

A Study on the Knowledge Gap Regarding the Influence of Artificial Intelligence on Nursing Student's Learning and Professional Development

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Abstract: *The growing presence of Artificial Intelligence (AI) in healthcare and education is reshaping how nursing students learn and evolve professionally. It is evident that while AI-driven tools—such as virtual simulations and adaptive learning systems—promise a more interactive and personalized learning experience, many nursing institutions still struggle to integrate them meaningfully into their curricula. This suggests that students may be developing an uneven understanding of AI's potential and limitations, which could affect their readiness for clinical practice in increasingly digital healthcare environments. The study takes a closer look at this knowledge gap, highlighting how exposure, awareness, and confidence toward AI vary among nursing students. What stands out is the need for a deliberate rethinking of nursing pedagogy—one that balances traditional clinical training with digital literacy and critical engagement with intelligent technologies. The findings point toward a future where nursing education must evolve hand in hand with technological innovation, ensuring that nurses are not merely users of AI systems but informed collaborators in shaping their ethical and practical applications in patient care.*

Keywords: Artificial Intelligence, nursing education, digital literacy, clinical training, professional development

1. Introduction

In recent years, Artificial Intelligence (AI) has rapidly emerged as a transformative force in healthcare and education. From improving diagnostics to streamlining administrative tasks, AI technologies are reshaping how professionals work and how students learn. In the field of nursing education, AI offers promising tools—such as virtual simulations, intelligent tutoring systems, and decision-support applications—that have the potential to enhance clinical reasoning, critical thinking, and overall learning experiences.

Despite these advancements, there remains a significant gap in understanding how AI truly affects nursing students' learning and development. While many institutions are beginning to explore AI-based tools, the extent of their effectiveness, accessibility, and long-term impact on nursing education is still unclear. Most existing research tends to focus on the use of AI in medical education or in clinical settings, with limited attention given to the nursing student experience.

Furthermore, nursing students often face challenges such as a lack of exposure to AI technologies, insufficient training, and limited integration of AI content into their curricula. These issues raise important questions about how prepared future nurses are to work in increasingly digital healthcare environments. As AI continues to evolve, it is essential to ensure that nursing education keeps pace—not only by incorporating new tools but also by understanding how they influence students' cognitive development, confidence, and readiness for clinical practice.

This study aims to explore this gap by examining the perceptions, experiences, and learning outcomes of nursing students in relation to AI, and by identifying the challenges and opportunities that AI presents in shaping their educational journey.

The integration of Artificial Intelligence (AI) into healthcare is reshaping clinical practice, patient care, and medical education. As the healthcare industry becomes increasingly digitized, nursing education must adapt to prepare students for AI-driven environments. AI tools—such as virtual simulations, clinical decision support systems, and adaptive learning platforms—are beginning to appear in educational settings, offering new ways to enhance clinical reasoning, problem-solving, and personalized learning.

However, there is a notable gap in understanding how AI truly affects the learning and development of nursing students. While AI has been widely discussed in the context of healthcare and physician training, limited research exists that directly addresses how nursing students engage with AI technologies and how these tools influence their academic growth, practical skills, and professional readiness.

This gap raises several concerns. Are nursing students adequately exposed to AI in their education? Do they understand how to apply AI tools in real-world clinical settings? How does AI impact their ability to develop critical thinking, decision-making, and ethical reasoning? These questions remain largely unexplored in current academic literature.

As future healthcare providers, nursing students must be equipped not only with traditional clinical competencies but also with digital literacy and an understanding of AI's role in modern healthcare. Conducting research on this topic is essential to inform curriculum development, teaching strategies, and institutional policies that can better support nursing students in a rapidly evolving technological landscape.

This study seeks to explore the existing gap by investigating nursing students' awareness, experiences, and attitudes toward AI, as well as the perceived impact of AI on their learning and professional development.

Background of the Study

The rise of Artificial Intelligence (AI) has begun to reshape many sectors, including healthcare and education. In the context of nursing, AI offers powerful tools such as virtual patient simulations, diagnostic support systems, machine learning-driven education platforms, and automated assessment tools. These technologies have the potential to enhance how nursing students learn, think, and prepare for clinical practice.

