Investigating the relationship between teachers' attitudes toward artificial intelligence and their artificial intelligence literacy

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Highlights	Abstract
- This research showed that teachers' positive attitudes toward artificial intelligence were high, and their levels of artificial intelligence literacy were medium. - This research emphasizes a positive, high-level, and significant relationship between teachers' positive attitudes toward artificial intelligence and their artificial intelligence literacy. - This research highlights that teachers' positive attitudes toward artificial intelligence significantly predicted teachers' artificial intelligence literacy levels.	This study aims to examine the relationship between teachers' attitudes toward artificial intelligence and their artificial intelligence literacy levels. In the present study, "General Attitude Toward Artificial Intelligence Scale" and "Artificial Intelligence Literacy Scale" were used. The study group consisted of 361 teachers working in public schools in Kartal, Pendik and Sultanbeyli districts of Istanbul province in Türkiye in the 2023-2024 academic year and selected by convenient sampling method. The findings obtained in this study showed that teachers' positive attitudes toward artificial intelligence were at a high level, while their negative attitudes were at a low level. The artificial intelligence literacy levels of the teachers were at a medium level. Teachers' positive and negative attitudes toward artificial intelligence and artificial intelligence literacy levels did not show significant differences according to their gender, professional seniority and education level. However, teachers' positive attitudes toward artificial intelligence and artificial intelligence literacy levels were significantly higher in teachers with graduate education than those with undergraduate education. Likewise, teachers' negative attitudes toward artificial intelligence were significantly higher in teachers with undergraduate education than those with graduate education. As a result of the correlation analysis, it was found that there was a positive, high-level and significant relationship between teachers' positive attitudes toward artificial intelligence and their artificial intelligence literacy. On the other hand, there was a negative, moderate and significant relationship between teachers' negative attitudes toward artificial intelligence and their artificial intelligence literacy. As a result of the findings obtained from this study, some suggestions for researchers and practitioners are presented.
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1. Introduction

Developments in artificial intelligence technology have brought some changes and transformations in education in every field (Cantu-Ortiz, Galeano Sanchez, Garrido, Terashima-Marin & Brena, 2020; Küçükali & Coşkun, 2021). Especially the applications developed in recent years have been used in a wide range of areas, ranging from monitoring the educational status of students to managing education as

well as teachers' classroom teaching processes (Durak & Cankaya, 2023; Haleem, Javaid, Qadri & Suman, 2022).

Artificial intelligence describes machine-based systems that make predictions, recommendations, or decisions that affect real or virtual environments in line with human-determined goals. Generative artificial intelligence, on the other hand, is artificial intelligence systems with human-like language abilities, and is usually trained using deep learning and neural networks, and can process data to make sense of it, produce it, or transform it. Advanced generative AI technologies such as ChatGPT are considered abstract technologies that process and use language. Generative AI represents a significant technological advancement with far-reaching implications for many areas of our lives, including education (Bozkurt, 2023). New technologies, especially artificial intelligence, machine learning, chatbots and personal virtual assistants, have great advantages (easy access to information, ease of measurement and evaluation, innovation in teaching and learning practices, etc.) and risks (plagiarism, ethics, privacy concerns, excessive dependence on technology, etc.) in the education sector. However, emphasizing the advantages while coping with the risks can have a great impact on the future of humanity (UNESCO, 2023).

However, although artificial intelligence reduces the need for the human factor in business processes, it does not make sense on its own. As a matter of fact, the possibilities that emerge with generative artificial intelligence beyond artificial intelligence technologies such as machine and deep learning can lead to the expansion of the scope of the existing roles of educators in the field of education or the emergence of new roles (learning facilitation, creativity of learning resources, learning evaluation, etc.) (Bozkurt & Sharma, 2023). Artificial intelligence has the potential to improve access to quality education, create personalized learning experiences, solve these challenges by supporting data-based decision-making, and develop sustainable education (Kamalov, Santandreu Calonge & Gurrib, 2023; Lin, Huang & Lu, 2023). In Turkey, in order to quickly adapt to the developing age, some goals have been determined for the use of artificial intelligence in education within the scope of the National Artificial Intelligence Strategy Action Plan (Digital Transformation Office of the Presidency of Republic of Türkiye, 2021). Therefore, in order to achieve these goals and to benefit from artificial intelligence technology effectively and efficiently in the education process, educators who can use it correctly and appropriately are needed (Liua, Salehb & Huang, 2021; Zawacki-Richter, Marín, Bond & Gouverneur, 2019). In this context, today's and especially future teachers are expected to be able to use this technology very well and integrate it into their lessons. Hence, teachers are expected to be interested in artificial intelligence technology, willingly follow and use new developments in this field. Based on these considerations, this study examined the relationship between teachers' attitudes toward artificial intelligence and their artificial intelligence literacy levels.

2. Literature

In recent years, several studies have examined in detail the impact of artificial intelligence technologies on education and teachers' approaches to these technologies. Chen, Chen and Lin's (2020) study indicates that artificial intelligence is increasingly being adopted in the education sector, improving both administrative efficiency and teaching quality. The advancement of artificial intelligence requires teachers to upgrade their professional qualifications to meet new educational requirements. These include some skills, such as improved teaching quality, information digital literacy, and using information wisely (Cai, 2023). In this context, raising teachers' professional qualifications and increasing their self-efficacy positively reflects the role of education in student achievement (Erduran Tekin, 2023).

