Volume 3, Issue 10, 2025

Frontier in Medical & Health Research

ISSN: (e) 3007-1607 (p) 3007-1593

STUDY ON AI ADOPTION READINESS & ATTITUDES IN MANSEHRA PRIVATE NURSING COLLEGES STUDENTS

Maria Bushra[1], Fida Muhammad[*2], Four Dil Khan[3], Amir Bashir[4], Samreen Shehzadi[5], Arooj Mehtab[6], Esfa Daniel[7]

[1]*MSN, Principal, Abbottabad College of Nursing & Allied Health Sciences, Abbottabad*
[*2, 3, 4,5,6,7] *Post RN BSN Student, Abbottabad College of Nursing & Allied Health Sciences, Abbottabad*

[1]mariabushra88@gmail.com, [*2]fida2040276@gmail.com, [3]fouredilkhan55@gmail.com, [4]aamirabbasi2334@gmail.com, [5]shamoonrandhawa888@gmail.com, [6]iammehtab916@gmail.com, [7]esfa6885@gmail.com

DOI: https://doi.org/10.5281/zenodo.18124925

Keywords
artificial intelligence, nursing education, awareness, readiness, attitudes, barriers, Mansehra, private nursing colleges

Article History
Received: 15 December 2025
Accepted: 20 December 2025
Published: 31 December 2025

Copyright @Author
Corresponding Author: *
Fida Muhammad

Abstract

Artificial intelligence is increasingly influencing health care and education, yet effective integration in nursing education depends on students' awareness, readiness, attitudes, and the availability of institutional support. This study assessed artificial intelligence awareness, adoption readiness, attitudes, and perceived barriers among nursing students enrolled in private nursing colleges in Mansehra District, Khyber Pakhtunkhwa, Pakistan. A quantitative cross sectional survey design was used. Data were collected from 130 students using a structured, self-administered questionnaire comprising demographics and AI exposure items, an AI awareness scale, an AI readiness and attitudes scale, and a perceived barriers scale. Data were analyzed using descriptive statistics and inferential tests (independent samples t test, one way ANOVA, and Pearson correlation), with internal consistency assessed using Cronbach's alpha.

Results showed that students reported strong engagement with digital tools: 94.6% owned a study device and 95.4% had used AI tools for study. Formal AI training was limited (43.1%). Overall AI awareness and attitudes were high: 74.6% of students met the study's awareness criterion, and 92.3% reported positive attitudes toward integrating AI into nursing education. However, readiness to use AI tools was comparatively lower (65.4%). Female students demonstrated higher AI awareness than male students ($p < .05$), while semester of study showed no significant association with awareness. The most frequently reported barriers were privacy concerns (86.2%), limited digital infrastructure (76.9%), and fear of job displacement (71.5%), lack of structured training (66.9%), cost and accessibility issues (64.6%), and limited faculty preparedness (56.9%).

The study concludes that although nursing students in Mansehra private colleges show favorable attitudes toward AI, practical readiness is constrained by training gaps, infrastructure limitations, and ethical and professional concerns. It is recommended that AI content be formally integrated into nursing curricula alongside faculty development, infrastructure strengthening, and clear institutional guidelines for ethical and safe use. Future research should evaluate

Frontier in Medical & Health Research

ISSN: (e) 3007-1607 (p) 3007-1593

training interventions and include broader, probability based sampling for improved generalizability.

INTRODUCTION

Chapter 1:

1.1 Background

Artificial intelligence is increasingly used within health systems for tasks such as clinical decision support, risk prediction, triage support, documentation assistance, and workflow optimization. As digital health expands, global policy guidance emphasizes that effective implementation depends not only on access to technologies but also on governance, workforce capacity, and sustainable integration into routine care (World Health Organization [WHO], 2020). These requirements are especially relevant to nursing because nurses are central to patient monitoring, communication, documentation, and many technology mediated processes that influence safety and quality.

Alongside potential benefits, AI in health care introduces ethical and governance risks, including bias, lack of transparency, privacy threats, accountability gaps, and inequitable distribution of benefits. WHO guidance on ethics and governance of AI for health highlights the need for safeguards that protect human rights, promote transparency and accountability, and ensure that health workers are equipped to use AI safely and responsibly (WHO, 2021). The workforce preparedness component is therefore a core element of safe adoption.

In education, the rapid uptake of AI based tools, including generative systems, has intensified concerns related to privacy, academic integrity, equity, and the need for clear institutional guidance. UNESCO guidance emphasizes that educational institutions should develop policies and build human capacity to ensure that AI use benefits learners and teachers while protecting data and supporting responsible practice (UNESCO, 2023). UNESCO's Recommendation on the Ethics of Artificial Intelligence similarly promotes a human centred approach and calls for ethical guardrails, including protections for rights and dignity (UNESCO, 2021).

Empirical research suggests that health profession learners often report generally positive orientations toward AI, but readiness and literacy vary and are shaped by training exposure, institutional support, and perceived risks. A recent systematic review of nurses and nursing students found that attitudes are commonly moderately positive, while literacy and readiness are frequently limited, with training and digital competence linked to higher readiness and adoption intention (Alkhalifah et al., 2025). These patterns suggest that positive attitudes alone may not translate into responsible and competent use.

