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RESEARCH ARTICLE

Exploring teachers' artificial intelligence awareness

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Abstract: The impact of artificial intelligence (AI) technological advancements is reshaping various aspects of our daily lives, including education. Integrating AI in education offers advantages such as personalized learning and operational efficiency. However, educators need to be aware of AI's implications in education. Teachers must enhance their awareness and knowledge levels to adapt to the educational environment where AI technologies are becoming increasingly prevalent. Therefore, this research aims to assess teachers' AI awareness levels and investigate whether AI awareness varies based on age, graduation status, and years of experience. This study used data collected from 147 educators using the Teachers' Artificial Intelligence Awareness Scale. The results indicated that teachers' AI awareness was at a moderate level. Additionally, the study examined teachers' AI awareness across different variables. Independent sample t-tests and one-way ANOVA analyses determined teachers' AI awareness variation based on age. The research findings suggest that younger educators and those with higher academic qualifications have more excellent practical knowledge of AI. The study's limitations included a relatively small sample size and the assumption of accurate participant responses. Despite these limitations, understanding teachers' AI awareness levels is a foundation for developing educational programs related to AI. By understanding teachers' perceptions and knowledge of AI, tailored interventions and training initiatives can enhance educators' proficiency in effectively utilizing AI technologies within educational settings.

Keywords: artificial intelligence awareness, quantitative analysis, educational technology

1 Introduction

Artificial intelligence (AI) encompasses technologies that equip machines with human-like intelligence, enabling them to learn, adapt, and make decisions autonomously (Chen et al., 2020). The extensive impact of AI across various sectors, economies, and societal structures highlights its significant transformative capacity, which also reaches into developing interdisciplinary areas such as Artificial Intelligence in Education (AIEd). Integrating AI into education holds immense potential to revolutionize teaching and learning methodologies. From personalized learning experiences to data-driven insights, AI offers promising avenues for enhancing educational outcomes. However, the effective utilization of AIEd hinges upon the preparedness and awareness of educators to harness its capabilities optimally.

The integration of AIEd requires teachers to be aware of these technologies in order to use them effectively. As AI becomes increasingly prevalent in education, understanding teachers' awareness of AI is crucial (Ferikoğlu & Akgün, 2022). This awareness is essential for teachers to know how to use AI tools and integrate them into classroom practices effectively (Ipek et al., 2023). Educators can identify areas where teachers lack knowledge or skills related to AI and tailor training sessions to effectively address these specific needs (Song et al., 2022). Measuring teachers' awareness of AI is essential for ensuring that educators are prepared to leverage the potential of AI in education, to equip students for the future (Yau et al., 2022), and to address the ethical and societal implications of AI technology (Adams et al., 2022).

Teacher awareness of AI is critically important for ensuring the effective use of AI technologies in education. Ng et al. (2023) emphasize the need for more comprehensive studies on AI literacy in the context of teacher education. This highlights the importance of examining teachers' levels of awareness regarding AI technologies. This study aims to determine teachers' awareness of AI and investigate whether this awareness varies based on age, graduation status, and years of service.

By filling the gap in the literature regarding the multifaceted nature of teachers' AI awareness, this research contributes significantly to the field. It provides evidence-based recommendations for designing educational programs and interventions to enhance AI literacy among educators. Furthermore, the findings underscore the need for continuous professional development and support to ensure teachers can effectively integrate AI technologies into their teaching practices, thereby improving educational outcomes and preparing students for a technology-driven future. Additionally, what sets this study apart is its comprehensive examination of AI awareness among teachers, encompassing various demographic factors such as age, graduation status, and years of experience. This research provides a holistic view by analyzing multiple variables simultaneously.

