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Artificial intelligence–assisted learning and standardized written examination performance among first-semester nursing and allied health diploma students: a cross-sectional census study

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Research Article

Keywords: Artificial intelligence, AI-assisted learning, Nursing education, Health professions education, Academic performance, Standardized examination

Posted Date: March 10th, 2026

DOI: https://doi.org/10.21203/rs.3.rs-9054724/v1

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Additional Declarations: No competing interests reported.

Abstract

Background

Artificial intelligence (AI) is increasingly integrated into health professions education; however, empirical evidence linking AI-assisted learning to objective academic performance remains limited. This study examined the level of AI-assisted learning and its association with standardized written examination performance among first-semester nursing and allied health diploma students.

Methods

A cross-sectional census study was conducted among 176 first-semester students at a Ministry of Health training institute. AI-assisted learning practices were measured using a validated 20-item questionnaire. Academic achievement was assessed using standardized final written examination scores (60%), comprising structured essay (40%) and multiple-choice questions (20%). Data were analysed using descriptive statistics, Pearson correlation, linear regression, and independent t-tests.

Results

Students reported high levels of AI-assisted learning engagement. However, no significant correlation was found between AI-assisted learning and examination performance ($r = .087$, $p = .252$). Regression analysis indicated that AI-assisted learning did not significantly predict examination scores ($\beta = .087$, $R^2 = .008$, $p = .252$). A significant difference in examination performance was observed between programmes ($p = .003$), although AI usage did not differ significantly.

Conclusion

While AI-assisted learning is widely adopted among health diploma students, its usage alone was not associated with improved standardized written examination performance. Structured pedagogical alignment and assessment design may be necessary to maximize the educational impact of AI integration in health professions education.

1. Introduction

Artificial intelligence (AI) technologies are increasingly transforming educational practices across higher education and professional training programmes. In recent years, AI-driven tools have been integrated into learning environments to support knowledge acquisition, personalized learning, and improved access to educational resources. These technologies have become particularly prominent with the emergence of generative artificial intelligence systems capable of assisting students in information retrieval, explanation of concepts, and academic writing support (Hwang et al., 2020; Zawacki-Richter et al., 2021).

Within health professions education, including nursing and allied health programmes, AI-assisted learning has attracted growing attention as an innovative approach to support student learning. AI tools may assist learners by providing rapid access to knowledge, offering explanations of complex concepts, and supporting self-directed learning processes. Several studies have suggested that AI technologies may contribute to enhanced learning experiences and improved educational efficiency when appropriately integrated into teaching and learning practices (Booth et al., 2022; O'Connor et al., 2023).

The rapid emergence of generative artificial intelligence tools such as ChatGPT has further accelerated the adoption of AI in educational contexts. These technologies have introduced new opportunities for students to engage with learning materials, obtain instant feedback, and clarify complex academic concepts. However, the increasing availability of such tools has also raised questions regarding their actual impact on measurable academic outcomes, particularly in formal assessment contexts (Kasneci et al., 2023; Tlili et al., 2023).

Although AI technologies may support students in accessing and organizing information, improvements in academic performance depend on multiple factors, including learning strategies, depth of understanding, and alignment between learning activities and assessment methods. Educational research suggests that meaningful learning outcomes are influenced not only by technological tools but also by students' ability to regulate their learning processes and apply knowledge effectively within assessment contexts (Chen et al., 2023; Panadero, 2022).

From a theoretical perspective, self-regulated learning frameworks emphasize the importance of learners' ability to plan, monitor, and evaluate their learning strategies. These frameworks suggest that technological tools alone may not directly lead to improved academic outcomes unless they are integrated into structured learning processes that promote deeper cognitive engagement (Zimmerman & Schunk, 2021).

Despite the growing integration of artificial intelligence technologies in education, empirical evidence linking AI-assisted learning practices to objective academic performance remains limited, particularly in health professions education. Previous studies have largely focused on students' perceptions of AI tools or their attitudes toward emerging educational technologies. However, fewer studies have examined whether the use of AI-assisted learning tools is associated with measurable academic outcomes such as standardized examination performance.

Therefore, this study aimed to examine the level of AI-assisted learning among first-semester nursing and allied health diploma students and to investigate its relationship with standardized written examination performance. Using a census-based cross-sectional design, the study provides empirical evidence on whether AI-assisted learning practices are associated with academic performance in early-stage health professions education.

2. Methods

Study Design

A cross-sectional census design was employed.

Participants

The study included all first-semester nursing and allied health diploma students (N = 176) enrolled during the study period.

Instrument

AI-assisted learning was measured using a previously published and validated 20-item instrument. Minor contextual adaptations were made to ensure relevance to the local academic setting while preserving the original construct and conceptual framework. The instrument was used solely for non-commercial academic research purposes. Permission to adapt the instrument was requested from the original author.

Responses were measured using a five-point Likert scale.

Academic Outcome Measure

Academic achievement was based on standardized final written examination scores (60%), comprising structured essay (40%) and multiple-choice questions (20%).

Data Analysis

Descriptive statistics were calculated for all variables. Pearson correlation analysis examined the relationship between AI-assisted learning and examination performance. Linear regression analysis assessed predictive effects. Independent t-tests compared programme differences. Statistical significance was set at $p < .05$.

3. Results

Students reported high levels of AI-assisted learning ($M = 4.47$, $SD = 0.54$). The mean standardized written examination score (60% component) was 48.21 ($SD = 4.26$). Descriptive statistics for the main study variables are presented in Table 1.