Evidence from Pakistan also indicates a need for structured preparation. A national cross sectional study involving health care students and professionals in Pakistan reported limited formal AI training alongside support for including AI content in undergraduate curricula (Habib et al., 2024). In addition, a nursing student study from Pakistan reported gaps in awareness and perception despite the presence of intention to adopt AI, indicating that willingness may not match preparedness without targeted education and institutional support (Sheraz et al., 2025). Together, these findings support the value of local assessments that can guide curriculum and policy decisions in specific educational settings.

Technology acceptance research provides useful lenses for understanding readiness and attitudes toward new systems. The Technology Acceptance Model proposes that perceived usefulness and perceived ease of use influence acceptance (Davis, 1989), and the Unified Theory of Acceptance and Use of Technology integrates determinants of intention and use such as performance expectancy and facilitating conditions (Venkatesh et al., 2003). These frameworks are frequently used in studies of technology adoption and can inform interpretation of student readiness and attitudes in nursing education contexts.

1.2 Problem Statement

Private nursing colleges in Mansehra District educate a diverse student population and are an important part of the regional nursing workforce pipeline. However, formal integration of AI related competencies, structured training opportunities, faculty preparedness, and institutional guidance may

Frontier in Medical & Health Research

ISSN: (e) 3007-1607 (p) 3007-1593

be limited or inconsistent across institutions. In the absence of local evidence about students' AI awareness, readiness, attitudes, and perceived barriers, institutions may struggle to design relevant curriculum enhancements and capacity building initiatives. This is a practical concern because international guidance stresses that safe and meaningful AI adoption requires governance, ethical safeguards, and workforce readiness (UNESCO, 2021, 2023; WHO, 2021).

1.3 Purpose of the Study

The purpose of this study is to assess AI awareness, AI adoption readiness, attitudes toward AI, and perceived barriers to AI adoption among nursing students in private nursing colleges in Mansehra District, Khyber Pakhtunkhwa, Pakistan, using a quantitative cross sectional survey design.

1.4 Research Questions and Objectives

1.4.1 Research Questions

1. What is the level of AI adoption readiness among nursing students in private nursing colleges in Mansehra?
2. What are students' attitudes toward integrating AI into nursing education and future practice?
3. What is the level of AI awareness regarding concepts and applications relevant to health care and learning?
4. What barriers and concerns do students perceive as influencing AI adoption, including privacy, infrastructure, training, policy, and professional concerns?
5. What relationships exist between AI awareness, readiness, attitudes, perceived barriers, and selected demographic or academic characteristics?

1.4.2 Research Objectives

1. Measure AI adoption readiness among nursing students in private nursing colleges in Mansehra.
2. Assess students' attitudes toward integrating AI in nursing education and practice.
3. Evaluate students' awareness of AI concepts and applications relevant to health care and learning.
4. Identify perceived barriers and concerns affecting AI adoption.
5. Examine relationships between AI awareness, readiness, attitudes, and selected demographic or academic variables.

1.5 Significance of the Study

This study is significant for nursing education and institutional planning in Mansehra in several ways. First, it will provide baseline evidence on students' awareness, readiness, and attitudes, supporting evidence informed curriculum planning and training development. This aligns with global priorities for strengthening human capacity for digital health transformation (WHO, 2020). Second, by identifying perceived barriers such as infrastructure and training gaps, the findings can support targeted institutional strategies that improve facilitating conditions for responsible use (Venkatesh et al., 2003; WHO, 2020). Third, documenting privacy and ethical concerns can guide policy development consistent with international recommendations for ethical governance and responsible adoption (UNESCO, 2021; WHO, 2021). Finally, the study contributes local evidence from private nursing colleges in Mansehra, a context that is under represented in the broader literature, and can inform future intervention studies evaluating whether structured training improves readiness and responsible practices (Alkhalifah et al., 2025).

1.6 Operational Definitions

Artificial intelligence (AI) refers to computer based systems that perform tasks commonly associated with human intelligence, such as pattern recognition, classification, prediction, and decision support (WHO, 2021).

AI awareness is defined as the extent to which students understand foundational AI concepts and can recognise examples of AI use in health care and education. In this study, AI awareness is measured using Section B of the study questionnaire.

AI adoption readiness refers to students' perceived preparedness and willingness to learn and use AI tools appropriately in academic and, where relevant, clinical contexts. In this study, readiness is measured using Section C of the study questionnaire and is interpreted in relation to technology acceptance theory (Davis, 1989; Venkatesh et al., 2003).

Frontier in Medical & Health Research

ISSN: (e) 3007-1607 (p) 3007-1593

Attitudes toward AI refer to students' positive or negative evaluations of integrating AI into nursing education and practice, including perceived usefulness and concerns. In this study, attitudes are assessed using Section C of the study questionnaire (Davis, 1989).

Perceived barriers refer to student reported factors that may hinder AI adoption, such as privacy concerns, limited infrastructure, lack of training, cost, lack of institutional policy, and ethical concerns. In this study, barriers are measured using Section D of the study questionnaire (UNESCO, 2023; WHO, 2021).

