becomes clear, posing challenges regarding the extent of regulation and its effects on innovation. [6,7,8]
AI can assist with various tasks, including content creation, automated grading and assessment, and analyzing student behavior through learning analytics. [9,10] Specifically, AI tools like chatbots such as ChatGPT can boost student engagement and interaction by reshaping traditional teaching and learning methods, simulating human conversation, and producing human-like text from natural language input. [9,10,11] Artificial intelligence (AI) technology has been shown to be an effective means of

boosting learners' academic outcomes within structured educational settings, supporting both teaching practices and student learning.

Critical thinking is essential for assessing information, addressing problems, and making well-informed decisions in both academic settings and everyday life. [12] Critical thinking is a core competency, crucial for effective problem-solving, decision-making, and the ability to critically analyze and integrate information. [13] It is particularly important for students to cultivate these skills in order to navigate an increasingly complex and information-saturated world. Nevertheless, an expanding body of research indicates that while AI-assisted learning offers numerous benefits, it may also unintentionally hinder the growth of critical thinking skills.[13,14)] This concern stems from the way AI technologies often deliver immediate solutions and information, which can reduce students' motivation to engage deeply with content and strengthen their analytical thinking. [13,14,15]

The growing reliance on Artificial Intelligence (AI) tools among young healthcare students has sparked concerns about potential over-dependence, which could affect their academic performance and critical thinking abilities. Since critical thinking and independent decision-making are fundamental to healthcare practice, it is crucial to investigate how AI usage impacts these skills. At present, there is a lack of research on this emerging issue. Therefore, this study aims to explore patterns of AI dependency, evaluate its effects on students' academic and critical thinking and offer recommendations for creating balanced and effective educational strategies.

Materials and methods

Study Design-

The present study was a cross-sectional study conducted to evaluate the validity of the Critical Thinking Evaluation Scale in the Indian population after the approval of ethical committee. Furthermore, the study aimed to determine the association between AI dependency, academic performance, and critical thinking among participants.

Data Collection Procedure-

Data collection was carried out using an online Google Form distributed among students of University. Written informed consent was obtained from all participants through the Google Form before participation in the study.

Sample Size Calculation-

The sample size was calculated using the formula for observational studies:[15)]

$$N = \frac{(Z_{1-\alpha/2})^2(p)(q)}{d^2}$$

Where:

- $Z_{1-\alpha/2} = 1.96$
- $p = 0.54$ (expected prevalence based on previous research)
- $q = 1 - p = 0.46$
- $d = 0.05$(margin of error)

The final calculated sample size for the study was 395 participants.

Study Population-

The study population included healthcare professional students who were actively using and aware of AI tools in academic or clinical settings.

Inclusion Criteria

- Participants aged between 18–35 years
- Both male and female participants
- Students engaged in hospital or clinical postings
- Participants actively using AI tools
- Participants having knowledge regarding AI tools
- Healthcare professionals and healthcare students
- Participants from medical, allied health, and paramedical fields

Exclusion Criteria

- Students not engaged in hospital or clinical postings
- Participants not belonging to healthcare professions
- Participants suffering from neurological conditions
- Participants suffering from psychiatric conditions

Reliability and Validation of critical thinking evaluation scale-

- The present study also evaluated the reliability and validity of the Critical Thinking Evaluation Scale for its applicability in the Indian population, as the original scale was developed based on a Colombian population. Cronbach's alpha value, ANOVA Tukey test, Hotelling's T-square test, KMO test, and Bartlett's test are the following test which were used for the reliability and validity evaluation of critical thinking evaluation scale.

