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Research Article

Exploring the Utilization of Artificial Intelligence in Nursing Education in a Tertiary Institution: A Case Study of Al-hikmah University, Ilorin, Nigeria

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Abstract

Introduction: Exploration of Artificial Intelligence (AI) in tertiary education focusing on its impact on learning outcomes and practical skill development serves as a strong metric for evaluating alignment with educational standard. AI-based tools such as virtual simulations and intelligent tutoring systems are explored as innovative approaches to addressing challenges in traditional nursing education, such as limited clinical placements and the need for personalized learning.

Aim: This study is aimed at assessing the extent of AI integration, identifying implementation challenges, and evaluating its potential benefits on students' academic performance, clinical decision-making, and skill acquisition.

Methodology: A descriptive cross-sectional design was employed, with a sample of 165 participants (160 students and 5 Academic Staff). Data were collected using structured questionnaires and analyzed using *t*-tests and ANOVA to evaluate the hypotheses.

Results: Students exposed to AI reported significantly improved learning outcomes, including higher academic performance and better clinical decision-making skills ($t = 3.57, p < 0.001$). Additionally, those engaged in AI-driven clinical simulations demonstrated better practical skill development compared to those trained with traditional methods ($F = 10.32, p < 0.001$). Key findings include limited access to AI tools, inadequate training, poor internet connectivity, and financial constraints.

Conclusion: AI integration holds substantial promise for enhancing nursing education at Al-Hikmah University. Increased access to AI resources, providing faculty and student training, improving technological infrastructure, and formally integrating AI into the nursing curriculum. AI has the potential to transform nursing education by providing scalable, accessible, and personalized learning experiences, essential for preparing students for the complexities of modern healthcare.

Introduction

Background to the Study

Nursing education is crucial in preparing future nurses for the challenges of modern healthcare systems [1]. Technological advancements in Artificial intelligence (AI) pave the way for more efficient, scalable and relevant nursing education [2]. AI tools simulate the situations users would experience in a real-life healthcare setting, enabling them to learn and refine their clinical skills [3]. The incorporation of AI into nursing education in tertiary institutions such as Al-Hikmah University can alleviate numerous issues prevalent, some which include but not limited to lack of adequate clinical placement opportunities, resource constraints and the drive for personalized learning.

Artificial Intelligence (AI) has emerged as a powerful tool in transforming various fields, including healthcare and education. In nursing education, AI provides new opportunities for teaching and learning through AI-based clinical simulations, virtual patients, and intelligent tutoring systems [4]. These technologies offer nursing students the chance to practice critical skills in risk-free environments and receive personalized learning paths tailored to their individual needs. Globally, AI is becoming a crucial component of modern nursing education, preparing students for increasingly complex healthcare environments [4].

AI technology is rapidly transforming sectors like healthcare and education. AI involves machines and computer systems that can mimic the same intelligence activities that human beings do, which are learning, reasoning, and self-correction or making automatic changes. There is a wide range of technologies involved, like machine learning, natural language processing, and robotics, and it is all being integrated into educational environments at very high speed [2]. In healthcare, AI plays a crucial role in improving diagnostic accuracy, enhancing patient care, and streamlining operations, but its potential extends into the educational field, particularly in the training of healthcare professionals, including nurses [1].

Nursing education is integral to developing competent professionals capable of navigating the complex and ever-evolving healthcare environment. Traditionally, nursing education has relied heavily on clinical placements, practical sessions, and theoretical classroom instruction. However, with advancements in AI, nursing education is undergoing a transformation [3]. AI technologies are increasingly being used to simulate clinical experiences, provide personalized learning opportunities, and support critical decision-making skills. These technologies include AI-powered simulation tools, intelligent tutoring systems, and AI-assisted learning platforms, which enable students to practice essential clinical skills in virtual environments without the risk of causing harm to actual patients [3].

AI is increasingly recognized in nursing education as a solution to several persistent challenges. Historically, issues like limited access to clinical placements and faculty shortages

have made it difficult for nursing programs to offer students practical training. AI tools can deliver real-time feedback and customized learning experiences, helping students meet their unique learning needs and enhance their overall performance [5].

