

Evaluation of the Correlation Between Nursing Students' General Attitudes Toward Artificial Intelligence, Literacy and Anxiety Levels: A Descriptive and Correlational Study

Hemşirelik Öğrencilerinin Yapay Zekâya Yönelik Genel Tutumları ile Okuryazarlık ve Kaygı Düzeyleri Arasındaki İlişkinin Değerlendirilmesi: Tanımlayıcı ve İlişkisel Çalışma

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ABSTRACT Objective: This study aims to determine the relationship between nursing students' general attitudes toward artificial intelligence, literacy, and anxiety levels. **Material and Methods:** The study was conducted using a descriptive-correlation-seeking design. The sample consisted of 414 nursing students at a state university. The "Personal Information Form", "General Attitude Towards Artificial Intelligence Scale (GAAIS)", "Artificial Intelligence Anxiety Scale (AIAS)", and "Artificial Intelligence Literacy Scale (AILS)" were used as data collection tools. **Results:** The mean age of the students was 21.07±1.84 years; the majority were female (72.7%) and in their first year of education (30.9%). While 44.4% of the students' mothers and 44.0% of their fathers completed primary school 89.6% of the students' mothers were not working, and 78.7% of the students' fathers were working. The mean total scores of the students in the GAAIS, AIAS, and AILS were 65.87±9.42, 49.20±9.24 and 43.04±6.53, respectively. It was found that there was a statistically significant relationship between the GAAIS and the AIAS in a negative direction and a positive direction with the AILS (p=0.001). **Conclusion:** It was determined that students' general attitudes towards artificial intelligence and artificial intelligence literacy were high, and their artificial intelligence anxiety was at a medium level. Adding courses on artificial intelligence to all students at the university level will help them gain more knowledge about technological innovations and ensure awareness, which will help reduce anxiety levels while strengthening their literacy and general attitudes.

Keywords: Nursing student; anxiety; literacy; artificial intelligence

ÖZET Amaç: Bu çalışmanın amacı hemşirelik öğrencilerinin yapay zekâya yönelik genel tutumları ile okuryazarlık ve kaygı düzeyleri arasındaki ilişkiyi belirlemektir. **Gereç ve Yöntemler:** Çalışma tanımlayıcı-korelasyon arayıcı desen kullanılarak yürütülmüştür. Örneklem, bir devlet üniversitesinde öğrenim gören 414 hemşirelik öğrencisinden oluşmaktadır. Veri toplama aracı olarak "Kişisel Bilgi Formu", "Yapay Zekâya Yönelik Genel Tutum Ölçeği [General Attitude Towards Artificial Intelligence Scale (GAAIS)]", "Yapay Zekâ Kaygı Ölçeği [Artificial Intelligence Anxiety Scale (AIAS)]" ve "Yapay Zekâ Okuryazarlık Ölçeği [Artificial Intelligence Literacy Scale (AILS)]" kullanılmıştır. **Bulgular:** Öğrencilerin yaş ortalaması 21,07±1,84 yıl olup, çoğunluğu kadın (%72,7) ve eğitimlerinin ilk yılında (%30,9) idi. Öğrencilerin annelerinin %44,4'ü, babalarının ise %44,0'ı ilkokulu tamamlarken, öğrencilerin annelerinin %89,6'sı çalışmamakta, babalarının ise %78,7'si çalışmaktadır. Öğrencilerin GAAIS, AIAS ve AILS toplam puan ortalamaları sırasıyla 65,87±9,42, 49,20±9,24 ve 43,04±6,53'tür. GAAIS ile AIAS arasında negatif yönde, AILS ile pozitif yönde istatistiksel olarak anlamlı bir ilişki olduğu tespit edilmiştir (p=0,001). **Sonuç:** Öğrencilerin yapay zekâya yönelik genel tutumlarının ve yapay zekâ okuryazarlıklarının yüksek olduğu, yapay zekâ kaygılarının ise orta düzeyde olduğu tespit edilmiştir. Üniversite düzeyinde tüm öğrencilere yapay zekâ ile ilgili derslerin eklenmesi, teknolojik yenilikler hakkında daha fazla bilgi sahibi olmalarına ve farkındalık sağlamalarına katkıda bulunabilir, bu da okuryazarlıklarını ve genel tutumlarını güçlendirirken kaygı düzeylerini azaltmaya yardımcı olabilir.

Anahtar Kelimeler: Hemşirelik öğrencileri; anksiyete; okuryazarlık; yapay zekâ

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Computers and machines that aim to think and reason like humans by simulating human intelligence are called artificial intelligence (AI) tools.¹ In addition, AI is a technical field in which many human-like characteristics, such as learning, reading, writing, problem-solving, communication, and decision-making, are imitate.² AI technologies have rapidly influenced many fields, such as industry, defense, education, entertainment, and trade. One of these areas is health services.³ AI technologies can deliver effective and efficient healthcare by providing personalized care.⁴ Nurses, the largest group among medical and health professionals, constitute an important group that is most needed globally, and this need has reached 5.9 million according to the World Health Organization 2020 report.^{5,6} Emerging situations such as meeting the current need for nurses, reducing costs in health services, increasing efficiency, saving nursing resources, and meeting the increasing expectations in nursing care and practices have accelerated the orientation towards AI technologies in nursing.⁷ In the last decade, the use of AI technologies in nursing practices has rapidly increased and revolutionized.^{8,9} It is thought that AI technologies will facilitate the preparation of medicines and management of patient treatments, support patient-related decision-making potential and care in clinical settings, and facilitate care and follow-up by providing remote access with AI technologies that provide access to the patient such as telehealth, telemedicine, telenursing, telecare.¹⁰⁻¹² It also allows people to create free time as it will increase personal productivity, reduce human errors, fulfill routine tasks, and overcome complex problems.¹³ On the contrary, there are opinions that AI technologies will be contrary to the principles of nursing care because they do not take into account the emotional well-being of patients, are limited from feelings of compassion and conscience, and lack skills such as empathizing by opening communication channels.¹⁴ In this regard, Watson et al. argued that with AI technologies, nurses would move away from the bedside, and the basis of care would be jeopardized.¹⁵ This research aims to examine the relationship between nursing students' general attitudes towards AI and their literacy and anxiety levels.