Private nursing colleges in Mansehra are registered nursing education institutions located in Mansehra District that are privately administered.

Chapter 2:
Literature Review

2.1 Introduction

This chapter reviews scholarly and policy literature on artificial intelligence in health care and nursing education, focusing on four areas aligned with the present study: AI awareness, adoption readiness, attitudes, and perceived barriers. The review synthesizes global guidance on digital health and ethical governance, empirical evidence from nursing and health professions education, and adoption theory frameworks that inform interpretation of readiness and acceptance. International reports emphasize that digital transformation depends on infrastructure, governance, and human capacity, which makes workforce readiness in nursing education a central concern (World Health Organization [WHO], 2020, 2021). Recent education guidance also stresses the need for institutional policies and capacity building for responsible use of generative AI tools (UNESCO, 2023).

2.2 Global Trends in AI Adoption

2.2.1 AI in Clinical Practice

AI tools are increasingly deployed across clinical workflows, including risk prediction, monitoring support, decision support, and documentation assistance. However, global guidance highlights that health sector AI introduces risks related to privacy, transparency, accountability, bias, and unequal impacts if safeguards are weak (WHO, 2021). The WHO guidance outlines ethical principles and governance priorities, emphasizing human oversight, patient safety, and protection of rights when AI is used in health contexts (WHO, 2021). These considerations are directly relevant for nursing because nurses are frequent end users of clinical technologies and are responsible for safe implementation within patient care environments.

At the system level, WHO's global strategy for digital health underscores that implementation requires coordinated investment in human resources, organizational capacity, and technological infrastructure rather than technology acquisition alone (WHO, 2020). This implies that student preparation and institutional readiness in nursing education are necessary conditions for safe future adoption.

2.2.2 AI in Nursing Education

Nursing education is responding to AI expansion through discussions of AI literacy, competency development, and curriculum integration. Systematic evidence indicates that AI related content is being introduced unevenly across programmes and that educators often face limited institutional support and limited training to teach AI competencies (El Banna et al., 2025). The same review also reports substantial variation in measured awareness and attitudes across nursing populations and settings, supporting the need for context specific assessment before curricular decisions are made (El Banna et al., 2025).

Generative AI tools have amplified urgency because students can access them easily for learning tasks, writing, and study support, which creates both opportunities and integrity risks. A call to action in Nurse Education Today argues that nursing programmes should explicitly teach generative AI literacy, including evaluation of outputs, safe use, and ethical practice, rather than treating student use as purely a disciplinary concern (Simms, 2025). UNESCO guidance similarly recommends policy development, protection of data privacy, and human capacity development to support responsible integration of generative AI in education (UNESCO, 2023).

Empirical synthesis focused on nursing students suggests that AI supported educational interventions can improve learning outcomes and attitudes,

Frontier in Medical & Health Research

ISSN: (e) 3007-1607 (p) 3007-1593

although the evidence base is still developing. A systematic review in International Nursing Review found that available studies reported generally positive associations between AI interventions and nursing students' knowledge acquisition, skills development, and attitudes, while also noting that the evidence remains limited in size and scope (Bozkurt et al., 2025).

2.3 AI Awareness and Knowledge

2.3.1 Limited Understanding despite Exposure

Across many contexts, nursing students report exposure to AI related tools while demonstrating variable AI literacy. A global systematic review of nursing students and nurses found that learners often report moderately positive attitudes toward AI, but literacy and readiness are commonly moderate or limited, and are influenced by training exposure and digital competence (Alkhalifah et al., 2025). This pattern supports the distinction between informal tool use and deeper understanding of how AI systems function, what risks they pose, and how to evaluate outputs responsibly.

This gap is particularly important because responsible clinical use requires recognizing limitations of AI outputs, understanding bias risks, and maintaining accountability for decisions. WHO guidance notes that AI systems can amplify existing inequities and cause harm if used without appropriate oversight and governance (WHO, 2021). Therefore, awareness should include not only recognizing examples of AI, but also understanding privacy risks, bias, and the need for human judgement.

2.3.2 AI Awareness in Pakistan

Evidence from Pakistan indicates similar or greater gaps in formal training and awareness. A cross sectional study in PLOS Digital Health examining health care students and professionals in Pakistan assessed knowledge, attitudes, and perceptions and highlighted training limitations alongside generally positive views about AI's potential (Habib et al., 2024). Nursing specific evidence also points to limited awareness despite positive intention. A recent study in the Journal of the Pakistan Medical Association reported that many nursing students had poor awareness and poor perception, while intention to adopt AI was more positive, suggesting that willingness may not reflect preparedness (Sheraz et al., 2025).

These findings support the rationale for local assessment in Mansehra's private nursing colleges. The present study's focus on awareness and readiness responds to the need to document baseline conditions before curriculum reforms or institutional policies are developed.

2.4 AI Readiness and Adoption Models

Readiness and acceptance are often interpreted using technology adoption theories that explain why individuals intend to use technologies and what conditions support use.

2.4.1 Technology Acceptance Model

The Technology Acceptance Model proposes that perceived usefulness and perceived ease of use are key determinants of acceptance and use of information technologies (Davis, 1989). In educational contexts, these constructs relate to whether students believe AI tools improve learning performance and whether they feel capable of using the tools effectively. This model supports examining readiness and attitudes together, since perceived benefit and usability can shape both confidence and intention.