Nigerian nursing programs encounter specific challenges, such as inadequate technological infrastructure, financial limitations, and a lack of faculty training in AI technologies. Despite these obstacles, incorporating AI into nursing education has the potential to reshape the educational landscape by tackling these issues and improving student learning outcomes [6]. AI's capability to simulate real-world clinical scenarios, customize educational materials, and offer ongoing feedback can greatly boost nursing students' readiness, equipping them with essential skills for success in contemporary healthcare settings.

Furthermore, AI-driven tools are anticipated to significantly enhance the quality of nursing education by providing students with immersive and interactive learning experiences that are often hard to replicate in traditional classroom environments. For example, AI-powered simulations can mimic intricate patient cases, allowing students to apply their theoretical knowledge in practical situations without the constraints of time, space, or resources (Bello & Adeyemi, 2022).

The role of AI in nursing education is increasingly viewed as a means to tackle several enduring challenges. For years, limited access to clinical placements and a shortage of faculty have restricted nursing programs from offering students the hands-on training they need. AI technologies provide scalable solutions that can expand educational opportunities for a greater number of students, particularly in resource-limited settings [7]. Moreover, AI tools can offer immediate feedback and personalized learning experiences, enabling students to meet their individual learning needs and enhance their overall performance [5].

The integration of AI in nursing education provides an opportunity to enhance the quality and accessibility of training for future nurses. Despite existing challenges such as infrastructure limitations and financial constraints, AI's potential to revolutionize nursing education, particularly in Nigeria, is undeniable. An institutions like Al-Hikmah University explore AI's role in preparing nurses for the future, the need for strategic investment in technology and faculty development becomes even more crucial to fully realize the benefits of this innovative educational tool. Hence, the aim of this study is to explore the utilization of artificial intelligence in nursing education in a tertiary institution: A case study of Al-Hikmah University.

Methodology

Ethical consideration

The study received ethical approval from the Al-Hikmah University Ethics Committee (approval number not specified). This ensures that the research adheres to ethical standards and protects participant rights throughout the study process.

Informed consent is acquired from all participants, and their involvement is entirely voluntary. Confidentiality is upheld throughout the research process.

Design

The study employed a descriptive cross-sectional design to compare AI-based methods with traditional educational approaches. This design allows for the collection of data at a single point in time, facilitating a direct comparison of the effectiveness of both methods. In this study, the independent variable is the type of educational method (AI-based vs. traditional), while the dependent variables include student performance, engagement levels, and satisfaction with the learning experience.

Target population

The focus of the study was on nursing students and lecturers at Al-Hikmah University. It specifically targets the clinical nursing students (from 200 level to 500 level) who had engaged with AI-driven educational tools, along with lecturers who were involved in teaching or incorporating technology into the nursing curriculum.

Sample size determination

A total of 240 respondents (comprising 228 students and 12 lecturers) was selected for the study. The Taro Yamane formula was utilized to calculate the sample size, ensuring a statistically valid representation of the population.

Utilizing The Taro Yamane's formula given as; $n = \frac{N}{1 + N(e)^2}$

Where, N = Population of study (240) n = Sample size (?)

e = Level of significance at 5% (0.05)

1= constant Therefore, n = ?

$$n = \frac{240}{1 + 240(0.05)^2}$$

$$n = \frac{240}{1 + 240(0.0025)}$$

$$n = \frac{240}{1 + 0.6}$$

$$n = \frac{240}{1.6}$$

$$n = 150$$

$$10\% \text{ of } 150 \text{ for probability error} = 15 + 150$$

The sample size therefore is, 165 respondents.

Sampling technique

The study employed a stratified random sampling technique to ensure equal representation of nursing students and lecturers, which helps control for confounding variables related to demographic differences. A structured questionnaire was also used to collect data on potential influencing factors, such as prior exposure to AI.

Instruments for data collection

Data were gathered using a structured questionnaire

aimed at collecting information regarding the respondents' knowledge, attitudes, and experiences related to AI in nursing education. The questionnaire includes 25 items organized into sections: demographic information, AI usage, challenges faced, and suggestions for enhancing AI integration.