While research shows that artificial intelligence reduces teachers' workload and improves their information literacy, most teachers acknowledge the role of artificial intelligence in their professional development, but some are still skeptical about the benefits of this technology (Al-Zyoud, 2020; Xue & Wang, 2022; Yangyang, 2023). However, today, artificial intelligence has deeply affected educational methodologies, and it has become necessary for teachers to improve themselves in this regard. This

adaptation includes understanding and using artificial intelligence tools to optimize teaching processes and reduce workload, thus improving teachers' information literacy (Xue & Wang, 2022). Indeed, research on teaching artificial intelligence at various educational levels has shown that artificial intelligence education can significantly influence teaching strategies and that there is a need to focus on AI literacy among teachers to facilitate effective teaching (Kandlhofer, Steinbauer, Hirschmugl-Gaisch & Huber, 2016). In this regard, Cai (2023) emphasizes the crucial steps toward effectively integrating artificial intelligence into teaching by improving the quality of teachers' education, digital literacy and their ability to use information effectively.

To fully utilize the advantages of artificial intelligence in education, it is imperative to improve teachers' artificial intelligence literacy and attitudes toward artificial intelligence. Teachers need to gain awareness about artificial intelligence, develop the skills to use artificial intelligence correctly and effectively, and use different applications safely and effectively by making a qualified assessment in this area and adhering to ethical principles and values. Artificial intelligence literacy can provide the necessary knowledge and skills for all these issues, allowing them to integrate artificial intelligence into teaching practices more effectively. Accordingly, the professional qualifications of teachers who follow current developments, such as artificial intelligence applications increase, and contribute to student education (Erduran Tekin, 2023).

Teachers' cognitions and attitudes toward the application of artificial intelligence in education are important indicators of their artificial intelligence literacy (Dai, 2021). Indeed, Polak, Schiavo, and Zancanaro's (2022) study reveals that teachers generally have a positive attitude toward artificial intelligence education and are highly motivated to integrate artificial intelligence content in schools. Moreover, Pokrivcakova's (2023) study shows that teachers' attitudes are important for successfully implementing artificial intelligence in education. Similarly, Cai (2023) discusses the changes that need to be made in teacher literacy in the face of the rapid progress of artificial intelligence, emphasizing that teachers need to update their skills to keep up with technological developments. However, at this point, it is thought that teachers' attitudes toward artificial intelligence may also be effective. In fact, the Technology Acceptance Model (TAM), developed by Davis (1989) by analyzing the individual's acceptance and use of information technologies, supports this idea.
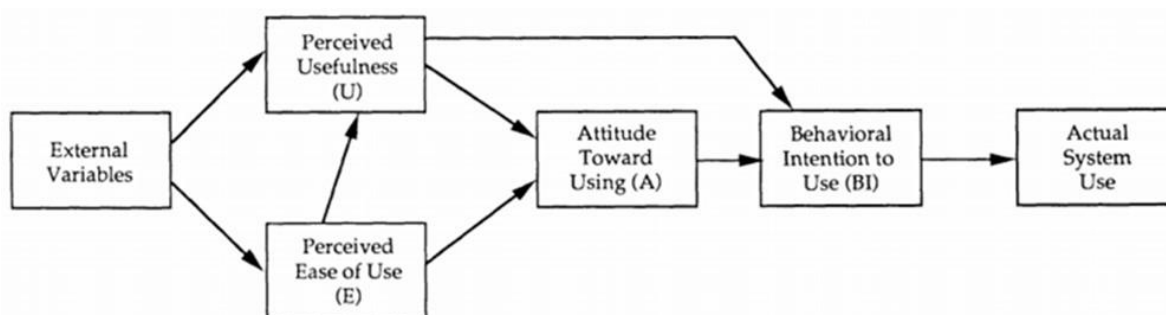

Fig. 1. Technology Acceptance Model (Davis, 1989).

As shown in Figure 1, this model measures technology acceptance based on four basic elements: "perceived ease of use", "perceived usefulness", "attitude toward using" and "behavioral intention to use" (Davis, Bagozzi, & Warshaw, 1989). When the existing studies on teachers' use of artificial intelligence are examined, it is seen that these studies generally focus on teachers' artificial intelligence awareness levels (Aksu & Durak, 2019; McGrath, Pargman, Juth & Palmgren, 2023), their ability to integrate artificial intelligence into teaching (Dülger & Gümüşeli, 2023; Han, Kim & Kwon, 2020), or their attitudes toward artificial intelligence (Galindo-Domínguez et al., 2024; Kuleto et al., 2022; Randhawa & Jackson, 2020). However, as mentioned before, the attitudes of individuals on any subject can also be very effective in taking action on that subject. In this respect, it is thought that teachers' attitudes toward artificial intelligence may also be effective in their artificial intelligence literacy. Based on these considerations, this study aims to examine the relationship between teachers' attitudes toward artificial

intelligence and their artificial intelligence literacy levels. In addition, individuals' attitudes and behaviors can be affected by their demographic variables (gender, education level, etc.) (Aassve, Sironi & Bassi, 2013). Therefore, the aim of the study was to reveal the current situation by examining teachers' attitudes towards artificial intelligence and artificial intelligence literacy levels according to some demographic variables. Thus, it is hoped that the findings to be obtained from the research will partially contribute to the gap in the literature. Within the framework of this general purpose, answers to the following questions were sought in the research:

1) What is the level of teachers' attitudes toward artificial intelligence and their artificial intelligence literacy?