Outcome measure-

The following outcome measure were used in the study-

1. **AI- Health Professionals & Students Dependency Index-** The current outcome measure is designed to assess the level of AI dependency among healthcare professionals and students. It comprises seven questions in total. Scores range from a minimum of 0 to a maximum of 21, with dependency levels classified into three categories: Mild (15–21), Moderate (8–14), and Complete (0–7).[16)]
2. **Academic performance scale-** The Academic Performance Scale (APS) is an instrument designed to evaluate a student's academic achievements, typically through a set of questions rated on a scale. It includes eight questions, each rated on a 5-point scale. The assessment emphasizes aspects such as effort exertion on challenging tasks and problem-solving abilities. Scores range from 33 to 40 showing excellent academic performance, 25-32 shows good and 17-24 shows moderate academic performance.[17)]
3. **Critical thinking evaluation scale -** The Critical Thinking Evaluation Scale (CTES) is an instrument developed to measure critical thinking skills. It consists of 17 items divided into two factors, showing strong content and structural validity along with high reliability. Scores are classified into categories such as high (62 to higher score), medium (48-61), and low (47 to less) level of critical thinking, representing both overall competence and proficiency in specific areas.[18)]

Statistical analysis

Statistical analysis was done using SPSS 20 version all the data was mentioned in frequency table with mean and SD. The cross tabulation was used to evaluate the prevalence and relationship between components. To find out the final relationship between AI, critical thinking and academic performance was evaluated using pearson correlation coefficient.

Results

Total 395 subjects participated in the study age between 18 -35 years with Mean ±SD of 25.25±5.361. Total 236 males participated in the study and 159 females with the mean value of 1.40±0.491. 395 students participated in the study from different health care professions such as medical, paramedical and allied health. As mentioned in table 1-

Table1- Demographic data

		Frequency	**Mean ±SD**
Age	18-35	395	25.25±5.361
Gender	Male	236	1.40±0.491
	Female	159	
Profession	Health care professional students	395	1.34±0.541

The present study included a total of 395 participants. The findings demonstrated that the majority of students exhibited moderate AI dependency (n=263), while fewer participants showed mild (n=78) and complete AI dependency (n=54). The mean AI dependency score was 1.94 ± 0.576, indicating that most participants relied moderately on artificial intelligence tools during academic activities.

Regarding academic performance, most students demonstrated moderate academic performance (n=233), followed by good (n=108) and excellent performance (n=54), with a mean score of 2.45 ± 0.723. This suggests that the majority of students were performing at an average academic level.

Assessment of critical thinking revealed that a large proportion of participants had low critical thinking ability (n=262), whereas fewer students demonstrated average (n=114) and high (n=19) critical thinking skills. The mean critical thinking score was 1.38 ± 0.578, indicating comparatively poor critical thinking ability among the study population.

Overall, the descriptive findings suggest that moderate AI dependency was commonly associated with moderate academic performance and lower critical thinking ability among students. As mentioned in table 2-

Table 2- AI dependency, academic performance and critical thinking distribution

		Frequency (n)	Percentage (%)	Mean ±SD
AI Dependency	Mild	78	19.74%	1.94±0.576
	Moderate	263	66.58%	
	Complete	54	13.67%	
Academic performance	Excellent	54	13.67%	2.45±0.723
	Good	108	27.34%	
	Moderate	233	58.98%	
Critical thinking	Low	262	66.32%	1.38±0.578
	Average	114	28.86%	
	High	19	4.81%	

The cross-tabulation analysis demonstrated a clear association between AI dependency, academic performance, and critical thinking ability. Students with excellent academic performance showed relatively better critical thinking levels, whereas students with moderate academic performance predominantly demonstrated low critical thinking ability. Similarly, participants with complete AI dependency were mainly categorized under low critical thinking scores, while those with mild AI dependency demonstrated comparatively better critical thinking levels.

