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Bridging Technology and Pedagogy: A Cross-Sectional Analysis of AI Integration and Academic Success in Diverse Health Science Curricula

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Abstract

Background

Artificial Intelligence has emerged as a transformative force in health professions education, yet its impact on academic success and students' ethical concerns remains underexplored. This study evaluates AI utilization patterns and their perceived effects on learning outcomes among health science students.

Methods

Using a stratified two-stage cluster sampling design, data were collected from 310 students across various health-related programs via interviewer-administered questionnaires.

Results

Participants reported moderate familiarity with AI (mean knowledge score 3.08 ± 1.06). While 90% (n = 279) of students used ChatGPT, a significant training gap persists: 82.6% of respondents received no formal instruction on AI. AI usage frequency was significantly associated with higher GPAs (ANOVA, F = 15.56). Ethical concerns were prevalent (61%), with significant variance by gender (p = 0.0015) and academic program (p = 0.0114).

Conclusion

AI tools significantly enhance perceived study efficiency and comprehension of complex topics. However, disparities in formal training and significant ethical concerns necessitate the integration of a structured curriculum.

Implications for Practice:

Faculty should implement "proactive" AI training that addresses automation bias and ethical literacy to ensure equitable technological competency across healthcare disciplines.

Introduction

The integration of Artificial Intelligence into medical and health sciences education has shifted from a theoretical possibility to a practical necessity (Babur, 2025). Recent bibliometric analyses of the Web of Science database indicate that research in this field has surged since 2013, with a primary focus on learning support systems and academic outcomes (Chan & Zary, 2019; Wang et al., 2024). Despite this

growth, there is a lack of critical analysis regarding how these tools intersect with traditional pedagogical frameworks and student success. Therefore, a vital step in creating successful AI curricula is to understand how today's students and healthcare professionals view AI in healthcare, what they do and don't know, and how they understand its ethical aspects (Alowais et al, 2023; Li & Qin 2023; Civaner et al., 2022).

This study is grounded in the theoretical context of automation bias—the tendency for users to over-rely on automated systems—and the potential for personalized learning to bridge educational gaps (Babur, 2025; Knopp et al, 2023). As AI tools facilitate tasks from literature reviews to complex concept clarification, understanding the relationship between tool utilization and academic performance is vital for modern health sciences curricula (Leng, 2024; Ahmed et al, 2021).

Methods

Study Design and Population

A cross-sectional study was conducted among 310 students enrolled in health-related programs. The study employed a stratified two-stage cluster sampling method to ensure representative data across diverse academic levels and disciplines.

Instrumentation and Data Collection

Data were gathered via interviewer-administered questionnaires. The instruments were adapted from previous studies (Civaner et al., 2022; Doumat et al, 2023) assessing three primary domains: AI knowledge and training history, frequency and nature of AI tool use, and perceived academic impact and ethical concerns. Knowledge and impact were measured on 5-point Likert scales.

Ethical Considerations

Approval for this study was obtained from the Ethical Committee of the College of Medicine, University of Bisha (UBCOM), UB-RELOC H-06-BH-087/(16/05/47). Participant-informed consent was obtained from all participants via a consent letter, which was incorporated into the research process.

Results

The total number of respondents was 310, and their ages ranged from 18 to 26 years. The mean age was 20.98 ± 1.44. Table 1 presents the sociodemographic characteristics of the participants.