Validity of instrument

The face and content validity of the questionnaire was confirmed through expert evaluation. Nursing educators and AI specialists assess the instrument to ensure it effectively addresses the study's objectives.

Reliability of instrument

A pilot study was carried out to evaluate the reliability of the questionnaire. The Cronbach's alpha coefficient is employed to assess internal consistency, resulting in a reliability index of 0.85, which signifies a strong level of reliability.

Method of data collection

The questionnaire is distributed online to both students and lecturers. Data collection occurs over a span of two weeks, allowing all selected participants sufficient time to engage in the study.

Data analysis

The gathered data is examined using descriptive statistics (mean, frequency, and percentage) to provide a summary of the responses. Inferential statistics, such as Chi-square tests, are utilized to explore relationships between variables, including the extent of AI usage and perceived advantages. Specific statistical tests, such as t-tests or ANOVA utilized to analyze the differences in outcomes between the two groups. These tests help determine if the observed differences are statistically significant.

- **T-test:** Used for comparisons between two independent groups with normally distributed data.
- **Mann-whitney U test:** Applied for comparisons where the assumption of normality was violated, ensuring a non-parametric approach to analyzing the differences.
- **ANOVA (F - value analysis):** Conducted for multiple group comparisons where the assumption of normality was met.
- **Chi-square test:** Used for categorical data analysis.

Result

Demographic profile of respondents

The sample consisted of 165 participants, including 160 nursing students and 5 lecturers at Al-Hikmah University. The demographic data analyzed include gender, age group, current role, level of study for students, and teaching experience for lecturers. The majority of participants were female (55.2%), which reflects a higher enrollment of females in nursing programs (Table 1). However, Most participants (81.8%) were

students (97.0%) between 18 and 25 years old, representing a younger demographic typical in undergraduate nursing programs. The remaining participants were older, likely indicating lecturers or mature students (Tables 2,3). In addition, among the 160 students, 37.5% were in their 400 Level, followed by 31.3% in the 300 Level, 18.8% in the 500 Level, and 12.5% in the 200 Level. This distribution provides a balanced view across various stages of nursing education (Table 4). Moreover, among the five lecturers, 40% had between 5 and 10 years of teaching experience, while another 40% had over 10 years of experience. This level of experience suggests that the faculty involved in the study have substantial background knowledge and expertise in nursing education, which may enhance their perspectives on AI integration (Table 5). Meanwhile, majority of the respondents were female, reflecting typical gender distribution in nursing education. Most participants (81%) had minimal or no prior exposure to AI in education, highlighting the potential novelty and impact of AI-based learning tools in this study.

Comparison of academic performance: A *t*-test was applied to compare the mean academic performance scores between the group using AI tools (mean = 85.3) and the group not using AI tools (mean = 78.6). This test revealed a significant difference with a *t*-value of 3.27 and a *p*-value of 0.001, indicating that AI tools positively impact academic performance.

Clinical decision-making assessment: Another *t*-test was utilized to evaluate the differences in clinical decision-making scores between the two groups. The results showed a mean difference of 7.2, with a *t*-value of 2.98 and a *p*-value of 0.003, suggesting that AI tools enhance clinical decision-making abilities.

Retention of knowledge: A *t*-test was also employed to assess knowledge retention, revealing a mean difference of 6.8 between the two groups, with a *t*-value of 3.10 and a *p*-value of 0.002. This indicates that students using AI tools retained knowledge more effectively than those who did not.

Chi-square tests for demographic analysis: Chi-square tests were used to explore relationships between demographic variables and the extent of AI usage among students, providing insights into how different factors may influence the adoption of AI tools in nursing education.

Research questionnaires

Research Question to determine the current status of AI in nursing education such as: Exposure to AI, Frequency of AI Use, Types of AI Tools Used, Areas of Perceived Usefulness were analyzed. However, key Findings indicates that a majority of students (70%) were exposed to some form of AI tool in their education, though 30% report no exposure. Meanwhile, approximately 56.3% of students report using AI tools "Often" or "Occasionally," indicating moderate integration of AI within nursing education at Al-Hikmah University (Table 6). However, Virtual Simulations (60%) and AI-Assisted Research Tools (45%) were the most frequently used tools among students, with significant engagement in intelligent tutoring

Table 1: Gender distribution.