These findings indicate that increasing dependency on AI tools may negatively influence students' independent thinking abilities and academic outcomes. Students who relied excessively on AI appeared to have reduced critical thinking skills and comparatively poorer academic performance. Thus, the study findings suggest an inverse relationship between AI dependency and critical thinking, while also highlighting the influence of critical thinking on academic achievement. As mentioned in table 3-

Table 3 – Cross relation between components

	Critical thinking			
Academic performance	**Low**	**Average**	**High**	**Total score**
Excellent	63	10	5	78
Good	176	75	12	263
Moderate	23	29	2	54
Total	262	114	19	395
	Critical thinking			
AI dependence	**Low**	**Average**	**High**	**Total score**
Mild	41	13	0	54

Moderate	42	47	19	108
Complete	179	54	0	233
Total	262	114	19	395

Pearson correlation analysis demonstrated statistically significant relationships among AI dependency, academic performance, and critical thinking, with p-values < 0.05. The significant correlation between AI dependency and academic performance indicates that AI usage patterns are associated with students' academic outcomes. Similarly, the statistically significant relationship between AI dependency and critical thinking suggests that increased dependence on AI tools may affect students' ability to analyze, reason, and think critically.

The significant association between academic performance and critical thinking further supports the idea that students with stronger critical thinking abilities tend to perform better academically. Therefore, the correlation analysis confirms that AI dependency, academic performance, and critical thinking are significantly interrelated variables. As mentioned in table 4-

Table 4- Person correlation coefficient

	AI Dependency Person correlation coefficient p-value	**Academic performance Person correlation coefficient p-value**	**Critical thinking Person correlation coefficient p-value**
AI Dependency Person correlation coefficient p-value	-	p<0.0005	p<0.001
Academic performance Person correlation coefficient p-value	p<0.00	-	p<0.01
Critical thinking Person correlation coefficient p-value	p<0.01	p<0.01	-

'AI- Health Professionals & Students Dependency Index'		
	Components	**Percentage of AI dependency**
1.	'Are you using AI tool for planning patient's treatment protocol?'	12
2.	'Are you giving preference to AI over the books and article findings for study?'	17
3.	'Are you using combination of AI and your treatment protocol for patients?'	18
4.	'Are you preferring AI- based dosages for treatment of patients?'	13
5.	'Are you preferring AI- based diagnosis and same treatment for your patients?'	12
6.	'Are you taking patient feedback after giving AI treatment?'	14

7.	'Are you finding AI as easy access tool in reference of your books or articles and using it for study purpose?'	14

Table 5 – AI dependency percentage for different purpose

The findings of the AI–Health Professionals & Students Dependency Index indicate a moderate level of dependence on artificial intelligence tools among healthcare professionals and students for both academic and clinical purposes. The highest percentage of AI dependency was observed in the use of a combination of AI and personal treatment protocols for patients (18%), suggesting that participants commonly integrate AI assistance with their own clinical judgment rather than relying solely on AI systems.

A considerable proportion of respondents also preferred AI over books and research articles for study purposes (17%), reflecting the growing trust in AI as a quick and accessible source of information. Similarly, 14% of participants reported using AI because of its ease of access compared to conventional academic resources, while another 14% stated that they take patient feedback after implementing AI-assisted treatment approaches, indicating some degree of professional responsibility and outcome monitoring.

Lower dependency percentages were noted in AI-based dosage selection (13%), AI-assisted treatment planning (12%), and AI-based diagnosis with similar treatment approaches for patients (12%). These findings suggest that although AI is increasingly being adopted, most participants still demonstrate caution in completely relying on AI for critical clinical decision-making processes.

Overall, the results indicate that AI is becoming an important supportive tool in healthcare education and clinical practice. However, the comparatively lower percentages in direct diagnostic and treatment dependency imply that healthcare professionals and students continue to value human expertise, clinical reasoning, and evidence-based practice alongside AI assistance. As mentioned in table 5-

Reliability and Validation of critical thinking evaluation scale-

The present study also evaluated the reliability and validity of the Critical Thinking Evaluation Scale for its applicability in the Indian population, as the original scale was developed based on a Colombian population.The reliability analysis demonstrated a Cronbach's alpha value of 0.813, which indicates good internal consistency and acceptable reliability of the scale. This finding suggests that the items within the scale consistently measure the construct of critical thinking. The ANOVA Tukey test within items showed statistical significance ($p = 0.000$), indicating consistency among scale items. Hotelling's T-square test was also statistically significant ($p = 0.000$), supporting the multivariate reliability of the scale.

