International Journal of Progressive Education, Volume 22 Number 4, 2026

Examining the Relationship between Teachers' Artificial Intelligence Awareness and Artificial Intelligence Literacy

Özlem Kalaycı *
Ministry of National Education (Türkiye)

Seyfullah Gökoğlu **
Bartın University (Türkiye)

Abstract

The purpose of this study is to investigate the relationship between teachers' artificial intelligence (AI) awareness and their AI literacy. Additionally, the study examines whether teachers' AI awareness and literacy vary by factors such as gender, seniority, educational level, subject area, school level, frequency of AI tool use, and daily duration of AI tool use. The study was conducted with 888 teachers from different branches working in public primary and secondary schools in a province in the Western Black Sea Region of Türkiye. As data collection instruments, the "AI Literacy Scale" and the "Teachers' AI Awareness Level Scale" were employed. In the analysis, descriptive statistics, independent-samples t-tests, One-Way Analysis of Variance, Correlation, and simple linear regression were used. The research found a significant, positive relationship between teachers' AI awareness and AI literacy. Furthermore, it was determined that AI awareness is a significant predictor of AI literacy scores and explains a high proportion of the total variance in AI literacy. Additionally, significant differences were found in all other variables, except for gender and education level in teachers' AI awareness, and gender in AI literacy. The findings further demonstrate that, although teachers' AI awareness and literacy were relatively high, they experienced significant uncertainty about the functions and pedagogical opportunities offered by AI in teaching and learning. We recommend that high-quality professional development programs be designed to support teachers in acquiring knowledge and experience related to the pedagogical use of AI.

Keywords: AI, Artificial intelligence awareness, Artificial intelligence literacy, K–12 teachers.

DOI: https://doi.org/10.5281/zenodo.21786249

* ***Özlem KALAYCI***, Dr, Ministry of National Education, Bartın, Türkiye. Email: ozlem.ogretmen22@gmail.com ORCID: https://orcid.org/0000-0002-1705-7519

** ***Seyfullah GÖKOĞLU,*** Assoc. Prof. Dr., Bartın University, Faculty of Sciences, Department of Computer Technology and Information Systems, Bartın, Türkiye. Email: seyfullahgokoglu@hotmail.com, ORCID: https://orcid.org/0000-0003-0074-7692 .

***Correspondence*:** ozlem.ogretmen22@gmail.com

Introduction

Technological advancements have influenced the field of education as they have every other domain, and the use of AI in education has been discussed since the early 21st century. Consequently, the role of AI in education has become increasingly important across the learning-teaching process, teachers' instructional practices, and student learning. Potential effects of AI in the educational process include identifying students' individual learning needs, providing learning experiences tailored to students' levels (Aleven et al., 2019), developing learning materials (Hew & Cheung, 2018), and monitoring and measuring student achievement (Cai & Shen, 2021).

In recent years, breakthroughs in fields such as deep learning and artificial neural networks have enabled AI to provide personalized instructional services. By addressing students' learning processes, abilities, and needs, these services can overcome the limitations of traditional teaching environments (Chen et al., 2020). AI applications enrich the learning process, particularly through personalized instruction tailored to students' individual learning processes, paces, and needs (Crompton & Burke, 2023), adaptive feedback mechanisms, and interactive problem-solving scenarios (Ojeda-Bazaran et al., 2021). Indeed, AI technologies have the potential to improve educational processes by over 30% (Chen et al., 2020).

When evaluating the impact of AI from the teacher's perspective, AI tools can transform education. This is because AI technologies offer significant opportunities for teachers to guide their students better and provide recommendations by analyzing student performance (Cooper, 2023; Livieris et al., 2019). For example, through AI-supported tools, teachers can monitor student progress, evaluate student performance, and provide individual support when necessary (Zhang & Lu, 2021). Furthermore, AI stands out as a critical support element in facilitating teachers' professional tasks, such as grading, measurement, and evaluation, and providing feedback during the assessment of student learning (Zawacki-Richter et al., 2019). In this respect, AI provides pedagogical and technical support to teachers during the instructional process while offering the potential to provide more meaningful learning experiences for students (How & Hung, 2019). Consequently, AI assists teachers in maximizing student potential and creating a more effective learning environment (Shastri et al., 2021). Evaluated from this perspective, the rapid development of educational technologies has further heightened the importance of teachers' digital literacy and technological competence. Therefore, this development has made it necessary for teachers to recognize AI technologies and integrate them into instructional processes to effectively use AI in education (Holmes et al., 2019; Luckin, 2017). In this context, AI can be seen as a tool that helps teachers better respond to their students' needs. Both using AI effectively and benefiting from its opportunities require AI literacy (Davenport & Ronanki, 2018; Kandlhofer et al., 2016).

Internationally, countries such as China, Korea, India, and various European nations have recognized the transformative potential of AI in education and have begun integrating this technology into their curricula (Karan & Angadi, 2023; Park & Lim, 2023). Similarly, AI literacy has increasingly been included in the national curricula of many countries in recent years (Ayanwale et al., 2022; Han et al., 2018). However, research on the systematic, comprehensive, and holistic integration of this concept into teacher education programs is quite limited (Vazhayil et al., 2019). The growing impact of AI applications in education necessitates equipping teachers with the knowledge, skills, and attitudes to interact with them in a critical, ethical, and reflective manner during their professional development (pre-service and in-service) (Sperling et al., 2024). This global trend clearly underscores the importance of supporting teachers with the professional knowledge, technical skills, and pedagogical resources needed to integrate AI-based tools into instructional processes effectively. Thus, there is a significant need for research that reveals teachers' levels of AI-based competency.
An examination of the literature reveals that studies on AI literacy (Eguchi, 2021; Ng et al., 2021) have primarily been conducted in various fields such as K–12 (from preschool to secondary education), higher education (Bond et al., 2024; Laupichler, 2022), and professional life (Cetindamar et al., 2022), generally within the context of general AI literacy; teacher-oriented research appears to be quite limited. Therefore, to utilize AI technologies accurately, reliably, and effectively in

educational processes, it is considered crucial to determine the AI awareness and literacy levels of teachers responsible for planning these processes. Indeed, it is emphasized that determining teachers' competencies is vital not only for their ability to use technology but also for their capacity to guide students in critical thinking and to navigate AI-supported content (Ng et al., 2023).

Artificial intelligence awareness

Various studies in the literature have examined teachers' AI awareness. Analyzing these studies is essential for accurately assessing teachers' AI awareness and for identifying effective strategies to develop it. In some of these studies, AI awareness has been addressed through different dimensions. For instance, Li et al. (2025) define AI awareness through four fundamental components: "metacognition," "self-awareness," "social awareness," and "situational awareness." Metacognition is defined as the ability to represent and reason about one's own cognitive state; self-awareness as the capacity to recognize one's identity, knowledge level, and limitations; social awareness as the skill to understand the mental states, emotions, and intentions of others and to model social norms; and situational awareness as the competence to evaluate the environmental context and provide appropriate responses. At the national level, Ferikoğlu and Akgün (2022) address AI awareness in four dimensions: "Association," "Belief and attitude," "Theoretical knowledge," and "Practical knowledge." The association dimension measures the extent to which individuals relate AI to daily life, education, and professional practices; the belief and attitude dimension examines general acceptance and attitudes toward AI; the theoretical knowledge dimension assesses cognitive awareness regarding the fundamental concepts and mechanisms of AI; and the practical knowledge dimension measures individuals' skills in recognizing, using, and implementing AI tools in instructional environments. Furthermore, Ünal (2025) classifies AI awareness into two dimensions: cognitive and pedagogical. Cognitive awareness refers to teachers' level of understanding of the basic concepts, operating principles, potential, and limitations of AI, encompassing the skills to accurately define, exemplify, and relate to AI in interdisciplinary contexts. Pedagogical awareness, on the other hand, refers to the level of consciousness regarding how teachers can integrate AI technologies into instructional processes, use them to enrich teaching strategies, and manage the effects of AI on students' learning experiences. These studies demonstrate that AI awareness is a multifaceted construct that encompasses not only possessing knowledge but also how teachers internalize this knowledge and reflect it in educational processes.