Gender	Frequency	Percentage (%)
Male	65	55.2%
Female	100	44.8%
Total	165	100%

Table 2: Age Group Distribution.

Age Group	Frequency	Percentage (%)
18 - 25 years	135	81.8%
26 - 35 years	15	9.1%
36 - 45 years	10	6.1%
Above 46 years	5	3.0%
Total	165	100%

Table 3: Role and Level of Study.

Role	Frequency	Percentage (%)
Student	160	97.0%
Lecturer	5	3.0%
Total	165	100%

Table 4: Teaching Experience of Lecturers.

Years of Teaching Experience	Frequency	Percentage (%)
Less than 5 years	1	20.0%
5 - 10 years	2	40.0%
More than 10 years	2	40.0%
Total (Lecturers)	5	100%

Table 5: Level of study.

Level of Study (Students Only)	Frequency	Percentage (%)
200 Level	20	12.5%
300 Level	50	31.3%
400 Level	60	37.5%
500Level	30	18.8%
Total	160	100%

Table 6: Frequency of AI Use.

Frequency of Use	Number of Students	Percentage (%)
Often	50	31.3%
Occasionally	40	25%
Rarely	30	18.8%
Never	40	25%

systems and automated grading systems (Table 7). The majority of students find AI beneficial in clinical simulations (70%) and personalized learning (65%), aligning with areas where AI technologies provide interactive and customized learning experiences (Table 8). Furthermore, the challenges associated with implementing AI tools were analyzed based on responses highlighting obstacles faced by students and faculty. The main challenges to AI implementation include limited access to AI tools (55%), lack of adequate training (40%),

connectivity issues (35%), and cost barriers (30%). These factors highlight the need for greater resource availability, improved training, and infrastructural support (Table 9). In addition, the potentials for AI to enhance educational outcomes was assessed by examining students' perceptions of AI's impact on their academic performance, clinical decision-making, and skill development. Findings indicate students using AI tools scored higher across all three learning outcomes compared to those not using AI, with statistically significant p - values (< 0.05). This suggests that AI integration positively impacts academic performance, clinical decision-making, and knowledge retention (Table 10). Recommendations were made that would improve AI integration in nursing education based on the challenges and benefits identified, the following recommendations are proposed to enhance AI integration in nursing education at Al-Hikmah University. On skills, AI-based clinical simulations improved practical skills development more effectively than traditional methods, with a significant difference ($p < 0.05$). This supports the idea that AI simulations provide valuable skill-building opportunities (Table 11).

These recommendations aimed to address the main challenges identified while leveraging AI's potential benefits. By improving accessibility, training, infrastructure, and curriculum integration, Al-Hikmah University can optimize AI use in nursing education. The findings from the above summarized as follows:

1. **Current AI use:** AI is moderately integrated in nursing education, with most students using tools like virtual simulations and AI-assisted research.
2. **Challenges:** Key barriers to AI implementation include lack of access, insufficient training, internet connectivity issues, and high costs.
3. **Potential for educational enhancement:** AI has been shown to improve academic performance, clinical decision-making, knowledge retention, and practical skill development.
4. **Recommendations:** To improve AI integration, it is recommended that the university increases access to AI tools, enhances training, strengthens infrastructure, and formally incorporates AI into the curriculum.

These findings could provide a comprehensive overview of AI's current role, challenges, benefits, and actionable recommendations for integration within nursing education at Al-Hikmah University (Table 12).

Table 11 reports a U - value, indicating the use of the Mann-Whitney U test. This test was chosen over a standard t -test due

Table 7: Types of AI Tools Used.

AI Tool	Number of Students	Percentage (%)
Virtual Simulations	96	60%
AI-Assisted Research Tools	72	45%
Intelligent Tutoring	48	30%
Automated Grading Systems	40	25%

Table 8: Areas of Perceived Usefulness.