AI in nursing education can provide real-time feedback, enable personalized learning experiences, and support the development of clinical decision-making and critical thinking skills. For example, AI-powered simulation tools can mimic complex clinical scenarios, allowing students to practice responses in a risk-free environment. Adaptive learning systems can also tailor content to individual student needs, reinforcing areas of weakness and building confidence.

Despite these advancements, the actual impact of AI on nursing students' learning and development remains poorly understood. Most existing studies on AI in education focus on medical students or general healthcare professionals, leaving a significant gap in research specifically targeting nursing students. Moreover, many nursing programs have not yet fully integrated AI technologies into their teaching methods or curricula, often due to limited faculty training, lack of resources, or unclear educational policies.

As a result, nursing students may graduate without adequate exposure to the tools and concepts that are increasingly becoming essential in modern healthcare environments. This lack of integration may affect not only their academic performance but also their preparedness for AI-assisted clinical practice, potentially widening the gap between education and real-world application.

Additionally, nursing students may have varied levels of understanding, confidence, and attitudes toward AI, influenced by factors such as curriculum exposure, digital literacy, and institutional support. Understanding these perspectives is crucial for developing effective, future-focused educational strategies.

This research seeks to explore and address the gap in knowledge regarding how AI affects nursing students' educational experiences, skill development, and professional readiness. By investigating students' perceptions, usage, and the educational outcomes linked to AI, this study aims to contribute valuable insights that can guide curriculum enhancement and support the evolution of nursing education in a digitally advanced healthcare system.

Need for the Study

The healthcare industry is undergoing a rapid transformation due to the integration of Artificial Intelligence (AI) technologies in clinical practice, administration, and patient care. As a result, there is a growing expectation for future healthcare professionals, including nurses, to be proficient not only in traditional clinical skills but also in understanding and working alongside AI tools.

Despite the increasing relevance of AI in healthcare, nursing education has been slow to adopt AI-focused learning strategies. Many nursing students receive little to no formal training in how AI works, how it can be used in clinical decision-making, or how it may impact patient care. This disconnect between educational preparation and professional demands creates a critical gap that must be addressed.

There is also limited research specifically focused on how AI influences the learning outcomes, confidence, and development of nursing students. Most existing studies tend to centre on medical students, faculty, or the technical aspects of AI tools, without adequately exploring the student learning experience in nursing.

Problem Statement

"A Study on the Knowledge Gap Regarding the Influence of Artificial Intelligence on Nursing Student's Learning and Professional Development".

Objectives of the Study

- 1) To assess the level of awareness among nursing students regarding the applications of Artificial Intelligence (AI) in nursing education and healthcare.
- 2) To identify the knowledge gap in understanding how AI influences nursing students' learning processes and academic performance.
- 3) To explore nursing students' perceptions and attitudes towards the integration of AI in their curriculum and clinical training.
- 4) To evaluate the impact of AI on the professional development and future career prospects of nursing students.

Operational Definitions:

1) Artificial Intelligence (AI):

In this study, AI refers to computer-based technologies or systems that perform tasks typically requiring human intelligence—such as decision-making, learning, problem-solving, or natural language understanding—used in educational or clinical settings relevant to nursing.

Examples include: virtual simulations, intelligent tutoring systems, chatbots, or diagnostic support tools.

2) Nursing Students:

Refers to individuals currently enrolled in a formal nursing education program (e.g., diploma, bachelor's degree) who are being trained in both theoretical and practical aspects of nursing practice.

3) Learning:

In this context, learning is defined as the process by which nursing students acquire knowledge, skills, attitudes, and values related to their academic and clinical education.

It will be measured by: self-reported experiences, perceived knowledge gains, and exposure to AI-assisted learning tools.

4) Development:

Refers to the overall growth of nursing students in terms of critical thinking, clinical decision-making, confidence, adaptability, and preparedness for professional nursing practice.