Furthermore, validity assessment using factor analysis demonstrated strong construct validity. The Kaiser-Meyer-Olkin (KMO) value of 0.84 indicated adequate sampling adequacy for factor analysis, while Bartlett's test of sphericity was statistically significant ($p = 0.000$), confirming that the data were suitable for factor analysis. As mentioned in table 6-

Overall, these findings confirm that the Critical Thinking Evaluation Scale is a reliable and valid instrument for assessing critical thinking ability among the Indian student population.

Table 6 - Reliability and Validation of critical thinking evaluation scale-

	Cronbach's alpha		
Cronbach's alpha value	0.813		
	Values	**Mean square**	**Significance level**
ANOVA Tukey test within the item	0.80	0.810	0.000
Hotelling's T square test	40.616	-	0.000
KMO test	0.84	-	0.000
Bartlett's test	1011.75	-	0.000

Discussion

The present study aimed to evaluate AI dependency among young healthcare professional students and to examine its association with academic performance and critical thinking abilities. The findings revealed that a considerable number of students are dependent on AI tools, and this dependency appears to influence both their academic outcomes and critical thinking skills.

A study conducted by Majid Ali in 2024[19] investigated the impact of AI-generated study materials and feedback on pharmacy students' academic performance and anxiety levels. The study reported that AI tools neither significantly improved academic performance nor reduced examination-related anxiety; however, no harmful effects were observed either. The authors emphasized that the integration of AI tools into pharmacy education does not automatically guarantee better academic outcomes or reduced stress levels. They further highlighted the importance of adopting individualized and context-specific approaches while implementing AI-based educational strategies, as the effectiveness of such tools may vary according to students' learning environments and personal needs.

In the present study, it was observed that students use AI tools not only for educational purposes but also for assistance in medical diagnosis and clinical learning. The immediate availability of responses and easy accessibility of information were major factors attracting students toward AI usage. However, excessive dependence on AI tools may negatively influence students' critical thinking abilities and decision-making skills, thereby potentially affecting both their professional competence and personal judgment. As mentioned in table 4 and 5. Additionally, overdependence on AI may also contribute to psychological concerns such as stress and anxiety, although these aspects were not specifically assessed in the current study.

A study by Darwin [12,20] explored students' perceptions regarding critical thinking and the role of AI in supporting it among English as a Foreign Language (EFL) students. The findings suggested that students considered critical thinking to be a complex cognitive process and valued AI tools for supporting tasks such as research, analysis, and information gathering. Nevertheless, concerns were raised regarding the limitations of AI, including lack of personalization, potential bias, and limited contextual understanding. The study recommended a balanced and cautious approach toward AI integration by utilizing its advantages while remaining aware of its limitations. Similar findings were observed in the present study, where frequent and effortless access to AI-generated responses appeared to reduce students' engagement in analytical thinking, problem-solving, and independent reasoning. Continuous reliance on AI tools for academic tasks may therefore weaken critical thinking ability and intellectual involvement among students.

Another study conducted by Muneer in 2023[21,22] examined the role of artificial intelligence, particularly natural language processing technologies such as ChatGPT, in enhancing academic performance within the fields of economics and finance. The study highlighted that AI tools can assist researchers and students in areas such as data analysis, scenario development, literature synthesis, and communication of research findings. However, the authors also identified several limitations, including lack of contextual understanding, limited originality, dependence on input data quality, ethical concerns, and absence of domain-specific expertise. Therefore, they emphasized that AI tools should be used alongside human judgment and critical analysis rather than as replacements for independent thinking. The findings of the present study support these observations, as many students appeared to focus primarily on the benefits and convenience of AI tools without adequate awareness regarding their limitations and potential negative consequences.

Overall, the findings of the current study demonstrate a growing dependence on AI tools among healthcare professional students, particularly for academic activities such as assignments, research work, writing tasks, and examination preparation. Although AI tools may improve efficiency and provide rapid access to information, excessive dependence on these technologies may adversely affect critical thinking skills, reflective learning, and independent problem-solving abilities, which are essential competencies in healthcare education and clinical practice.