MATERIAL AND METHODS

TYPE OF RESEARCH

This research was planned using descriptive relational research from quantitative research methods.

PERIOD OF THE RESEARCH

The research was conducted between July 03, 2024-October 21, 2024. The research data were collected by online survey method. In this context, the questionnaire form prepared through Google Forms (Google, USA) was delivered to the nursing department students of the relevant university. In the data collection process, WhatsApp Messenger (WhatsApp Inc., Menlo Park, CA, USA) class groups of the department were used, and the survey form was shared with the students with the support of student representatives and academic counsellors. The data collection process was completed by obtaining online consent from all participants on a voluntary basis.

POPULATION AND SAMPLE OF THE STUDY

The population of the study comprised nursing department students enrolled at a state university. The nursing department of the university where the research was conducted consists of 430 students and it was aimed to reach the entire population. The study was completed with 414 students who met the inclusion criteria. Accordingly, the sample number constitutes approximately 96.3% of the population.

Inclusion criteria:

- Active nursing students of the university where the research was conducted,
- Volunteering to participate in the research and giving consent,
- Not having any disability that would prevent answering the survey questions.

Exclusion criteria:

- The student volunteered to participate in the research and then wanted to withdraw from the research,
- Incomplete completion of the data collection forms.

DATA COLLECTION TOOLS

Personal Information Form: It consists of 16 questions that question nursing students' age, gender,

parents' education level, parents' working status, grade, willingly choosing the nursing profession, the suitability of the department they chose, having information about the profession while choosing the nursing profession, and nursing students' views on AI.

General Attitudes Toward AI Scale (GA AIS):

Scale was developed by Schepman and Rodway and adapted into Turkish by Kaya et al.^{13,16} The scale consists of 2 sub-dimensions, positive and negative attitudes towards AI, and is graded with a 5-point Likert type. The scale consists of a total of 20 items, 12 positive attitude items and 8 negative attitude items. It should be noted that the negative attitude items of the scale are reverse coded. The scale ranges from 12 to 60 for the positive attitude sub-dimension and from 8 to 40 for the negative attitude sub-dimension. In the study in which the scale was adapted, Cronbach Alpha values were found to range from 0.82 to 0.88, with reliability values recorded at 0.77 for positive attitude and 0.83 for negative attitude.¹³ In this study, the Cronbach Alpha coefficient was calculated as 0.821 for the entire scale, 0.851 for positive attitude, and 0.835 for negative attitude.

AI Anxiety Scale (AIAS): Scale was developed by Wang and Wang.¹⁷ It is a 16-question, 5-point Likert-type scale that was adapted by Akkaya et al.¹⁸ Participants are asked to indicate the extent to which they agree with each statement regarding AI anxiety. A minimum of 16 and a maximum of 80 points can be obtained from the scale. Scores on the scale that fall within the highest quartile are indicative of high AI anxiety. The scale comprises 4 subscales: "Learning", "Job Change", "Sociotechnical Blindness" and "AI Configuration". The learning subscale consists of items 1-5, the job switching subscale consists of items 6-9, the sociotechnical blindness subscale consists of items 10-13, and the AI configuration subscale consists of items 14-16. Cronbach's Alpha coefficient of the scale was found to be 0.96 for the original version and 0.94 for the adaptation.¹⁸ In this study, the Cronbach Alpha coefficient of the scale was calculated to be 0.931.

AI Literacy Scale (AILS): Developed by Wang et al.¹⁹ It was adapted into Turkish by Polatgil and

Güler.²⁰ The scale consists of 12 questions, 4 sub-dimensions and 5-point Likert type. The score that can be obtained from the scale is between 12-60. Questions 2, 5 and 11 of the scale are reverse coded. In the sub-dimensions of the scale; items 1,2,3 are "Awareness", items 4,5,6 are "Use", items 7,8,9 are "Evaluation" and items 10,11,12 are "Ethics". Cronbach's Alpha coefficient of the scale is 0.939.²⁰ This study calculated the Cronbach Alpha coefficient for the total scale as 0.775.

DATA ANALYSIS AND EVALUATION

Personal information about the students was given in numbers and percentages. Number, percentage, arithmetic mean, standard deviation, minimum, and maximum values were given in evaluating the scores obtained from the scales. Kolmogorov-Smirnov tests, Skewness and Kurtosis values, histogram graph, coefficient of variation, and detrended graph evaluated whether the data were normally distributed. In addition, it is stated in the literature that Skewness and Kurtosis values between -1.5 and +1.5 are sufficient for normal distribution.²¹ In this study, Skewness/Kurtosis values were calculated as 0.535/1.394 for the General Attitude towards the AI Scale, -0.216/0.168 for the AIAS, 0.238/-0.163 for the AILS, and it was determined that the scale showed a normal distribution. Furthermore, as the data satisfied the additional normality criteria (skewness and kurtosis values, histogram, and detrended graph), it was determined that the data were normally distributed. In this direction, an analysis was conducted of the difference between the total and sub-dimensions of the scale according to the demographic characteristics of the students. For this analysis, a t-test was used for categorical variables with 2 groups, and an analysis of variance test was used for categorical variables with 3 or more groups. Pearson correlation analysis was used to determine the relationship between the scales.

ETHICAL ASPECTS OF THE RESEARCH

Ethics committee approval was obtained for the conduct of the study (date: May 25, 2024, no: 446.39.11) and the principles of the Declaration of Helsinki were complied with. In addition, the data were collected after consent of the students was obtained.