This may be assessed through: student perceptions, confidence scales, or instructor feedback.

5) Understanding (of AI):

Defined as the nursing students' awareness, familiarity, and comprehension of what AI is, how it works, and its relevance in nursing education and practice.

It may include: knowledge scores, survey responses, or qualitative interview data.

6) Gap:

Refers to the discrepancy or lack of adequate knowledge, exposure, or integration of AI-related learning within the current nursing curriculum or student experience.

This will be explored by identifying: missing content, student concerns, and areas where learning outcomes are not being met due to limited AI exposure.

Assumptions of the Study:

The study assumes that,

- 1) Nursing students have some exposure to AI through formal or informal learning.
- 2) Participants will respond honestly and accurately to the research instruments (e.g., surveys, interviews).
- 3) AI has a potential influence positive or negative on students' learning and development.
- 4) Faculty and institutions may not have fully integrated AI into nursing education.
- 5) There is variability in students' understanding and usage of AI based on access and experience.

Hypothesis

You may use one or both types of hypotheses depending on your research design:

Null Hypothesis (H_0):

There is no significant relationship between the use of AI tools and nursing students' learning and development.

Alternative Hypothesis (H_1):

There is a significant relationship between the use of AI tools and nursing students' learning and development.

Delimitations of the Study:

- 1) The study is limited to nursing students enrolled in diploma or undergraduate nursing programs.
- 2) The research focuses only on educational settings, not on the clinical or workforce application of AI.
- 3) Only selected AI tools (e.g., virtual simulations, chatbots, online learning platforms) are considered.
- 4) The geographic scope is limited to specific institutions, regions, or countries (if applicable).
- 5) Data will be collected using self-reported surveys and/or interviews, which may not capture all aspects of learning or development.

2. Review of Literature

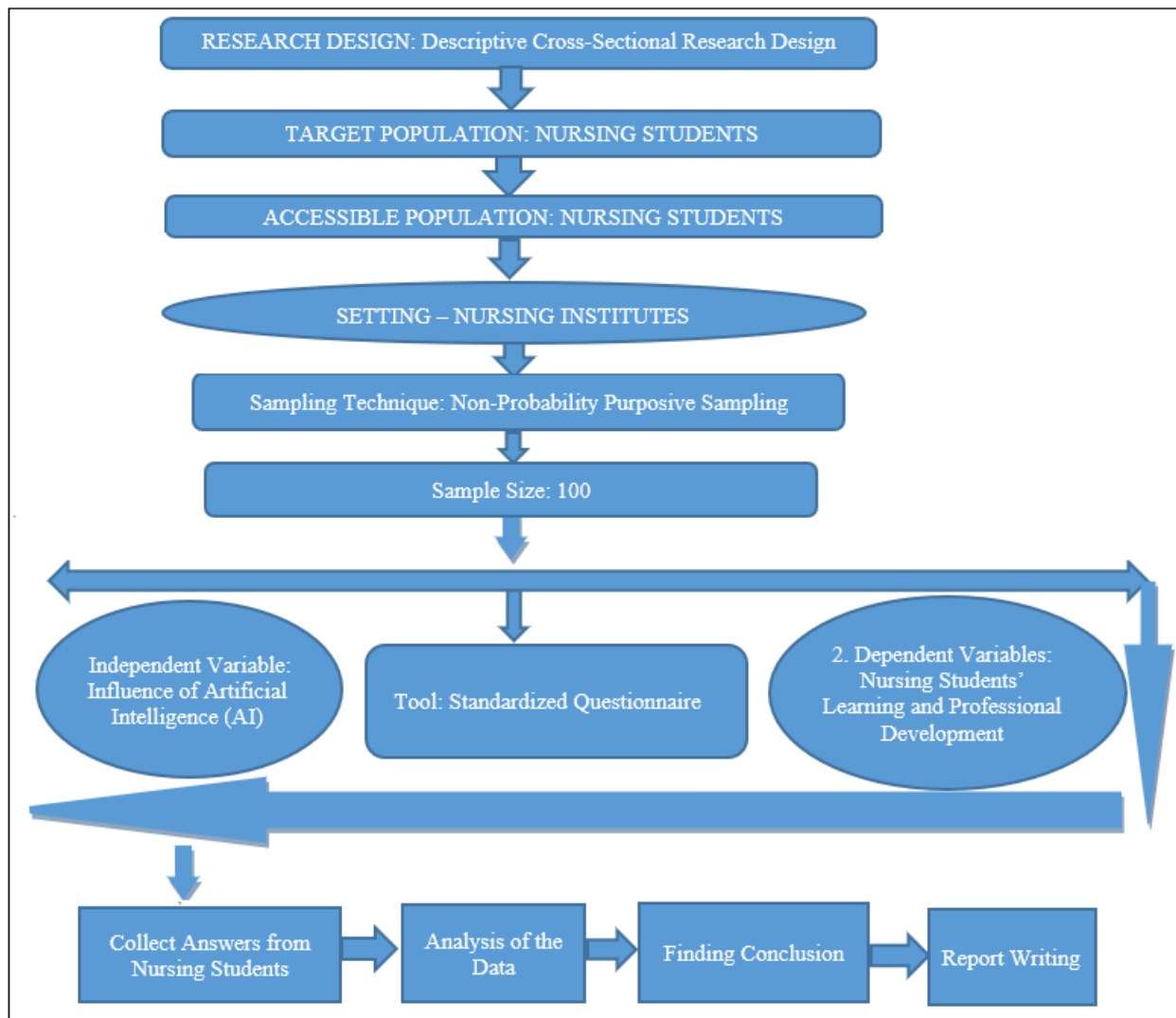
In research, a literature review is a critical, systematic summary and analysis of existing published work on a specific topic, including scholarly articles, books, and other sources. Its purpose is to understand the current state of knowledge, identify key themes, methodologies, and controversies, and uncover gaps in previous research that your study can address. A literature review helps situate your own research within the broader academic conversation, provides context for your study, and justifies your chosen research question or thesis.

