AI-Based Learning Tools in Physiotherapy Education: Exploring Their Impact on Knowledge Retention, Engagement, and Learning Outcomes: A Cross-Sectional Study

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Abstract

Background: The integration of Artificial Intelligence (AI) into education has revolutionized teaching and learning, particularly in health sciences. Physiotherapy education, which combines theoretical understanding and clinical skills, is increasingly leveraging AI tools to enhance knowledge retention, student engagement, and academic outcomes. However, the specific impact of these tools in physiotherapy remains underexplored. **Objective:** To assess the effect of AI-based learning tools on knowledge retention, student engagement, and learning outcomes in undergraduate physiotherapy education. **Method:** A cross-sectional study was conducted among 410 undergraduate physiotherapy students across multiple institutions. Participants who had experience using AI tools (e.g., ChatGPT, Quizizz, Socratic, Kahoot) completed a series of digital surveys: a pre-survey, the Student Engagement Scale, a Learning Outcomes Survey, and an AI Perception and Usability Survey. Descriptive statistics and Pearson's correlation analysis were used to evaluate associations between AI tool usage and academic metrics. **Result:** Students reported higher engagement (M = 3.49), academic performance (M = 3.50), and knowledge retention (M = 3.53) with AI tools. Strong positive correlations were observed between AI tool usage and retention (r = 0.363), engagement (r = 0.285), and academic performance (r = 0.229). A negative correlation was found between reliance on traditional methods and AI usage (r = -0.217), indicating a preference shift toward AI-based learning. **Conclusion:** AI-based learning tools significantly contribute to improved academic engagement, knowledge retention, and educational outcomes in physiotherapy students. These tools demonstrate superiority over traditional teaching methods and should be considered essential components in modern physiotherapy curricula.

Keywords: Artificial Intelligence, Physiotherapy Education, Knowledge Retention, Student Engagement, Learning Outcomes, AI Tools

Introduction

The integration of Artificial Intelligence (AI) into educational practices is transforming how knowledge is delivered and assessed, particularly in health sciences education. Physiotherapy, a domain that requires both theoretical knowledge and clinical proficiency, has increasingly adopted AI-based learning tools to enhance teaching methodologies and student engagement (Topal, 2021). These tools, ranging from adaptive learning platforms to virtual simulations, are designed to cater to individual learning needs and offer real-time feedback, potentially improving students' knowledge retention and academic performance (Zawacki-Richter et al., 2019; Hodges & Barone, 2022).

AI-based educational technologies have demonstrated potential in promoting personalized learning environments, improving diagnostic reasoning, and increasing motivation through interactive platforms (Alshahrani & Ally, 2021; Dankbaar et al., 2017). In medical education, where retention of complex information and continuous engagement are critical for competence, AI-driven tools have shown promise in increasing interactivity and facilitating deeper learning (Chan et al., 2021). Moreover, studies have shown that intelligent tutoring systems and simulation-based learning, supported by AI, can enhance students' critical thinking and decision-making skills (Ruiz et al., 2020; Zhang et al., 2022).

However, the effectiveness of these technologies in the context of physiotherapy education remains under-explored. While studies in broader medical and nursing education suggest positive outcomes with AI integration (Al-Kumaim et al., 2021), there is limited empirical evidence examining how such tools specifically influence physiotherapy students' knowledge retention, engagement, and learning outcomes.

This study aims to bridge this gap by investigating the impact of AI-based learning tools on undergraduate physiotherapy education. By conducting a cross-sectional evaluation, this research seeks to assess students' perceived engagement, actual academic performance, and knowledge retention outcomes, contributing valuable insights into the pedagogical value of AI in specialized health science education.

Materials and Methods

A cross-sectional research design was adopted to examine the influence of AI-based learning tools on knowledge retention, student engagement, and academic performance in physiotherapy education. The study included students who had prior exposure to AI-supported learning platforms, and therefore, no control or comparison group was included. Data were collected from multiple physiotherapy institutions offering Bachelor of Physiotherapy (BPT) programs, and to ensure broad accessibility, questionnaires were administered digitally through Google Forms.