TABLE 1: The correlation between sociodemographic characteristics of the students and total and subscale scores of the GAAS, AIAS and AILS

Variables		AIAS													AILS	
Age: 21.07±1.84		GAAS					Sociotechnical					Artificial Intelligence				
	n (%)	Positive attitude	Negative attitude	Total	Learning	Job change	blindness	configuration	Total	Awareness	Use	Evaluation	Ethics	Total		
Gender																
Male	113 (27.3)	42.19±8.26	24.02±5.94	66.22±9.89	13.80±4.45	13.23±3.32	12.01±3.80	8.84±2.80	47.90±10.51	10.20±1.90	10.09±1.87	11.14±2.38	10.07±2.01	41.52±6.20		
Female	301 (72.7)	41.76±6.46	23.98±5.63	65.74±9.25	13.02±4.20	13.41±2.65	13.36±3.61	9.87±2.95	49.69±9.68	10.68±1.88	10.42±1.95	11.39±2.36	11.09±2.19	43.61±6.57		
Test and significance value		t=0.503	t=0.074	t=0.462	t=1.645	t=-0.589	t=-3.334	t=-3.193	t=-1.610	t=-2.308	t=-1.553	t=-0.984	t=-4.311	t=-2.926		
		p=0.616	p=0.941	p=0.645	p=0.101	p=0.556	p=0.001	p=0.002	p=0.109	p=0.021	p=0.121	p=0.326	p=0.001	p=0.004		
Class level																
1	128 (30.9)	40.50±6.33	24.39±5.65	64.90±8.86	12.40±4.02	12.67±2.69	13.17±3.66	9.50±3.05	47.75±9.09	10.77±1.85	10.55±1.92	11.53±2.55	11.21±2.40	44.07±6.83		
2	93 (22.5)	41.21±7.74	24.05±6.05	65.26±10.30	13.15±4.32	13.27±3.03	12.62±3.92	9.56±3.13	48.62±9.49	10.69±2.07	10.38±2.19	11.39±2.69	10.32±2.08	42.80±7.23		
3	100 (24.2)	41.39±7.51	23.43±5.74	64.82±9.75	14.41±3.93	13.23±3.02	13.39±3.29	9.92±2.33	50.95±9.26	10.00±1.81	9.96±1.86	11.13±2.22	10.82±2.08	41.91±5.89		
4	93 (22.5)	44.95±5.55	23.97±5.43	68.93±8.32	13.22±4.70	14.54±2.28	12.70±3.95	9.40±3.20	49.89±9.93	10.69±1.76	10.39±1.70	11.19±1.87	10.77±2.01	43.06±5.84		
Test and significance value		F=8.522	F=0.541	F=4.373	F=4.219	F=8.412	F=0.969	F=0.573	F=2.569	F=3.848	F=1.866	F=0.672	F=3.073	F=2.133		
		p=0.001	p=0.655	p=0.005	p=0.006	p=0.001	p=0.407	p=0.633	p=0.044	p=0.010	p=0.135	p=0.569	p=0.028	p=0.095		
		(4>1)	(4>2)	(4>3)	(3>1)	(4>1)	(4>2)	(4>3)	(3>1)	(1>3)	(2>3)	(4>3)	(1>2)			
Mother education level																
Illiterate	91 (22.0)	40.64±6.85	24.00±5.33	64.64±9.29	13.78±3.91	12.80±2.83	12.82±3.61	9.86±2.76	49.27±9.14	9.96±1.87	10.06±2.09	10.92±2.32	10.45±2.28	41.40±6.84		
Literate	55 (13.3)	42.50±7.23	23.38±5.40	65.89±9.73	13.60±4.78	13.67±3.03	13.74±3.82	9.60±3.07	50.61±10.76	10.29±1.61	10.10±1.77	11.20±2.32	10.50±1.87	42.10±6.03		
Primary school	184 (44.4)	42.42±6.82	24.14±6.13	66.57±9.58	12.91±4.29	13.61±2.77	12.80±3.87	9.46±3.11	48.79±9.27	10.95±1.89	10.54±1.99	11.54±2.38	11.16±2.17	44.21±6.46		
High school	51 (12.3)	41.05±6.54	24.19±4.55	65.25±7.52	12.92±4.24	12.82±2.34	13.49±3.20	9.88±2.79	49.11±7.89	10.90±1.76	10.70±1.57	11.74±2.51	10.60±2.39	43.96±6.34		
University	33 (8.0)	42.42±8.34	23.84±6.59	66.27±11.00	13.48±4.38	13.84±3.18	12.54±3.47	9.15±2.52	49.03±8.83	9.81±2.02	9.72±1.71	10.78±2.11	10.78±1.98	41.12±5.72		
Test and significance value		F=1.329	F=0.268	F=0.704	F=0.824	F=2.122	F=1.082	F=0.594	F=0.416	F=6.504	F=2.504	F=1.947	F=2.200	F=4.266		
		p=0.258	p=0.934	p=0.589	p=0.510	p=0.077	p=0.365	p=0.667	p=0.797	p=0.001	p=0.042	p=0.102	p=0.088	p=0.002		
		(3>1)	(3>5)			(3>1)	(4>1)	(3>5)	(3>1)	(4>1)	(3>5)		(3>1)			
Mother's employment status																
Yes	43 (10.4)	42.97±7.50	24.53±6.20	67.51±11.75	13.37±4.07	13.88±3.31	13.23±3.55	9.81±2.45	50.30±7.38	10.32±1.99	10.46±1.88	11.62±2.18	11.23±2.06	43.65±6.03		
No	371 (89.6)	41.75±6.93	23.92±5.65	65.68±9.11	13.22±4.30	13.30±2.78	12.97±3.72	9.57±3.00	49.07±9.43	10.57±1.88	10.32±1.94	11.29±2.38	10.77±2.20	42.97±5.59		
Test and significance value		t=1.087	t=0.657	t=0.987	t=0.211	t=1.263	t=0.439	t=0.510	t=0.826	t=-0.830	t=0.454	t=0.875	t=1.302	t=0.647		
		p=0.278	p=0.512	p=0.329	p=0.833	p=0.207	p=0.661	p=0.610	p=0.410	p=0.407	p=0.650	p=0.382	p=0.194	p=0.518		
Father education level																
Illiterate	19 (4.6)	41.31±6.26	24.05±5.72	65.36±7.30	13.78±3.50	13.10±3.24	11.15±3.37	8.68±2.38	46.73±6.66	9.94±2.29	10.52±2.24	11.57±2.31	10.94±1.84	43.00±7.39		
Literate	52 (12.6)	42.34±6.41	22.82±5.25	65.17±8.41	13.98±4.40	13.78±2.59	13.50±3.50	10.07±3.02	51.34±10.21	9.90±2.01	10.26±1.61	10.75±2.59	10.01±1.84	40.94±6.14		
Primary school	182 (44.0)	41.20±7.64	24.48±5.82	65.69±10.35	13.05±4.34	13.02±3.08	13.04±3.85	9.53±3.07	48.65±9.58	10.56±1.80	10.28±1.97	11.32±2.32	11.00±2.31	43.17±6.47		
High school	100 (24.2)	42.50±6.46	24.00±5.84	66.50±9.04	13.06±4.32	13.54±2.64	13.07±3.76	9.69±2.93	49.36±8.81	10.90±1.88	10.36±1.96	11.39±2.31	10.91±2.17	43.56±6.46		
University	61 (14.7)	42.65±6.47	23.47±5.50	66.13±8.66	13.29±4.18	13.81±2.41	12.88±3.34	9.50±2.68	49.50±8.04	10.68±1.83	10.47±1.97	11.63±2.39	10.78±2.13	43.59±6.71		
Test and significance value		F=0.897	F=1.011	F=0.223	F=0.597	F=1.477	F=1.445	F=0.858	F=1.224	F=2.875	F=0.180	F=1.109	F=2.130	F=1.638		
		p=0.466	p=0.402	p=0.926	p=0.655	p=0.208	p=0.218	p=0.489	p=0.300	p=0.019	p=0.948	p=0.352	p=0.076	p=0.164		
		(4>2)								(4>2)						
Father's employment status																
Yes	326 (78.7)	41.99±7.03	23.75±5.87	65.74±9.47	13.38±4.33	13.37±2.84	13.32±3.69	9.76±2.96	49.84±9.17	10.61±1.84	10.37±1.93	11.35±2.39	10.78±2.21	43.13±6.48		
No	88 (21.3)	41.46±6.86	24.88±4.99	66.35±9.27	12.72±4.05	13.31±2.85	11.78±3.53	8.96±2.80	46.79±9.13	10.32±2.06	10.19±1.94	11.21±2.28	10.94±2.08	42.68±6.70		
Test and significance value		t=0.624	t=-1.657	t=-0.538	t=1.271	t=0.173	t=3.506	t=2.272	t=2.773	t=1.246	t=0.791	t=0.502	t=-0.588	t=0.581		
		p=0.533	p=0.098	p=0.591	p=0.204	p=0.863	p=0.001	p=0.024	p=0.006	p=0.213	p=0.429	p=0.616	p=0.557	p=0.562		