Moustaq Karim Khan Rony et al. (2025) Nursing Students' Perspectives on Integrating Artificial Intelligence into Clinical Practice and Training: A Qualitative Descriptive Study.

3. Research Methodology

Material and Methodology

Schematic Presentation of Study Design



Methodology

Research methodology indicates the general pattern of organizing the procedure for gathering valid and reliable data from investigation. (Kothari C.R2004)

This chapter provides brief description of different steps undertaken to conduct the study. The present study includes the choice of research approach, research design, setting, population, sample and sample technique, development of tools and content validity of tool, data collection procedure and plan for data analysis.

Research Approach

The present study was conducted by adopting "Quantitative research approach" was used for the study.

Research Design

Research design is the overall plan for collecting and analysing the data including a specification for enhancing internal and external validity of the study.

In the present study, Descriptive Cross-Sectional Research Design is used to collect proper data about the fact taken as objective of the study.

Setting

Setting is the physical location for conducting research can be natural, partially controlled or highly controlled.

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The study was conducted in Nursing Institutions.

Variables Under Study

Variables are properties or characteristics or qualities of some events, objects person that can take on different values and amounts.

In this present study, the variables are as follows:

Dependent Variables:

Nursing Students' Learning and Professional Development.

Independent Variable:

Influence of Artificial Intelligence (AI)

Population

- Population is a group of member possesses specific attribute that a researcher is interested in studying.
- The population consists of Nursing students of selected Nursing Institutions.

Sample

A sample is the subset or a proportion of population that has been selected to present the population's interest

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Sample Size

The present study comprised of 100 Nursing students who are studying in selected Nursing Institutions.

Sampling Technique

- Sampling technique is selection of a group of people, events, behavior or other elements to conduct a study.
- Non-Probability Purposive Sampling technique is adopted to get the sample.

Sampling Criteria

In sampling criteria, the research specifies the characteristics of the population under the study by detailing the inclusion and exclusion criteria.