Table 1
Sociodemographic features among the participants (N = 310)

Sociodemographic features	Frequency	Percentage (%)
Gender		
Male	195	62.9
Female	115	37.1
Residency		
village	78	25.2
urban	232	74.8
Academic Program		
MBBS	149	48.1
Nursing	121	39.0
Respiratory Therapy	13	4.2
Medical Lab Science	17	5.5
Public Health	4	1.3
Midwifery	6	1.9
Academic Year		
second year	99	31.9
Third year	95	30.6
fourth year	59	19.0
Fifth year	29	9.4
sixth year	28	9.0
GPA category		
Less than 2.0	1	.3
2.0-2.74	7	2.3
2.75–3.74	109	35.2
3.75–4.49	141	45.5
4.50-5.0	52	16.8
Income		
Less than 900	12	3.9

Sociodemographic features	Frequency	Percentage (%)
900	192	61.9
990–2000	82	26.5
> 2000	15	4.8
No fixed income	9	2.9

AI Familiarity and Usage Patterns

Respondents demonstrated a moderate baseline of AI knowledge with a mean score of 3.08 ± 1.06. Despite the absence of formal training among 82.6% of the cohort, tool adoption was nearly universal: 90% (n = 279) used ChatGPT specifically for academic purposes. Common use cases included summarizing content, clarifying concepts, and time management (study plans and prioritization) as shown in Table 2.

Table 2
Knowledge and use of artificial intelligence tools and impact for academic purposes (N = 310)

Knowledge Use and impact	**Frequency**	**%**
How would you rate your knowledge of AI applications in the health field		
No knowledge	24	7.7
Basic Knowledge	67	21.6
Partial knowledge	104	33.5
Good Knowledge	91	29.4
Advanced knowledge	24	7.7
AI-based tools or applications frequently use in your studies		
Chat GPT	279	90.0
Grammarly	99	31.9
Siri/Alexa/Google	92	29.7
Gemini	39	12.6
Others. e.g Canva	79	25.5
Extent to which AI tools have impacted academic performance		
No impact	18	5.8
Minor impact	61	19.7
Moderate impact	131	42.3
High impact	72	23.2
Very High impact	28	9.0
Ways AI has influenced academic performance		
Improved grade	168	54.2
Increased study motivation	119	38.4
Better time management	182	58.7
Enhanced knowledge acquisition	165	53.2
Facilitates collaborative work	104	33.5
Reduced stress	102	32.9
No effect	0	0
How I utilize AI tools for your academic education		

Knowledge Use and impact	Frequency	%
Summarizing content (lectures, textbooks, articles	226	72.9
Clarification of complex concepts	222	71.6
Practice questions for exams	218	70.3
Preparing Assignments	175	56.5
Language practice and translation	118	38.1
Editing and proofreading	79	25.5
Assist in research (literature review, data analysis	119	38.4
Time management (study plans, reminders, prioritization)	110	35.5
Academic Impact Summary		
	Mean	SD
Rate your knowledge of AI applications in the health and education field?	3.08	1.06
AI has improved my study efficiency	3.70	1.08
Using AI tools helps me better understand complex topics	3.90	1.14
AI tools have enhanced my retention of information	3.55	1.11
AI tools have impacted your academic performance	3.10	1.01

Respondents reported an average AI knowledge score just over 3 out of 5. Regarding tool usage, ChatGPT was used much more frequently than other tools. The impact of AI on academia is evident, with most impact scores between three and four, indicating a moderate to considerable effect on study efficiency. As illustrated in the figure below.

Academic Success and Correlation

Students widely adopted AI tools, with ChatGPT being the most popular, used by 279 students (90.0%). Those with higher GPAs tended to use multiple tools more often (see Fig. 1). Statistical analysis revealed a strong positive relationship between the number of AI tools employed and perceived academic success. Students in higher GPA brackets used AI tools significantly more frequently (ANOVA, $F = 15.56$, $p < 0.001$). Regression analysis confirmed that increased tool utilization was a significant predictor of higher impact scores on study efficiency (mean impact 3.70 ± 1.08) and comprehension of complex topics (3.90 ± 1.14).