F: One-way analysis of variance test value; t: Independent Sample T-Test value; p: Significance Level; GAAS: General Attitude Towards Artificial Intelligence Scale; AIAS: Artificial Intelligence Anxiety Scale; AILS: Artificial Intelligence Literacy Scale

RESULTS

The mean age of the students was 21.07 ± 1.84 ; 72.7% were female, 30.9% were the 1st year, 44.4% of the students' mothers and 44.0% of the students' fathers were primary school graduates, 89.6% of the students' mothers were not working, and 78.7% of the students' fathers were working (Table 1). Among the students, 57.5% said they chose the nursing profession willingly, and 65% chose it because of accessible job opportunities (Table 2). Among the students, 47.6% stated that nursing education should be carried out with the support of AI, 42.0% said that AI was partially dangerous for the nursing profession, 40.3% stated that developments in AI would not cause the nursing profession to lose its importance, and 41.1% stated that they did not experience anxiety and fear (unemployment, etc.) about their profession due to developments in AI (Table 3).

The findings revealed that female students demonstrated higher scores in the Sociotechnical Blindness ($p=0.001$), AI configuration ($p=0.002$), awareness ($p=0.021$), ethics ($p=0.001$) sub-dimension, and AILS total scores ($p=0.004$) when compared to their male counterparts. The study revealed that the 4th-grade students demonstrated higher levels of positive attitude ($p=0.001$), job-switching ($p=0.001$) sub-dimensions, and GAAIS total scores ($p=0.005$) when compared to students in other grades. Furthermore, it was determined that the learning ($p=0.006$) sub-dimension and AIAS total scores ($p=0.044$) of the 3rd-grade students were statistically significantly higher than those of the 1st-grade students. The findings of the study also showed that the awareness ($p=0.001$) sub-dimension and the AILS total score ($p=0.002$) were statistically significant among students whose mothers were illiterate compared to those whose mothers were not literate. The mean score of the awareness ($p=0.019$) sub-dimension for students whose fathers had university degrees was found to be statistically significantly higher than for those who were literate. Furthermore, it was determined that the sociotechnical blindness ($p=0.001$), AI configuration ($p=0.024$) sub-dimension and AIAS total score ($p=0.006$) for students whose fathers were employed was statistically significantly higher (Table 1).

It was determined that the students who did not choose the nursing profession willingly had statistically significantly higher scores in positive attitude ($p=0.034$), job change ($p=0.040$), use ($p=0.003$) sub-dimension, and total score of AILS ($p=0.046$) (Table 2).

It was determined that the positive attitude ($p=0.001$), use ($p=0.042$), evaluation ($p=0.046$) sub-dimensions, GAAIS ($p=0.001$), and AILS ($p=0.044$) total score of the students who thought that nursing education should be supported by AI, sociotechnical blindness ($p=0.001$), AI configuration ($p=0.015$) sub-dimensions, and AIAS total score ($p=0.012$) of the students who thought that nursing education should be partially supported by AI were statistically significantly higher (Table 3).