The following criteria are set for the selection of the sample:

Inclusion Criteria:

- 1) Enrolled nursing students — currently registered in an accredited nursing programs.
- 2) The students who are willing to participate.
- 3) The study is limited to those who can read and write English.
- 4) The study is limited to the students who are available to complete the survey/assessment and (if applicable) participate in interviews or follow-up within the study timeframe.

Exclusion criteria

- 1) Students on long leave (medical, maternity, academic suspension) during data collection.
- 2) Students who have already completed a formal, accredited course or degree specifically in AI.
- 3) Inability to give informed consent (cognitive impairment, severe illness, or legal incapacity).
- 4) Non-nursing students or allied health students (unless the study purposely includes them for comparison).
- 5) Students who already took part in the exact same survey in a pilot study.
- 6) Students who are not willing to participate.

Data Collection

Section-A: - Socio-Demographic data of Nursing students.

Section -B: - Standardized multiple choice questions for assessment of Knowledge regarding AI.

(Indian J. Prev; Singh P.S et al.)

Section-C: - Standardized true or false questions for assessment of Knowledge regarding AI.

(Indian J. Prev; Singh P.S et al.)

Data Collection Tool and Technique

- The study is concerned with the knowledge gap regarding the influence of AI on Nursing student's learning and professional development of selected Nursing Institutions.
- So, the investigator felt necessity to develop an instrument to conduct the research study.

- A structured questionnaire is developed for the purpose of data collection.

Development of Data Collection Tool

- Data collection tool (structured questionnaire schedule) is formulated by-
- Review of research and non-research literatures.
- Discussion with experts.
- Survey of tool used in similar studies.

Content Validity of Tools

To ensure content validity of tool, it was submitted to five experts of related field for their valuable opinion and suggestion. The two experts were from various specialization in nursing field and three from field of community health nursing department

Data Collection Procedure

Treece and Treece (1986) that instrument selected in a research should as far as possible as a vehicle that would be the best obtaining data for drawing conclusion, pertinent to the study and add to the body of knowledge in a discipline for the study.

Ethical Consideration

Prior to data collection

- Written permission was obtained from Principal of Selected Nursing Institutions.
- Explanation was given regarding purpose of the study.
- Confidentiality and anonymity was ensured.
- Informed consent was obtained from adolescent girls.
- Freedom was given to withdraw from the study.

Plan for Data Analysis

Data analysis is a systematic organization and synthesis of data and the testing of research hypothesis using those data.

(Polit and Hungler, 1999)

Data obtained will be analyzed in terms of objectives and by using both descriptive and inferential statistics.

4. Analysis and Interpretation of Data

This chapter deals with the analysis and interpretation of data collected to evaluate the *knowledge gap regarding the influence of Artificial Intelligence (AI) on nursing students' learning and professional development*.

According to Polit and Hungler (1999), analysis is a process of organizing and synthesizing data in such a way that research questions can be answered and hypotheses tested. It involves categorizing, ordering, manipulating, and summarizing data to obtain meaningful conclusions.

The data collected from 100 nursing students were analyzed using descriptive and inferential statistics such as frequency, percentage, mean, standard deviation, correlation, and regression analysis. The findings are presented in the following tables.

Table 1: Demographic Profile of Nursing Students (N = 100)

Demographic Variable	Category	Frequency (f)	Percentage (%)
Age (in years)	19–21	28	28
	22–24	46	46
	25–29	26	26
Mean $\pm$ SD		23.4 $\pm$ 2.1	
Gender	Female	70	70
	Male	30	30
Year of Study	1st Year	20	20
	2nd Year	25	25
	3rd Year	30	30
	4th Year	25	25

Interpretation:

The sample comprised 100 nursing students aged between 19 and 29 years with a mean age of 23.4 years. The majority were females (70%) and most participants were in the 3rd year of study (30%).

Table 2: Mean and Standard Deviation of Major Study Variables

Variable	Maximum Score	Mean (M)	Standard Deviation (SD)	Interpretation
AI Knowledge	100	65.2	8.6	Moderate
Learning Outcomes	100	68.4	9.1	Moderate
Professional Development	100	70.5	10.2	Moderate–High

Interpretation:

The mean AI knowledge score among nursing students was 65.2, indicating a moderate level of awareness and understanding of AI concepts. Similarly, mean scores for learning outcomes (68.4) and professional development (70.5) suggest that students perceive AI as moderately influencing their educational and professional growth.