Training Disparities and Ethics

Table 3 indicates that most participants (82.6%, n = 251) have not received additional AI training, pointing to limited access. Despite this lack of formal training, students frequently use AI tools for studies and rate their comfort at 4 or 5 on a 5-point scale. The average AI knowledge score rises with the number of training types, from 3.03 (no training) to 4.5 (three types), suggesting that more training enhances perceived understanding. Students use AI tools moderately to frequently; 4.2% never, 39% occasionally, 32% frequently, 15.8% always. The average knowledge score remains above 3, with ChatGPT being the most commonly used; students typically use 1.90 ± 1.1 AI tools. AI's impact on academics is moderate to strong, improving efficiency, comprehension, and performance. Most students lack formal training, with only small percentages participating in online courses (8.1%), electives (7.4%), seminars (5.2%), or required courses (3.2%). Despite this, students feel comfortable using AI tools, mainly rating their comfort at 4 or 5.

Table 3
Students' training needs and reliance on AI tools for academic purposes (N = 310)

Training Needs assessment	**Frequency**	**%**
Self- reported knowledge		
Very low	24	7.7
Low	67	21.6
moderate	104	33.5
High	91	29.4
Very High	24	7.7
Distribution of training received by type		
No training	256	82.5
Elective course	23	7.4
Seminar or presentations	16	5.2
Part of required course	10	3.2
Online training	25	8.1
Comfortable using AI tools for study purposes?		
Very uncomfortable	3	1.0
Uncomfortable	10	3.2
Neutral	73	23.5
Comfortable	136	43.9
Very comfortable	88	28.4
Support the inclusion of structured training in AI applications as part of medical education	275	88.7
Frequent use AI tools to assist with your academic studies (e.g., virtual tutoring, study aids)		
Never	13	4.2
rarely	27	8.7
occasionally	121	39.0
Frequently	100	32.3
Always	49	15.8

The boxplot in Fig. 2 indicates that younger individuals are more likely to have received AI training, suggesting they are more inclined to pursue it. Consequently, training efforts should focus on older students who have less access. Additionally, standardizing access to training across programs can promote equitable AI preparation in healthcare. Significant correlations were observed among AI training, age, and academic programs, with younger students and certain programs showing a higher prevalence of training. Younger students are more likely to seek elective or online training ($p = 0.0303$), as shown in Table 4.

Table 4
Training needs among respondents (N = 310)

Sociodemographic features	Support for inclusion of structured AI training		Test statistics	P value
	Yes	No		
Age				0.03
Residency				
village	69	9	.06	.936
urban	206	26		
Gender				
Males	170	25	1.305	.521
Females	104	10		
GPA Category			1.708	.779
Less than 2.0	1	0		
2.0-2.74	6	1		
2.75–3.74	96	13		
3.75–4.49	128	13		
4.50-5.0	44	8		
Academic program				
MBBS	128	21	6.303	.278
Nursing	113	8		
Respiratory Therapy	10	3		
Medical Lab Science	15	2		
Public Health	4	0		
Midwifery	5	1		

There is overwhelming support for incorporating structured AI training into medical education, with most students expressing the highest levels of support.

Students reported multiple ethical concerns about AI. The distribution of these concerns is detailed, with most students showing neutral-to-positive attitudes towards replacing traditional methods with AI, especially at Levels 3 and 4. The ethical concern score is 188/310 (61%), indicating that about 61% of respondents shared this concern. Table 5 presents various concerns, and a significant relationship exists

between the concern score and sex (F = 10.291, P = 0.0015) and with the academic program (F = 3.011, P = 0.0114). No link was found with age or residence (p > 0.05). Students' primary concerns involved privacy and data security in AI for education and healthcare. Significant gender differences were noted, with one gender expressing more concern, and concerns varied across academic programs, influenced by program-specific factors.

Residency status affects perceptions of AI's ability to replace traditional methods, with one group more open to this idea. Students generally show moderate acceptance of AI replacing study methods, mostly neutral to positive. Institutions should address ethical issues like privacy and data security when adopting AI and tailor AI ethics education to different programs and student groups to address varying concerns.