In addition to studies aimed at identifying the dimensions of AI awareness, research is conducted at international and national levels to develop teachers' AI awareness. One such initiative is the "Education and Awareness for Intelligent Systems (ENARIS)" project, carried out by educators in Austria and Hungary. The project aimed to strengthen the AI awareness and conceptual understanding of K–12 teachers. Within this framework, workshops were conducted over two years under the titles of "AI basics," "Ethics," "Supervised learning," "Reinforcement learning," "Natural language processing," "Neural networks," "Art and artificial intelligence," and "AI and manipulation in social media." Although the results of this long-term research showed a significant increase in teachers' awareness and general knowledge of AI, they also highlighted that a large group of teachers still had low awareness. Another study conducted by Chiu (2023) found that the majority of teachers believed generative AI technologies, such as ChatGPT, made instruction more enjoyable and engaging, and that teachers were eager to learn more about the pedagogical applications of these technologies. Additionally, this research reported that some teachers expressed concerns regarding the potential impact of AI on the role of the teacher and the quality of education. At the national level, research on teachers' AI awareness remains quite limited. In a study examining teachers' AI awareness in terms of various demographic variables, Ünal (2025) found that teachers' AI awareness differed significantly according to the variables of branch and duration of technology use; however, no significant differences were found regarding gender, age, seniority, education level, school type, or participation in in-service training. Specifically, it was noted that information technology and science teachers exhibited higher awareness than teachers in other branches. Consequently, the research emphasized the importance of branch-based in-service training programs in increasing teachers' AI awareness. In another study conducted by Güler (2025), it was determined that faculty members working at

universities possessed high AI awareness; among the dimensions of association, belief, and attitude, theoretical knowledge, and practical knowledge, the highest awareness was found in the "Theoretical Knowledge" dimension, while the lowest was in "Belief and Attitude." Furthermore, awareness differed significantly by age, academic title, and field, with faculty members in engineering and the sciences exhibiting higher levels. When studies in the literature are evaluated overall, it can be argued that developing teachers' AI awareness is critical to ensuring an innovative, ethical, and pedagogically grounded integration of AI in education.

Artificial intelligence literacy

While there is no universally accepted definition of AI literacy, one of the most frequently referenced definitions in the literature was provided by Long and Magerko (2020, p. 2). According to this definition, AI literacy is explained as "a set of competencies that enables individuals to evaluate AI technologies critically; communicate and collaborate effectively with AI; and use AI as a tool online, at home, and in the workplace." This definition is closely related to the concept of "AI readiness," which refers to the processes of understanding, applying, and integrating AI-based technologies across education and beyond (Luckin et al., 2022). Furthermore, the Digital Education Council (2025) defines AI literacy as the competency to use AI tools effectively and ethically, to evaluate the resulting outputs, to position humans at the center of AI processes, and to adapt to the evolving AI ecosystem at both personal and professional levels. This framework emphasizes five core dimensions that support individuals' skills in understanding, interacting with, and critically evaluating AI: 1) Understanding AI and data, 2) Critical thinking and judgment, 3) Ethical and responsible use, 4) Human-centeredness, emotional intelligence, and creativity, and 5) Domain expertise. Other studies also address AI literacy through a series of fundamental dimensions such as "understanding," "applying," "evaluating," "creating," and "addressing ethical concerns" (Chen & Zhang, 2025; Kalantzis & Cope, 2025; Ng et al., 2021).

These various approaches demonstrate that AI literacy is not limited to technical knowledge alone; it also encompasses higher-order cognitive skills such as critical thinking, ethical awareness, and creativity. In general, AI literacy refers to understanding AI technology's capabilities and limitations, and how it can be used to solve real-world problems (Kong et al., 2023). In other words, AI literacy involves not only technical proficiency but also the ability to integrate these technologies into one's life in an ethical, conscious, and responsible manner. This is because AI literacy concerns individuals' capacity to integrate AI technologies into their daily lives, use them ethically and effectively, select appropriate AI applications, reflect on the results, and evaluate them critically (Wang Rau & Yuan, 2022). Moreover, AI literacy is critical, especially for future teachers, for sustainable development and individual entrepreneurial orientation (Rieckmann et al., 2017; Zhao et al., 2024). This significance necessitates that teachers possess the required knowledge and skills in AI to effectively use AI technologies in the classroom (Selwyn, 2019). Indeed, the development of these competencies in teachers contributes not only to students' effective use of technology but also to their ability to apply technology responsibly and sustainably (Polat et al., 2025).

Aims and Research Questions

The digital generation expects technology-enhanced learning experiences, which necessitates the effective integration of AI into instructional processes (Zhou et al., 2024). Therefore, it is of paramount importance for teachers to ensure the equitable and responsible use of AI by developing pedagogical strategies. In this context, identifying teachers' AI awareness and literacy is vital for assessing their current state and guiding their professional development. Accordingly, the purpose of this study is to examine the relationship between teachers' AI awareness and their AI literacy. Within the scope of this objective, the study investigated whether teachers' AI awareness and AI literacy differ according to various variables (gender, seniority, educational level, branch, school level, knowledge of AI use, frequency of AI tool use, and daily duration of AI tool use) and determined the relationship between teachers' AI awareness and their AI literacy. The specific research questions (sub-problems) addressed in this study are as follows:

1. What are the levels of AI awareness among teachers?
2. What are the levels of AI literacy among teachers?
3. How do teachers' AI awareness vary according to the variables of gender, seniority, educational level, branch, school level, frequency of AI tool use, and daily duration of AI tool use?
4. How do teachers' AI literacy vary according to the variables of gender, seniority, educational level, branch, school level, frequency of AI tool use, and daily duration of AI tool use?
5. Is there a significant relationship between teachers' AI awareness and their AI literacy?
6. How does teachers' AI awareness predict their AI literacy?

Methodology

Participants and context

The study participants are 888 teachers from various branches (Mathematics, Science, Information Technology, etc.) working in public primary and secondary schools in a province in Türkiye's Western Black Sea Region during the 2024-2025 academic year. These teachers were selected from a population of approximately 2,000 teachers serving throughout the province. In selecting participants, the convenience sampling method was employed, with ease of access and feasibility of implementation taken into account. Demographic information regarding the research sample is presented in Table 1.