A minimum sample of 410 students was targeted to achieve adequate statistical power. Recruitment was carried out through academic networks, institutional communication channels, and social media platforms, using convenience sampling to obtain a diverse pool

of participants. Students currently enrolled in any year of the BPT programme and who had used at least one AI-based learning platform such as Kahoot, Quizizz, Socratic, or ChatGPT were included. Participants unfamiliar with AI tools or unwilling to provide informed consent were excluded.

Data were collected through structured, self-administered questionnaires combining demographic details, academic background, frequency of AI tool use, and general learning habits. The Student Engagement Scale (SES) was utilised to measure perceived motivation, involvement, and study behaviour related to AI-based learning. Additionally, a Learning Outcomes Survey enabled participants to self-report perceived gains in conceptual clarity, problem-solving ability, and application of physiotherapy knowledge. An AI Perception and Usability Survey was also administered, incorporating rating scales and open-ended responses regarding accessibility, usability, and perceived usefulness of AI platforms.

Procedurally, students first provided informed consent digitally, following access to study information describing purpose, data usage, privacy protection and voluntary participation. Participants then completed the SES, followed by the Learning Outcomes Survey and the AI-Perception and Usability questionnaire. All responses were submitted electronically, allowing confidentiality to be maintained through anonymised records.

Ethical approval was obtained from the Institutional Review Board. All participants were assured transparency regarding study objectives, voluntary involvement, and their right to withdraw without consequences. Data confidentiality, security, and anonymity were strictly maintained throughout, and participants were not subjected to any academic, emotional, or physical risk during the study.

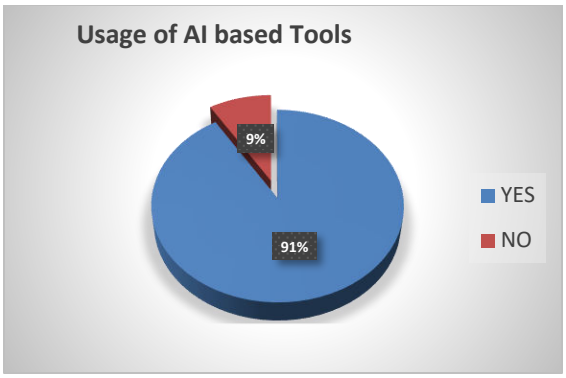
Data analysis

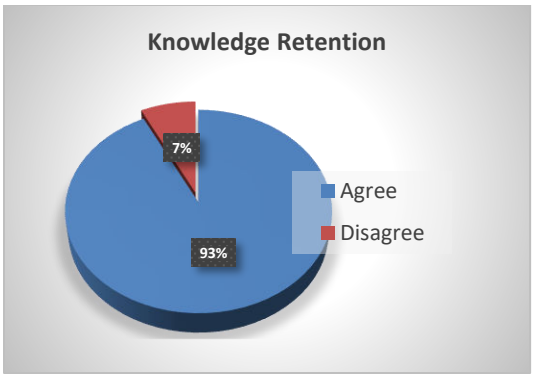
The data were analyzed using descriptive statistics and Pearson's correlation to evaluate relationships among variables such as engagement, understanding, academic performance, and the use of AI-based tools.