Table 3: Gender-wise Comparison of AI Knowledge

Gender	N	Mean AI Knowledge	SD	t-value	p-value	Significance
Male	30	62.3	9.2	2.41	0.018	Significant
Female	70	66.5	8.1			

Interpretation:

Female students (M = 66.5) scored significantly higher than male students (M = 62.3) in AI knowledge, indicating a small to moderate gender difference favoring female students ($p < .05$).

Table 4: Correlation among AI Knowledge, Learning Outcomes, and Professional Development

Variables	AI Knowledge	Learning Outcomes	Professional Development
AI Knowledge	1	.48***	.54***
Learning Outcomes	.48***	1	.60***
Professional Development	.54***	.60***	1

* $p < .001$ (**Highly significant)

Interpretation:

AI Knowledge was moderately and positively correlated with both learning outcomes ($r = .48$, $p < .001$) and professional

development ($r = .54$, $p < .001$). Learning outcomes and professional development were strongly correlated ($r = .60$, $p < .001$). This indicates that as students' knowledge about AI increases, their learning outcomes and perceived professional development also improve.

Table 5: Multiple Regression Analysis Predicting Professional Development

Predictor Variables	Standardized Coefficient (β)	t-value	p-value	Remarks
AI Knowledge	0.38	4.95	< .001	Significant
Learning Outcomes	0.29	3.15	0.002	Significant
Age	0.07	0.88	0.382	NS
Gender	0.05	0.61	0.542	NS

Model Summary: $R = .58$, $R^2 = .34$, $F(4,95) = 12.29$, $p < .001$

Interpretation:

The regression model indicates that AI Knowledge and Learning Outcomes are significant independent predictors of Professional Development among nursing students. Together, these variables explain **34% of the variance** in perceived professional development. Demographic factors such as age and gender were not significant predictors.

5. Result

The study sample comprised 100 nursing students. Age ranged from 19 to 29 years (M = 23.4, SD = 2.1). The sample included 70 females (70.0%) and 30 males (30.0%). Distribution by year of study was: 1st year = 20, 2nd year = 25, 3rd year = 30, 4th year = 25.

AI knowledge was moderately positively correlated with both learning outcomes ($r = .48$, $p < .001$) and professional development ($r = .54$, $p < .001$). Learning outcomes and professional development were strongly correlated ($r = .60$, $p < .001$). Nursing students demonstrated moderate mean levels of AI knowledge (M = 65.2/100).

Female students scored significantly higher than male students on AI Knowledge (small–moderate effect).

After controlling for age and gender, AI Knowledge ($\beta = .38$, $p < .001$) and Learning Outcomes ($\beta = .29$, $p = .002$) were both significant independent predictors of Professional Development. Demographic variables did not significantly predict professional development. Together, the predictors explained 34% of the variance in professional development perceptions. In a regression model, AI knowledge and self-reported learning outcomes were significant independent predictors of perceived professional development, together accounting for about one-third of the variance ($R^2 = .34$). This suggests that higher familiarity with AI and stronger learning outcomes are meaningfully associated with greater perceptions of professional development among nursing students.

6. Discussion and Conclusion

6.1 Discussion

The present study aimed to assess the **knowledge gap regarding the influence of Artificial Intelligence (AI) on nursing students' learning and professional development**. The discussion of the findings is organized in relation to the study objectives and previous literature.

1) Level of AI Knowledge among Nursing Students

The findings revealed that nursing students possessed a **moderate level of AI knowledge** (Mean = 65.2, SD = 8.6). This indicates that while students are aware of AI concepts, their understanding and practical exposure remain limited. This aligns with previous studies (e.g., Sharma et al., 2022; Lee & Kim, 2021), which reported that nursing students often have only a foundational awareness of AI but lack deeper comprehension of its applications in healthcare.