1.1 Conceptual framework for artificial intelligence in education

As we delve deeper into understanding teachers' awareness of AI, exploring the conceptual frameworks guiding the integration and application of AI technologies within educational contexts becomes essential. Xu and Ouyang (2022) stated that most of the existing research has addressed AIEd from a technological perspective, which needs to provide an in-depth understanding of the complex roles of AI in teaching and learning processes and its relationship with other educational elements. To fill this gap, they proposed a conceptual framework. This conceptual framework includes three leading roles for AI: AI as a new topic, AI as a direct mediator, and AI as a supplementary assistant. Utilization of AI as a new topic's category includes using AI as a new subject by modifying existing subjects. AI's potential to replace traditional courses or subjects taught to students is emphasized. Using AI as a direct mediator's category includes cases where AI acts as a bridge between different subjects. That is, AI is used to connect and integrate existing lessons or subjects. Using AI as a supplementary assistant category includes cases where AI indirectly supports courses or subjects. AI is used to provide students with additional resources or improve learning processes but does not replace the core lessons or subjects. This research effectively highlights the comprehensive approach taken by Xu and Ouyang (2022) to address the limitations of existing research on AIEd by proposing a nuanced conceptual framework that categorizes the roles of AI in education into three distinct areas: as a new topic, a direct mediator, and a supplementary assistant, thereby providing a deeper understanding of AI's multifaceted impact on teaching and learning processes (Tülübaş et al., 2023).

Holmes et al.'s (2019) book "Artificial Intelligence in Education: Promises and Implications for Teaching and Learning" provides a comprehensive theoretical framework that delves deeply into various applications of AIEd and their pedagogical impacts. The book discusses AI's potential in education under critical headings such as personalized learning, learning analytics, and adaptive learning systems. It focuses on how AI can support teachers' roles, enhance student engagement and motivation, and promote equal opportunities in education. Additionally, the book showcases practical application examples of AI in education, such as AI-supported intelligent tutoring systems, language learning applications, and virtual assistants, highlighting the multifaceted impacts of AI in education (Karakose et al., 2023).

Despite its nearly three-decade existence, educators still grapple with effectively employing AI pedagogically on a broad scale and understanding its significant implications for teaching and learning in education (Zawacki-Richter et al., 2019). Research by Zawacki-Richter et al. (2019) aims to provide an overview of research on AI applications in education. The synthesis of the study results, in which 146 articles are included, presents four areas of AIEd applications: Profiling and prediction, assessment and evaluation, adaptive systems and personalization, and intelligent tutoring systems. The results reflect an almost inadequate treatment of the challenges and risks of AIEd and a weak link to theoretical and pedagogical perspectives. When the literature is examined, it is seen that the theoretical infrastructure in the field of AIEd is insufficient.

1.2 Literature review

Teacher awareness of AI is essential for understanding how AI technologies can be utilized in educational processes (Karakose et al., 2023). For instance, a study by Athanassopoulos et al. (2023) highlights the supportive role of ChatGPT in the language learning process. This study demonstrates the potential of AI to enhance students' writing skills. Similarly, Karakose et al. (2023) examined the impact of the COVID-19 pandemic on education through an interview conducted with ChatGPT. This study provides significant insights into human-AI collaboration in education and supports the current study's findings.

The literature on AIEd encompasses diverse studies that shed light on various aspects of AI integration in teaching and learning practices. AlKanaan (2022) explored pre-service science teachers' awareness of AI, revealing that awareness levels were generally low. This study used a mixed-method approach, combining quantitative and qualitative interviews, to provide a comprehensive view of pre-service teachers' perceptions and the factors influencing their awareness. The research underscored the need for targeted professional development programs to enhance AI literacy among future educators. In this research, using only pre-service science teachers as a sample limits the generalizability of the results. This study, however, has reached teachers from various disciplines. Additionally, in this study, teachers' awareness of AI was examined using different variables and presented to the reader across a broad spectrum.

Chounta et al. (2021) investigated Estonian K-12 teachers' perceptions of AI as a tool to support teaching. Their study found that while teachers recognized the potential benefits of AI, there were significant concerns about the need for more training and resources to implement AI in classrooms effectively. The study emphasized the importance of providing ongoing support and professional development to help teachers integrate AI technologies into their teaching practices. Perceptions of AI and AI awareness are distinct concepts with significant differences. Perceptions of AI refer to individuals' subjective evaluations and attitudes towards AI, reflecting their views and beliefs about the technology. On the other hand, AI awareness pertains to the objective level of knowledge individuals possess about AI, indicating their factual understanding of the technology without necessarily delving into technical details or in-depth expertise. This differentiation is crucial as it underscores the subjective nature of perceptions and the factual basis of awareness when considering individuals' views and understanding of AI (Zhang, 2023).