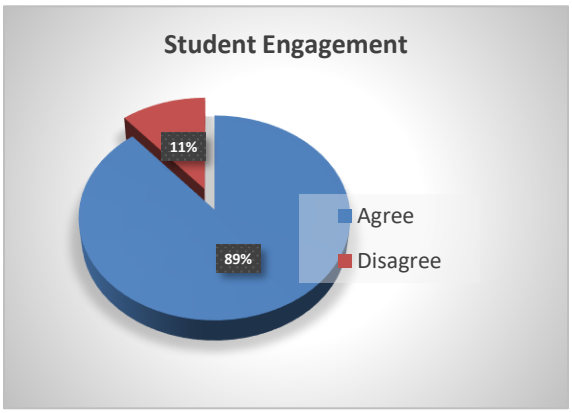
Descriptive Statistics

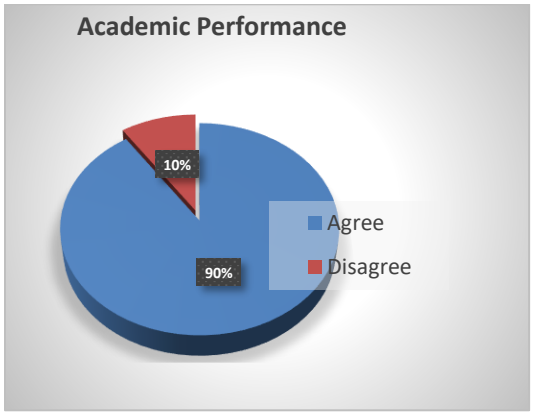
The mean scores across key dimensions are visualized in the figure below. Most variables scored above the neutral point (3.0 on a 5-point Likert scale), indicating a generally positive perception of AI-based tools in learning.

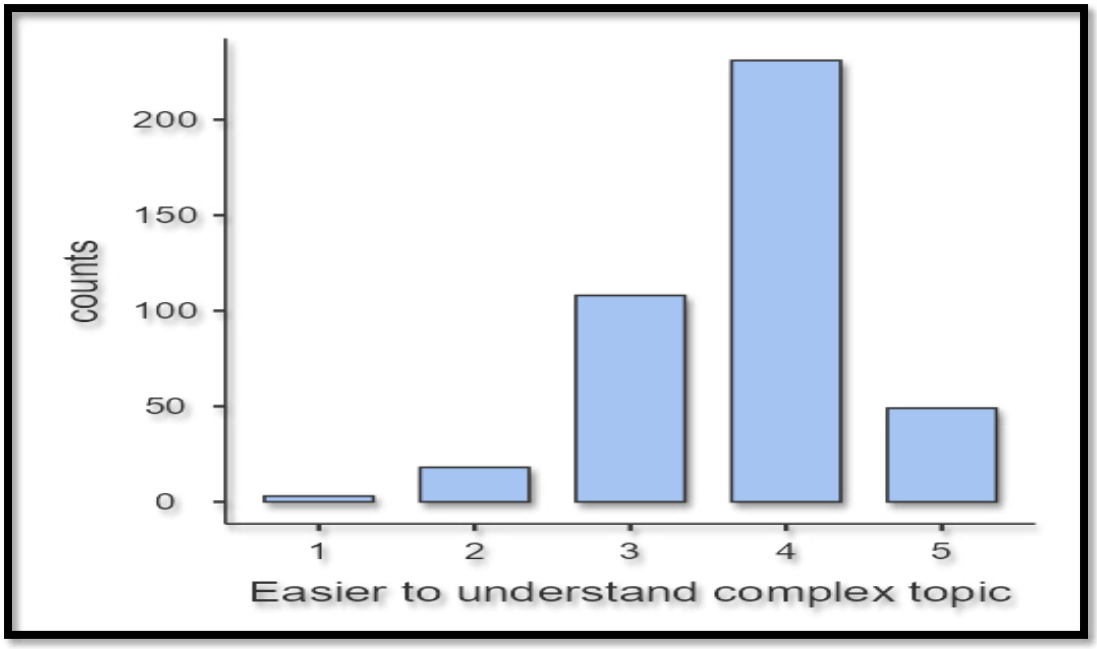
	Uses of AI tools	**Engagement**	**Academic Performance**	**Retention of Knowledge**
Mean	2.58	3.49	3.50	**3.53**
Median	3	4	4	3
Mode	3.00	4.00	4.00	3.00
Minimum	1	1	1	1











- **Highest Mean Scores:**
  - Easier understanding of complex topics (M = 3.75)
  - Confidence in using AI (M = 3.57)
  - Retention of knowledge (M = 3.53)