2) Do teachers' attitudes toward artificial intelligence and artificial intelligence literacy levels show significant differences in demographic variables (gender, professional seniority, level of education and educational background)?

3) Is there a significant relationship between teachers' attitudes toward artificial intelligence and their artificial intelligence literacy levels?

4) Are teachers' attitudes toward artificial intelligence a significant predictor of their artificial intelligence literacy levels?

3. Methodology

3.1. Research Model

This study, which examined the relationship between teachers' attitudes toward artificial intelligence and artificial intelligence literacy levels, was designed in the relational survey model, one of the quantitative research models. Relational survey models were research models that aim to determine the existence or degree of change between two or more variables (Karasar, 2023).

3.2. Data Collecting Tools

The data collection tool consisted of three parts. The first section included questions to learn the personal information of the participants. The second and third sections included the General Attitude toward Artificial Intelligence Scale developed by Schepman and Rodway (2020) and adapted into Turkish by Kaya, Aydın, Schepman, Rodway, Yetişensoy and Demir-Kaya (2022) and the Artificial Intelligence Literacy Scale developed by Wang, Rau and Yuan (2022) and adapted into Turkish by Çelebi, Yılmaz, Demir and Karakuş (2023). These scales were used in their original form after obtaining the necessary permissions from the researchers who developed the scales and without making any structural changes in terms of statistics. Information on the validity and reliability analyses stated by the researchers who developed the scales is presented below.

3.2.1. General Attitude Toward Artificial Intelligence Scale

The general attitude toward artificial intelligence scale, which measures the level of individuals' attitudes toward artificial intelligence, has two sub-dimensions, namely a positive attitude sub-dimension and negative attitude sub-dimension, and 20 items. As a result of the confirmatory factor analysis of the 5-point Likert-type scale, the factor loading values for the positive attitude sub-dimension were between .40 and .71, and for the negative attitude sub-dimension between .41 and .76. As a result of confirmatory factor analysis, it was revealed that the values of the model showed a good fit (x^2 =557.01, df=169, x^2/df=3.30=0.92, NNFI=0.91, SRMR=0.067, RMSEA=0.081) Cronbach's alpha internal consistency coefficient for the positive attitude sub-dimension of the scale was .82, and the internal consistency coefficient for the negative attitude sub-dimension was .84 (Kaya, Aydın, Schepman, Rodway, Yetişensoy & Demir-Kaya, 2022).

3.2.2. Artificial Intelligence Literacy Scale

The artificial intelligence literacy scale, which measured individuals' artificial intelligence literacy levels, had four sub-dimensions named awareness, usage, evaluation and ethics and a total of 12 items. As a result of the confirmatory factor analysis of the 7-point Likert-type scale, it was revealed that the values of the model showed a good fit (x^2 /df =1.82, RMSEA=0.04, RMR=0.03, NFI=0.95, CFI=0.98, GFI =0.96 and AGFI=0.94). Cronbach's alpha internal consistency coefficient of the scale was .72 for the awareness sub-dimension, .74 for the use sub-dimension, .76 for the evaluation sub-dimension, .72 for the ethics sub- dimension and .85 for the overall scale (Çelebi, Yılmaz, Demir & Karakuş, 2023).

3.3. Study Group

The study group of this research consisted of 361 teachers working in Kartal, Pendik and Sultanbeyli districts of Istanbul province in the 2023-2024 academic year and selected by convenient sampling method. In convenience sampling, researchers select participants from individuals who are easy to reach, suitable for the study, and volunteer (Gravetter & Forzano, 2012). Personal information of the study group is presented in Table 1.

Table 1.

Frequency and Percentage Values of Personal Information

Variable	Groups	Frequency (f)	Percentage (%)
Gender	Female	212	59
	Male	149	41
	Total	361	100
Professional Seniority	0-5 years	56	16
	6-10 years	73	20
	11-15 years	98	27
	16-20 years	75	21
	21 years and over	59	16
	Total	361	100
Level of Education	Primary School	118	32
	Secondary School	151	42
	High School	92	25
	Total	361	100
Education Status	Undergraduate	282	78
	Graduate	79	22
	Total	361	100

As shown in Table 1 above, there were 361 teachers in the study group, 212 (59%) of whom were female and 149 (41%) male. Of the teachers participating in the present study, 56 (16%) had 0-5 years, 73 (20%) 6-10 years, 98 (27%) 11-15 years, 75 (21%) 16-20 years, and 59 (16%) 21 years or more of professional seniority; 118 (32%) were working in primary schools, 151 (42%) in secondary schools, and 92 (25%) in high schools; 282 (78%) had undergraduate education and 79 (22%) had graduate education.