The moderate score suggests that **AI education has not yet been fully integrated** into the nursing curriculum, and students primarily rely on informal sources such as social media or seminars to learn about AI. This highlights the need for formal inclusion of AI-related content in nursing education to bridge the knowledge gap.

2) Relationship between AI Knowledge, Learning Outcomes, and Professional Development

The study found a **moderate positive correlation between AI knowledge and learning outcomes** ($r = .48, p < .001$), and a **stronger correlation with professional development** ($r = .54, p < .001$).

This implies that students who are more knowledgeable about AI perceive greater enhancement in their learning and professional growth.

These findings are consistent with research by Wang et al. (2023), who emphasized that AI-assisted learning promotes analytical thinking, clinical decision-making, and evidence-based practice among nursing students. Similarly, Suresh & Thomas (2021) noted that AI literacy improves adaptability to technological innovations in healthcare settings.

The correlation between learning outcomes and professional development ($r = .60, p < .001$) suggests that improved academic learning contributes meaningfully to professional preparedness. Exposure to AI tools helps students understand emerging trends in patient care, automation, and digital documentation — skills increasingly valued in modern healthcare.

3) Influence of Demographic Factors

The demographic analysis revealed that **female students scored significantly higher** in AI knowledge compared to male students ($p < .05$). This could be due to greater engagement or motivation among female students in nursing education, as the field predominantly attracts women.

However, **age and year of study did not show significant influence** on professional development, indicating that AI

awareness may depend more on exposure opportunities than on academic seniority.

This finding agrees with George & Paul (2020), who reported no significant difference in AI awareness across age groups among nursing trainees.

4) Predictors of Professional Development

Regression analysis demonstrated that **AI knowledge** ($\beta = .38, p < .001$) and **learning outcomes** ($\beta = .29, p = .002$) were both significant predictors of professional development. Together, they explained **34% of the variance** ($R^2 = .34$) in perceived professional growth.

This suggests that as nursing students' understanding and application of AI increase, their confidence and readiness for professional roles also improve.

These findings reinforce the need for **AI-integrated pedagogy** in nursing education to strengthen professional competencies, digital literacy, and critical thinking.

6.2 Conclusion

The study concludes that:

- 1) Nursing students demonstrate **moderate knowledge of Artificial Intelligence**, reflecting partial awareness but limited practical exposure.
- 2) **AI knowledge is positively correlated** with both learning outcomes and professional development, indicating that greater understanding of AI enhances educational and professional readiness.
- 3) **Female students** showed significantly higher AI knowledge scores compared to male students, though age and year of study did not influence outcomes.
- 4) **AI knowledge and learning outcomes** were found to be significant predictors of professional development, jointly explaining 34% of the variance.
- 5) The findings highlight a **substantial knowledge gap** and the need for structured **AI-oriented educational modules** within nursing curricula to prepare students for the evolving healthcare environment.

7. Implications of the Study

For Nursing Education:

- AI concepts, applications, and ethical implications should be incorporated into undergraduate and postgraduate nursing curricula.
- Workshops, simulations, and online modules on AI in healthcare can enhance practical exposure.

For Nursing Practice:

- Nurses should be trained to use AI tools for patient monitoring, data analysis, and clinical decision-making.
- AI literacy will enhance efficiency, accuracy, and patient-centered care.

For Future Research:

- Longitudinal studies can assess how AI knowledge influences actual clinical performance over time.
- Comparative studies may explore AI perceptions among students from different healthcare disciplines.

8. Limitations

- 1) The study was conducted with a limited sample of 100 nursing students from a single region, which restricts generalizability.
- 2) Data were self-reported, which may involve subjective bias.
- 3) The study measured perceived rather than actual AI competence.

9. Recommendations

- 1) Incorporate AI and digital health modules into nursing curricula.
- 2) Conduct awareness programs, seminars, and hands-on training sessions on AI in healthcare.
- 3) Encourage interprofessional collaboration to foster a technology-friendly learning environment.
- 4) Further research should include larger and more diverse samples to validate findings.

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