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PERCEIVED ROLE OF AI CHATBOTS IN SUPPORTING SELF-DIRECTED LEARNING AMONG UNDERGRADUATE NURSING STUDENTS: A CROSS-SECTIONAL STUDY IN MARDAN

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Abstract

Background: The incorporation of artificial intelligence into higher education has put in place new opportunities in enhancing self-directed learning (SDL), specially in nursing education where ongoing learning and clinical thinking is necessary. Objectives: To examine the role of AI chatbots in enhancing self-directed learning among undergraduate nursing students in Mardan. Methodology: This quantitative cross-sectional study was conducted in 197 undergraduate nursing students including Final year students and Nursing internee, selected through convenient sampling technique. Data were collected using structured, self-administered questionnaire examining perceived educational benefits, interaction and personalization concerns, learning limitations, implementation challenges, and reliability problems related to AI chatbot use. Internal Consistency of the questionnaire showed a very good Cronbach's alpha value of 0.850. Descriptive statistics of the participants provided summary of their background information and opinions. Independent sample t test was applied to compare self-directed learning parts between final year students and nursing interns. Result: The result shows that most of the respondent's thoughts AI chatbots were helpful for understanding complex nursing concepts, getting ready for exam, and finding medical information. There was a statistically significant difference between final year students and nursing interns in term of how much they think they benefit from their education (p=0.022), and their worries about putting what they learned into practice (p=0.030). Still, there was no statistically significant difference in the overall self-directed learning score between the two groups (p=0.954). Conclusion: Although there are worries about ethics, less interaction with teachers, and whether the information is reliable, many people see AI chatbots as helpful tools for learning on your own. The study finds that AI chatbots can help nursing students learn on their own when used together with regular teaching methods.

INTRODUCTION:

The rapid advancement of artificial intelligence (AI) has significantly transformed higher education, mostly in health sciences education. Most of the AI-driven technologies, AI chatbots have arisen as interactive digital tools capable of providing education, personalized learning support, and continuous academic performance [1][2][3][4].

Self-directed learning (SDL) is an essential capability for undergraduate nursing students, as the nursing profession demands continuous nursing skills and critical thinking. It is a process in which learners take responsibility on behalf of their learning needs, setting goals for their learning, evaluating their outcomes, and their education level are shift from teacher-centered to learner-centered [5][6][7]. Rooted in adult learning theory, SDL promotes autonomy and lifelong learning skills which are essential for healthcare professional. In nursing education, AI chatbots can effectively support SDL by providing on-demand guidance, facilitating independent review, and assisting students in learning complex concepts and providing learning resources [8]. Additionally, most of the article highlighted that SDL empowers students to identify their plan, implement, and evaluate their learning activities through self-study and appropriate learning strategies [9].

Artificial intelligence (AI) is increasingly integrated into education due to simulate human cognitive ability and their thought such as decision-making, and learning skills. Educational AI tools, like intelligent tutoring systems, learning trackers, and chatbots, help tailor learning to each student by looking at how they perform, what they like, and how they learn [7]. AI chatbots help students learn better by giving them personal feedback and support. They encourage thinking and can be used in many different subjects and teaching styles. As chatbot technology improves, more studies are looking at how well people accept and use them in schools[10].

Active student participation is a key factor in strengthening self-directed learning, as learners who possess motivation, confidence, and decision-making skills are more likely to take ownership of their learning. Educators can support by giving choice, flexible learning pathways, and varied assessment methods aligned with students' interests and needs. Goal-setting strategies, such as SMART goals, further enhance students' ability to manage and monitor their learning effectively [11].

In nursing education, advanced technologies are essential to address the growing complexity of healthcare and to prepare students for clinical practice. Tools such as virtual reality, simulation, artificial intelligence, and the Internet of Things enhance experiential learning and support the development of self-directed learning skills. The COVID-19 pandemic highlighted gaps in traditional clinical training, reinforcing the need for technology-enhanced learning approaches to reduce anxiety and improve preparedness[12].

Nursing students enhancing their clinical reasoning, critical thinking, and decision-making process through AI chatbots. On behalf of their benefits, concerns remain regarding information accuracy, ethical considerations, data privacy, reduced critical thinking, and diminished student–teacher interaction [13]. Similarly, tools such as Intelligent Tutoring Systems and ChatGPT have demonstrated potential to improve academic performance and learning efficiency but occur issues related to bias, academic integrity, and data security [14][15]. When implemented responsibly with clear guidelines, these technologies providing an effective educational support. However, limited evidence exists regarding the role of AI chatbots in supporting self-directed learning among undergraduate nursing students in Pakistan, particularly in Mardan. Therefore, this study aims to examines that how AI chatbots influence self-directed learning and student agency among undergraduate nursing students.