Table 5
Students' perceptions about the ethical use of AI tools

Sociodemographic feature	**Statistic Test**					
	Mean	**SD**	**Correlation Coefficient (r)**	**P value**	**ANOVA (F)**	**P value**
Age			0.064	0.265		
Ethical Concern score by Gender						
Male	2.96	1.52			10.291	0.0015
Female	3.50	1.26				
Ethical Concern score by residency						
City	3.17	1.41			0.004,	0.9518
Village	3.16	1.46				
Ethical Concern Score by Academic Program						
MBBS	3.44,	1.34			3.011	0.0114
Nursing	2.79,	1.49				
Respiratory Therapy	3.00	1.3				
Medical Lab Science	3.12	1.81				
Public Health	3.75	0.43				
Midwifery	3.50	0.50				

Ethical concerns score 61%, with significant differences by gender ($F = 10.291$, $p = 0.0015$) and academic program ($F = 3.011$, $p = 0.0114$), reflecting diverse cultural attitudes toward technology.

Figure 3 shows that academic programs significantly affect ethical concern scores ($p = 0.0114$). Program 5 had the highest mean score (3.75), while Program 2 had the lowest (2.79). Residency status also influences views on replacing traditional methods with AI ($p = 0.0262$), with Residency 1 students more likely to agree (mean = 3.45) than Residency 2 students (mean = 3.11).

Discussion

Our study explored how healthcare students use and understand artificial intelligence (AI), including its academic impact. Our results align with a recent study on AI use among health students, such as Wood et al. (2021), which reported moderate familiarity with AI tools, with an average knowledge score of 3.077 ± 1.06. About 7.7% of respondents had no prior AI experience, similar to Abbas et al. (2023) (5.2%). Participants noted that AI tools significantly improved their study efficiency, especially in time management and organization, echoing findings by Glauberman et al (2023). This trend highlights how educational tech, especially AI-driven platforms, is increasingly used to personalize learning and reduce administrative burdens (Sanchez-Gonzalez & Terrell, 2023). The average efficiency score of 3.08 underscores AI's role in helping students grasp complex subjects more easily. Our data reveal that students see AI as beneficial for improving study efficiency, understanding difficult topics, and retaining information, with mean scores of 3.70, 3.90, and 3.55, respectively. AI's ability to condense info and offer tailored explanations is particularly helpful for challenging topics. Beyond comprehension, many students believe AI also boosts long-term memory retention. These improvements in learning outcomes are consistent with other studies on AI's impact. However, the overall effect of AI on academic performance remains moderate, with a mean score of 3.10, indicating students recognize its benefits but see it as one of several factors influencing success. Notably, ChatGPT's frequent use compared to other AI tools demonstrates its accessibility and usefulness, likely due to its versatile language-processing capabilities, which facilitate tasks ranging from literature reviews to content creation. The study found significant associations among age, academic program, and AI training, suggesting these factors influence engagement with AI education, consistent with findings from Abbas et al. (2024). Younger individuals may be more exposed to AI through education or more eager to learn it for future careers; this finding is similar to those reported by Mah and Gross (2024). The strong association between academic disciplines and AI training indicates that some fields actively integrate AI into their curricula. Our ethics concern score was 61%, with demographic variables such as sex and academic program shaping perceptions of AI ethics. Similar results were seen in Al-Zahrani et al. (2024). These findings imply that personal background influences ethical outlooks more than age or residence. Privacy and data security concerns dominate ethical concerns in both education and healthcare, underscoring the need for clear guidelines and frameworks to manage AI responsibly and build trust (Mallillin, 2024; Qawqzeh, 2024; Orchard & Radke, 2023). Gender differences in ethical concerns likely reflect societal roles and experiences, which should inform AI ethics education. The significant link between gender and ethical perceptions ($F = 10.291$, $P = 0.0015$) aligns with prior research, highlighting the importance of

understanding how social and cultural factors influence attitudes toward AI ethics. The findings highlight a "proactive" but largely self-directed engagement with AI among health science students. While the high utilization of ChatGPT (90%) suggests that students find these tools indispensable for managing the cognitive load of health curricula, the 82.6% training gap is a critical vulnerability. Without formal instruction, students may be susceptible to automation bias, where the convenience of AI-generated content outweighs critical appraisal (Babur, 2025; Nguyen, 2023).