Shi (2024) aimed to investigate the AI literacy levels of teacher trainees and strategies to improve these levels. The research involved surveying and interviewing 430 teacher trainees. The results indicate that teacher trainees need more AI knowledge and capabilities but possess relatively high AI awareness. The article recommends improving AI literacy at the school, teacher, and student levels. Zhao et al. (2022) also investigated the AI literacy of primary and middle school teachers in China. The study found that teachers generally have a medium to high literacy level in using AI resources in the classroom. AI literacy and awareness of AI may appear similar, yet they represent distinct concepts. AI literacy includes the ability to use AI technologies consciously and responsibly. While awareness suggests general knowledge and comprehension, it does not necessarily entail technical expertise or profound understanding.

Investigating teachers' awareness of AI is crucial for several reasons. Firstly, many teachers need to understand how AI functions and how it can be effectively utilized in education (Du, 2024). This lack of knowledge hinders their ability to leverage AI in educational settings fully. Secondly, exploring teachers' perceptions and attitudes towards AI is essential for promoting their intentions to learn about AI and its educational implications (AlKanaan, 2022). Understanding teachers' attitudes and expectations regarding AI is a fundamental step toward successfully implementing AI in the classroom (Pörn, 2024).

Moreover, as AI technologies evolve, they are increasingly integrated into educational practices, transitioning from basic computer systems to more advanced forms like robots that can perform teacher-like functions (Chen et al., 2020). This shift underscores the importance of teachers being aware of AI and its potential impact on teaching methodologies. Additionally, teachers must recognize that integrating AI in schools will necessitate changes in the traditional teaching system (Zormanová, 2024). By acknowledging AI as a tool that can enhance their work and make it more efficient, teachers can adapt to the changing educational landscape.

Investigating teachers' awareness of AI is vital for preparing educators to effectively integrate AI technologies into teaching practices, adapt to changing educational paradigms, and ensure that students receive a quality education that leverages the benefits of AI. While there are some studies on the broader topic of AIEd, many do not focus explicitly on teachers' awareness to integrate these technologies effectively (Simhadri & Swamy, 2023). Simhadri and Swamy (2023) collectively underline the need for more targeted research in this area and state that there is a notable gap in the existing literature on teachers' awareness of AI. By understanding where teachers stand regarding AI awareness, educational institutions can make more informed decisions about resource allocation, training needs, and curriculum adjustments to better prepare students for the future (Ferikoğlu & Akgün, 2023). It is necessary to ascertain the AI awareness of teachers who are leading the teaching process. Therefore, this study investigates teachers' awareness of AI and whether AI awareness varies based on age, graduation status, and years of experience.

2 Methods

2.1 Research model

This research aims to systematically assess and measure teachers' awareness of AI using a structured scale designed for this purpose. The study employed a quantitative method involving analyzing, testing, and interpreting problems and phenomena using numerical data to draw research conclusions. Quantitative research methods are systematic and structured, relying on numbers and measurements for data analysis (Shara et al., 2020). The choice of employing a quantitative research method in this study aimed to provide numerical data and statistical analysis regarding teachers' awareness of artificial intelligence. This approach allows for quantifying responses obtained through the "Teachers' Artificial Intelligence Awareness Scale," enabling a systematic examination of the levels of AI awareness among participants.

2.2 Data collection tool

The Teachers' Artificial Intelligence Awareness Scale, developed by Ferikoğlu and Akgün (2022), was used as a data collection tool in this study. The scale was designed to determine teachers' awareness of AIEd and their tendencies towards the concept of AI and its sub-branches.