3.4. Procedures and Data Analysis

The data were collected when the link to the online form containing the data collection tools was sent by the researchers to the teachers who voluntarily participated in this study. The data from 361 scales filled by the participants through the link sent were included in the analysis. The collected data were analyzed using the SPSS 25.0 program. Before starting the analysis, it was examined whether the collected data met the unidirectional and multidirectional normality assumptions. George and Mallery (2003) state that if the skewness and kurtosis coefficients are within the range of ±2, the data distribution meets the

normality assumption. Based on this information, the skewness and kurtosis values and Q-Q graphs of the data were examined. It was concluded that the positive attitude (-.38 to -.87), negative attitude (.20 to -.90), awareness (-.65 to -.32), usage (-.22 to -.08), evaluation (-.21 to -1.02), ethics (.63 to .07) and artificial intelligence literacy (scale total score) (.17 to -.93) scores were within the normal distribution limits. In addition, it was observed that the expected and actual values of the data in the Q-Q graphs were distributed close to a line with a slope of 45 degrees. This showed that the data distribution could be accepted as normal (Can, 2014). In the analyses, the significance of the difference between the averages was tested at a .05 level. In the interpretation of the arithmetic averages in this study, the range of 1.00-1.79 was considered "strongly disagree", the range of 1.80-2.59 as "disagree" , the range of 2.60-3.39 as "neutral", the range of 3.40-4.19 as "agree" and the range of 4.20-5.00 as "strongly agree" in the five-point Likert-type scales; and the range of 1.00-1.86 as "very low" in the seven-point Likert-type scale.00-1.86 as "strongly disagree", 1.86-2.72 as "disagree", 2.72-3.58 as "partially disagree", 3.58-4.44 as "neutral", 4.44-5.30 as "partially agree", 5.30-6.16 as "agree" and 6.16-7.00 as "strongly agree". In addition, in the interpretation of correlation analysis, the range of .00-.30 was accepted as "low", the range of .31-.70 as "medium" and the range of .71-1.00 as "high" level relationship (Büyüköztürk, 2011). Descriptive statistics, correlation and simple linear regression analysis were used to analyze the data.

4. Findings

The arithmetic mean, standard deviation and skewness kurtosis values of teachers' attitudes toward artificial intelligence and artificial intelligence literacy levels are presented in Table 2.

Table 2.

Arithmetic Mean, Standard Deviation and Skewness-Proportionality Values of Teachers regarding the Variables of this Study

Scales and Sub-dimensions	$\bar{x}$	Sd	Skewness	Kurtosis
1. Positive Attitude	3.98	.67	-.38	-.87
2. Negative Attitude	2.22	.71	.20	-.90
3. Awareness	4.40	.59	-.65	-.32
4. Usage	4.28	.58	-.22	-.08
5. Evaluation	4.02	.96	-.21	-1.02
6. Ethics	3.80	1.04	.63	.07
7. Artificial Intelligence Literacy	4.13	.62	.17	-.93

Teachers' positive attitudes toward artificial intelligence ($\bar{x}$=3.98) and negative attitudes ($\bar{x}$=2.22) were at a low level (Table 2). On the other hand, teachers' artificial intelligence literacy levels (scale total score) ($\bar{x}$=4.13) and awareness ($\bar{x}$= 4.40), utilization ($\bar{x}$=4.28), evaluation ($\bar{x}$=4.02) and ethics ($\bar{x}$=3.80) sub-dimension scores were at a moderate level. When the standard deviation values were analyzed, it was seen that the most homogeneous group was in the use dimension (.58). In other words, teachers' levels of artificial intelligence use were more similar to each other. The least homogeneous group was in the ethical dimension (1.04). This showed that teachers' levels of compliance with ethical principles and values in the use of artificial intelligence in the context of research variables differed more from each other.

Comparison of Teachers' Attitudes toward Artificial Intelligence and Artificial Intelligence Literacy Levels regarding Demographic Variables

An independent group t-test was conducted to determine whether the general attitude scale toward artificial intelligence and artificial intelligence literacy scale scores of the teachers constituting the study group showed a significant difference according to the gender variable. As shown in Table 3, there was no significant difference between the groups' positive attitude (t= -.23; p>.05), negative attitude (t= .63;

p>.05), awareness (t= -.01; p>.05), usage (t= .23; p>,05), evaluation (t=.49; p>,05), ethics (t= .53; p>,05) and artificial intelligence literacy (total) (t= .46; p>,05) scores according to the gender variable.

Table 3.