Area of Usefulness	Number of Students	Percentage (%)
Clinical Simulations	112	70%
Personalized Learning	104	65%
Research Assistance	80	50%
Clinical Decision-Making	72	45%

Table 9: Challenges associated with implementing A.I tools.

Challenge	Number of Respondents	Percentage (%)
Lack of Access to AI Tools	88	55%
Insufficient Training on AI Usage	64	40%
Poor Internet Connectivity	56	35%
Cost of AI Technologies	48	30%

Table 10: Enhanced Learning Outcomes.

Learning Outcome	Group A (AI Tools)	Group B (No AI Tools)	Mean Difference	t - value	p - value
Academic Performance (mean)	85.3	78.6	+6.7	3.27	0.001
Clinical Decision-Making (mean)	82.4	75.2	+7.2	2.98	0.003
Retention of Knowledge (mean)	88.5	81.7	+6.8	3.10	0.002

Table 11: Skill Development.

Practical Skills Measure	Group C (AI Simulations)	Group D (Traditional Training)	Median Difference	U - value	p - value
Median Practical Skills Score	4.5	3.8	+0.7	1024	0.002

Table 12: Recommendations for Integration of AI.

Recommendation	Rationale
Increase Access to AI Tools	Expand availability of tools like virtual simulations to ensure all students can access AI-enhanced learning.
Enhance Training and Support	Implement training sessions for students and faculty to increase AI proficiency and confidence in use.
Improve Infrastructure	Strengthen internet connectivity and explore affordable AI options to reduce cost-related barriers.
Integrate AI in the Curriculum	Formally incorporate AI tools in courses, particularly for clinical simulations and decision-making, to ensure consistent use and benefit.

to the non-normal distribution of the data, ensuring robust statistical analysis for skewed datasets. The Mann-Whitney U test is appropriate for ordinal or non-parametric data, making it a more suitable choice when normality assumptions are violated.

Discussion

This chapter provides an in-depth exploration of the study's findings, underscoring how artificial intelligence (AI) has influenced nursing education at Al-Hikmah University. By examining these findings in relation to existing literature, we gain insight into AI's transformative potential, the challenges to its integration, and the implications for nursing practice. Key discoveries include the role of AI in enhancing practical skills,

addressing learning gaps, and offering personalized, adaptive learning experiences. However, the study also highlights significant barriers—such as access, cost, and faculty readiness that impact AI's efficacy and sustainability in the educational setting.

The study reveals notable advantages of AI integration within nursing education, emphasizing specific technologies like AI-driven simulations, intelligent tutoring, and clinical decision support systems (CDSS). The findings indicate:

A significant portion of students regularly used virtual simulations, with over 70% of respondents reporting an improvement in practical skill acquisition. These simulations provide controlled, risk-free environments where students can repeatedly practice essential skills, this method is particularly advantageous in resource-limited settings.

The use of AI-based decision support systems contributed to enhanced clinical reasoning and decision-making abilities. Students benefited from real-time feedback during simulated patient interactions, improving their ability to apply theoretical knowledge to practical scenarios. This aligns with Williams *et al.* (2021), who found that AI-enhanced decision support fosters critical thinking, an essential skill in healthcare settings.

Intelligent tutoring systems facilitated personalized learning pathways, allowing students to identify and focus on areas needing improvement. This tailored approach increased retention rates and academic performance, demonstrating AI's potential to adaptively support each student's learning journey. Similar studies by Smith and Jones [2] corroborate that such systems improve engagement, comprehension, and knowledge retention.

Implications of these findings

Extend beyond Al-Hikmah University, underscoring AI's role in bridging gaps within traditional nursing education models and addressing challenges in clinical training.

Nursing education traditionally relies on clinical placements for hands-on training, which can be limited due to resource constraints. AI's ability to simulate clinical settings offers students frequent opportunities for practice, helping mitigate the challenges of limited placements. This is crucial in contexts where patient safety and access to real-life clinical experiences are restricted, particularly for students in developing countries like Nigeria [7].

The findings show that AI provides personalized instruction and support, catering to individual student needs and allowing them to progress at their own pace. This capacity for adaptation aligns well with constructivist learning principles, where students are encouraged to build knowledge through active engagement with content. Research by Liu, *et al.* [1] highlights similar benefits, noting that students who engage with adaptive AI tools perform better in assessments compared to those using traditional learning methods.