2.4.2 Unified Theory of Acceptance and Use of Technology

The Unified Theory of Acceptance and Use of Technology integrates multiple acceptance theories and identifies core determinants such as performance expectancy, effort expectancy, social influence, and facilitating conditions (Venkatesh et al., 2003). This framework is relevant to nursing education because facilitating conditions map closely onto barriers frequently reported in the literature, including inadequate infrastructure, insufficient training, and lack of institutional guidelines. Where facilitating conditions are weak, acceptance and sustained use may remain low even when attitudes are positive.

2.4.3 Technology Readiness

Technology readiness research focuses on individuals' propensity to embrace new technologies, including dimensions such as optimism and discomfort. The updated Technology Readiness Index (TRI 2.0) provides a framework for understanding why some

Frontier in Medical & Health Research

ISSN: (e) 3007-1607 (p) 3007-1593

individuals are more prepared to adopt emerging technologies than others (Parasuraman & Colby, 2015). This complements acceptance models by acknowledging that individual differences can shape readiness, anxiety, and trust in AI outputs, which are frequently reported in nursing student studies (Alkhalifah et al., 2025).

2.5 Attitudes Toward AI

2.5.1 Optimism and Enthusiasm

A consistent theme across reviews is that nursing students often express interest in AI and recognize potential educational and clinical benefits. The global systematic review by Alkhalifah et al. (2025) reported generally moderately positive attitudes, and the education focused review by Bozkurt et al. (2025) described positive shifts in engagement and confidence in studies involving AI supported learning. In Pakistan, broader health professions evidence similarly suggests that attitudes are often favorable even when formal training is limited (Habib et al., 2024).

2.5.2 Concerns and Skepticism

Despite optimism, concerns about trust, reliability, and professional impact persist. The global synthesis by Alkhalifah et al. (2025) identified anxiety and concerns related to integrity and reliability as factors that can reduce readiness. WHO guidance emphasizes that lack of transparency, bias, and accountability risks can undermine trust and patient safety if AI systems are adopted without safeguards (WHO, 2021). In educational contexts, UNESCO guidance highlights privacy and governance concerns, including risks associated with unregulated generative AI use (UNESCO, 2023). These concerns support measuring both positive attitudes and negative expectations, including fears about job displacement or reduced professional value, as included in the present study instrument.

2.6 Perceived Barriers to AI Adoption

2.6.1 Technological Infrastructure

Infrastructure is repeatedly identified as a prerequisite for meaningful adoption. WHO's digital health strategy explicitly links successful implementation to adequate technological resources and enabling systems, not simply the availability of tools (WHO, 2020). In low and middle income settings, inconsistent internet access, device constraints, and limited institutional digital infrastructure can directly reduce opportunities for training and safe experimentation, making readiness uneven across students.

2.6.2 Lack of Training and Faculty Preparedness

Training gaps are among the most consistent barriers. A meta analytic review of AI literacy and competency in nursing education reported that faculty preparedness and institutional support are common bottlenecks to curriculum integration (El Banna et al., 2025). A generative AI literacy call to action argues that programmes should explicitly teach how to evaluate and use AI outputs responsibly and incorporate structured guidance rather than relying on informal learning (Simms, 2025). In Pakistan, limited formal training is also highlighted in health professions evidence (Habib et al., 2024) and nursing student findings showing poor awareness and perception (Sheraz et al., 2025).

2.6.3 Cost and Accessibility

Cost and access barriers relate to software subscriptions, data packages, and device availability. These factors intersect with equity concerns emphasized in global ethics guidance, which warns that AI can widen disparities if benefits accrue mainly to those with better access and resources (UNESCO, 2021; WHO, 2021). Measuring student reported cost and access barriers is therefore important for planning equitable educational interventions.

2.6.4 Ethical and Governance Concerns

Ethical concerns include privacy, bias, unclear accountability, and the risk of misuse for academic work. UNESCO's ethics recommendation and generative AI guidance both emphasise human centred governance, privacy protection, and policy development to prevent harm and misuse (UNESCO, 2021, 2023). WHO similarly stresses governance mechanisms to ensure AI benefits the public and protects rights (WHO, 2021). These principles align with common student concerns about uploading sensitive information, trusting outputs, and unclear institutional rules, which are directly assessed by the present study's perceived barriers scale.

Frontier in Medical & Health Research

ISSN: (e) 3007-1607 (p) 3007-1593

2.7 Summary

The reviewed literature indicates that AI is expanding in health care and education, but safe integration depends on governance, infrastructure, and workforce capacity (WHO, 2020, 2021; UNESCO, 2021, 2023). Empirical evidence suggests that nursing students often have generally positive orientations toward AI, while awareness and readiness vary widely and are strongly influenced by training exposure, digital competence, and institutional support (Alkhalifah et al., 2025; El Banna et al., 2025). In Pakistan, available studies similarly show limited training and mixed awareness despite positive intention, supporting the need for local baseline assessment (Habib et al., 2024; Sheraz et al., 2025). Technology acceptance and readiness theories provide useful frameworks to interpret how perceived usefulness, usability, facilitating conditions, and individual readiness shape adoption intentions (Davis, 1989; Parasuraman & Colby, 2015; Venkatesh et al., 2003). These findings justify the present study's focus on awareness, readiness, attitudes, and perceived barriers among nursing students in private colleges of Mansehra.