Independent Group t-test Results to Determine whether Teachers' Attitudes toward Artificial Intelligence and Artificial Intelligence Literacy Levels Differentiate according to Gender Variable Information

Score	Groups	n	$\overline{\text{x}}$	Sd	Se	*t* Test		
						t	Df	*p*
Positive Attitude	Female	212	3.98	.68	.05	-.23	359	.82
	Male	149	3.99	.66	.05			
Negative Attitude	Female	212	2.24	.79	.05	.63	359	.53
	Male	149	2.19	.58	.05			
Awareness	Female	212	4.40	.59	.04	-.01	359	.99
	Male	149	4.40	.58	.05			
Usage	Female	212	4.29	.55	.04	.23	359	.82
	Male	149	4.28	.62	.05			
Evaluation	Female	212	4.04	1.00	.07	.49	338	.62
	Male	149	3.99	.90	.07			
Ethics	Female	212	3.83	1.07	.07	.53	359	.59
	Male	149	3.77	.99	.08			
Artificial Intelligence	Female	212	4.14	.65	.04	.46	359	.65
	Male	149	4.11	.58	.05			

One-way analysis of variance (ANOVA) was conducted to determine whether the general attitude toward the artificial intelligence scale and artificial intelligence literacy scale scores of the teachers constituting the study group showed a significant difference according to the professional seniority variable. As shown in Table 4, there was no significant difference between the groups' positive attitude (F= 1.52; p>.05), negative attitude (F= .29; p>.05), awareness (F= .40; p>.05), usage (F=.69; p>,05), evaluation (F=1.40; p>,05), ethics (F= 1.34; p>,05) and artificial intelligence literacy (total) (F= 1.19; p>,05) scores according to the variable of professional seniority.

Table 4.

 ANOVA Results to Determine whether Teachers' Attitudes toward Artificial Intelligence and Artificial Intelligence Literacy Levels Differentiate according to Professional Seniority Variable

Score	Groups	*n*	$\overline{\text{x}}$	Sd	Source of Variation	*SS*	*Df*	*MS*	*F*	*p*
Positive Attitude	0-5 years	56	4.15	.58	Between Groups	2.71	4	.68	1.52	.20
	6-10 years	73	4.05	.66	Within Groups	158.33	356	.45		
	11-15 years	98	3.92	.65	Total	161.04	360			
	16-20 years	75	3.96	.68						
	21 years or more	59	3.89	.75						
	Total	361	3.98	.67						
Negative Attitude	0-5 years	56	2.19	.72	Between Groups	.60	4	.15	.29	.88
	6-10 years	73	2.18	.69	Within Groups	181.17	356	.51		
	11-15 years	98	2.27	.74	Total	181.77	360			
	16-20 years	75	2.25	.68						
	21 years or more	59	2.18	.72						
	Total	361	2.22	.71						

Score	Groups	n	x̄	Sd	Source of Variation	SS	Df	MS	F	p
Awareness	0-5 years	56	4.36	.61	Between Groups	.55	4	.14	,40	,81
	6-10 years	73	4.42	.52	Within Groups	122.84	356	.35		
	11-15 years	98	4.41	.63	Total	123.38	360			
	16-20 years	75	4.44	.58						
	21 years or more	59	4.33	.58						
	Total	361	4.40	.59						
Usage	0-5 years	56	4.38	.52	Between Groups	.92	4	.23	.69	.60
	6-10 years	73	4.28	.55	Within Groups	119.07	356	.33		
	11-15 years	98	4.23	.54	Total	119.99	360			
	16-20 years	75	4.31	.71						
	21 years or more	59	4.24	.54						
	Total	361	4.28	.58						
Evaluation	0-5 years	56	4.19	.89	Between Groups	5.08	4	1.27	1.40	.24
	6-10 years	73	4.12	.91	Within Groups	324.05	356	.91		
	11-15 years	98	3.91	.97	Total	329.13	360			
	16-20 years	75	4.04	1.02						
	21 years or more	59	3.86	.95						
	Total	361	4.02	.96						
Ethics	0-5 years	56	4.07	.96	Between Groups	5.72	4	1.43	1.34	.26
	6-10 years	73	3.79	.98	Within Groups	380.22	356	1.07		
	11-15 years	98	3.67	.97	Total	385.95	360			
	16-20 years	75	3.83	1.19						
	21 years or more	59	3.75	1.04						
	Total	361	3.80	1.04						
Artificial Intelligence Literacy	0-5 years	56	4.25	.56	Between Groups	1.82	4	.46	1.19	.32
	6-10 years	73	4.15	.60	Within Groups	136.96	356	.39		
	11-15 years	98	4.06	.62	Total	138.78	360			
	16-20 years	75	4.16	.70						
	21 years or more	59	4.05	.61						
	Total	361	4.13	.62						

ANOVA was performed to determine whether the scores of the general attitude toward the artificial intelligence scale and artificial intelligence literacy scale of the teachers who constituted the study group showed a significant difference according to the educational level variable. There was no significant difference between the positive attitude (F= .00; p>.05), negative attitude (F= 1.81; p>.05), awareness (F= 2.22; p>.05), usage (F=.54; p>,05), evaluation (F=.95; p>,05), ethics (F= 2.08; p>,05) and artificial intelligence literacy (total) (F= 1.01; p>,05) scores of the groups according to the education level variable (Table 5).

Table 5.