The study also revealed that many students use AI tools as their primary source of academic assistance rather than as supplementary learning aids. Such overreliance may encourage superficial learning approaches and hinder the development of long-term analytical and reasoning skills. These findings highlight important implications for educators, academic institutions, and curriculum developers. There is a need to establish clear guidelines regarding the ethical and responsible use of AI in education. Furthermore, educators should promote balanced learning approaches that integrate AI as a supportive educational tool while simultaneously encouraging critical thinking, reflective practice, clinical reasoning, and problem-based learning strategies among students.

Conclusion

This study finds that although AI tools can significantly improve academic productivity for young healthcare professional students, overdependence on these technologies may lead to a decline in critical thinking skills. The habitual use of AI for everyday academic tasks and the easy access to information can hinder students from engaging in deep, independent, and reflective thinking—an essential competency in the healthcare field. Thus, a balanced use of AI is crucial: it should serve as an aid while educators promote critical thinking through targeted teaching methods. Institutions and educators must emphasize the development of both cognitive abilities and digital proficiency to prepare future healthcare professionals who are not only well-informed but also capable of analytical reasoning.

Data Availability Statement- Data will be shared if required by the author with the valid requirement/ reason.

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Conflict of Interest- Nil

References

1. Amann J, Blasimme A, Vayena E, Frey D, Madai VI, Precise4Q Consortium. Explainability for artificial intelligence in healthcare: a multidisciplinary perspective. BMC medical informatics and decision making. 2020 Dec;20:1-9. (https://scholar.google.com/scholar?hl=en&as_sdt=0%2C5&q=1.%09Amann+J%2C+Blasimme+A%2C+Vayena+E%2C+Frey+D%2C+Madai+VI%2C+Precise4Q+Consortium.+Explainability+for+artificial+intelligence+in+healthcare%3A+a+multidisciplinary+perspective.+BMC+medical+informatics+and+decision+making.+2020+Dec%3B20%3A1-9.&btnG=)
2. Higgins D, Madai VI. From bit to bedside: a practical framework for artificial intelligence product development in healthcare. Advanced intelligent systems. 2020 Oct;2(10):2000052.(https://scholar.google.com/scholar?hl=en&as_sdt=0%2C5&q=2.%09Higgins+D%2C+Madai+VI.+From+bit+to+bedside%3A+a+practical+framework+for+artificial+intelligence+product+development+in+healthcare.+Advanced+intelligent+systems.+2020+Oct%3B2%2810%29%3A2000052.&btnG=)
3. Reddy S, Allan S, Coghlan S, Cooper P. A governance model for the application of AI in health care. Journal of the American Medical Informatics Association. 2020 Mar;27(3):491-7. (https://scholar.google.com/scholar?hl=en&as_sdt=0%2C5&q=3.%09Reddy+S%2C+Allan+S%2C+Coghlan+S%2C+Cooper+P.+A+governance+model+for+the+application+of+AI+in+health+care.+Journal+of+the+American+Medical+Informatics+Association.+2020+Mar%3B27%283%29%3A491-7.&btnG=)