Table 1. Demographics of the sample group

Variable	Category	N	%
Gender	Female	530	59.7
	Male	358	40.3
Education level	Undergraduate	748	84.2
	Graduate	145	16.4
Seniority	1-5 years	82	9.2
	6-10 years	126	14.2
	11-15 years	214	24.1
	16-20 years	129	14.5
	21-25 years	139	15.7
	26-30 years	107	12.0
	30 years and above	91	10.2
Branch	Physical Education	35	3.9
	Other (Information Technology and Vocational Courses)	83	9.3
	Religious Culture and Ethics	44	5.0
	Visual Arts, Technology Design, Music, etc.	52	5.9
	English (Middle School/High School)	89	10.0
	Preschool	52	5.9
	Science (Middle School/High School Physics, Chemistry, Biology)	72	8.1
	Mathematics (Middle School/High School)	75	8.4
	Special Education	41	4.6
	Psychological Counselor and Guidance	25	2.8
	Primary	171	19.3
	Social Studies, History, Geography, etc.	57	6.4
	Turkish/Turkish Language and Literature	92	10.4

School level	Preschool	55	6.2
	Elementary	208	23.4
	Middle	361	40.7
	Secondary	264	29.7
Frequency of AI tool use	Never	140	15.8
	Rarely	397	44.7
	Once a month	22	2.5
	Once a week	190	21.4
	Almost every day	139	15.7
Daily duration of AI tool use	None	366	41,2
	1-2 hours	474	53,4
	3-4 hours	43	4,8
	4 hours and above	5	0,6

Approximately 60% of the participants are female, and 40% are male, with their seniority distribution predominantly (24.1%) falling within the 11-15 years range. The highest participation rate is among primary teachers (19.3%), while the lowest is among school counselors (2.8%). 84.2% of the participants have an undergraduate degree, while 16.4% have a graduate degree. The highest participation rate is among teachers at the middle school level (40.7%). Regarding AI use, a large proportion of participants (44.5%) reported having "limited knowledge." Similarly, the proportion of those who state they rarely use AI tools is also high (44.7%). While 41.2% of participants do not use AI tools at all, the majority (53.4%) reported using AI tools for 1-2 hours per day.

Data collection

The "AI Literacy Scale," adapted into Turkish by Eniş-Erdoğan and Ekşioğlu (2024), and the "AI Awareness Level Scale for Teachers," developed by Ferikoğlu and Akgün (2021), were utilized as data collection tools. The AI Awareness Level Scale for Teachers consists of 51 items across four sub-dimensions: Association, Belief and Attitude, Theoretical Knowledge, and Practical Knowledge. It was determined that this four-factor scale explained 70.27% of the total variance. The scale items are designed in a 5-point Likert-type format, ranging from "Strongly Agree" to "Strongly Disagree." The internal consistency coefficient for the scale's reliability was 0.986.

The validity and reliability of the AI Literacy Scale—originally developed by Wang et al. (2023) and adapted into Turkish by Eniş-Erdoğan and Ekşioğlu (2024)—were tested through factor analysis and internal consistency coefficients. Exploratory factor analysis (EFA) results indicated that the scale consists of four dimensions, consistent with the original version, and the total variance explained was 82.873%. The goodness-of-fit indices for the scale were calculated as follows: RMSEA = 0.078, NFI = 0.944, TLI = 0.952, CFI = 0.967, IFI = 0.967, and GFI = 0.931. The Cronbach's Alpha value for the scale was 0.861. This scale comprises 12 items across four sub-dimensions: Awareness, Usage, Evaluation, and Ethics. It is a 5-point Likert-type scale ranging from "Strongly Disagree" to "Strongly Agree.".

Internal consistency coefficients were recalculated in the present study to ensure the reliability of the instruments for this specific sample. While the original internal consistency coefficient for the AI Awareness Level Scale was reported as 0.986, it was 0.912 in this study. Similarly, the internal consistency coefficient for the AI Literacy Scale, which was 0.861 in the original adaptation, was calculated as 0.804 in the current study. The Cronbach's Alpha internal consistency coefficients obtained from both the original studies and the current research were high and consistent. These results indicate that the data collected through these scales are reliable for the sample group under investigation.

Data collection procedure

This research was conducted with the approval obtained from the Bartın University Social and Human Sciences Ethics Committee (Date: March 12, 2025; Decision No: 2025-SBB-0178). The study's data were collected via an online form created in Google Forms. This form included items from the AI Awareness Scale and the AI Literacy Scale, along with questions to collect participants' demographic information. The average completion time for the form was approximately 14 minutes. Participation in the study was strictly voluntary.

Data analysis

Before the analyses, the normality of the data obtained from both scales was examined using kurtosis and skewness coefficients. The kurtosis and skewness values for the AI Literacy Scale were calculated as 0.041 and -0.227. For the AI Awareness Level Scale for Teachers, the kurtosis was 0.652, and the skewness was -0.235. The fact that these values fall within ±1.96 standard errors indicates that the data follow a normal distribution (Tabachnick & Fidell, 2013).
Descriptive statistics, Independent Samples t-test, One-Way Analysis of Variance (one-way ANOVA), Correlation, and Simple Linear Regression analyses were utilized for the data analysis. The homogeneity of variances was analyzed using Levene's test. When variances were homogeneous, the Bonferroni post hoc test was preferred to account for differences in group sample sizes. Conversely, when variances were heterogeneous, the Welch test, which is robust to unequal variances and provides reliable results across different group sizes, was applied; for multiple comparisons, the Games-Howell post hoc test was used. Significant findings were interpreted by calculating their respective effect size values (Cohen's *d* and Eta Squared). For Cohen's *d*, values of 0.2, 0.5, and 0.8 were considered small, medium, and large effects. For Eta Squared (η^2), values of 0.01 were interpreted as a small effect, 0.06 as a medium effect, and 0.14 as a large effect size (Green & Salkind, 2005). Descriptive analyses were employed to determine the participants' AI awareness and AI literacy. By examining the mean and standard deviation values, AI awareness and literacy were classified based on the scores obtained from the 5-point Likert-type scales: values between 1.00 and 1.80 were categorized as "Very low," 1.81 to 2.60 as "Low," 2.61 to 3.40 as "Moderate," 3.41 to 4.20 as "High," and 4.21 to 5.00 as "Very high."

Results

Teachers' AI awareness and AI literacy levels

Regarding the research questions, "What are the levels of AI awareness among teachers?" and "What are the levels of AI literacy among teachers?", the results obtained for the sub-dimensions of the AI Awareness Level Scale and the AI Literacy Scale are presented in Table 2.

Table 2. Descriptive statistics for the scales

Scales and Sub-Dimensions	**Kolmogorov-Smirnov**				
	Statistic	**df**	**Sig.**	**Skewness**	**Kurtosis**
AI Awareness					
Practical Knowledge	0.056		0.000	-0.660	1.186
Belief and Attitude	0.041		0.001	-0.129	-0.76
Association	0.056		0.000	-0.213	0.269
Theoretical Knowledge	0.056		0.000	-0.461	0.902
AI Literacy		888			
Awareness	0.142		0.000	0.096	-0.121
Usage	0.117		0.000	0.102	-0.669
Evaluation	0.130		0.000	-0.618	0.589
Ethics	0.134		0.000	-0.358	-0.851

The skewness and kurtosis values for the sub-dimensions of the scales used as data collection instruments range from -1.5 to +1.5. This finding indicates that the data about the sub-dimensions of the scales follow a normal distribution (Tabachnick & Fidell, 2013). The statistical results for determining participants' AI awareness and AI literacy are presented in Table 3.