ANOVA Results to Determine whether Teachers' Perception Levels of Motivational Language and Organizational Exclusion Differentiate according to the Educational Level Variable

Score	Groups	n	x̄	Sd	Source of Variation	SS	Df	MS	F	p
Positive Attitude	Primary school	118	3.98	.71	Between Groups	.00	2	.00	.00	1.00
	Secondary school	151	3.98	.60	Within Groups	161.03	358	.45		
	High school	92	3.99	.74	Total	161.04	360			
	Total	361	3.98	.67						
Negative Attitude	Primary school	118	2.26	.79	Between Groups	1.82	2	.91	1.81	.17
	Secondary school	151	2.26	.64	Within Groups	179.95	358	.50		
	High school	92	2.10	.70	Total	181.77	360			
	Total	361	2.22	.71						
Awareness	Primary school	118	4.49	.55	Between Groups	1.51	2	.76	2.22	.11
	Secondary school	151	4.34	.59	Within Groups	121.87	358	.34		

	High school	92	4.39	.61	Total	123.38	360		
	Total	361	4.40	.59					
Usage	Primary school	118	4.28	.61	Between Groups	.36	2	.18	
	Secondary school	151	4.25	.57	Within Groups	119.63	358	.33	.54 .58
	High school	92	4.33	.55	Total	119.99	360		
	Total	361	4.28	.58					
Evaluation	Primary school	118	3.95	.97	Between Groups	1.73	2	.87	
	Secondary school	151	4.00	.94	Within Groups	327.40	358	.92	.95 .39
	High school	92	4.13	.96	Total	329.13	360		
	Total	361	4.02	.96					
Ethics	Primary school	118	3.68	1.00	Between Groups	4.44	2	2.22	
	Secondary school	151	3.80	.97	Within Groups	381.50	358	1.07	2.08 .13
	High school	92	3.97	1.17	Total	385.95	360		
	Total	361	3.80	1.04					
Artificial Intelligence Literacy	Primary school	118	4.10	.62	Between Groups	.78	2	.39	
	Secondary school	151	4.10	.59	Within Groups	138.00	358	.39	1.01 .37
	High school	92	4.20	.66	Total	138.78	360		
	Total	361	4.13	.62					

An independent group t-test was conducted to determine whether the general attitude toward the artificial intelligence scale and artificial intelligence literacy scale scores of the teachers who constituted the study group showed a significant difference according to the educational status variable. As seen in Table 6, as a result of the independent samples t-test, the difference between the groups was not significant for the awareness (t= -1.50; p>.05) sub-dimension scores according to the educational status variable, while the difference between the groups was significant for the positive attitude (t= -.46; p<.05), usage (t= -2.59; p<.05), evaluation (t= - 3.44; p<.05) and ethics (t= -3.13; p<.05) sub-dimension scores and artificial intelligence literacy (t= -3.53; p<,05) score. The differences between the arithmetic averages of the groups were found significant in favor of the teachers with graduate education. On the other hand, the differences between the negative attitude (t= 7.75; p<.05) sub-dimension scores were significant in favor of teachers with undergraduate education.

Table 6.

Independent Group t-test Results to Determine Whether Teachers' Attitudes toward Artificial Intelligence and Artificial Intelligence Literacy Levels Differentiate according to Educational Status Variable

Score	Groups	n	$\overline{\mathrm{x}}$	Sd	Se	*t* Test		
						t	Df	*p*
Positive Attitude	Undergraduate degree	282	3.91	.69	.04	-.46	157	.00
	Graduate degree	79	4.25	.53	.06			
Negative Attitude	Undergraduate degree	282	2.33	.73	.04	7.75	204	.00
	Graduate degree	79	1.82	.45	.05			
Awareness	Undergraduate degree	282	4.37	.60	.04	-1.50	359	.13
	Graduate degree	79	4.49	.54	.06			
Usage	Undergraduate degree	282	4.25	.60	.04	-2.59	154	.01
	Graduate degree	79	4.41	.48	.05			
Evaluation	Undergraduate degree	282	3.93	.96	.06	-3.44	359	.00
	Graduate degree	79	4.34	.86	.10			
Ethics	Undergraduate degree	282	3.72	1.01	.06	-3.13	359	.00
	Graduate degree	79	4.12	1.06	.12			
Artificial Intelligence Literacy	Undergraduate degree	282	4.07	.61	.04	-3.53	359	.00
	Graduate degree	79	4.34	.60	.07			

Relationships between Variables

The relationships between the dependent and independent variables of this study were analyzed using Pearson correlation analysis. As a result of Pearson correlation analysis, it was found that there was a positive, high and significant relationship (r= .82; p< .01) between teachers' positive attitudes toward artificial intelligence and artificial intelligence literacy. On the other hand, there was a negative, moderate and significant relationship (r= -.58; p< .01) between teachers' negative attitudes toward artificial intelligence and their artificial intelligence literacy (Table 7).

Table 7.

Relationships between the Dependent and Independent Variables of this Study

	Artificial Intelligence Literacy
Positive Attitude	.82**
Negative Attitude	-.58**

**p<.01; *N*=361

The predictive power of the relationship between the predictor variables (teachers' positive and negative attitudes toward artificial intelligence) and the predicted variable (teachers' artificial intelligence literacy) was examined by simple linear regression analysis.

The regression analysis on the prediction of teachers' positive attitudes toward artificial intelligence on artificial intelligence literacy levels is presented in Table 8.