METHODOLOGY:

To examine the role of AI chatbot in self-directed learning in undergraduate nursing students in Mardan this quantitative cross-sectional study was conducted. Total population comprises 400 under graduate nursing students with 200 Final year students from four different colleges (Medical teaching institute Mardan College of Nursing Bacha Khan Medical College Mardan, Government College of Nursing Mardan, Professional institute of Nursing, and Mardan college of Nursing Mardan) and 200 Nursing internee from medical teaching institute Mardan

Medical Complex Hospital, Mardan. The study comprises only final year students and nursing internee, among them who were present during the data collection time and were exposed to AI since last 2 years were included in the study. Students of First, Second and Third year, those who were not exposed to the AI since last 2 years, and those who were absent and not willing to give data were excluded from the study. Using a self-administered structured questionnaire from [13] data were collected from 197 participants (based on Rao Soft calculation, with a 95% confidence level and 5% margin of error) by using convenient sampling technique due to accessibility constraints. The questionnaire consists of demographic variables (Age, gender, level of education and Chatbot Application Familiarity) and Likert-scale items including educational benefits, interaction and personalization, learning limitations, implementation challenges, and reliability concerns which collectively shows the perception of AI chatbots related to self-directed learning. The internal consistency of the entire questionnaire was assessed through Cronbach alpha, which shows good reliability (α = 0.850). Participation was voluntary, confidentiality was maintained, and informed consent was obtained from all respondents. Data were entered and analyzed using SPSS version 27, with descriptive statistics used to summarize frequencies, percentages, while inferential statistics were applied to compare self-directed learning scores between final-year students and nursing internees.

RESULT:

The study comprises of 197 undergraduate nursing students. Out of which 50.8% have their ages 24-26 years, followed by 44.7% with 20-23 years old. 58.9% were male while 41.1% were female students. In terms of educational level 64.5% students were in their final year, however 35.5% have started their internship (Nursing Internee). ChatGPT were found most familiar platform among AI Chatbot applications, followed by Meta AI and Google Assistant/Gemini, showing widespread exposure to AI-based learning tools.

Section A — Demographic Information

Variable	Categories	Frequency	Percentages (%)
Age	20–23	88	44.7%
	24–26	100	50.8%
	27–29	8	4.1%
	Above 30	1	0.5%
Gender	Male	116	58.9%
	Female	81	41.1%
Level of Education	Final Year	127	64.5%
	Nursing Intern	70	35.5%
Chatbot Application Familiarity	ChatGPT	154	36.8%
	Meta AI	132	31.5%
	Google Assistant / Gemini	90	21.5%
	Perplexity	22	5.3%
	Microsoft Copilot	14	3.3%
	DeepSeek	2	0.5%
	Notebook	2	0.5%
	Consensus	1	0.2%
	Jenni	1	0.2%
	Grok	1	0.2%

Perceived educational benefits analysis illustrated that majority of the students agreed/strongly agreed that AI chatbots enhanced their understanding of complex nursing concepts, helps to prepare effectively for examination, and provide quick access to reliable nursing and medical knowledge. A significant proportion of participants also stated that AI chatbots help them to apply theoretical knowledge to clinical scenarios, improved their academic performance, and assisted with small academic projects and research tasks, showing their perceived educational benefits.

Section B: Component 1: Perceived Educational Benefits

S. No	Statement	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
1.	AI chatbots improve my understanding of complex nursing concepts.	8 (4.1%)	8 (4.1%)	17 (8.6%)	76 (38.6%)	88 (44.7%)
2.	AI chatbots help me prepare effectively for nursing examinations.	2 (1.0%)	14 (7.1%)	29 (14.7%)	104 (52.8%)	48 (24.4%)
3.	AI chatbots provide quick access to reliable nursing and medical knowledge.	2 (1.0%)	11 (5.6%)	18 (9.1%)	78 (39.6%)	88 (44.7%)
4.	AI chatbots help me apply theoretical knowledge to real clinical scenarios.	6 (3.0%)	14 (7.1%)	40 (20.3%)	79 (40.1%)	58 (29.4%)
5.	AI chatbots offer interactive explanations that enhance learning.	7 (3.6%)	8 (4.1%)	24 (12.2%)	92 (46.7%)	66 (33.5%)
6.	Using AI chatbots has improved my academic performance.	3 (1.5%)	7 (3.6%)	29 (14.7%)	90 (45.7%)	68 (34.5%)
7.	AI chatbots support small academic projects and research tasks.	2 (1.0%)	9 (4.6%)	28 (14.2%)	94 (47.7%)	64 (32.5%)

Regarding interaction and personalization, many students expressed concern that AI chatbots could reduce student–faculty interaction and may not always provide realistic nursing case scenarios. However, a majority still agreed that AI chatbots offered personalized feedback that supported their learning, suggesting a balance between perceived limitations and benefits.