Chapter 3:
Research Methodology

3.1 Introduction

This chapter describes the methods used to assess artificial intelligence awareness, adoption readiness, attitudes, and perceived barriers among nursing students enrolled in private nursing colleges in Mansehra District. The methodology is aligned with the study objectives and the structured questionnaire (Annexure I). The chapter presents the research design, setting, population, sampling, sample size estimation, research instrument, validity and reliability procedures, data collection and analysis plans, and ethical considerations (Creswell & Creswell, 2018; Polit & Beck, 2021).

3.2 Research Design

A quantitative cross sectional survey design will be used to measure participants' awareness, readiness, attitudes, and perceived barriers at a single point in time. Cross sectional designs are appropriate for describing distributions of variables and examining associations among variables in real world educational settings (Creswell & Creswell, 2018; Polit & Beck, 2021).

3.3 Population of the Study

The study population will include nursing students enrolled in private nursing colleges located in Mansehra District, Khyber Pakhtunkhwa, Pakistan. Eligible participants will be those present during the data collection period and willing to provide informed consent.

3.4 Sampling Technique

Non probability convenience sampling will be used due to feasibility constraints and access considerations across multiple institutions. Convenience sampling is commonly used in nursing education research when probability sampling is not operationally possible, though it may limit generalizability (Polit & Beck, 2021).

3.5 Sample Size Determination

A target sample of approximately 130 students will be recruited. The sample size is based on the ability to detect a small to moderate correlation between core constructs such as awareness and readiness (for example, $r \approx .25$) with alpha = .05 and power near .80. Power calculations for correlation can be conducted using Fisher's z transformation methods (Fisher, 1915, 1921; WebPower documentation).

To reduce the impact of incomplete responses or nonresponse, the minimum estimated requirement is increased to approximately 130 participants.

3.6 Research Instrument

Data will be collected using a structured, self-administered questionnaire developed for this study. Scale development and structured item design principles were followed to ensure clarity and alignment with the study constructs (DeVellis, 2016).

3.6.1 Section A: Demographics and AI Exposure

Section A includes 11 items assessing age, gender, program, semester, device ownership, internet access, AI tool use, frequency of use, formal AI training, training source, and whether AI content is included in the curriculum.

Frontier in Medical & Health Research

ISSN: (e) 3007-1607 (p) 3007-1593

3.6.2 Section B: AI Awareness Scale

Section B consists of 10 Likert type items assessing understanding of basic AI concepts, recognition of AI in health care, awareness of errors and the need for human checking, privacy risks, bias, and the need for institutional guidance. Responses are recorded on a 5 point scale from 1 (strongly disagree) to 5 (strongly agree). Likert scaling is appropriate for measuring attitudes and perceived knowledge when items are carefully constructed and internally consistent (DeVellis, 2016).

3.6.3 Section C: AI Readiness and Attitudes Scale

Section C consists of 12 Likert type items measuring readiness (confidence, willingness to learn, perceived preparedness) and attitudes (perceived importance and usefulness), as well as concerns related to anxiety, trust, and job displacement. Several items are conceptually informed by technology adoption theory, which emphasizes perceived usefulness, perceived ease of use, and facilitating conditions as determinants of acceptance (Davis, 1989; Venkatesh et al., 2003).

3.6.4 Section D: Perceived Barriers to AI Adoption Scale

Section D includes 10 Likert type items assessing barriers such as privacy concerns, limited infrastructure, lack of training, lack of faculty preparedness, cost and accessibility, lack of institutional guidelines, fear of job displacement, potential misuse due to unclear rules, limited demonstrations, and ethical concerns.

3.7 Validity of the Instrument

3.7.1 Content Validity

Content validity will be established through expert review to evaluate whether items adequately represent the constructs of AI awareness, readiness and attitudes, and perceived barriers. A small panel of relevant experts (for example, nursing education faculty and research supervisors) will review the instrument for relevance, clarity, and coverage. Expert based content validation is a standard approach in instrument development and nursing research (DeVellis, 2016; Polit & Beck, 2021).

3.7.2 Face Validity

Face validity will be assessed by piloting the questionnaire with a small group of nursing students from a similar population. Participants will be asked to comment on item clarity, ambiguity, and completion time. Feedback will be used to refine wording and improve comprehension prior to full data collection (Polit & Beck, 2021).

3.8 Reliability

Internal consistency reliability will be assessed using Cronbach's alpha for each scale (Awareness, Readiness and Attitudes, and Barriers). Cronbach's alpha is a widely used indicator of internal consistency for multi item scales (Cronbach, 1951). Interpretation of alpha will follow established measurement guidance and will be reported for each subscale (DeVellis, 2016).