Table 3. Information regarding teachers' AI awareness and literacy

Sub-Dimensions	M	Sd.	Level	N
AI Awareness				**888**
Practical Knowledge	3.93	0.64	High	
Belief and Attitude	3.46	0.80	High	
Association	3.43	0.78	High	
Theoretical Knowledge	3.63	0.75	High	
Total	3.61	0.66	High	
AI Literacy				**888**
Awareness	3.66	0.70	High	
Usage	3.65	0.76	High	
Evaluation	3.61	0.91	High	
Ethics	4.03	0.78	Very High (at limit)	
Total	3.74	0.63	High	

Participants' overall AI awareness is at a "high" level. Regarding the sub-dimensions of the scale, the practical knowledge dimension (M = 3.93) had the highest mean, followed by theoretical knowledge (M = 3.63), belief and attitude (M = 3.46), and association (M = 3.43). It is observed that the participants' awareness is "high" across all sub-dimensions. Similarly, the participants' AI literacy was found to be at a "high level" (M = 3.74). Upon examining the sub-dimensions, the ethics dimension (M = 4.03) had the highest mean, followed by awareness (M = 3.66), usage (M = 3.65), and evaluation (M = 3.62).

Distribution of teachers' AI awareness levels

Under this heading, the variations in participants' AI awareness was examined across gender, educational level, seniority, branch, school level, AI knowledge, frequency of AI tool use, and daily duration of AI tool use. An independent-samples t-test was conducted to determine whether there was a significant difference in participants' AI awareness across gender groups. The test results revealed that participants' AI awareness scores did not show a significant difference according to their gender ($t_{(886)} = -0.984$, $p = 0.325 > 0.05$). When the mean AI awareness of the teachers was examined by gender, it was determined that the awareness means of female teachers (M = 3.59, SD = 0.64) and male teachers (M = 3.64, SD = 0.69) were quite similar to each other. The variation in participants' AI awareness by educational level was also analyzed using an independent-samples t-test. The results obtained are presented in Table 4.

Table 4. AI Awareness scores according to educational level

Level	N	M	SD	t	df	*p*	Cohen's *d*
Undergraduate	748	3.58	0.65	-2.778	886	0.006*	0.17
Graduate	140	3.75	0.71				

**p < 0.05*

As a result of the analysis, a statistically significant difference was identified in the total mean AI awareness scores of the participants regarding the educational level variable, favoring teachers with a graduate degree ($t_{(886)} = -2.778$, $p = 0.006 < 0.05$). The effect size for this difference was found to be at a small level (Cohen, 1988). For the variables of seniority and branch, an ANOVA was used to examine whether there was a significant difference in participants' AI awareness scores. The analysis results indicated no significant difference in AI awareness scores by seniority ($F_{(6, 881)} = 1.526$, $p = 0.167 > 0.05$) or branch ($F_{(12, 885)} = 0.926$, $p = 0.520 > 0.05$). To examine the frequency of AI tool use,

an ANOVA was conducted to determine whether participants' AI awareness scores differed. The test results revealed a significant difference in participants' AI awareness based on their frequency of use ($F_{(4, 883)} = 23.566$, $p < 0.001$, $\eta^2 = 0.096$). The effect size of this difference was interpreted as medium (Green & Salkind, 2005). The relevant findings are presented in Table 5.

Table 5. AI awareness scores according to the frequency of AI tool use

Frequency of Use	N	M	SD	F	*p*	Difference	η^2
Never (1)	140	3.34	0.72	23.566	0.00*	1-2,1-3,1-4,1-5,	0.096
Rarely (2)	397	3.51	0.63			2-4, 2-5, 4-5	
Once a month (3)	22	3.83	0.46				
Once a week (4)	190	3.71	0.59				
Almost every day (5)	139	3.99	0.63				
Total	888	3.61	0.66				

**p < 0.05*

Post hoc test results indicated that participants who never use AI tools (M = 3.34) had significantly lower awareness scores than those in all other groups. Furthermore, the awareness of teachers who use the tools rarely (M = 3.51) was significantly lower than those of teachers who use them once a week (M = 3.71) and almost every day (M = 3.99). The group with the highest awareness score consisted of participants who used AI tools almost every day. An ANOVA was conducted to examine whether participants' AI awareness scores differed as a function of daily AI tool use duration. The relevant findings are presented in Table 6.

Table 6. AI awareness scores according to daily duration of AI tool use

Daily duration of AI tool use	N	M	SD	F	*p*	Difference	η^2
None (1)	366	3.41	0.63	20.07	0.00*	1-2, 1-3	0.063
1-2 hours (2)	474	3.73	0.65				
3-4 hours (3)	43	3.89	0.68				
4 hours and above (4)	5	3.85	0.71				
Total	888	3.61	0.66				

**p < 0.05*

A significant difference was identified in participants' AI awareness regarding the daily duration of use ($F_{(3, 884)} = 20.07$, $p < 0.001$, $\eta^2 = 0.063$), with a medium effect size (Green & Salkind, 2005). According to the results of the Bonferroni post-hoc test, the awareness scores of teachers who do not use AI tools at all (M = 3.41) were significantly lower than those of teachers who use them for 1-2 hours (M = 3.73) and 3-4 hours (M = 3.89). In contrast, no significant difference was found between the groups using the tools for 1-2 hours, 3-4 hours, or 4 hours and above. This finding suggests that daily interaction with AI contributes to the development of awareness up to a certain level; however, this increase does not continue to a statistically significant degree beyond 3-4 hours of use. Whether there was a significant variation in participants' AI awareness scores across the school-level variable was examined using an ANOVA. The relevant findings are presented in Table 7.

Table 7. AI awareness scores according to school level

School level	N	M	F	*p*	Difference	η^2
Preschool (1)	55	3.54	3.020	0.029*	3-4	0.01
Elementary (2)	208	3.60				
Middle (3)	361	3.68				
Secondary (4)	264	3.53				
Total	888	3.61				

**p < 0.05*

A significant difference was identified in the participants' AI awareness regarding the school level variable ($F_{(3, 884)} = 3.02$, $p = .029 < 0.05$, $\eta^2 = 0.01$), and the effect size for this difference was found to be at a small level (Green & Salkind, 2005). According to the results of the Bonferroni multiple-comparison test, a significant difference was observed only between teachers at the middle school and secondary school levels ($p = 0.020$), in favor of those at the middle school level. Consequently, AI awareness among middle school teachers was significantly higher than among secondary school teachers.

Distribution of teachers' AI literacy levels

In this section, it was examined whether teachers' AI literacy varies across gender, educational level, seniority, branch, school level, AI knowledge, frequency of AI tool use, and daily duration of AI tool use. An independent-samples t-test was conducted to determine whether there was a significant difference in participants' AI literacy scores based on gender. The test results revealed that participants' AI literacy scores did not differ significantly by gender ($t_{(886)} = -1.710$, $p = 0.088 > 0.05$). The mean scores of females (M = 3.71) and males (M = 3.78) teachers were quite similar. Accordingly, it can be stated that gender is not a decisive factor in teachers' AI literacy. An independent-samples t-test was performed to investigate whether participants' AI literacy differed by educational level. The findings are presented in Table 8.