The significant correlation between academic program and AI training ($p < 0.0001$) suggests that certain disciplines are more advanced in integrating technology than others. To align with the standards of Advances in Health Sciences Education, it is recommended that institutions move beyond ad hoc use of tools and implement structured AI literacy programs. These programs should address the 61% ethical concern score by incorporating discussions on data privacy, algorithmic bias, and the professional responsibilities of the "augmented" healthcare provider (Babur, 2025; Ellaway & Tolsgaard, 2023). The absence of a statistically significant relationship between ethical concern scores and age or place of residence ($p > 0.05$) suggests that these factors may not be as influential in shaping ethical perceptions as gender and academic discipline in the studied population (Ateeq et al., 2024).

Conclusion

AI integration is no longer optional in health sciences education. While students report significant gains in study efficiency and retention (mean score 3.55 ± 1.11), the reliance on informal learning pathways creates inequities in training and ethics. Future research should focus on longitudinal assessments of AI's impact on clinical decision-making skills to ensure that "academic success" in the classroom translates to "clinical excellence" in practice.

Declarations

Ethics approval and consent to participate

The study received approval from the Ethical Committee of the College of Medicine, University of Bisha (UBCOM). UB-RELOC H-06-BH-087/(16/05/47) Participant consent was obtained through a consent letter, which was incorporated into the research process. Written consent was obtained from each participant after approval by the ethics committee. All data were handled with strict confidentiality to protect participants' anonymity throughout the study.

Consent for publication

Not applicable. No individually identifiable patient images or personal details are included in this manuscript.

Availability of data and materials

All data produced or examined in this study are included in this published article and its supplementary files.

Competing interests

The authors declare that they have no competing interests.

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Author contributions

All authors contributed to the study conception and design. Material preparation, data collection, and analysis were performed by Abdulaziz Faleh Alshahrani, Ayidh Faleh Alshahrani, Ghada Ayed Mohammed Alqarni, Mansour Abdullah Alghamdi, Abdullah Mohammed Almarhabi, Mohammed Turki Almuawi, Saleh Hadhir Alharthi, Dalal Mohammed Alhuian, Khalid Hassan S Alshahrani, Abubakar Mohamed Jibo, and Ibrahim Awad Eljack Ibrahim. The first draft of the manuscript was written by Abdullah M. Alshahrani and Abubakar Mohamed Jibo, and all authors commented on earlier versions. All authors read and approved the final manuscript.

Use of artificial intelligence-assisted tools

Artificial intelligence-assisted language and formatting tools were used to support manuscript editing and alignment with journal formatting. The authors reviewed, verified, and take full responsibility for all scientific content, analyses, interpretations, and conclusions.

Large Language Model Disclosure:

In accordance with BMC Medical Education standards, the authors disclose that no AI tools were used to generate the primary data or statistical findings presented in this study. AI was used as a supplementary tool for text refinement and bibliography formatting.