TABLE 2: The correlation between students' views on the nursing profession and the total and subscale scores of the GAAIS, AIAS, and AILS

TABLE 2: The correlation between students' views on the nursing profession and the total and subscale scores of the GAAIS, AIAS, and AILS															
Variables	n (%)	GAAIS			AIAS				AILS						
		Positive attitude	Negative attitude	Total	Sociotechnical		Artificial intelligence		Total	Awareness	Use	Evaluation	Ethics	Total	
					Learning	Job change	blindness	configuration							
The status of choosing the nursing profession willingly	Yes	238 (57.5)	41.25±7.10	23.86±5.76	65.11±9.79	13.24±4.39	13.12±2.96	12.86±3.79	9.47±3.02	48.71±9.61	10.47±1.90	10.09±1.84	11.18±2.32	10.72±2.08	42.49±6.34
	No	176 (42.5)	42.72±6.78	24.17±5.65	66.89±6.82	13.23±4.13	13.69±2.65	13.17±3.58	9.76±2.84	49.86±8.70	10.65±1.89	10.66±2.01	11.51±2.42	10.94±2.32	43.78±6.72
Test and significance value			t=2.130	t=0.544	t=1.911	t=0.012	t=2.060	t=0.815	t=0.977	t=1.256	t=0.924	t=2.942	t=-1.394	t=-1.003	t=-1.998
			p=0.034	p=0.587	p=0.057	p=0.991	p=0.040	p=0.415	p=0.329	p=0.210	p=0.356	p=0.003	p=0.164	p=0.317	p=0.046

F: One-way analysis of variance test value; t: Independent Sample T-Test value; p: Significance level; GAAIS: General Attitude Towards Artificial Intelligence Scale; AIAS: Artificial Intelligence Anxiety Scale; AILS: Artificial Intelligence Literacy Scale

TABLE 3: The correlation between students' views on artificial intelligence and total and subscale scores of GA AIS, AIAS, and AILS

Variables	n (%)	GA AIS			AIAS				AILS						
		Positive attitude	Negative attitude	Total	Sociotechnical Artificial Intelligence			Total	Awareness	Use	Evaluation	Ethics	Total		
					blindness	configuration	blindness								
Artificial intelligence-supported nursing education	Yes	197 (47.6)	43.76±7.25	24.66±6.31	68.43±10.26	12.68±4.60	13.82±2.93	12.24±3.93	9.20±3.07	47.96±9.61	10.64±2.01	10.54±1.99	11.48±2.27	10.90±2.19	43.58±6.47
	No	88 (21.3)	38.85±6.51	23.79±4.67	62.64±7.94	13.86±3.97	12.43±2.92	13.28±3.48	9.62±2.85	49.20±9.08	10.42±1.83	9.92±1.90	10.77±2.67	10.40±2.24	41.52±6.97
	Partly	129 (31.2)	41.06±6.01	23.10±5.26	64.16±7.87	13.66±3.87	13.29±2.50	13.94±3.25	10.17±2.73	51.07±8.49	10.50±1.75	10.31±1.83	11.46±2.25	10.96±2.12	43.24±6.18
Test and significance value			F=17.590	F=3.018	F=15.570	F=3.264	F=7.595	F=8.818	F=4.221	F=4.482	F=0.486	F=3.188	F=3.111	F=2.019	F=3.156
			p<0.001	p=0.050	p<0.001	p=0.039	p<0.001	p<0.001	p=0.015	p=0.012	p=0.615	p=0.042	p=0.046	p=0.134	p=0.044
			(1>3>2)	(1>3)	(1>2)	(1>3)	(1>2)	(3>1)	(3>1)	(3>1)		(1>2)	(1>2)		(1>2)
The danger of artificial intelligence in terms of the nursing profession	Yes	76 (18.4)	40.63±8.25	21.52±5.36	62.15±8.76	15.10±4.23	13.27±3.26	13.92±3.50	10.25±2.75	52.55±9.60	10.05±1.93	10.19±2.01	10.82±2.57	10.55±2.21	41.63±6.91
	No	164 (39.6)	43.70±7.11	25.98±6.23	69.69±10.27	11.70±4.23	13.85±2.92	11.80±3.89	8.60±3.15	45.96±9.36	10.76±2.07	10.51±2.10	11.43±2.49	10.87±2.37	43.60±6.99
	Partly	174 (42.0)	40.70±5.87	23.18±4.66	63.89±7.44	13.87±3.85	12.94±2.50	13.71±3.30	10.24±2.56	50.78±7.99	10.56±1.66	10.22±1.72	11.44±2.12	10.88±1.99	43.12±5.81
Test and significance value			F=9.662	F=20.589	F=26.076	F=21.735	F=4.438	F=15.091	F=16.337	F=19.107	F=3.750	F=1.183	F=2.081	F=0.700	F=2.410
			p<0.001	p<0.001	p<0.001	p<0.001	p=0.012	p<0.001	p<0.001	p<0.001	p=0.024	p=0.307	p=0.126	p=0.497	p=0.091
			(2>1)	(2>1)	(2>1)	(1>2)	(2>3)	(1>2)	(1>2)	(1>2)	(2>1)				
Developments in artificial intelligence may cause the nursing profession to lose its importance	Yes	103 (24.9)	40.68±8.04	22.17±5.68	62.86±8.83	14.33±4.07	13.13±3.15	13.80±3.46	10.33±2.60	51.60±8.49	10.30±1.87	10.06±1.95	10.95±2.43	10.57±2.04	41.89±6.41
	No	167 (40.3)	42.81±6.80	25.26±6.10	68.08±10.32	12.32±4.56	13.56±2.90	12.17±3.85	8.93±3.12	47.01±9.74	10.70±2.01	10.70±1.99	11.55±2.51	10.99±2.32	43.94±6.75
	Partly	144 (34.8)	41.64±6.28	23.81±4.85	65.45±8.02	13.52±3.87	13.29±2.54	13.36±3.53	9.84±2.82	50.02±8.63	10.56±1.76	10.11±1.80	11.34±2.11	10.79±2.12	42.81±6.23
Test and significance value			F=3.092	F=9.865	F=10.446	F=7.669	F=0.808	F=7.454	F=8.165	F=9.067	F=1.417	F=5.013	F=2.053	F=1.191	F=3.319
			p=0.046	p<0.001	p<0.001	p<0.001	p=0.446	p<0.001	p<0.001	p<0.001	p=0.244	p=0.007	p=0.130	p=0.305	p=0.037
			(2>1)	(2>1)	(2>1)	(1>2)	(1>2)	(1>2)	(1>2)	(1>2)		(2>1)	(2>1)		(2>1)
Concerns or fears about the profession due to developments in artificial intelligence	Yes	109 (26.3)	40.41±8.10	22.25±6.04	62.66±8.93	14.36±4.28	13.04±3.10	14.22±3.42	10.35±2.66	51.96±9.05	10.11±2.06	10.16±1.91	11.13±2.40	10.69±2.06	42.11±6.48
	No	170 (41.1)	43.76±6.81	25.82±5.95	69.59±10.39	12.12±4.40	13.96±2.88	11.68±3.82	8.65±3.18	46.43±9.66	10.76±1.88	10.60±2.05	11.46±2.49	10.86±2.33	43.71±6.81
	Partly	135 (32.6)	40.68±5.62	23.08±4.32	63.77±6.53	13.73±3.79	12.86±2.43	13.65±3.26	10.17±2.52	50.42±7.86	10.63±1.72	10.14±1.76	11.31±2.17	10.83±2.10	42.93±6.14
Test and significance value			F=11.031	F=16.720	F=25.655	F=10.893	F=6.700	F=20.428	F=15.970	F=14.683	F=4.095	F=2.660	F=0.637	F=0.257	F=2.026
			p<0.001	p<0.001	p<0.001	p<0.001	p=0.001	p<0.001	p<0.001	p<0.001	p=0.017	p=0.071	p=0.529	p=0.774	p=0.133
			(2>1)	(2>1)	(2>1)	(1>2)	(2>1)	(1>2)	(1>2)	(1>2)	(2>1)				