Section B: Component 2: Concerns About Interaction & Personalization

S. No	Statement	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
8.	AI chatbots reduce interaction between students and faculty.	14 (7.1%)	28 (14.2%)	33 (16.8%)	66 (33.5%)	56 (28.4%)
9.	AI chatbots rarely provide realistic nursing case scenarios.	3 (1.5%)	29 (14.7%)	57 (28.9%)	70 (35.5%)	38 (19.3%)
10.	AI chatbots provide personalized feedback that supports my learning.	4 (2.0%)	11 (5.6%)	42 (21.3%)	92 (46.7%)	48 (24.4%)

Analysis regarding learning limitations and adaptability revealed that a significant number of students believed AI chatbots might foster passive learning and that students conceivably misuse or misunderstand AI-generated information. Moreover, majority of the participants found that AI chatbots lacked emotional support and empathy crucial for nursing education. In spite of these concerns, many people were agreed that AI chatbots were adaptable to changes in nursing course content.

Section B: Component 3: Limitations in Learning & Adaptability

S. No	Statement	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
11.	AI chatbots encourage passive learning rather than active engagement.	8 (4.1%)	17 (8.6%)	43 (21.8%)	75 (38.1%)	54 (27.4%)

12.	Students may misuse or misunderstand information provided by AI chatbots.	8 (4.1%)	21 (10.7%)	50 (25.4%)	78 (39.6%)	40 (20.3%)
13.	AI chatbots cannot provide emotional support or empathy needed in nursing.	3 (1.5%)	13 (6.6%)	44 (22.3%)	97 (49.2%)	40 (20.3%)
14.	AI chatbots adapt well when nursing course content changes.	4 (2.0%)	10 (5.1%)	53 (26.9%)	69 (35.0%)	61 (31.0%)

Regarding implementation and integration, most respondent narrated that they know how to effectively integrate AI chatbots into their study routines, however majority of them also facing challenges in integrating these tools into learning methods. Ethical and legal concerns related to AI chatbot use were also commonly reported among respondents.

Section B: Component 4: Implementation & Integration Concerns

S. No	Statement	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
15.	I know how to effectively integrate AI chatbots into my study routine.	11 (5.6%)	10 (5.1%)	34 (17.3%)	95 (48.2%)	47 (23.9%)
16.	Integrating AI chatbots into learning methods is challenging.	3 (1.5%)	16 (8.1%)	65 (33.0%)	78 (39.9%)	35 (17.8%)
17.	I am concerned about legal and ethical issues when using AI chatbots.	10 (5.1%)	21 (10.7%)	25 (12.7%)	90 (45.7%)	51 (25.9%)

In term of reliability and misinformation, most of the students recognize that AI chatbots sometime may provide incorrect or unreliable information. Yet, a majority participants thought that AI chatbots could help answer tricky nursing questions and were capable of showing uncertainty when information was unclear.

Section B: Component 5: Reliability & Misinformation Concerns

S. No	Statement	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
18.	AI chatbots sometimes provide incorrect or unreliable nursing information.	17 (8.6%)	19 (9.6%)	36 (18.3%)	76 (38.6%)	49 (24.9%)
19.	AI chatbots can address unique or complex nursing questions effectively.	2 (1.0%)	13 (6.6%)	50 (25.4%)	87 (44.2%)	45 (22.8%)
20.	I trust AI chatbots to indicate uncertainty when information is unclear.	7 (3.6%)	14 (7.1%)	37 (18.8%)	90 (45.7%)	49 (24.9%)

Independent samples t-tests were applied for inferential analysis. Analysis illustrated statistically significant difference between final-year students and nursing internees in perceived educational benefits of AI chatbots, with final-year students showing higher mean scores ($p = 0.022$). There was also significant difference in implementation and integration concerns, where nursing internees were more concerned than final-year students ($p = 0.030$). There were no statistically significant differences were found between the two groups for concerns about interaction and personalization, and Limitations in Learning & Adaptability.

Section C: Component 1: Independent Sample t-test of level of education with component 1, 2, 3, 4, and 5 of Section B.