Table 8. Teachers' AI literacy scores according to educational level

Education level	**N**	**M**	**SD**	**t**	**Df**	***p***	**Cohen's *d***
Undergraduate	748	3.71	0.61	-3.21	886	0.002*	-0.33
Graduate	140	3.91	0.71				

**p < 0.05*

Teachers' AI literacy differs significantly by educational level. Levene's test indicated that the variances were not homogeneous ($F_{(1, 886)} = 5.29$, $p = 0.022$). Consequently, the assumption of equality of variances was bypassed, and Welch's t-test results were considered. According to Welch's t-test, a significant difference in teachers' AI literacy scores by educational level was identified ($t_{(179.24)} = -3.21$, $p = 0.002 < 0.05$). While the difference is statistically significant, the effect size is small ($d = -0.33$). The mean score of teachers with a graduate degree (M = 3.91, SD = 0.71) is significantly higher than that of teachers with an undergraduate degree (M = 3.71). This result indicates that teachers with graduate-level education have more advanced AI literacy. Whether there was a significant variation in participants' AI literacy scores across seniority levels was investigated using an ANOVA. Relevant findings are presented in Table 9.

Table 9. AI literacy scores according to the seniority variable

Seniority	**N**	**M**	**F**	**p**	**Difference**	**η^2**
1-5 years (1)	82	3.96	3.81	0.001	1-6, 1-7	0.025
6-10 years (2)	126	3.75				
11-15 years (3)	214	3.76				
16-20 years (4)	129	3.80				
21-25 years (5)	139	3.71				
26-30 years (6)	107	3.60				
30 years and above (7)	91	3.59				
Total	**888**	**3.74**				

**p < 0.05*

AI literacy differs significantly according to the seniority variable ($F_{(6, 881)} = 3.82$, $p = 0.001 < 0.05$). Bonferroni multiple comparison test results indicate a significant difference between teachers with 1-5 years of seniority and those with 26-30 years and over 30 years of seniority. When the mean differences are examined, the difference favors teachers with less seniority. However, the effect size

was small ($\eta^2 = 0.025$). Whether there was a significant variation in participants' AI literacy scores across the branch variable was investigated using an ANOVA. The relevant findings are presented in Table 10.

Table 10. AI literacy scores according to the branch variable

Branş	**N**	**M**	**F**	***p***	**Difference**	**η^2**
Physical Education (1)	35	3.80	2.69	0.001	2-6	0.036
Other (Information Technology and Vocational Courses) (2)	83	3.94				
Religious Culture and Ethics (3)	44	3.58				
Visual Arts, Technology Design, Music, etc. (4)	52	3.88				
English (Middle School/High School) (5)	89	3.78				
Preschool (6)	52	3.53				
Science (Middle School/High School Physics, Chemistry, Biology) (7)	72	3.63				
Mathematics (Middle School/High School) (8)	75	3.78				
Special Education (9)	41	3.94				
Psychological Counselor and Guidance (10)	25	3.67				
Primary (11)	171	3.75				
Social Studies, History, Geography, etc. (12)	57	3.64				
Turkish/Turkish Language and Literature (13)	92	3.64				
Total	888	3.74				

**p < 0.05*

AI literacy differs significantly according to the branch variable ($F_{(12, 875)} = 2.69$, $p = 0.001 < 0.05$). According to the results of the Bonferroni test. However, this difference is significant between preschool teachers and teachers in other branches ($p = 0.014$), favoring preschool teachers. The effect size ($\eta^2 = 0.036$) indicates that this difference is small. This finding suggests that teachers' AI literacy differ across branches. In this framework, it can be argued that early childhood teachers, in particular, should be supported in integrating technology and AI. To examine the frequency of AI tool use, an ANOVA was conducted to determine whether participants' AI literacy scores differed significantly. The relevant findings are presented in Table 11.

Table 11. AI literacy scores according to the frequency of AI tool use

Frequency of AI tool use	**N**	**M**	**F**	***p***	**Difference**	**η^2**
Never (1)	140	3.35	58.085	0.000*	1-2, 1-3, 1-4, 1-5,	0.21
Rarely (2)	397	3.59			2-3, 2-4, 2-5,	
Once a month (3)	22	4.02			4-5	
Once a week (4)	190	3.94				
Almost every day (5)	139	4.24				
Total	888	3.74				

**p < 0.05*

Levene's test indicated that the variances were not homogeneous ($p < 0.05$). Therefore, Welch's test results were utilized as the basis for the analysis. According to the analysis results, participants' AI literacy differed significantly based on the frequency of AI tool use ($F_{(4, 136.66)} = 58.085$, $p < 0.05$). Games-Howell multiple comparison test results revealed that the literacy scores of teachers who "never used" AI tools ($M = 3.10$) were significantly lower than all other groups. Additionally, those who used the tools "almost every day" ($M = 4.00$) exhibited significantly higher literacy scores compared to those who used them "once a week" ($M = 3.85$). When the mean differences were examined, it was observed that as the frequency of AI tool use increased, teachers' AI literacy scores rose markedly. Consequently, the difference in literacy between teachers who used AI tools more frequently was not only statistically significant but also had a large effect size ($\eta^2 = 0.21$). Whether there was a significant variation in participants' AI literacy scores regarding the daily

duration of AI tool use was investigated using an ANOVA. The relevant findings are presented in Table 12.

Table 12. AI literacy scores according to the daily duration of AI tool use

Daily duration of use	N	M	F	*P*	Difference	η^2
None (1)	366	3.50	34.737	0.000*	1-2, 1-3	0.10
1-2 hours (2)	474	3.88				
3-4 hours (3)	43	4.12				
4 hours and above (4)	5	4.03				
Toplam	888	3.74				

**p < 0.05*

Participants' AI literacy differs significantly according to the daily duration of AI tool use ($F_{(3, 884)} = 34.74$, $p < 0.05$). Bonferroni multiple comparison test results indicate that participants in the "None" range (M = 3.50) possess significantly lower AI literacy scores than those who use AI tools for "1-2 hours" (M = 3.88) and "3-4 hours" (M = 4.12) ($p < 0.05$). Upon examining the mean scores, it is observed that participants using AI tools for 3–4 hours daily have the highest AI literacy scores. In contrast, those who do not use them at all have the lowest. The significant difference between participants' daily AI usage durations and their AI literacy scores was found to have a medium effect size. This finding suggests that the duration of AI tool use has a positive and medium-level effect on teachers' literacy. An ANOVA was conducted to investigate whether there was a significant difference in participants' AI literacy scores across school levels. The relevant findings are presented in Table 13.

Table 13. AI literacy scores according to the school level variable

School level	N	M	F	*p*	Difference	η^2
Preschool (1)	55	3.54	4.185	0.006	1-3	0.014
Elementary (2)	208	3.76				
Middle (3)	361	3.80				
Secondary (4)	264	3.67				
Toplam	888	3.74				

**p < 0.05*

A significant difference with a small effect size (Cohen, 1988) was identified in participants' AI literacy for the school-level variable ($F_{(3, 884)} = 4.19$, $p = 0.006 < 0.05$, $\eta^2 = 0.014$). According to the results of the Bonferroni multiple comparison test, this difference was found between preschool teachers and middle school teachers, favoring the latter ($p = 0.022 < 0.05$). Upon examining the mean scores, it was determined that the AI literacy scores of preschool teachers (M = 3.54) were significantly lower than those of middle school teachers (M = 3.80).

Relationship between teachers' AI awareness and AI literacy levels

A Pearson correlation analysis was conducted to examine the relationship between participants' AI awareness and AI literacy. The findings are presented in Table 14.

Table 14. Relationship between AI awareness and AI literacy

Awareness_Literacy	**Pearson r**	0.626*
	p	0.000*
	N	888

**p < 0.01*

There is a significant positive relationship between the participants' AI awareness and their AI literacy ($r = 0.626$, $p < 0.01$). In this context, the variance in participants' AI awareness scores can explain approximately 39.1% [$(0.626)^2 = 0.391$] of the change in their AI literacy scores.