F: One way analysis of variance test value; p: Significance level; GA AIS: General Attitude Towards Artificial Intelligence Scale; AIAS: Artificial Intelligence Anxiety Scale; AILS: Artificial Intelligence Literacy Scale

It was found that students who thought AI was not dangerous for the nursing profession and who did not experience anxiety and fear about their profession due to the developments in AI had statistically significantly higher positive attitudes ($p=0.001$), negative attitudes ($p=0.001$), job change respectively ($p=0.012$); ($p=0.001$), and awareness respectively ($p=0.024$); ($p=0.017$) sub-dimensions and total score of GAAIS ($p=0.001$) (Table 3).

In addition, it was determined that the students who thought that AI was dangerous for the nursing profession, that the developments in AI would cause the nursing profession to lose its importance, and who experienced anxiety and fear about their profession due to the developments in AI had statistically significantly higher AIAS subscale and total scores ($p=0.001$). It was found that the students who thought that the developments in AI would not cause the nursing profession to lose its importance had statistically significantly higher scores in positive attitude ($p=0.046$), negative attitude ($p=0.001$), Use ($p=0.007$) sub-dimensions, GAAIS ($p=0.001$), and AILS ($p=0.037$) total score (Table 3).

As a result of this study, the mean total scores of the students in the GAAIS, AIAS, and AILS were 65.87 ± 9.42 , 49.20 ± 9.24 , and 43.04 ± 6.53 , respectively. The findings determined that the students' general attitudes towards AI and AI literacy were above average, and their AI anxiety was at an average value (Table 4).

It was found that there was a statistically significant relationship between the General Attitude Towards the AI Scale and the AIAS in a negative direction and a positive direction with the AILS ($p=0.001$) (Table 5).

DISCUSSION

Sociotechnical blindness, AI configuration, awareness, ethics, and AI literacy levels of female students were statistically significantly higher than male students. This situation can be associated with gender roles. That is to say, according to gender roles, women are assigned domestic jobs, and men are assigned outdoor jobs. In this direction, men are aware of technological developments faster and use them more.²² Again, in patriarchal societies, there is a male-dominated structure in technological fields in general. This situation reduces women's self-confidence and assertiveness in this field and increases sociotechnical blindness.²³ The higher level of sociotechnical blindness of women may be associated with this situation. Again, depending on gender roles, women's ethical values and awareness levels may be higher than men's. As a matter of fact, according to a study, the ethical values of women were found to be significantly higher compared to men, which supports the findings of this study.²⁴ In line with these findings, more participation of women in technological developments can be ensured, initiatives can be taken to increase ethical awareness in

TABLE 4: Total and sub-dimensional scores of the students in the GAAIS, AIAS and AILS

Scale and subscales		Minimum	Maximum	\bar{X}	SD
GAAIS	Positive attitude	12.00	60.00	41.87	6.99
	Negative attitude	8.00	40.00	23.99	5.71
	Total	38.00	100.00	65.87	9.42
AIAS	Learning	5.00	25.00	13.24	4.28
	Job change	4.00	20.00	13.36	2.84
	Sociotechnical blindness	4.00	20.00	12.99	3.70
	Artificial intelligence configuration	3.00	15.00	9.59	2.94
	Total	22.00	73.00	49.20	9.24
AILS	Awareness	5.00	15.00	10.55	1.89
	Use	4.00	15.00	10.33	1.93
	Evaluation	4.00	15.00	11.32	2.36
	Ethics	3.00	15.00	10.82	2.18
	Total	26.00	60.00	43.04	6.53

SD: Standard deviation; GAAIS: General Attitude Towards Artificial Intelligence Scale; AIAS: Artificial Intelligence Anxiety Scale; AILS: Artificial Intelligence Literacy Scale

TABLE 5: The correlation between the total and sub-dimensional scores of the students in the GAAIS, AIAS, AILS