4. Cath C. Governing artificial intelligence: ethical, legal and technical opportunities and challenges. Philosophical Transactions of the Royal Society A: Mathematical, Physical and Engineering Sciences. 2018 Nov 28;376(2133):20180080.(https://scholar.google.com/scholar?hl=en&as_sdt=0%2C5&q=4.%09Cath+C.+Governing+artificial+intelligence%3A+ethical%2C+legal+and+technical+opportunities+and+challenges.+Philosophical+Transactions+of+the+Royal+Society+A%3A+Mathematical%2C+Physical+and+Engineering+Sciences.+2018+Nov+28%3B376%282133%29%3A20180080.&btnG=)
5. Pertiwi RW, Kulsum LU, Hanifah IA. Evaluating the Impact of Artificial Intelligence-Based Learning Methods on Students' Motivation and Academic Achievement. International Journal of Post Axial: Futuristic Teaching and Learning. 2024 Mar 27:49-58.(https://scholar.google.com/scholar?hl=en&as_sdt=0%2C5&q=5.%09Pertiwi+RW%2C+Kulsum+LU%2C+Hanifah+IA.+Evaluating+the+Impact+of+Artificial+Intelligence-Based+Learning+Methods+on+Students%27+Motivation+and+Academic+Achievement.+International+Journal+of+Post+Axial%3A+Futuristic+Teaching+and+Learning.+2024+Mar+27%3A49-58.&btnG=)
6. Morales-García WC, Sairitupa-Sanchez LZ, Morales-García SB, Morales-García M. Development and validation of a scale for dependence on artificial intelligence in university students. InFrontiers in Education 2024 Mar 12 (Vol. 9, p. 1323898). Frontiers Media SA.(https://scholar.google.com/scholar?hl=en&as_sdt=0%2C5&q=6.%09Morales-Garc%C3%ADa+WC%2C+Sairitupa-Sanchez+LZ%2C+Morales-Garc%C3%ADa+SB%2C+Morales-Garc%C3%ADa+M.+Development+and+validation+of+a+scale+for+dependence+on+artificial+intelligence+in+university+students.+InFrontiers+in+Education+2024+Mar+12+%28Vol.+9%2C+p.+1323898%29.+Frontiers+Media+SA.&btnG=)
7. Tai MC. The impact of artificial intelligence on human society and bioethics. Tzu chi medical journal. 2020 Oct 1;32(4):339-43.(https://scholar.google.com/scholar?hl=en&as_sdt=0%2C5&q=7.%09Tai+MC.+The+impact+of+artificial+intelligence+on+human+society+and+bioethics.+Tzu+chi+medical+journal.+2020+Oct+1%3B32%284%29%3A339-43.&btnG=)
8. Nemitz P. Constitutional democracy and technology in the age of artificial intelligence. Philosophical Transactions of the Royal Society A: Mathematical, Physical and Engineering Sciences. 2018 Nov 28;376(2133):20180089.(https://scholar.google.com/scholar?hl=en&as_sdt=0%2C5&q=8.%09Nemitz+P.+Constitutional+democracy+and+technology+in+the+age+of+artificial+intelligence.+Philosophical+Transactions+of+the+Royal+Society+A%3A+Mathematical%2C+Physical+and+Engineering+Sciences.+2018+Nov+28%3B376%282133%29%3A20180089.&btnG=)
9. Dong L, Tang X, Wang X. Examining the Effect of Artificial Intelligence in Relation to Students' Academic Achievement in Classroom: A Meta-Analysis. Computers and Education: Artificial Intelligence. 2025 Mar 20:100400.(https://scholar.google.com/scholar?hl=en&as_sdt=0%2C5&q=9.%09Dong+L%2C+Tang+X%2C+Wang+X.+Examining+the+Effect+of+Artificial+Intelligence+in+Relation+to+Students%E2%80%99+Academic+Achievement+in+Classroom%3A+A+Meta-Analysis.+Computers+and+Education%3A+Artificial+Intelligence.+2025+Mar+20%3A100400.&btnG=)