3.9 Data Collection Procedure

1. Administrative permission will be obtained from each participating private nursing college.
2. Eligible students will be briefed on the purpose of the study, voluntary participation, confidentiality, and their right to withdraw without penalty.
3. Written informed consent will be obtained prior to participation.
4. The questionnaire will be administered in paper format and or a controlled online format, depending on institutional feasibility.
5. Privacy will be maintained during completion, and questionnaires will be collected immediately after completion.
6. Questionnaires will be coded using participant IDs only; no names will be recorded. Data will be stored securely in password protected files, and paper forms will be stored in a locked location.

3.10 Data Analysis

3.10.1 Descriptive Statistics

Data will be analyzed using SPSS or an equivalent statistical package. Descriptive statistics will include frequencies, percentages, means, and standard deviations for demographic variables and scale scores (Polit & Beck, 2021).

Frontier in Medical & Health Research

ISSN: (e) 3007-1607 (p) 3007-1593

3.10.2 Inferential Statistics

Inferential analyses will be conducted to address study objectives and explore associations:

1. Independent samples t tests for comparisons across two groups (for example, gender; trained versus untrained).
2. One way ANOVA for comparisons across multiple groups (for example, semester).
3. Pearson correlation to examine relationships among awareness, readiness and attitudes, and perceived barriers.
4. The level of significance will be set at $p < .05$ (Polit & Beck, 2021).

3.11 Ethical Considerations

Ethical approval will be obtained through the relevant institutional process prior to data collection. Participation will be voluntary, and written informed consent will be required. Confidentiality will be maintained by using anonymous codes rather than names, securing data storage, and reporting results in aggregate form only. These protections align with standard ethical requirements for research involving human participants in nursing and education settings (Polit & Beck, 2021).

3.12 Summary

This study will use a quantitative cross sectional design to measure AI awareness, readiness and attitudes, and perceived barriers among nursing students in private nursing colleges in Mansehra. Convenience sampling will be used to recruit approximately 130 participants. Data will be collected using a structured questionnaire and analyzed using descriptive statistics, reliability testing with Cronbach's alpha, and inferential tests including t tests, ANOVA, and Pearson correlation. Instrument validity will be supported through expert content review and student piloting, and ethical safeguards will be implemented throughout the study.

Chapter 4:
Results

4.1 Demographic Characteristics of Participants

A total of **130** nursing students from private nursing colleges in Mansehra participated in the study. Most participants were **female (62.3%, n = 81),** while **37.7% (n = 49)** were male. Regarding semester, most students were in the **third semester (45.4%, n = 59),** followed by the **second semester (29.2%, n = 38)** and **fourth semester (25.4%, n = 33).** The majority reported owning a digital device for study **(94.6%, n = 123)** and reported prior use of AI tools **(95.4%, n = 124).** However, fewer than half reported any formal AI training **(43.1%, n = 56).**

Table 4.1 - Demographic Profile of Participants (n = 130)

Variable	Category	Frequency (n)	Percentage (%)
Gender	Male	49	37.7
	Female	81	62.3
Semester	2nd Semester	38	29.2
	3rd Semester	59	45.4
	4th Semester	33	25.4
Digital Device Ownership	Yes	123	94.6
	No	7	5.4
Prior Use of AI Tools	Yes	124	95.4
	No	6	4.6
Formal AI Training	Yes	56	43.1
	No	74	56.9

4.2 Level of Artificial Intelligence Awareness

AI awareness was assessed and then categorized as "Yes" for participants who met the awareness criterion used in the report. Based on Table 4.2, **74.6% (n = 97)** of students were categorized as AI aware. Female students showed higher AI awareness **(80.2%, n = 65)** compared with male students **(65.3%, n = 32).** The report indicated that this difference was statistically

Frontier in Medical & Health Research

ISSN: (e) 3007-1607 (p) 3007-1593

significant (**p < .05**). The report also stated that there was no statistically significant association between semester of study and AI awareness.

Table 4.2 - Association between Gender and AI Awareness (n = 130)

Gender	AI Awareness (Yes) n (%)	Statistical Significance
Male (n = 49)	32 (65.3%)	
Female (n = 81)	65 (80.2%)	p < .05

4.3 AI Readiness and Student Attitudes

Most participants reported positive attitudes toward integrating AI into nursing education. Overall, **92.3% (n = 120)** reported excitement and positive attitudes toward AI integration. In contrast, **65.4% (n = 85)** reported that they felt ready to use AI tools in academic or clinical learning contexts. Additional indicators of readiness and perceptions are summarized in Table 4.3. Most respondents believed AI is important in nursing **(80.0%, n = 104)** and understood AI's role in health care **(75.4%, n = 98).** A smaller proportion reported that AI content is covered in their curriculum **(60.0%, n = 78),** suggesting a gap between interest and formal educational preparation.