Scale and subscales		GAAIS					AIAS					AILS				
		1	2	3	a	b	c	d	e	I	II	III	IV	V		
GAAIS	1.Positive attitude	r value	1	0.090	-0.114**	0.862**	-0.103*	-0.103*	0.139**	0.217**	0.264**	0.277**	0.101*	0.276**		
		p value		0.068	<0.001	<0.001	0.036	0.035	0.005	<0.001	<0.001	<0.001	0.039	<0.001		
	2.Negative attitude	r value	0.090	1	-0.461**	0.071	-0.425**	-0.451**	-0.506**	0.086	0.060	0.042	0.109	0.094		
		p value			<0.001	0.147	<0.001	<0.001	<0.001	0.082	0.227	0.393	0.027	0.055		
	3.GAAIS total	r value	0.797**	0.673**	1	-0.364**	0.683**	-0.334**	-0.350**	0.213**	0.232**	0.231**	0.141**	0.262**		
		p value	<0.001	<0.001		<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.004	<0.001		
	a. Learning	r value	-0.114**	-0.461**	-0.364**	1	-0.065	0.428**	0.471**	0.765**	-0.187**	-0.169**	-0.123*	-0.203**		
		p value	0.021	<0.001	<0.001		0.188	<0.001	<0.001	<0.001	<0.001	<0.001	0.012	<0.001		
	b. Job change	r value	0.862**	0.071	0.683**	-0.065	1	-0.081	-0.085	0.218**	0.154**	0.176**	0.182**	0.184**		
AIAS	c.Sociotechnical blindness	p value	<0.001	0.147	<0.001	0.188	0.099	0.084	<0.001	0.002	<0.001	<0.001	0.196	<0.001		
		r value	-0.103*	-0.425**	-0.334**	0.428**	-0.081	1	0.722**	0.805**	0.055	0.048	0.132**	0.124*		
		p value	0.036	<0.001	<0.001	<0.001	0.039		<0.001	<0.001	0.265	0.333	0.007	0.006		
	d.Artificial intelligence configuration	r value	-0.103*	-0.451**	-0.350**	0.471**	-0.085	0.722**	1	0.801**	0.004	0.021	0.068	0.039		
		p value	0.035	<0.001	<0.001	<0.001	0.084	<0.001	<0.001	<0.001	0.941	0.670	0.170	0.658		
	e.AIAS total	r value	0.139**	-0.506**	-0.204**	0.765**	0.218**	0.805**	0.801**	1	-0.016	0.002	0.074	0.007		
		p value	0.005	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.748	0.972	0.135	0.894		
	I.Awareness	r value	0.217**	0.086	0.213**	-0.187**	0.154**	0.055	0.004	-0.016	1	0.525**	0.498**	0.386**		
		p value	<0.001	0.082	<0.001	<0.001	0.002	0.265	0.941	0.748	<0.001	<0.001	<0.001	<0.001		
AILS	II.Use	r value	0.264**	0.060	0.232**	-0.169**	0.176**	0.048	0.002	0.525**	1	0.595**	0.351**	0.783**		
		p value	<0.001	0.227	<0.001	<0.001	<0.001	0.333	0.670	<0.001	<0.001	<0.001	<0.001	<0.001		
	III.Evaluation	r value	0.277**	0.042	0.231**	-0.123*	0.182**	0.132**	0.068	0.498**	0.595**	1	0.472**	0.842**		
		p value	<0.001	0.393	<0.001	0.012	<0.001	0.007	0.170	<0.001	<0.001	<0.001	<0.001	<0.001		
	IV.Ethics	r value	0.101*	0.109*	0.141**	-0.161**	0.064	0.136**	0.022	0.386**	0.351**	0.472**	1	0.723**		
		p value	0.039	0.027	0.004	0.001	0.196	0.006	0.658	<0.001	<0.001	<0.001	<0.001	<0.001		
	V.AILS total	r value	0.276**	0.094	0.262**	-0.203**	0.184**	0.124*	0.039	0.757**	0.783**	0.842**	0.723**	1		
		p value	<0.001	0.055	<0.001	<0.001	<0.001	0.012	0.428	<0.001	<0.001	<0.001	<0.001	<0.001		

*Weak Correlation; **Moderate Correlation; ***High-Level Correlation; r: Pearson Correlation Analysis Coefficient; p: Significance Value; GAAIS: General Attitude Towards Artificial Intelligence Scale; AIAS: Artificial Intelligence Anxiety Scale; AILS: Artificial Intelligence Literacy Scale

male individuals, and a gender-egalitarian approach can be adopted in AI.

It was found that the positive attitudes towards AI, anxiety towards changing jobs, and general attitudes towards AI of the 4th-grade students were statistically significantly higher than the other grades. In addition, it was determined that the AI learning level and AI anxiety total score of the third-grade students and the AI anxiety of the 3rd-grade students were statistically significantly higher than that of the 1st-grade students. These findings show that students have different AI attitudes, anxiety, and literacy levels, depending on their grade level. The fact that students at advanced grade levels are more exposed to education and courses related to AI throughout their education may lead them to be more positive towards AI and have good general attitudes toward it. However, having a good attitude towards AI may have led to awareness of technological developments and, accordingly, to uncertainties about how AI will affect their professions. Based on these findings, attempts should be made to provide students with the relationship between AI and their professional lives, the changes it will bring, and positive attitudes towards AI. In addition, providing AI training at earlier grade levels may contribute to their having more knowledge and experience in the future.

The findings showed that the AI awareness and literacy levels of the students whose mothers had an elementary school education were higher than the students whose mothers were illiterate. Furthermore, it was observed that the AI awareness levels of students whose fathers had received a university education were higher than those of students whose fathers were literate. These findings can be associated with increased AI awareness and literacy of parents as their education level increases. It is thought that the increase in parents' AI awareness and literacy also increases the attitude towards AI. In the literature, in the study conducted by Urbano to determine the perceptions about AI, the reluctance towards the use of AI was found to be 22.2% among those with a post-graduate degree, 43.9% among those with a university degree and 54.5% among those who only completed high school.²⁵ These findings show the effect of parents' education level on children's AI

awareness and literacy, revealing that this awareness increases in parallel with parents' education level. In addition, similar studies in the literature also confirm that the level of education shapes attitudes toward AI technologies.²⁶ Therefore, for AI to become widespread and to be used effectively, it is important to raise the awareness of individuals through education from an early age.

Sociotechnical blindness, AI configuration, and AI anxiety were found to be statistically significantly higher in students whose fathers were employed. This may be attributed to the fact that their fathers are more exposed to AI technologies in their professional lives and are more interested in the technical and social dimensions of AI technologies in this direction. Talking about the developments and effects of AI technologies in the family may have also affected the level of anxiety. A quasi-experimental study conducted with students determined a significant positive relationship between the perceived danger of AI and the level of anxiety, supporting this study's findings.²⁷ In line with these findings, individuals' attitudes and anxiety levels towards AI technologies can be determined, and support can be provided. In addition, discussing developments and technologies related to AI in a more constructive language in family communication may positively affect students' perspectives.