Table 8.

Simple Linear Regression Analysis Results for the Prediction of Artificial Intelligence Literacy Scale

Model	B	Std. E.	β	t	p	R	R²	F	p
1.(constant)	1.092	.113		9.641	.000	.820	.673	737.617	.000
Positive Attitude	.761	.028	.820	27.159	.000				

The ANOVA table for the simple linear regression analysis showed that the regression model explained was statistically significant. As shown in Table 8, according to the regression analysis, teachers' positive attitudes toward artificial intelligence significantly predicted teachers' artificial intelligence literacy levels. Teachers' positive attitudes toward artificial intelligence explained 67% of the total variance of artificial intelligence literacy levels [$F_{(1,359)}$ = 737.617; p<0.001].

According to the regression analysis results, the regression equation predicting the artificial intelligence literacy scale is as follows:

Artificial intelligence literacy = (.761 x positive attitude toward artificial intelligence) +1.092

The regression analysis of the prediction of teachers' negative attitudes toward artificial Intelligence on artificial intelligence literacy levels is presented in Table 9.

Table 9.

Simple Linear Regression Analysis Results for the Prediction of Artificial Intelligence Literacy Scale

Model	B	Std. E.	β	t	p	R	R²	F	p
1.(constant)	5.245	.088		59.721	.000	.577	.333	179.023	.000

Negative Attitude	-.504	.038	-.577	-13.380	.000

The ANOVA table for the simple linear regression analysis showed that the regression model explained was statistically significant. As seen in Table 9, according to the regression analysis, teachers' negative attitudes toward artificial intelligence significantly predicted teachers' artificial intelligence literacy levels. Teachers' negative attitudes toward artificial intelligence explained 33% of the total variance of artificial intelligence literacy levels [$F_{(1,359)}$ = 179.023; p<0.001].

According to the regression analysis results, the regression equation predicting the artificial intelligence literacy scale is as follows:

Artificial intelligence literacy = (-.504 x negative attitude toward artificial intelligence) + 5.245

5. Conclusion and Discussion

Since new technologies are unfamiliar to users, users may have difficulty understanding and using them. Therefore, when a new technology is introduced, it is necessary to analyze the attitudes of individuals towards this technology and the factors that affect these attitudes (Bechtold, Stauder & Fieder, 2024; Kelly, Kaye & Oviedo-Trespalacios, 2023). Based on this idea, this research examined the relationship between the attitudes of 361 teachers working in public schools in Kartal, Pendik and Sultanbeyli districts of Istanbul province in the 2023-20234 academic year and their artificial intelligence literacy levels. The findings obtained in this study showed that teachers' positive attitudes toward artificial intelligence were at a high level, while their negative attitudes were at a low level. On the other hand, the artificial intelligence literacy levels of the teachers were at a medium level. As in every field, artificial intelligence is gaining importance day by day in the field of education and with different applications produced, significant contributions are offered to both teachers and students. Therefore, it can be considered a positive and desirable situation that teachers' attitudes toward artificial intelligence are high and their artificial intelligence literacy levels are not low. When the results of different studies in the literature are examined, it is seen that educators' awareness levels toward artificial intelligence are high, their attitudes are positive and they can use artificial intelligence applications at a certain level (Dülger & Gümüşeli, 2023; İçöz & İçöz, 2024; Kaplan-Rakowski Grotewold, Hartwick, & Papin, 2023; Iqbal, Ahmed, & Azhar, 2022; Williamson & Eynon, 2020). For example, Tan, Ceylan and Öztürk (2023) found that teachers' positive attitudes toward artificial intelligence were at a high level and their negative attitudes were at a low level. Çolak-Yazıcı and Erkoç (2023), as a result of their qualitative research on teachers' use of artificial intelligence, found that teachers' views on the use of artificial intelligence in lessons mainly included positive statements. In addition, as a result of the research, they concluded that artificial intelligence applications are remarkable and dynamic, provide permanent learning, are practical/useful, facilitate learning and contribute to individualized learning. Senger (2024), as a result of his research, revealed that the level of artificial intelligence awareness of teachers is above average, but there are still areas that need improvement. Similarly, Kebapçı (2024) found that teachers' perceptions of artificial intelligence were generally positive, although they indicated some potential problems that artificial intelligence could cause. In fact, Chounta et al. (2022), in their study on teachers' views on the use of artificial intelligence, concluded that teachers have limited knowledge about artificial intelligence and the use of artificial intelligence but also concluded that teachers consider the use of artificial intelligence in education as an opportunity.

According to another finding obtained from this study, teachers' positive and negative attitudes toward artificial intelligence and artificial intelligence literacy levels did not show significant differences according to their gender, length of service in the profession and the level of education in which they work. When similar studies were examined, it was seen that teachers' attitudes toward artificial intelligence and artificial intelligence literacy levels did not show significant differences according to the variables of gender, length of service in the profession and level of education (Kebapçı, 2024; Senger, 2024; Tan, Ceylan & Öztürk, 2023). However, teachers' positive attitudes toward artificial intelligence

and artificial intelligence literacy levels were significant in favor of teachers with graduate education. In addition, teachers' negative attitudes toward artificial intelligence were significant in favor of teachers with undergraduate education. Ferikoğlu (2021), in his research, found that as the level of education of teachers increased, their level of artificial intelligence awareness also increased and interpreted the situation as the level of mastery of current technological developments and following these developments increased as the level of education increased. Similarly, Güneş and Buluç (2017), in their research on the use of technology by classroom teachers, emphasized that teachers with graduate qualifications use technology more intensively in the education process. Attitudes and behaviors can be affected by different sociocultural factors (Kim & Lee, 2024). Therefore, it can be considered normal for different results to be found in the studies conducted.