Variables	Level of Education	N	Mean	Std. Deviation	t	df	p-value
Perceived Educational Benefits	Final Year	127	4.12	.549	2.301	195	.022
	Internee	70	3.91	.738			
Concerns About Interaction & Personalization	Final Year	127	3.61	.756	-1.851	195	.066
	Internee	70	3.81	.752			
Limitations in Learning & Adaptability	Final Year	127	3.75	.644	-0.279	195	.780
	Internee	70	3.78	.738			
Implementation & Integration Concerns	Final Year	127	3.65	.718	-2.184	195	.030
	Internee	70	3.88	.664			
Reliability & Misinformation Concerns	Final Year	127	3.73	.754	-0.497	195	.620
	Internee	70	3.78	.681			

A composite Self-directed learning (SDL) score was computed by calculating the mean score of items from all five sections to represent self-directed learning. Negatively worded items related to interaction reduction, passive learning, misinformation, implementation challenges, and ethical concerns were reverse coded prior to computing the overall Self-Directed Learning (SDL) composite score to ensure that higher scores consistently reflected stronger perceived support for self-directed learning. Comparison of overall self-directed learning scores revealed no significant difference between final-year students and nursing internees (p = 0.954), showing similar overall SDL levels across both groups.

Section C: Component 2: Independent Sample t-test of level of education with Self-Directed Learning Score.

	Level of Education	n	Mean	Std. Deviation	t	df	p-value
SDL	Final Year	127	3.84	.489	-0.776	195	.438
	Internee	70	3.85	.552			

DISCUSSION

This study examined the part of AI chatbots in enhancing self-directed learning among undergraduates nursing students in Mardan. The results indicated that AI chatbots are extensively used and perceived as helpful educational tools, although students also reported important concerns regarding trust ability, and ethical issues. These mixed opinions reflect the enhancing part of artificial intelligence in nursing education and align with the current literature pressing both its implicit and limitations.

Most of the participants reported that AI chatbots improved their understanding of complex nursing concepts, supported examination medication, and handed rapid access to medical and nursing knowledge. The study participants also expressed that chatbots is helpful for them in applying theoretical knowledge to clinical scripts, bettered their academic performance, and supported small academic and exploration tasks. These findings showed that AI chatbots give an accessible, on demand academic aids that strengthen independent literacy and knowledge gaining. Similar finding have been reported in the studies [16] , (2) where AI powered tools similar as chatbots and intelligent training systems enhanced learning effectiveness, handed real time feedback, and supported personalized literacy pathways.

AI chatbots have brought advancements specifically in nursing education, in clinical logic, self-confidence, learning satisfaction of nursing students and faculty [18].

This showed that AI chatbots can appreciatively contribute to the development of self-directed they're by enhancing autonomy and nonstop academic engagement.

Anyhow of these advantages, a significant of the scholars believed that AI chatbots may reduce commerce between students and faculty and may not constantly give realistic clinical scripts. But, most of the participants still agreed that chatbots deliver feedback that supports education. These indicate that participants perceive AI chatbots as helpful in learning but not a relief for teachers.

Likewise, nursing education relies significantly on mentorship, existential literacy, and emotional support which technology can not completely replicate. Study by [19] also emphasizes that AI tools should complement rather than replace traditional tutoring, maintaining the essential part of preceptors in contextualizing literacy.

This study also showed some issues regarding limitations of AI chatbots. Numerous students agreed that AI chatbots might encourage unresistant literacy and that users can misinterpret or misuse AI generated information.

A large proportion also felt that chatbots support the empathy and emotional understanding necessary in nursing education. These findings indicate a crucial limitation of AI in healthcare training while chatbots can give explanations and information's, they cannot fulfill the humanistic qualities necessary in nursing. These align with studies [20],[21] that too much reliance on AI may reduce critically thinking and reflective practice if users are not properly guided.

Regarding adoptability, numerous participants believed that chatbots can adapt to changes in nursing course content, indicated that learners view AI as a flexible and evolving educational resources. Still, most of the participants knew their integration into practice.

Ethical and legal concerns were also showed. These findings indicate that while students are digitally aware, so institutional guidelines are necessary for AI use.

Previous study suggests that educational institutions enhance ICT self-efficacy and give structured training on ethical AI use, data sequestration, and academic integrity[10].

Also, numerous participants reported that AI chatbots may occasionally give incorrect or unreliable information. Still, the participants believed that chatbots can address complex questions when information is unclear.

These dual perceptions indicated that both trust in AI capabilities and awareness of its limitations. These findings are similar to the previous study[21].

Conclusion:

The chatbot educational program could be an effective educational method to positively influence nursing students' clinical reasoning competency, self-confidence, and education satisfaction. It can enhance self-directed learning among nursing students and effectively improve nursing competency. Despite concerns related to reduced student's teacher interaction and other issues like ethical and legal, AI chatbots can be effective when used with traditional teaching.

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