Table 4.3 - AI Readiness and Perception Indicators (n = 130)

Statement	Agree n (%)
Believe AI is important in nursing	104 (80.0%)
Understand AI's role in health care	98 (75.4%)
Feel ready to use AI tools	85 (65.4%)
Can identify AI tools	85 (65.4%)
AI covered in curriculum	78 (60.0%)

4.4 Perceived Barriers to Artificial Intelligence Adoption

Despite high interest and generally positive attitudes, students reported multiple barriers that could hinder safe and effective AI adoption. The most frequently reported barrier was **data privacy concerns (86.2%, n = 112).** Other major barriers included **limited infrastructure (76.9%, n = 100)** and **fear of job displacement (71.5%, n = 93).** Training and support barriers were also common, including **lack of student training (66.9%, n = 87), cost and accessibility issues (64.6%, n = 84), and untrained faculty (56.9%, n = 74).**

Table 4.4 - Perceived Barriers to AI Adoption (n = 130)

Barrier	Agree n (%)
Data privacy concerns	112 (86.2%)
Limited infrastructure	100 (76.9%)
Fear of job displacement	93 (71.5%)
Lack of student training	87 (66.9%)
Cost and accessibility issues	84 (64.6%)
Untrained faculty	74 (56.9%)

4.5 Summary of Key Findings

- Most respondents were female (62.3%), and most were enrolled in the third semester (45.4%).
- Device ownership and informal AI tool use were common (94.6% and 95.4%, respectively).
- Formal AI training was limited (43.1%).

Frontier in Medical & Health Research

ISSN: (e) 3007-1607 (p) 3007-1593

- AI awareness (categorized as "Yes") was 74.6% overall, with higher awareness among females than males ($p < .05$).
- Positive attitudes toward AI integration were high (92.3%), but readiness to use AI tools was lower (65.4%).
- The leading barriers were privacy concerns, infrastructure limitations, fear of job displacement, limited training, cost and access issues, and limited faculty capacity.

Chapter 5:
Conclusion and Recommendations

5.1 Conclusion

This study assessed artificial intelligence awareness, adoption readiness, attitudes, and perceived barriers among nursing students in private nursing colleges in Mansehra District using a structured, self-administered questionnaire. The findings indicate that students demonstrate strong interest and generally positive attitudes toward integrating artificial intelligence into nursing education. However, readiness to use artificial intelligence tools and formal training exposure remain limited. In addition, students reported substantial concerns about privacy, infrastructure constraints, and professional implications, which may hinder safe and sustainable adoption.

Overall, the pattern of findings suggests an important readiness gap: students are willing and optimistic, yet institutional capacity and structured preparation appear insufficient. This conclusion aligns with international guidance emphasizing that responsible adoption requires governance, workforce competence, and enabling conditions rather than technology access alone (World Health Organization [WHO], 2020, 2021; UNESCO, 2021, 2023).

5.2 Recommendations

Recommendations are organized according to the study findings and are aligned with global education and health governance guidance for safe use of artificial intelligence (UNESCO, 2021, 2023; WHO, 2020, 2021).

5.2.1 Curriculum Development

1. **Integrate core artificial intelligence competencies** into nursing curricula, including basic concepts, appropriate use, limitations, bias awareness, and safe learning practices.
2. Develop **module based content** that explicitly addresses ethical and professional accountability in technology supported care, consistent with WHO emphasis on safe governance and human oversight (WHO, 2021).
3. Include **applied learning activities** such as guided demonstrations, supervised practice tasks, and case based discussions to improve readiness beyond awareness.

5.2.2 Faculty Training

1. Implement structured faculty development programmes to strengthen educators' ability to teach artificial intelligence concepts and supervise student use responsibly.
2. Provide faculty guidance on academic integrity and assessment design in the context of widely available generative tools, consistent with UNESCO's emphasis on institutional capacity building (UNESCO, 2023).
3. Establish a small group of trained faculty leads in each institution to support ongoing mentoring and oversight.

5.2.3 Infrastructure Support

1. Strengthen digital infrastructure in participating colleges, including reliable internet access, adequate computer lab facilities, and access to learning platforms, because infrastructure limitations were among the most commonly reported barriers.
2. Ensure equitable access by prioritising low cost or institution supported resources to reduce cost related barriers, consistent with international concerns about equity in digital transformation (UNESCO, 2021; WHO, 2020).

5.2.4 Ethical Guidelines and Privacy Protection

1. Develop and disseminate institutional guidelines that clearly prohibit uploading patient or confidential institutional data into public tools, and provide safe alternatives for learning activities.
2. Provide student oriented training on privacy, confidentiality, and responsible use, reflecting global recommendations for ethical governance in health and education (UNESCO, 2021; WHO, 2021).

Frontier in Medical & Health Research

ISSN: (e) 3007-1607 (p) 3007-1593

3. Include reporting mechanisms and supervision practices to reduce misuse and clarify accountability.

5.2.5 Student Capacity Building

1. Offer short skill based workshops focused on safe and effective educational use, including evaluating output quality, verifying information with credible sources, and recognizing limitations.
2. Provide orientation sessions for new cohorts so readiness improves early in the programme, addressing the gap between positive attitude and practical confidence.
3. Encourage responsible peer learning through supervised study groups and guided practice sessions.

5.2.6 Policy Recommendations

1. Colleges should adopt a written institutional policy on acceptable use in education, assessment rules, privacy requirements, and academic integrity expectations, consistent with UNESCO guidance on governance for generative tools (UNESCO, 2023).
2. At the regional level, nursing education stakeholders may consider developing a shared minimum standard for artificial intelligence literacy and safe use to reduce variation across institutions.
3. Policies should be reviewed periodically to keep pace with rapid developments in educational tools and to maintain alignment with ethical and safety standards (WHO, 2021; UNESCO, 2021).