The teachers' Artificial Intelligence Awareness Scale was applied by Ferikoğlu & Akgün (2022) to 561 teachers for validity and reliability. According to the results of the study conducted by Ferikoğlu & Akgün (2022), the scale was reported to be reliable (Cronbach's Alpha = 0.986). In the study conducted by Ferikoğlu and Akgün (2022), in determining the fit of the model, the Comparative Fit Index (CFI) and Root Mean Square Error of Approximation (RMSEA) were utilized. χ2/df ratio was 3,67, which indicates a good fit between the model and the data. The CFI value was calculated as .903, and RMSEA was .069. The results indicated that the model demonstrated a high level of fit. The findings of the study conducted by Ferikoğlu and Akgün (2022) demonstrate the validity of the scale and the appropriateness of the model in fitting the data.

The scale prepared in a five-point Likert type consists of 51 items and four sub-dimensions. Items 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11 of the scale measure teachers' theoretical knowledge about AI; items 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 27, 38, 39 measure teachers' practical knowledge of AI; items 25, 26, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 48, 49 measure teachers' beliefs-attitudes towards AI; items 40, 41, 42, 43, 44, 45, 46, 47, 50, 51 measure teachers' integration ability.

The subtest of *theoretical knowledge* within the teachers' AI awareness scale aims to assess educators' understanding of AI's fundamental principles, concepts, and theoretical foundations. Within the context of AI awareness among teachers, practical knowledge refers to educators' proficiency in applying AI concepts, tools, and techniques in real-world educational settings. Teachers' *attitudes* toward AI technologies reflect their willingness to adopt and utilize them in education. A positive attitude facilitates a better understanding and acceptance of the potential of AIEd. *Integration Ability,* as a subtest of the teachers' AI awareness scale, aims to measure educators' capacity to effectively combine and incorporate AI concepts, tools, and methodologies into their teaching practices.

The amalgamation of these dimensions allows for a multifaceted assessment of teachers' awareness of AI, facilitating the effective promotion of AIEd.

2.3 Study group

The study included educators employed within the region of Eskisehir, Turkey. The survey instrument was adapted for use on Google Forms, and the resulting hyperlink was disseminated among teachers via the school's official WhatsApp group. The sampling method employed in sending the scale to all teachers is convenience sampling. Convenience sampling involves selecting participants based on their easy availability and accessibility (Robinson, 2014). In this case, utilizing the official WhatsApp group of the school to distribute the survey link to all teachers represents a convenient way to reach the target population for the study. One hundred fifty-one participants responded. Before starting the analysis, it was checked whether there were any incorrect data entries, and outliers in the dataset were identified. It was concluded that all values are present. Outliers are data points far from a given distribution's mean (Jarrell, 1994). It can be determined by a statistical method known as Mahalanobis distance (Mertler & Vannatta, 2005). The critical chi-square value, when read from the table for α = 0.001 and "K-1" degrees

of freedom, is accepted to be between 86.661 ($p<.001$) for 51 variables (Tabachnick & Fidell, 2013). Outliers increase error variance and decrease the power of statistical tests (Rasmussen, 1988). Pallant (2012) suggests that deleting these values from the dataset could be a solution to deal with outliers. After examining the dataset of the current study for outliers, it was decided to exclude data from 4 participants from the analyses. As a result, the number of participants decreased from 151 to 147. Data on teachers' age, years in the profession, and graduation status are presented in Table 1.

Table 1 Distribution of participants

Variables	f	%	Skewness	Kurtosis
Age				
25-40	49	33		
41-49	65	44	0.177	-1.1
50-64	33	22		
Graduation Status				
Bachelor's degree	97	65	0.682	-1.5
Postgraduate	50	34		
Years of Service				
1-20	68	46	-0.152	-2.0
21-40	79	53		

When examining the age distribution of the participants, it is evident that most of the teachers fall within the middle-aged group. There are no participants over 65, explained by the retirement age limit 65. Therefore, most of the teachers in this study are within the active working age.

In the dataset provided, it is observed that there are 68 teachers classified as belonging to the new generation, characterized by 1-20 years of teaching experience. Conversely, 79 teachers identified as part of the old generation, defined by having 21-40 years of teaching experience. Based on the data presented in Table 1, it is apparent that there is a balanced representation of teachers in both the new generation (1-20 years of experience) and the old generation (21-40 years of experience) categories.