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Figures

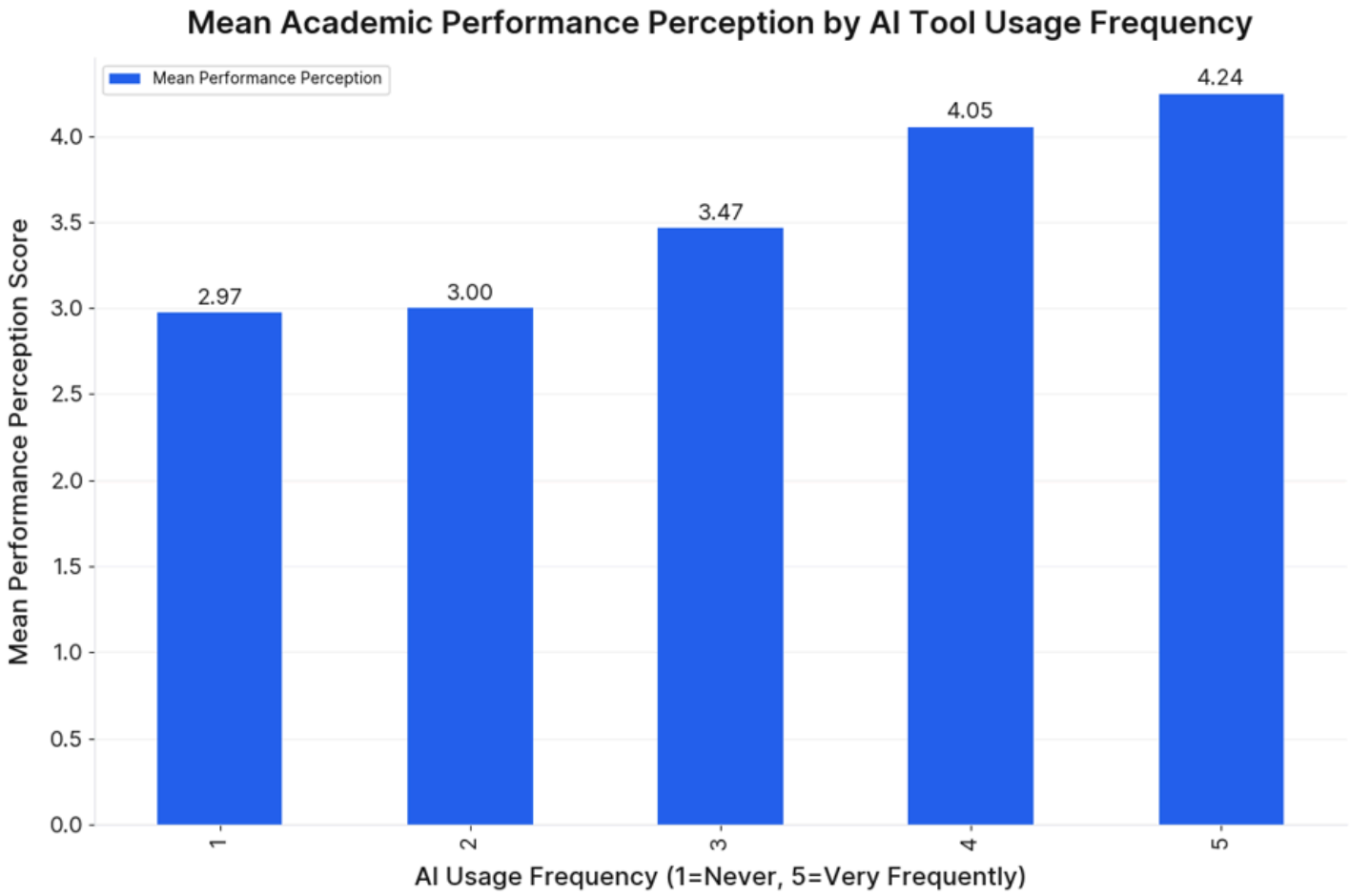


Figure 1

The use of AI and mean performance perception based on knowledge (N=310)