Prediction of Teachers' AI Literacy by AI Awareness

A Simple Linear Regression analysis was conducted to reveal how AI awareness predicts AI literacy. The relevant results are presented in Table 15.

Table 15. Prediction of AI literacy scores by AI awareness scores

Variable	β	SH β	R	t	R^2	%95 CI
Fixed	1.601	0.091				1.423
AI Awareness	0.592	0.025	0.626	23.924	0.392	0.544

*$p < 0.05$

There is a significant relationship between participants' AI awareness scores and AI literacy scores ($\beta = 0.626$, $R^2 = 0.392$); furthermore, AI awareness is a significant predictor of AI literacy scores ($F_{(1, 886)} = 572.369$, $p < 0.05$). Participants' AI awareness explains 39.2% of the variance in their AI literacy scores, indicating that the model possesses high explanatory power (Cohen, 1988). The significance test of the coefficient for the primary predictor variable ($\beta = 0.592$) also demonstrates that AI awareness is a significant predictor ($p < 0.05$). The regression equation is as follows:
AI literacy score = (0.592 × AI awareness) + 1.601

In conclusion, AI awareness positively and significantly affects AI literacy scores. In other words, as AI awareness increases, participants' AI literacy also increases significantly.

Discussion and Conclusion

This study examined whether there is a significant relationship between teachers' AI awareness and their AI literacy. Furthermore, it sought to determine how these levels vary according to variables such as gender, seniority, educational level, branch, school level, frequency of AI tool use, and daily duration of AI tool use. The results indicated that teachers' AI awareness is generally high. Upon examining the sub-dimensions, the highest mean was observed in the practical knowledge dimension, suggesting that teachers have a relatively higher awareness of how AI can be used in classroom applications. Indeed, Ünal (2025) stated that teachers' AI awareness was highest in the practical sub-dimension; thus, the results of this study support that finding.

Another significant finding regarding AI awareness is the predominance of "undecided" responses concerning AI's potential for personalized instruction. Specifically, the "undecided" responses were in the majority for items such as "AI systems identify students' personalities, strengths, and weaknesses well," "Through AI, we can better learn students' personal needs," and "AI individualizes education." This situation may be attributed to teachers' lack of a clear conviction regarding AI's potential to support individualized instruction. Consequently, these results suggest that while teachers recognize AI at a general level, they may lack sufficient knowledge and experience with the specific opportunities AI offers for personalized instruction, or a clear idea of how to leverage them. Effectively integrating AI into instructional processes offers critical opportunities such as personalized learning, monitoring student progress, enhancing assessment and feedback, and improving the overall learning experience (Kamalov et al., 2023). Therefore, while high AI awareness are positive for recognizing AI's transformative potential, the weight of "undecided" responses indicates a need for applied professional development support to effectively realize this potential (Re et al., 2024).

Similarly, this study determined that teachers' AI literacy is generally high. This result is consistent with previous research demonstrating high AI literacy among teachers (İçen, 2024; Muzaffer & Ünal, 2025; Yüreğilli Göksu & Göksu, 2024). Regarding sub-dimensions, the ethics dimension had the highest mean, followed by awareness, usage, and evaluation, respectively. Indeed, Muzaffer and Ünal (2025) also emphasized that teachers' AI literacy is particularly high concerning the ethical dimension.

Regarding gender, no statistically significant differences were found in AI awareness or literacy. This overlaps with findings in the literature (Çayak, 2024; İçen, 2024; Muzaffer & Ünal, 2025; Ünal, 2025), suggesting that gender is not a decisive variable. However, the reporting of significant gender-based differences in some studies (İçen, 2024; İçöz & İçöz, 2024; Yüreğilli Göksu & Göksu, 2024) indicates a lack of consensus in the field, suggesting that results may vary across samples.

Regarding professional seniority, a significant difference with a small effect size was found in AI literacy, favoring teachers with less seniority. In contrast, no significant difference was detected for AI awareness. However, the observed downward trend in awareness scores with increasing seniority may be explained by high-seniority teachers' more limited experience with digital interaction. Kaplan and Haenlein (2019) and Kaya (2017) found that teachers with less experience are more open to technological innovations and use educational technology more intensively. This could also be related to the potential slowing of cognitive processes with age and the increasing need to adapt to new information (Cangöz, 2009). Conversely, conflicting results in the literature regarding seniority and technology use (Şengür, 2020) suggest that widespread digitalization and easier access to technology may now enable teachers to develop AI awareness regardless of their seniority.

In terms of educational level, both AI awareness and literacy differed significantly, favoring teachers with graduate degrees (small effect size). This is consistent with Ferikoğlu (2021), who emphasized that as educational levels increase, so does the level of monitoring and mastering current technological developments. However, some research suggests that education level has no significant effect on AI awareness (Erdoğan & Demirtaş, 2021; Ünal, 2025), suggesting that these competencies may be more closely related to individual motivation, interaction frequency, and institutional integration strategies than to degree level alone.

Regarding the branch variable, no significant difference was found in AI awareness, but a small, significant difference was identified in AI literacy, favoring preschool teachers. This may be explained by preschool teachers working with younger age groups, which limits the integration of AI tools. Variations in AI literacy across branches are closely related to the instructional level and the technology requirements. For teachers to develop competence, the inclusion of theoretical and applied digital content during undergraduate education is vital (Lindsey, 2015). Consequently, lower literacy in branches where AI use is not yet widespread (such as Preschool or Religious Culture and Ethics) may reflect current curricula.

For the school level, a significant difference was found in favor of middle school teachers in both awareness and literacy (small effect size). This contradicts studies suggesting AI awareness is independent of school type (Aksu, 2024; Ünal, 2025) and shows that diverse results can be reported in the literature.

Regarding the frequency of AI use, significant differences were found in awareness (medium effect) and literacy (large effect), favoring teachers who use AI tools almost every day. The marked increase in literacy scores with greater usage frequency suggests that experience-based practice is critical. This aligns with research reporting higher literacy among frequent users (Muzaffer & Ünal, 2025) and emphasizes that AI literacy develops through direct experience and application rather than just theoretical knowledge (Ravi et al., 2023; Zhao et al., 2022).

Similarly, daily usage duration showed significant differences with a medium effect size for both awareness and literacy. Teachers using AI for 3–4 hours daily exhibited the highest levels, while non-users had the lowest. The finding that growth plateaus after 4 hours underscores the importance of qualified, balanced interaction with technology. This is consistent with Ünal (2025), who identified significant differences in awareness based on usage duration.

Furthermore, this study identified a significant positive relationship between AI awareness and AI literacy. AI awareness was a significant predictor of AI literacy, accounting for 39% of the total

variance. This indicates high explanatory power for the model (Cohen, 1988) and suggests that AI awareness is a fundamental component in developing AI literacy.

Implications

This research was conducted with 888 teachers in a province in Turkey's Western Black Sea Region. Although the sample size is sufficient, the use of convenience sampling and the single-province focus limit the generalizability of the results. Future research should involve larger, stratified samples across different geographical regions in Turkey. Given that AI research in Turkey often focuses on undergraduate students (Aruğaslan & Çivril, 2021; Tekin, 2023), this teacher-centered study provides a significant contribution to the literature.