Finally, the research findings revealed statistically significant relationships between teachers' positive and negative attitudes toward artificial intelligence and artificial intelligence literacy levels. As a result of regression analyses, it was found that teachers' positive and negative attitudes toward artificial intelligence significantly predicted teachers' artificial intelligence literacy levels. Attitude is formed as a function of beliefs and values or as an evaluation of the situation toward any event and object. In this context, attitude is a tendency attributed to an individual and forms his/her thoughts, feelings and behaviors about a psychological object regularly (Güvenç, 1972). Therefore, it is expected that teachers' high positive attitudes toward artificial intelligence will have a positive effect on their artificial intelligence literacy. Seyrek, Yıldız, Emeksiz, Şahin and Türkmen (2024), in their research on the use of artificial intelligence in lessons, found that teachers generally welcomed artificial intelligence in a positive way and that teachers recognized the potential benefits of using artificial intelligence in education and believed that it could improve students' learning experiences. The study also indicated that there is a belief that AI-based tools can make significant contributions to teachers in areas, such as preparing course materials, assessing student performance, and providing individualized feedback to students. On the other hand, İçöz and İçöz (2024) found that educators have a high level of awareness of artificial intelligence applications and that they have a higher than average level of awareness in the dimensions of associating, attitude, theoretical knowledge and application knowledge related to artificial intelligence. In their study by Demir and Özdaş (2020), in which they included teachers' opinions on the distance education process, they found that teachers evaluated the process positively for themselves. According to the findings of the study, it was seen that teachers who had positive experiences in this process continued to include the programs and practices that they considered efficient at the end of the process in their lessons. Based on this information, it can be said that this finding obtained from this research is in line with the findings of the current research in the literature. When the results of this study and similar studies conducted by different researchers are evaluated as a whole, the findings suggest that teachers generally positively perceive artificial intelligence. It is also understood that teachers recognize the potential benefits of using artificial intelligence in education and believe that it can improve students' learning experiences. As a matter of fact, Kim (2023) revealed in his research on middle school students that students who participated in artificial intelligence training based on experiential learning had more positive attitudes towards artificial intelligence.

6. Limitations

This study has some limitations. This study was conducted in Istanbul, the largest city in Türkiye. Conducting similar studies in schools located in different cities or rural areas where fewer teachers work may be more useful regarding the generalizability of the findings. In the present study, scales, which are self-report-based data collection tools and frequently used in quantitative research methods, were used. Therefore, the research data are limited to teachers' responses to the measurement tools and the scope of the questions in the measurement tools. More comprehensive data to be collected using qualitative research methods and more in-depth analysis can be conducted in further studies.

7. Suggestions

In line with the findings obtained in this study, the following suggestions have been made for researchers and practitioners:

Suggestions for researchers

1. Quantitative research method was utilized in this study. By conducting the research with mixed and qualitative research methods, teachers' attitudes toward artificial intelligence and artificial intelligence literacy levels can be examined in more detail.

2. This research was conducted with teachers working in public schools. The attitudes of teachers working in the public and private sectors toward artificial intelligence and artificial intelligence literacy levels can be examined comparatively by conducting similar research on teachers working in private schools.

3. The present study was conducted in Istanbul, one of the largest cities in Turkey. A similar study can be conducted with teachers working in provinces with different socioeconomic potentials.

4. Different studies can be conducted on what other factors (attitude towards technology, technology leadership behaviors of school principals, etc.) may affect teachers' artificial intelligence literacy levels.

5. Different studies can be conducted to test variables that may have a mediating role in the relationship between teachers' attitudes towards artificial intelligence and their artificial intelligence literacy levels (technology self-efficacy, artificial intelligence awareness, artificial intelligence anxiety, artificial intelligence readiness, etc.).

Suggestions for practitioners

1. Professional development programs on artificial intelligence can be designed for teachers using artificial intelligence-based tools more effectively in their lessons and to increase their attitudes toward the use of artificial intelligence in education to higher levels.

2. To increase teachers' knowledge and experience about artificial intelligence technology, experience sharing communities can be established among teachers.

3. Various incentive systems can be developed to ensure that teachers use AI-supported tools both in the teaching process and in the measurement and evaluation process

4. Guidelines can be prepared for teachers on the ethical principles they should follow in the process of using artificial intelligence in education.

5. The study found that teachers with postgraduate education had higher positive attitudes towards artificial intelligence and higher levels of artificial intelligence literacy than teachers with undergraduate education. Therefore, teachers can be encouraged to develop themselves professionally by taking postgraduate education.

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