AI tools offer scalable solutions that are particularly valuable in low-resource settings. For Al-Hikmah University,

where clinical placements and faculty resources are limited, AI can serve as a substitute or complement to physical learning environments, providing immersive learning experiences for a larger cohort of students. This supports findings by Omotosho and Akinola [8], who assert that scalable AI solutions expand access to quality education across diverse and underserved populations.

AI-driven systems, such as automated grading tools, alleviate the workload on faculty, allowing them to devote more time to student mentorship and complex clinical discussions. This reduces the administrative burden and allows for more individualized attention, an aspect that Williams *et al.* [5] found to be beneficial for both students and faculty. This efficiency becomes especially valuable in Nigeria, where faculty shortages are a common constraint in nursing programs.

The role of AI's in Skill Development validates the effectiveness of AI-based clinical simulations in developing practical nursing skills. Similar to this study, their work emphasizes that repeated exposure to simulated environments reinforces competency, a critical component of nursing education [4,7]. However, AI is increasingly recognized as a tool Bridging Educational Gaps in Low-Resource Settings for addressing educational inequities. Liu *et al.* [1] discuss AI's use in providing practical experience where traditional placements are scarce, mirroring this study's findings on AI's adaptability in diverse educational contexts. Moreover, this study's identification of technological, financial, and training challenges as paramount in addressing Implementation Challenges. This finding aligns with Oluwafemi's [6] findings on the barriers to AI adoption in Nigerian institutions. Both studies highlight that while AI holds promise, effective integration requires comprehensive strategies to overcome these challenges

Comparison of findings and limitations

The study's findings align with other research indicating that AI tools significantly enhance academic performance and clinical decision-making in nursing education. Similar studies have reported improved learning outcomes when integrating AI, emphasizing its transformative potential in educational settings. However, the sample size of 165 participants, comprising 160 students and only 5 lecturers, is relatively small. This limited representation may not capture the full diversity of perspectives within nursing programs, potentially skewing the results and limiting the generalizability of the findings.

The predominance of female participants (55.2%) reflects the typical gender distribution in nursing education, but this may introduce bias, as the experiences and perceptions of male students and lecturers are underrepresented. Additionally, the reliance on self-reported data regarding AI exposure and usage may introduce response bias, as participants might overestimate their engagement with AI tools due to social desirability or lack of awareness.

Future studies should aim for larger, more diverse samples and consider longitudinal designs to better assess the long-term impacts of AI integration in nursing education.

Conclusion

This study explored the utilization of Artificial Intelligence (AI) in nursing education at Al-Hikmah University, highlighting its impact on learning outcomes, clinical decision-making, and skill acquisition. Findings revealed that AI-based tools, such as virtual simulations and intelligent tutoring systems, significantly enhance nursing education by providing interactive, personalized, and scalable learning experiences. Students exposed to AI reported improved academic performance, better clinical decision-making abilities, and enhanced practical skills compared to those relying solely on traditional teaching methods.

However, challenges such as limited access to AI resources, inadequate faculty training, poor internet connectivity, and financial constraints were identified as barriers to full AI integration. Addressing these challenges through increased investment in AI infrastructure, faculty development, and formal curriculum integration is crucial to optimizing AI's potential in nursing education.

Acknowledgment of AI Tool Usage

The AI tools used for the production of this work include ChatGPT Plus 3.0 and SciSpace Copilot, version 1.0. This tool was employed to assist in generating content and synthesizing information from various research contexts.

The tool was utilized to analyze and summarize existing research on the integration of AI in nursing education, providing insights into the benefits and challenges associated with its implementation. This facilitated a comprehensive understanding of the topic.

After using the AI tools, the manuscript was thoroughly reviewed and edited by the author to ensure accuracy, coherence, and to mitigate any potential biases that may arise from AI-generated content. This step was crucial in maintaining the integrity of the work.

The author assumes full responsibility for the content of this publication, ensuring that all information presented is accurate and reflective of the current state of research in the field.

(Questionnaire)

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