Table 1
Descriptive statistics of AI-assisted learning and examination performance (N = 176)

Variable	Mean (M)	Standard Deviation (SD)
AI-assisted learning	4.47	0.54
Standardized written examination score (60%)	48.21	4.26
Note: Examination score represents the standardized final written examination component consisting of structured essay questions (40%) and multiple-choice questions (20%).		

Pearson correlation analysis revealed no significant association between AI-assisted learning and examination performance ($r = .087$, $p = .252$).

Table 2
Pearson correlation between AI-assisted learning and examination performance

Variable	r	p-value
AI-assisted learning vs examination performance	.087	.252
Note: Pearson correlation analysis; significance level set at $p < .05$.		

Linear regression analysis further indicated that AI-assisted learning did not significantly predict examination scores ($\beta = .087$, $p = .252$), explaining less than 1% of score variance ($R^2 = .008$).

Table 3
Linear regression analysis predicting examination performance

Predictor	β	R^2	p-value
AI-assisted learning	.087	.008	.252
Note: Dependent variable = standardized written examination score.			

Although AI utilization did not differ significantly between programmes ($p = .716$), allied health students achieved significantly higher examination scores than nursing students ($p = .003$, Cohen's $d = 0.54$).

4. Discussion

This study examined the level of AI-assisted learning among first-semester nursing and allied health diploma students and its relationship with standardized written examination performance. The findings indicate that although students reported high levels of engagement with AI-assisted learning tools, no statistically significant relationship was observed between AI-assisted learning and examination performance. Similarly, AI-assisted learning did not significantly predict students' standardized written examination scores.

These findings suggest that the presence or frequency of AI usage alone may not necessarily translate into improved academic outcomes. Educational technology research has consistently highlighted that the effectiveness of technological tools in learning environments depends largely on how these technologies are pedagogically integrated into teaching and learning practices. In other words, technology adoption alone does not guarantee improved academic performance unless it is supported by appropriate instructional strategies and meaningful learning activities (Hwang et al., 2020; Zawacki-Richter et al., 2021).

One possible explanation for the absence of a significant relationship may relate to the way students utilize artificial intelligence tools in their learning processes. Many AI platforms are commonly used by students for quick information retrieval, summarizing study materials, or clarifying concepts. While these functions may facilitate access to information and support learning efficiency, standardized written examinations often require deeper cognitive processing, integration of knowledge, and application of concepts rather than simple information recall.

The increasing availability of generative artificial intelligence tools, such as large language models, has significantly transformed how students interact with learning resources. These tools provide rapid access to explanations and structured summaries of complex topics. However, emerging literature suggests that although generative AI technologies may support learning activities, their direct influence on measurable academic performance remains uncertain and may depend on how students engage with these tools during their learning processes (Kasneci et al., 2023; Tlili et al., 2023).

From a theoretical perspective, learning outcomes are strongly influenced by students' ability to regulate their own learning processes. Self-regulated learning theories emphasize the importance of planning, monitoring, and evaluating learning strategies in achieving meaningful academic outcomes. Therefore, while AI tools may assist students in accessing information or organizing learning materials, improvements in academic performance may require deeper cognitive engagement and effective learning strategies beyond the mere use of technology (Panadero, 2022; Zimmerman & Schunk, 2021).

Another notable finding of this study is the significant difference in examination performance between the two academic programmes despite similar levels of AI-assisted learning usage. This observation suggests that factors beyond AI usage, such as programme structure, learning environments, or curricular differences, may play a more influential role in shaping students' academic outcomes. Institutional learning contexts and programme-specific teaching approaches may therefore contribute to variations in academic performance across different groups of students.

From an educational perspective, the findings of this study do not suggest that AI-assisted learning lacks value in health professions education. Instead, the results highlight that AI should be viewed as a supportive educational tool rather than a direct determinant of academic achievement. Educational institutions may therefore benefit from guiding students on how to use AI tools more strategically within their learning processes, such as for critical thinking exercises, problem-solving activities, and reflective learning tasks.

Overall, this study contributes empirical evidence to the growing discussion on the role of artificial intelligence in health professions education. While previous studies have primarily focused on students' perceptions and attitudes toward AI technologies, the present study provides objective evidence examining the relationship between AI-assisted learning practices and standardized examination performance. The findings suggest that future research should further explore how AI technologies can be effectively integrated into pedagogical practices to enhance meaningful learning outcomes in health professions education.

5. Conclusion

AI-assisted learning is widely used among first-semester health sciences students; however, its use was not associated with improved performance in standardized written examinations in this cohort. These findings indicate that AI should not be viewed as an automatic enhancer of academic achievement. Instead, meaningful educational impact likely depends on pedagogical integration, assessment alignment, and structured guidance. Future research should investigate longitudinal effects and broader competency-based outcomes, including clinical performance and higher-order cognitive skills.

Declarations

Ethics approval and consent to participate

Ethical approval was obtained from the Research Committee of the Training Institute of the Ministry of Health Malaysia, Kota Kinabalu. All participants provided informed consent prior to participation.

Consent for publication

Not applicable.

Availability of data and materials

The datasets generated and analysed during the current study are available from the corresponding author on reasonable request.

Competing interests

The authors declare that they have no competing interests.

Funding

No external funding was received for this study.

Authors' contributions

NM conceptualized the study, conducted the data analysis, and drafted the manuscript. RGJ and JBH contributed to data collection, manuscript review, and intellectual input. All authors read and approved the final manuscript.

Acknowledgements

The authors would like to thank the students who participated in this study.

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