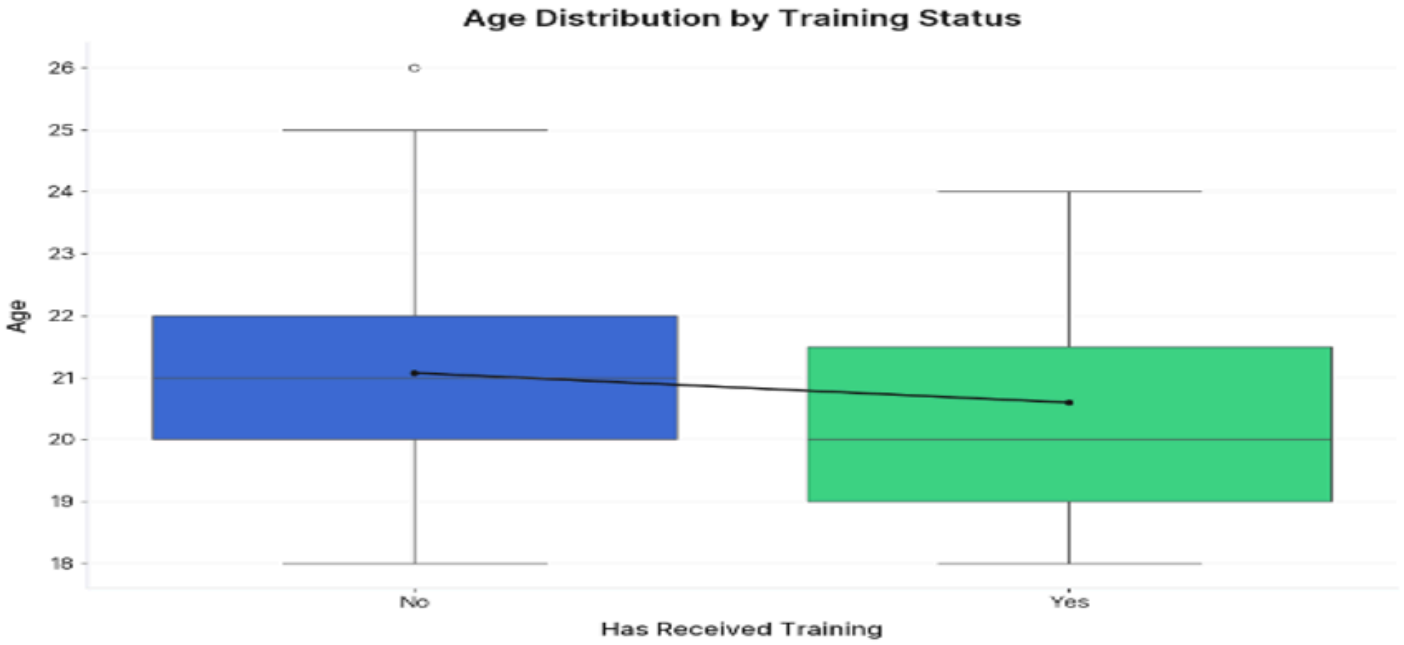
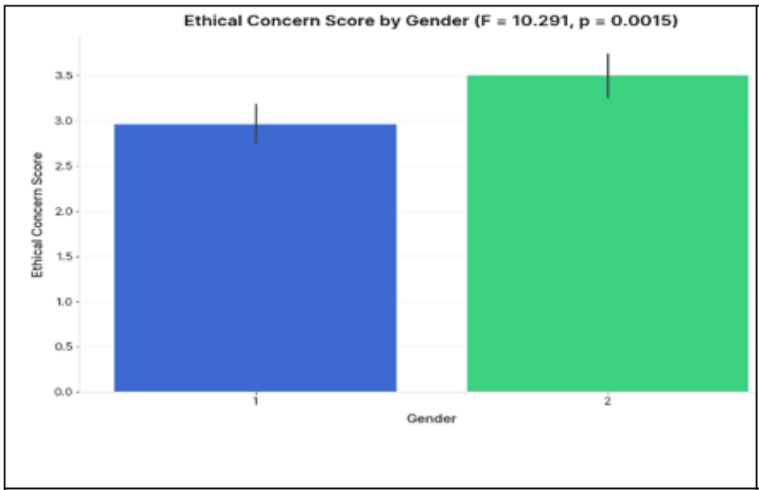
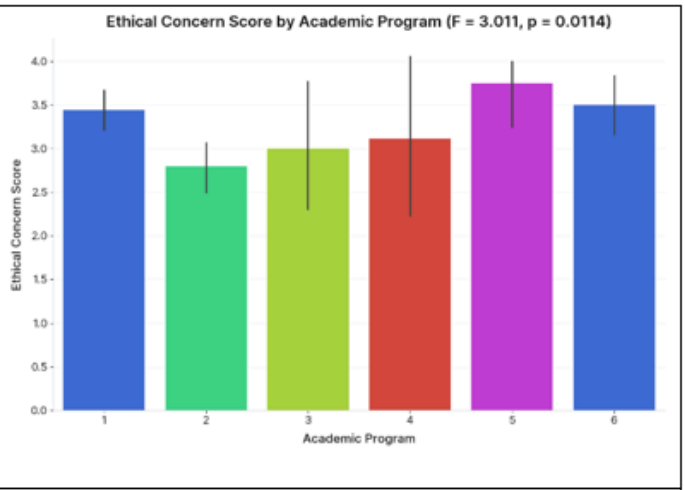