The results reveal that while teachers' AI awareness and literacy are relatively high, they experience clear indecision regarding the pedagogical opportunities AI offers. While they recognize potential impacts, they lack a clear vision for integration. This underscores the need for supportive mechanisms to translate knowledge into applied competence. In this context, it is recommended that pre-service education be supported with application-based training focusing on branch-specific AI integration for personalized learning. Similarly, for in-service teachers, professional development programs should be structured around Intelligent Tutoring Systems (Kamalov et al., 2023) that emphasize monitoring learning processes, identifying student errors in real time, and providing individualized feedback. Such programs will help teachers internalize the role of AI in education in a more meaningful and functional way.

Declaration of generative AI use

For the translation and localization of content, Grammarly Edu was employed. Human translators subsequently reviewed and adjusted the translations to ensure accuracy, cultural appropriateness, and contextual relevance. The final text was thoroughly reviewed and approved by the authors to ensure it accurately reflects the intended research outcomes and ethical standards. The authors also assessed and addressed potential biases inherent in the AI-generated content. The final version of the paper is the sole responsibility of the human authors.

Conflicts of Interest: The authors declare no conflicts of interest relevant to the content of this article.

Funding Details: This research received no external funding.

Ethical Statement: This research was conducted with the approval obtained from the Bartın University Social and Human Sciences Ethics Committee (Date: March 12, 2025; Decision No: 2025-SBB-0178).

Credit Author Statement: Both authors contributed equally to this work.

Özlem Kalaycı: Conceptualization, Methodology, Investigation, Data Curation, Formal Analysis, Visualization, Writing – Original Draft, Writing – Review & Editing, Supervision, Validation.

Seyfullah Gökoğlu: Conceptualization, Methodology, Investigation, Data Curation, Formal Analysis, Visualization, Writing – Original Draft, Writing – Review & Editing, Supervision, Validation.

Acknowledgements:
The authors would like to thank the Bartın Provincial Directorate of National Education for their support during the data collection process.

.

References

Aksu, B. (2024). *An Examination of the Relationship between Teachers' Levels of Artificial Intelligence Awareness and Artificial Intelligence Anxiety Levels* [Master's thesis]. Gazi University, Institute of Educational Sciences.

Aleven, V., Popović, Z., & Ogan, A. (2019). Artificial intelligence in education: *A survey of the state of the art. arXiv preprint arXiv:1902.06707*.

Aruğaslan, E., & Çivril, H. (2021). Data mining and artificial intelligence studies in the field of education in Turkey. *International Journal of Technological Sciences*, *13*(2), 81-89.

Ayanwale, M. A., Sanusi, I. T., Adelana, O. P., Aruleba, K. D., & Oyelere, S. S. (2022). Teachers' readiness and intention to teach artificial intelligence in schools. *Computers and Education: Artificial Intelligence*, *3*, 100099. https://doi.org/10.1016/j.caeai.2022.100099

Cai, Y., & Shen, Q. (2021). Artificial intelligence in education: *A review of recent advances. IEEE Access, 9, 153540-153557.*

Cetindamar, D., Kitto, K., Wu, M., Zhang, Y., Abedin, B., & Knight, S. (2022). Explicating AI literacy of employees at digital workplaces. *IEEE transactions on engineering management*, *71*, 810-823. https://doi.org/10.1109/TEM.2021.3138503

Chen, X., Xie, H., Zou, D., & Hwang, G. J. (2020). Application and theory gaps during the rise of artificial intelligence in education. *Computers and Education: Artificial Intelligence*, *1*, 1-20. https://doi.org/10.1016/j.caeai.2020.100002

Chen, Y. H., & Zhang, K. (2025). Impact of basic artificial intelligence (AI) course on understanding concepts, literacy, and empowerment in the field of AI among students. *Computer Applications in Engineering Education*, *33*(1), e22806. https://doi.org/10.1002/cae.22806

Chiu, T. K. (2024). How do emerging technologies CRAFT our education? Current state and future research recommendations related to AI and the metaverse. *Interactive Learning Environments*, *32*(3), 787-789. https://doi.org/10.1080/10494820.2024.2342635

Cooper, A., & Rodman, A. (2023). AI and medical education-a 21st-century Pandora's box. *N Engl J Med*, *389*(5), 385-387. https://doi.org/10.1056/NEJMp2304993

Crompton, H., & Burke, D. (2023). Artificial intelligence in higher education: the state of the field. *International journal of educational technology in higher education*, *20*(1), 22. (Ojeda-Bazaran vd., 2021). https://doi.org/10.1186/s41239-023-00392-8

Çayak, S. (2024). Investigating the relationship between teachers' attitudes toward artificial intelligence and their artificial intelligence literacy. *Journal of Educational Technology and Online Learning*, *7*(4-ICETOL 2024 Special Issue), 367-383. https://doi.org/10.31681/jetol.1490307

Davenport, T. H., & Ronanki, R. (2018). Artificial intelligence for the real world. *Harvard Business Review*, *96*(1), 108-116.

Eguchi, A., Okada, H., & Muto, Y. (2021). Contextualizing AI education for K-12 students to enhance their learning of AI literacy through culturally responsive approaches. *KI-Künstliche Intelligenz*, *35*(2), 153-161. https://doi.org/10.1007/s13218-021-00737-3

Eniş-Erdoğan, T. & Ekşioğlu, S. (2024). Yapay Zekâ Okuryazarlığı Ölçeği'nin Türkçeye uyarlanması. *TEBD*, *22*(2), 1196-1211. https://doi.org/10.37217/tebd.1496716

Erdoğan, M. ve Demirtaş, Z. (2021). Teacher awareness of artificial intelligence in education: The role of gender and experience. *Journal of Educational Research*, *40*(3), 150-163.

Ferikoğlu, D., & Akgün, E. (2022). An investigation of teachers' artificial intelligence awareness: A scale development study. *Malaysian Online Journal of Educational Technology*, *10*(3), 215-231. https://doi.org/10.52380/mojet.2022.10.3.407

Green, S.B., Salkind, *N.J. (2005). Using SPSS for Windows and Macintosh: Analyzing and Undestanding data* (4th edition). Pearson.

Güler, E., Uğur, S., & Güler, C. (2025). Determination of faculty of education lecturers' awareness of generative artificial intelligence and suggestions for its use in teacher training. *Mehmet Akif Ersoy University Journal of Education Faculty*, (74), 618-647. https://doi.org/10.21764/maeuefd.1627851

Haenlein, M., Kaplan, A., Tan, C. W., & Zhang, P. (2019). Artificial intelligence (AI) and management analytics. *Journal of Management Analytics*, *6*(4), 341-343. https://doi.org/10.1080/23270012.2019.1699876

Hallowell, N., Badger, S., McKay, F., Kerasidou, A., & Nellåker, C. (2023). Democratising or disrupting diagnosis? Ethical issues raised by the use of AI tools for rare disease diagnosis. *SSM-Qualitative Research in Health*, *3*, 100240. https://doi.org/10.1016/j.ssmqr.2023.100240

Hew, K. F., & Cheung, W. (2018). Artificial intelligence in education: Opportunities and challenges. *Educational Technology Research and Development*, 66(3), 289-302.

Holmes, W., Bialik, M., & Fadel, C. (2019). Artificial Intelligence in Education: Promises and Implications for Teaching and Learning. *In Center for Curriculum Redesign 14*(4), 251–259. https://doi.org/10.1046/j.1365-2729.1998.1440251.x

How, M. L., & Hung, W. L. D. (2019). Educing AI-thinking in Science, Technology, Engineering, Arts, and Mathematics (STEAM) education. *Education Sciences, 9*(3), 18. https://doi.org/10.3390/educsci9030184

İçen, E. (2024). *The relationship between teachers' awareness of artificial intelligence and innovative pedagogy practices* [Master's thesis]. Bahçeşehir University, Institute of Graduate Studies.