Table 1 shows that 50 teachers have obtained master's and doctoral degrees, while 97 hold bachelor's degrees. In Turkey, the rate of teachers who have received postgraduate education is 9% (Ministry of National Education, 2021). The low number of participants with doctorate and master's degrees is the low number of teachers who continue their education after undergraduate education.

Following the guidelines proposed by Trochim and Donnelly (2006), assessing normality assumption involves scrutinizing the skewness and kurtosis coefficients. These authors suggest that skewness and kurtosis values falling within the range of -2 to +2 indicate a satisfactory level of normal distribution for the data under consideration. Upon reviewing Table 1, the variables about the age, experience, and education of the participants conform to a normal distribution pattern.

2.4 Data collection and analysis

In this study, the Teacher AI Awareness Scale, used as the data collection tool, was transferred to a Google Form. The generated link was shared in the official WhatsApp groups of schools where teachers working in the Eskisehir province in Turkey are members. Teachers received the questionnaire link and could access and complete the survey at their convenience. The data collection process adhered to ethical considerations, ensuring the confidentiality and anonymity of the participants' responses. The researcher was available to address any queries or concerns raised by the participants during the data collection period.

Our participant group consists solely of adults, so we did not obtain an ethical committee approval document. According to the regulations and guidelines we followed, ethical approval is typically required for studies involving vulnerable populations or specific interventions, neither of which applies to our research. We ensured that our study adhered to all ethical standards, including informed consent and confidentiality for all participants.

Additionally, the normality of the data was thoroughly assessed, and kurtosis and skewness values were examined. Skewness values ranged for the theoretical knowledge subtest -.345, for practical knowledge subtest -.202, for the beliefs and attitude subtest -.359, for the integration ability subtest -.103 while kurtosis values ranged for the first subtest .998, for the second one .400, for the third subtest .462, and for the last one .883. It was found that the kurtosis and

skewness values of the dataset were within the range of -1 to +1, and the data set showed a normal distribution (Huck, 2012). In addition to skewness and kurtosis, Q-Q (quantile-quantile) plots have also been examined. For instance, Figure 1 shows the Q-Q plot for the 'Practical Knowledge' subscale of the measurement scale.

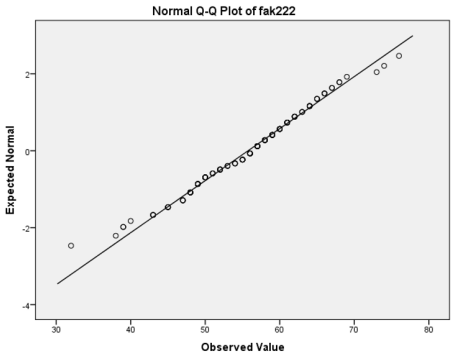

Figure 1 Q-Q plot for the 'Practical Knowledge' subscale

Upon examining Figure 1, the data set for the second subtest of the scale follows a normal distribution. Kolmogorov- Smirnov test results of total scores of the teachers' responses are given in Table 2.

Table 2 Kolmogorov-Smirnov test result

	Static	df	p
Total points	0.038	147	0.200

The Kolmogorov-Smirnov test assessed the normality of the total scores' distribution. Upon reviewing Table 2, the distribution of teachers' awareness scores regarding AI is normal ($p > 0.05$).

As a result of the dataset exhibiting a normal distribution, frequency analysis, one-way ANOVA, and independent samples t-test were used to examine whether teachers' awareness of AI differed based on their years of employment, age, and graduation status. The Bonferroni test was used in post hoc analyses with total scores. This is to control the error rate that arises from multiple comparisons. In statistical analyses, the likelihood of obtaining false positive results increases when you test multiple hypotheses. This can lead to mistakenly finding some results to be significant (Field, 2005). Statistical analyses and computations were performed using the Statistical Package for the Social Sciences (SPSS) software.

3 Findings and discussion

3.1 Findings

The Teachers' Artificial Intelligence Awareness Scale, consisting of 51 items and four sub-dimensions, was used to determine teachers' awareness of AI. In this study section, statistical analyses were conducted to investigate the significance of teachers' awareness of AI in terms of different variables. Following the analyses, the findings were presented and interpreted in tables.