Figure 2

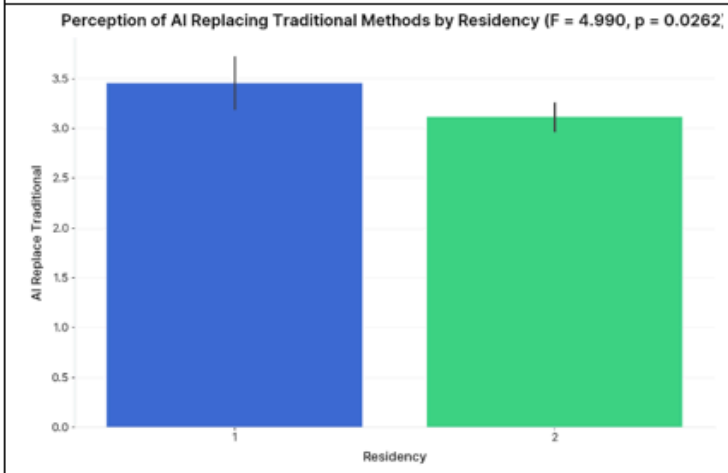
Age effect on AI training among the participants (N=310)

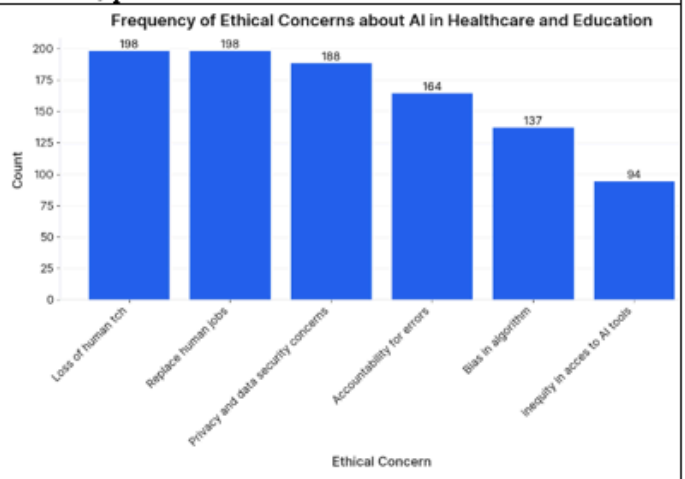


Gender vs Ethical Concern Score: F Stat = 10.291, p = 0.0015



Academic Program vs Ethical Concern Score: F Stat = 3.011, p = 0.0114





Residency vs AI Replace Traditional: F Stat = 4.990, p = 0.0262

Figure 3

Most Common Ethical Concern score plotted