5.2.7 Future Research

1. Conduct multi district studies using probability sampling where feasible to improve generalizability and enable comparisons across institutional types.
2. Evaluate training interventions using pretest and posttest designs to determine whether structured teaching improves readiness, ethical understanding, and responsible practice.
3. Add objective measures of competence, such as scenario based knowledge tests, to complement self-reported readiness and attitude measures.
4. Explore faculty perspectives and institutional readiness through mixed methods designs to provide a fuller implementation picture.

5.3 Final Conclusion

In conclusion, nursing students in private nursing colleges in Mansehra show high interest and positive attitudes toward artificial intelligence, but readiness is constrained by limited formal training, infrastructure barriers, and prominent concerns about privacy and professional impact. Strengthening curriculum content, developing faculty capacity, improving infrastructure, and implementing clear ethical and governance guidelines are essential steps for safe and sustainable integration. These actions are consistent with international recommendations that emphasize human capacity, governance, and equity as prerequisites for responsible digital transformation in health and education (WHO, 2020, 2021; UNESCO, 2021, 2023).

REFERENCES

Alkhalifah, S., Abdrbo, A., Hassanein, S., & Sagbakken, M. (2025). Artificial intelligence in nursing: A systematic review of attitudes, literacy, readiness, and adoption intentions among nursing students and practicing nurses. *Frontiers in Digital Health, 7*, 1666005. https://doi.org/10.3389/fdgth.2025.1666005

Bozkurt, S. A., Aydoğan, S., Dursun Ergezen, F., & Türkoğlu, A. (2025). A systematic review and sequential explanatory synthesis: Artificial intelligence in healthcare education, a case of nursing. *International Nursing Review, 72*(2), e70018. https://doi.org/10.1111/inr.70018

Cronbach, L. J. (1951). Coefficient alpha and the internal structure of tests. *Psychometrika, 16*(3), 297–334. https://doi.org/10.1007/BF02310555

Creswell, J. W., & Creswell, J. D. (2018). *Research design: Qualitative, quantitative, and mixed methods approaches* (5th ed.). SAGE.

Davis, F. D. (1989). Perceived usefulness, perceived ease of use, and user acceptance of information technology. *MIS Quarterly, 13*(3), 319–340. https://doi.org/10.2307/249008

DeVellis, R. F. (2016). *Scale development: Theory and applications* (4th ed.). SAGE.

Frontier in Medical & Health Research

ISSN: (e) 3007-1607 (p) 3007-1593

El-Banna, M. M., Sajid, M. R., Rizvi, M. R., Sami, W., & McNelis, A. M. (2025). AI literacy and competency in nursing education: Preparing students and faculty members for an AI-enabled future-a systematic review and meta-analysis. *Frontiers in Medicine, 12*, 1681784. https://doi.org/10.3389/fmed.2025.1681784

Habib, M. M., Hoodbhoy, Z., & Siddiqui, M. A. R. (2024). Knowledge, attitudes, and perceptions of healthcare students and professionals on the use of artificial intelligence in healthcare in Pakistan. *PLOS Digital Health, 3*(5), e0000443. https://doi.org/10.1371/journal.pdig.0000443

Parasuraman, A., & Colby, C. L. (2015). An updated and streamlined technology readiness index: TRI 2.0. *Journal of Service Research, 18*(1), 59–74. https://doi.org/10.1177/1094670514539730

Polit, D. F., & Beck, C. T. (2021). *Nursing research: Generating and assessing evidence for nursing practice* (11th ed.). Wolters Kluwer.

Sheraz, S., Shuaib, N., Khan, S., Sultan, A., Shahid, A., & Hussain, H. (2025). Nursing student's awareness, intention and perception towards the utilization of artificial intelligence (AI) in nursing practice. *Journal of the Pakistan Medical Association, 75*(10), 1598–1600. https://doi.org/10.47391/JPMA.21258

Simms, R. C. (2025). Generative artificial intelligence literacy in nursing education: A crucial call to action. *Nurse Education Today, 146*, 106544. https://doi.org/10.1016/j.nedt.2024.106544

UNESCO. (2021). *Recommendation on the ethics of artificial intelligence*. https://unesdoc.unesco.org/ark:/48223/pf0000381137

UNESCO. (2023). *Guidance for generative AI in education and research*. https://unesdoc.unesco.org/ark:/48223/pf0000386693

Venkatesh, V., Morris, M. G., Davis, G. B., & Davis, F. D. (2003). User acceptance of information technology: Toward a unified view. *MIS Quarterly, 27*(3), 425–478. https://doi.org/10.2307/30036540

World Health Organization. (2021a). *Ethics and governance of artificial intelligence for health: WHO guidance*. https://www.who.int/publications/i/item/9789240029200

World Health Organization. (2021b). *Global strategy on digital health 2020–2025*. https://www.who.int/publications/i/item/9789240020924

Zhang, Z. (2023). *WebPower: Basic and advanced statistical power analysis* (Version 0.9.4) [R package]. Comprehensive R Archive Network. https://CRAN.R-project.org/package=WebPower