The minimum education level required to become a teacher is a bachelor's degree. Some teachers continue their education beyond the bachelor's degree. In this study, doctoral and master's degrees were considered a single group and considered postgraduate education. Independent samples t-test was used to determine whether teachers' awareness of AI varies according to their graduation status. The findings are presented in Table 3.

When examining Table 3, a statistically significant difference is observed in the results of the practical knowledge subtest of participants' AI awareness between bachelor's degree and postgraduate degree holders ($p<0.05$). Descriptive findings indicate that although the number of teachers with master's and doctoral degrees is small, their average scores in the practical knowledge subtest are higher. However, no significant differences were found in the results of the theoretical knowledge, belief-attitude, and integration ability subtests. There is also no significant difference in total scores. The highest possible score from the scale is 255, and the

Table 3 Differentiation of teachers' awareness of AI according to graduation status variable

Subscale/Scale	Variables	n	Mean	SD	t	df	p
Theoretical Knowledge	Bachelor's degree	97	41.4	5.3	0.268	145	0.462
	Postgraduate	50	41.2	5.6			
Practical Knowledge	Bachelor's degree	97	54.4	13.5	-0.393	145	0.030
	Postgraduate	50	55.1	9.4			
Belief-Attitude	Bachelor's degree	97	48.8	7.8	0.324	145	0.388
	Postgraduate	50	48.3	6.7			
Integration Ability	Bachelor's degree	97	35.7	5.7	1.019	145	0.820
	Postgraduate	50	34.7	5.5			
Total	Bachelor's degree	97	180	24.9	0.154	145	0.806
	Postgraduate	50	179	23.9			

lowest is 51. The average score of the teachers is 180. The fact that the average score of teachers is relatively high indicates a generally positive level of awareness across the board, regardless of their degree level.

Independent samples t-test was used to determine whether teachers' awareness of AI varies according to experience. The findings are presented in Table 4.

Table 4 Differentiation of teachers' awareness of AI according to years of service variable

Subscale/Scale	Variables	n	Mean	SD	t	df	p
Theoretical Knowledge	1-20 years	68	42	5	1.408	145	0.347
	21-40 years	79	40.7	5			
Practical Knowledge	1-20 years	68	59.9	8.7	5.462	145	0.000
	21-40 years	79	49.8	12.9			
Belief-Attitude	1-20 years	68	49.8	7	1.781	145	0.601
	21-40 years	79	47.6	7			
Integration Ability	1-20 years	68	35.7	6	0.666	145	0.836
	21-40 years	79	35	5			
Total	1-20 years	68	187.6	25	3.722	145	0.250
	21-40 years	79	173.1	23			

According to Table 4, a statistically significant difference has been found in the practical knowledge subtest between new-generation teachers (those with 1-20 years of experience) and old-generation teachers (those with 21-40 years of experience) ($p<0.05$). This indicates that the practical knowledge level of new-generation teachers in AI is higher compared to old-generation teachers. However, no significant difference was found in the theoretical knowledge, belief and attitude, and integration ability subtests. When considering the total scores, there is no significant difference between new-generation and old-generation teachers. However, descriptive findings reveal that the average scores of new-generation teachers are higher than those of the old generation. Total scores of 187.6 and 173,1 indicate that teachers' level of AI awareness falls between moderate to high.

Due to the presence of only two variables (1-20 and 21-40) related to work experience, examining the findings related to age will provide a more detailed conclusion. Participants were asked to write down their ages during the data collection phase. Subsequently, the frequencies of the age variable were examined. Age intervals for analysis were determined, ensuring that the frequencies of participant ages were balanced. Accordingly, the age intervals for participants were set as 25-40, 41-49, and 50-64.

One-way ANOVA was used to determine whether there was a significant difference in teachers' awareness of AI based on the age variable. Before conducting the one-way ANOVA test, the homogeneity of the data, which is one of the assumptions of ANOVA, was checked. The homogeneity of variance assumption was examined using the Levene Test. The results of the Levene Test are provided in Table 5. The results of the analysis demonstrating the level of relationship between the variables are presented in Table 6.