10. Chang CY, Hwang GJ, Gau ML. Promoting students' learning achievement and self-efficacy: A mobile chatbot approach for nursing training. British Journal of Educational Technology. 2022 Jan;53(1):171-88. (https://scholar.google.com/scholar?hl=en&as_sdt=0%2C5&q=10.%09Chang+CY%2C+Hwang+GJ%2C+Gau+ML.+Promoting+students%27+learning+achievement+and+self%E2%80%90efficacy%3A+A+mobile+chatbot+approach+for+nursing+training.+British+Journal+of+Educational+Technology.+2022+Jan%3B53%281%29%3A171-88.&btnG=)
11. Chang CY, Kuo SY, Hwang GH. Chatbot-facilitated nursing education. Educational Technology & Society. 2022 Jan 1;25(1):15-27. (https://scholar.google.com/scholar?hl=en&as_sdt=0%2C5&q=11.%09Chang+CY%2C+Kuo+SY%2C+Hwang+GH.+Chatbot-facilitated+nursing+education.+Educational+Technology+%26+Society.+2022+Jan+1%3B25%281%29%3A15-27.&btnG=)
12. Darwin, Rusdin D, Mukminatien N, Suryati N, Laksmi ED, Marzuki. Critical thinking in the AI era: An exploration of EFL students' perceptions, benefits, and limitations. Cogent Education. 2024 Dec 31;11(1):2290342. (https://scholar.google.com/scholar?hl=en&as_sdt=0%2C5&q=12.%09Darwin%2C+Rusdin+D%2C+Mukminatien+N%2C+Suryati+N%2C+Laksmi+ED%2C+Marzuki.+Critical+thinking+in+the+AI+era%3A+An+exploration+of+EFL+students%E2%80%99+perceptions%2C+benefits%2C+and+limitations.+Cogent+Education.+2024+Dec+31%3B11%281%29%3A2290342.&btnG=)
13. Çela E, Fonkam MM, Potluri RM. Risks of AI-assisted learning on student critical thinking: a case study of Albania. International Journal of Risk and Contingency Management (IJRCM). 2024 Jan 1;12(1):1-9.(https://scholar.google.com/scholar?hl=en&as_sdt=0%2C5&q=13.%09%C3%87ela+E%2C+Fonkam+MM%2C+Potluri+RM.+Risks+of+AI-assisted+learning+on+student+critical+thinking%3A+a+case+study+of+Albania.+International+Journal+of+Risk+and+Contingency+Management+%28IJRCM%29.+2024+Jan+1%3B12%281%29%3A1-9.&btnG=)
14. Kitsantas A, Baylor AL, Hiller SE. Intelligent technologies to optimize performance: Augmenting cognitive capacity and supporting self-regulation of critical thinking skills in decision-making. Cognitive Systems Research. 2019 Dec 1;58:387-97. (https://scholar.google.com/scholar?hl=en&as_sdt=0%2C5&q=14.%09Kitsantas+A%2C+Baylor+AL%2C+Hiller+SE.+Intelligent+technologies+to+optimize+performance%3A+Augmenting+cognitive+capacity+and+supporting+self-regulation+of+critical+thinking+skills+in+decision-making.+Cognitive+Systems+Research.+2019+Dec+1%3B58%3A387-97.&btnG=)
15. Parsakia K. The effect of chatbots and AI on the self-efficacy, self-esteem, problem-solving and critical thinking of students. Health Nexus. 2023 Jan 1;1(1):71-6. (https://scholar.google.com/scholar?hl=en&as_sdt=0%2C5&q=15.%09Parsakia+K.+The+effect+of+chatbots+and+AI+on+the+self-efficacy%2C+self-esteem%2C+problem-solving+and+critical+thinking+of+students.+Health+Nexus.+2023+Jan+1%3B1%281%29%3A71-6.&btnG=)
16. Yogeshwar D, Saharan AK, Singh J, Sharma S, Choudhary A, Mathur M, Saini HN. Development and validation of a scale to assess AI dependency in healthcare professionals and students: a mixed-method study. Bulletin of Faculty of Physical Therapy. 2025 Nov 12;30(1):64. (https://scholar.google.com/scholar?hl=en&as_sdt=0%2C5&q=16.%09Yogeshwar+D%2C+Saharan+AK%2C+Singh+J%2C+Sharma+S%2C+Choudhary+A%2C+Mathur+M%2C+Saini+HN.+Development+and+validation+of+a+scale+to+assess+AI+dependency+in+healthcare+professionals+and+students%3A+a+mixed-method+study.+Bulletin+of+Faculty+of+Physical+Therapy.+2025+Nov+12%3B30%281%29%3A64.&btnG=)
17. Zhang S, Zhao X, Zhou T, Kim JH. Do you have AI dependency? The roles of academic self-efficacy, academic stress, and performance expectations on problematic AI usage behavior. International Journal of Educational Technology in Higher Education. 2024 May 17;21(1):34.(https://scholar.google.com/scholar?hl=en&as_sdt=0%2C5&q=17.%09Zhang+S%2C+Zhao+X%2C+Zhou+T%2C+Kim+JH.+Do+you+have+AI+dependency%3F+The+roles+of+academic+self-efficacy%2C+academic+stress%2C+and+performance+expectations+on+problematic+AI+usage+behavior.+International+Journal+of+Educational+Technology+in+Higher+Education.+2024+May+17%3B21%281%29%3A34.&btnG=)
18. Rodríguez-Rojas MP, Ramírez-Segura AM, Valenzuela-Mora P, Dampuré J, Riveros Munévar F. Critical Thinking Evaluation Scale: Design and Validation in a Colombian Population. Sage Open. 2024 Nov;14(4):21582440241297418. (https://scholar.google.com/scholar?hl=en&as_sdt=0%2C5&q=18.%09Rodr%C3%ADguez-Rojas+MP%2C+Ram%C3%ADrez-Segura+AM%2C+Valenzuela-Mora+P%2C+Dampur%C3%A9+J%2C+Riveros+Mun%C3%A9var+F.+Critical+Thinking+Evaluation+Scale%3A+Design+and+Validation+in+a+Colombian+Population.+Sage+Open.+2024+Nov%3B14%284%29%3A21582440241297418.&btnG=)
19. Ali M, Rehman S, Cheema E. Impact of Generative AI on the Academic Performance and Test Anxiety of Pharmacy Students in OSCE: A Randomized Controlled Trial.