- **Lowest Mean Scores:**
    - Traditional methods' adequacy for clinical practice (M = 1.57)
    - Preference for classroom over AI engagement (M = 2.88)

This suggests students find AI tools more effective than traditional methods in areas like knowledge retention and clinical understanding

Two Pearson correlation matrices were computed to examine inter-variable relationships. Significant positive correlations were found among:

- Use of AI tools and Retention of Knowledge (r = 0.363, p< .001)
- Use of AI tools and Engagement (r = 0.285, p< .001)
- Use of AI tools and Academic Performance (r = 0.229, p< .001)
- Understanding and Academic Performance (r = 0.543, p< .001)

Conversely, Traditional teaching methods were negatively correlated with AI usage (r = -0.217, p< .001), reinforcing a preference shift toward tech-enhanced learning.
These correlations underscore the effectiveness of AI tools in promoting deeper learning, better performance, and increased engagement.

Result

Descriptive analysis revealed that physiotherapy students reported moderate to high levels of engagement (M = 3.49) and motivation (M = 3.41) while using AI-based tools. Students spent slightly more time using AI tools (M = 3.26) than engaging in traditional classroom activities (M = 2.88), indicating a shift toward digital learning preferences.
AI-based tools were associated with enhanced academic outcomes. The mean scores for academic performance (M = 3.50), retention of knowledge (M = 3.53), and clinical application (M = 3.37) were notably high, while traditional teaching methods were rated low in adequacy for clinical practice (M = 1.57). This suggests students perceived AI-based platforms as more effective for developing clinical competencies.

Statistically significant positive correlations were observed:

- Use of AI tools and retention of knowledge (r = 0.363, p< .001)
- Use of AI tools and engagement (r = 0.285, p< .001)
- Use of AI tools and academic performance (r = 0.229, p< .001)
- Use of AI tools and understanding (r = 0.280, p< .001)

Additionally, understanding had the strongest correlation with academic performance (r = 0.543, p< .001), highlighting the mediating role of conceptual clarity.

Interestingly, a small but significant negative correlation was noted between perceived adequacy of traditional methods and use of AI tools ($r = -0.217$, $p < .001$), indicating a preference shift.

Discussion

This study provides compelling evidence that AI-based learning tools positively impact physiotherapy students' academic engagement, knowledge retention, and learning outcomes. The statistically significant associations between AI usage and critical academic parameters suggest that these tools are not merely supplementary but central to contemporary educational strategies.

The finding that engagement and motivation scores were relatively high aligns with literature that emphasizes the interactivity and autonomy provided by platforms like ChatGPT, Socratic, and Quizizz (Zawacki-Richter et al., 2019; Hodges & Barone, 2022). These platforms foster personalized learning pathways that likely contribute to better focus and sustained interest.

The strong correlations between AI tool use and knowledge retention confirm the cognitive advantages of adaptive feedback and repeated practice mechanisms embedded in AI systems. Furthermore, the observed relationship between understanding and academic performance ($r = 0.543$) underscores the transformative impact of AI in scaffolding complex information, especially in clinically applied subjects.

Importantly, the negative association with traditional methods may reflect growing dissatisfaction with one-size-fits-all pedagogies, highlighting a pressing need for curriculum innovation. While previous research has often generalized outcomes across health disciplines, this study makes a direct contribution to physiotherapy education by contextualizing AI's effectiveness within skill-intensive learning environments.

Conclusion

The findings of this cross-sectional study underscore the pivotal role of AI-based learning tools in enhancing academic engagement, knowledge retention, and learning efficacy among physiotherapy students. With demonstrable benefits over traditional teaching methods, AI platforms are not just add-ons but integral to modern pedagogy in health science education. These results advocate for curriculum planners and educators to adopt AI-enhanced teaching strategies more widely. Future studies may further explore longitudinal impacts and optimize tool integration for specific learning outcomes in clinical education.

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