Kalantzis, M., & Cope, B. (2025). Literacy in the time of artificial intelligence. *Reading Research Quarterly, 60*(1), e591. https://doi.org/10.1002/rrq.591

Kamalov, F., Santandreu Calonge, D., & Gurrib, I. (2023). New era of artificial intelligence in education: Towards a sustainable multifaceted revolution. *Sustainability*, *15*(16), 12451. https://doi.org/10.3390/su151612451

Kandlhofer, M., Steinbauer, G., Hirschmugl-Gaisch, S. & Huber, P. (2016). Artificial intelligence and computer science in education: From kindergarten to university. *2016 IEEE Frontiers in Education Conference (FIE)* içinde (pp.1-9). IEEE. https://doi.org/10.1109/FIE.2016.7757570

Kandlhofer, M., Weixelbraun, P., Menzinger, M., Steinbauer-Wagner, G., & Kemenesi, Á. (2023, October). Education and awareness for artificial intelligence. In *International Conference on Informatics in Schools: Situation, Evolution, and Perspectives* (pp. 3-12). Springer Nature Switzerland. https://doi.org/10.1007/978-3-031-44900-0_1

Karan, B., & Angadi, G. R. (2023). Potential risks of artificial intelligence integration into school education: A systematic review. *Bulletin of Science, Technology & Society*, *43*(3-4), 67-85. https://doi.org/10.1177/02704676231224705

Kaya, B. (2017). *The relationship between attitude levels and vocational relationship on the use of technology in education in classroom teachers* [Master's thesis]. Ahievran, Institute of Educational Sciences.

Kong, S. C., Cheung, W. M. Y., & Zhang, G. (2023). Evaluating an artificial intelligence literacy programme for developing university students' conceptual understanding, literacy, empowerment and ethical awareness. *Educational Technology & Society, 26*(1), 16–30. https://doi.org/10.30191/ETS.202301_26(1).0002

Li, X., Shi, H., Xu, R., & Xu, W. (2025). Ai awareness. *arXiv preprint arXiv:2504.20084*.

Livieris, I. E., Apostolopoulou, A., Tsakalidis, D., Domalis, G., & Karacapilidis, N. Leveraging AI techniques to augment actionable knowledge discovery and informed policy making in public deliberation.

Long, D., & Magerko, B. (2020, April). What is AI literacy? Competencies and design considerations. In *Proceedings of the 2020 CHI conference on human factors in computing systems* (pp. 1-16). https://doi.org/10.1145/3313831.3376727

Luckin, R. (2017). Towards artificial intelligence-based assessment systems. *Nature Human Behaviour*, *1*(3), 0028. https://doi.org/10.1038/s41562-016-0028

Luckin, R., Cukurova, M., Kent, C., & Du Boulay, B. (2022). Empowering educators to be AI ready. *Computers and Education: Artificial Intelligence*, *3*, 100076. (The Digital Education Council, 2025). https://doi.org/10.1016/j.caeai.2022.100076

Muzaffer, N., & Ünal, F. (2025). Investigating the relationship between Teachers' artificial intelligence literacy and ethical use of information technologies. *Western Anatolia Journal of Educational Sciences*, *16*(2), 2411-2438. https://doi.org/10.51460/baebd.1670058

Ng, D. T. K., Leung, J. K. L., Chu, S. K. W., & Qiao, M. S. (2021). Conceptualizing AI literacy: An exploratory review. *Computers and Education: Artificial Intelligence*, *2*, 100041. https://doi.org/10.1016/j.caeai.2021.100041

Ng, D. T. K., Su, J., Leung, J. K. L., & Chu, S. K. W. (2023). Artificial intelligence (AI) literacy education in secondary schools: a review. *Interactive Learning Environments*, 1-21.

Park, M., M., & Lim, W. (2023). *AI-integrated mathematics education: A review of literature in the Korean context. Mathematics Education Research, 33*(3), 771-795. https://doi.org/10.29275/jerm.2023.33.3.771

Polat, E., Zincirli, M., & Zengin, E. (2025). Examining the interaction between artificial intelligence literacy and individual entrepreneurial orientation in teacher candidates: The mediating role of sustainable development. *The International Journal of Management Education*, *23*(2), 101156. https://doi.org/10.1016/j.ijme.2025.101156

Rieckmann, M. (2017). *Education for sustainable development goals: Learning objectives*. UNESCO Publishing. KİTAP

Selwyn, N. (2019). *Should robots replace teachers?: AI and the future of education*. John Wiley & Sons.

Shastri, B. J., Tait, A. N., Ferreira de Lima, T., Pernice, W. H., Bhaskaran, H., Wright, C. D., & Prucnal, P. R. (2021). Photonics for artificial intelligence and neuromorphic computing. *Nature Photonics*, *15*(2), 102-114. https://doi.org/10.1038/s41566-020-00754-y

Sperling, K., Stenberg, C. J., McGrath, C., Åkerfeldt, A., Heintz, F., & Stenliden, L. (2024). In search of artificial intelligence (AI) literacy in teacher education: A scoping review. *Computers and Education Open*, *6*, 100169. https://doi.org/10.1016/j.caeo.2024.100169

Tekin, N. (2023). Artificial intelligence in education: A content analysis on trends in research from Türkiye. *Journal of Necmettin Erbakan University*, *5*(Special Issue), 387-411. https://doi.org/10.51119/ereegf.2023.49

Ünal, H. (2025). *Teachers' artificial intelligence awareness levels* [Non-Thesis Master's Project]. Pamukkale University, Institute of Educational Sciences.

Wang, B., Rau, P. L. P., & Yuan, T. (2023). Measuring user competence in using artificial intelligence: validity and reliability of artificial intelligence literacy scale. *Behaviour & Information Technology*, *42*(9), 1324-1337. https://doi.org/10.1080/0144929X.2022.2072768

Wang, B., Rau, P.-L. P., & Yuan, T. (2022). Measuring user competence in using artificial intelligence: validity and reliability of artificial intelligence literacy scale. *Behaviour & Information Technology, 42*(9), 1324–1337. https://doi.org/10.1080/0144929X.2022.2072768

Yüreğilli Göksu, D., and Göksu, S. (2024). Determination of artificial intelligence literacy and attitudes towards artificial intelligence of teachers working with gifted students and examining them according to some variables. *Instructional Technology and Lifelong Learning*, *5*(2). https://doi.org/10.52911/itall.1551369

Zawacki-Richter, O., Marín, V. I., Bond, M., & Gouverneur, F. (2019). Systematic review of research on artificial intelligence applications in higher education – where are the educators? *International Journal of Educational Technology in Higher Education*, *16*(1), 1-27. https://doi.org/10.1186/s41239-019-0171-0

Zhang, C., & Lu, Y. (2021). Study on artificial intelligence: The state of the art and future prospects. *Journal of Industrial Information Integration*, *23*, 100224. https://doi.org/10.1016/j.jii.2021.100224

Zhao, Y., Li, J., & Liu, K. (2024). A knowledge graph perspective on research status, hot spots, and frontier trends of information technology education towards promoting educational policy in China. *Education and Information Technologies,* *29*(4), 4673–4698. https://doi.org/10.1007/s10639-023-12005-y