(https://scholar.google.com/scholar?hl=en&as_sdt=0%2C5&q=19.%09Ali+M%2C+Rehman+S%2C+Cheema+E.+Impact+of+Generative+AI+on+the+Academic+Performance+and+Test+Anxiety+of+Pharmacy+Students+in+OSCE%3A+A+Randomized+Controlled+Trial.&btnG=)

20. Sallam M. ChatGPT utility in healthcare education, research, and practice: Systematic review on the promising perspectives and valid concerns. Healthcare (Basel). 2023;11(6):887. doi: 10.3390/healthcare11060887 (https://scholar.google.com/scholar?hl=en&as_sdt=0%2C5&q=20.%09Sallam+M.+ChatGPT+utility+in+healthcare+education%2C+research%2C+and+practice%3A+Systematic+review+on+the+promising+perspectives+and+valid+concerns.+Healthcare+%28Basel%29.+2023%3B11%286%29%3A887.+doi%3A+10.3390%2Fhealthcare11060887&btnG=)
21. Arshed MA, Gherghina ȘC, Dewi C, Iqbal A, Mumtaz S. Unveiling AI-generated financial text: A computational approach using natural language processing and generative artificial intelligence. Computation. 2024 May 15;12(5):101.(https://scholar.google.com/scholar?hl=en&as_sdt=0%2C5&q=21.%09Arshed+MA%2C+Gherghina+%C8%98C%2C+Dewi+C%2C+Iqbal+A%2C+Mumtaz+S.+Unveiling+AI-generated+financial+text%3A+A+computational+approach+using+natural+language+processing+and+generative+artificial+intelligence.+Computation.+2024+May+15%3B12%285%29%3A101.&btnG=)
22. M Alshater M. Exploring the role of artificial intelligence in enhancing academic performance: A case study of ChatGPT. Available at SSRN 4312358. 2022 Dec 26. (https://scholar.google.com/scholar?hl=en&as_sdt=0%2C5&q=22.+M+Alshater+M.+Exploring+the+role+of+artificial+intelligence+in+enhancing+academic+performance%3A+A+case+study+of+ChatGPT.+Available+at+SSRN+4312358.+2022+Dec+26.&btnG=)