The positive attitudes towards AI, changing jobs related to AI and AI configuration, usage, and intelligence literacy levels of students who chose the nursing profession involuntarily are statistically significantly higher. With the increase in AI literacy, students may think that rapid developments in AI technologies lead to the digitalization of the nursing profession and the necessity to keep up with this change. This thought may increase their concerns about changing jobs and AI configuration. The high level of AI literacy in individuals who choose the profession reluctantly may be associated with their search for different career paths. When the literature is examined, it is stated that the perception that AI will take over the nursing profession increases the career exploration behaviors of individuals experiencing job insecurity and occupational problems.²⁸ Based on these results, it can be suggested that students

should be informed about the professional integration of AI to ensure career management and prevent them from leaving the profession.

It was determined that the general attitude towards AI and AI literacy of the students who thought that nursing education should be carried out with AI support and the sociotechnical blindness and AI anxiety levels of the students who thought that nursing education should be partially supported by AI were statistically significantly higher. This may be attributed to the literature's relationship between knowledge and attitude towards AI.²⁹ Considering that students who want AI to be used in nursing education have more knowledge and literacy level towards AI, it is inevitable that their attitudes towards AI will be higher. Students who think that AI should partially support nursing education are more undecided about AI's opportunities and professional benefits. As a result of this ambivalence, they may have insufficient knowledge about the social and technical dimensions of AI and have higher levels of anxiety. Based on these findings, integrating AI in education programs and addressing its social and professional dimensions can positively affect students' attitudes and literacy and reduce their anxiety levels.

It was found that the students who thought that AI was not dangerous for the nursing profession and who did not experience anxiety and fear about their profession due to developments in AI had significantly higher general attitudes towards AI. It was found that the general attitude towards AI and AI literacy of the students who thought that the developments in AI would not cause the nursing profession to lose its importance were statistically significantly higher. In addition, it was determined that the total and sub-dimension scores of AI anxiety were statistically significantly higher in students who thought that AI was dangerous for the nursing profession, that developments in AI would cause the nursing profession to lose its importance, and who experienced anxiety and fear about their profession due to developments in AI. These findings are important in revealing how attitudes toward the professional effects of AI affect attitudes toward AI. According to the study examining the readiness of nursing students to use AI, it was found that students who believed

that AI could not change the profession had a more positive attitude toward AI.³⁰ In the opposite case, an increase in anxiety level can be expected. Students who are aware of the benefits of the profession of AI will have more positive attitudes, and anxiety levels will decrease. Therefore, organizing a training program that emphasizes the professional contributions of AI and provides opportunities to experience AI technologies will contribute to developing a more positive attitude among students.

It was found that there was a statistically significant relationship between students' general attitudes towards AI and their AI anxiety levels in a negative direction and a positive relationship with their AI literacy levels. The literature states that AI anxiety can negatively affect attitudes towards AI, and AI literacy positively increases attitudes towards AI.^{23,31} In light of these findings, reducing anxiety towards AI and increasing the level of literacy will lead to a more positive attitude towards these technologies. It can be suggested that seminars on AI be organized, positive examples should be presented, and a practical training environment should be provided.

As a result, students' general attitudes towards AI, their concerns about AI and their literacy in this field are above average. These findings are associated with the formation of student interest and awareness towards AI technologies. In addition, the development of AI in health services affects many health service groups, especially nursing. As a result, there is a growing concern that individuals' anxiety levels regarding AI are increasing.

LIMITATIONS

This study has some limitations. First, the study was conducted in only one state university, which limits the generalizability of the results to all nursing students. Secondly, the cross-sectional research design measures attitudes and perceptions only in a specific time period; therefore, it is not possible to establish causal relationships. Thirdly, data were collected through self-report questionnaires, which carries the risk of respondent bias. Future longitudinal and multicenter studies may reveal the dynamics of AI literacy and anxiety levels in nursing students over time in more depth.

CONCLUSION

As a result of a comprehensive study, it was determined that there was a negative relationship between nursing students' general attitudes towards AI and their AI concerns, and a positive relationship between their AI literacy. In addition, it was determined that the students' general attitudes and literacy towards AI were high, and their AI anxiety had an average value.

In line with the findings obtained, it is seen that nursing students' attitudes towards AI, literacy and anxiety levels significantly affect their readiness for the integration of technology into future nursing practices. This situation reveals the necessity of including structured theoretical knowledge and practical experiences related to AI technologies in the content of nursing education programs. In this way, students' self-confidence can be supported, their anxiety levels regarding AI can be reduced, and their professional identities can develop more consciously and more compatible with technological transformation. In this direction, it is recommended that courses on AI should be added to nursing education and workshops and seminars should be organized to raise awareness on this issue. The findings obtained offer

an important perspective to both nursing educators and policy makers in the process of preparing for technology-oriented health services.

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Conflict of Interest

No conflicts of interest between the authors and / or family members of the scientific and medical committee members or members of the potential conflicts of interest, counseling, expertise, working conditions, share holding and similar situations in any firm.

Authorship Contributions

Idea/Concept: Ayşe Eminoğlu, Sebahat Kuşlu, Beşir Çakır; **Design:** Ayşe Eminoğlu, Sebahat Kuşlu, Beşir Çakır; **Control/Supervision:** Ayşe Eminoğlu, Sebahat Kuşlu; **Data Collection and/or Processing:** Ayşe Eminoğlu, Sebahat Kuşlu, Beşir Çakır; **Analysis and/or Interpretation:** Ayşe Eminoğlu, Sebahat Kuşlu; **Literature Review:** Ayşe Eminoğlu, Sebahat Kuşlu; **Writing the Article:** Ayşe Eminoğlu, Sebahat Kuşlu; **Critical Review:** Ayşe Eminoğlu, Sebahat Kuşlu, Beşir Çakır; **References and Fundings:** Ayşe Eminoğlu, Sebahat Kuşlu, Beşir Çakır; **Materials:** Ayşe Eminoğlu, Sebahat Kuşlu.

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