When Table 5 is examined, the Levene test results for the variables are not significant ($p > 0.05$). Thus, the dataset is suitable for the ANOVA test.

According to Table 6, a statistically significant difference is observed in the age variable of the participants, in the practical knowledge subtest scores and total scores of AI awareness ($F(2.144) = [11.250]$, $p < 0.05$). This may suggest a significant influence of age on AI awareness. The Bonferroni test was employed to determine the source of these significant differences in the

Table 5 Levene test

Subscale/Scale	Levene	sd1	sd2	p
Theoretical Knowledge	1.408	2	144	0.243
Practical Knowledge	0.372	2	144	0.773
Belief-Attitude	0.105	2	144	0.957
Integration Ability	0.411	2	144	0.663

Table 6 Differentiation of teachers' awareness of AI according to the age variable

Subscale/Scale	Variables	n	Mean	SD	df	F	p
Theoretical Knowledge	25-40 years	49	41.8	5.7	144	0.344	0.710
	41-49 years	65	41	5.8			
	50-64 years	33	41.2	4			
Practical Knowledge	25-40 years	49	61.2	9.6	144	38.210	0.000
	41-49 years	65	55.8	8.6			
	50-64 years	33	41.9	12.6			
Belief-Attitude	25-40 years	49	49.9	8.6	144	1.776	0.173
	41-49 years	65	48.6	6.8			
	50-64 years	33	46.8	6.5			
Integration Ability	25-40 years	49	35.6	7.2	144	0.120	0.887
	41-49 years	65	35.3	4.8			
	50-64 years	33	35	4.6			
Total	25-40 years	49	188.8	24.8	144	11.250	0.000
	41-49 years	65	180.8	23.5			
	50-64 years	33	164.3	18.5			

Teachers' Artificial Intelligence Awareness Scale's total scores and practical knowledge subtest (Field, 2005). As a result of the test, teachers between the ages of 25-40 (X = 188.8, SD = 24.8) had a higher level of AI awareness than teachers between the ages of 50-64 (X = 164.3, SD = 18.5). Teachers between the ages of 41-49 (X = 180.8, SD = 23.5) had a higher level of AI awareness than teachers between 50-64 (X = 164.3, SD = 18.5). It was concluded that there is no significant difference between the ages of 25-40 (X = 188.8 SD = 24.8) and 41-49 (X = 180.8, SD = 23.5).

4 Discussion

When examining the descriptive findings, teachers' levels of awareness regarding AI are moderate. This indicates that teachers possess a certain knowledge and awareness about AI but could gain more knowledge and skills in this area. A moderate level of awareness suggests that teachers have the potential to integrate AI technologies into their educational processes; however, they may need further training and resources to do so. It is possible to elevate this level through educational programs and awareness-raising activities.

Based on the available research, there is a mix of findings regarding teachers' levels of awareness regarding AI. AlKanaan (2022) reported that pre-service science teachers need the knowledge to employ AI in science education. On the other hand, Zhao et al. (2022) found that most of the teachers have a moderate to high level of AI literacy, indicating a relatively in-depth understanding of the use of AI resources in the classroom. Chounta et al. (2021) also highlighted that teachers need more knowledge about AI and its potential to support their education practice.

Due to the different results in the literature regarding teachers' awareness of AI, it is also necessary to examine the results of the subtests. When examining the descriptive findings of the scale subtests, teachers' awareness of the theoretical knowledge subtest is high. Teachers possess a high level of knowledge about AI, machine learning, and the relationship between data and AI. It was concluded that teachers' theoretical knowledge about AI is similar according to age, work experience, or graduation status. The results of the study conducted by Zhao et al. (2020) are consistent with the conclusion that teachers' theoretical knowledge of AI is high. In their research involving 1,013 teachers, Zhao et al. (2020) examined AI literacy among teachers. The average score for the dimension of knowing and understanding AI was found to be 3.64, indicating that teachers' theoretical knowledge levels are generally good.

When examining the descriptive findings of the practical knowledge subtest of the Teachers'

Artificial Intelligence Awareness Scale, it can be stated that teachers' practical knowledge of AI is at a medium level. Teachers' awareness of the applications and benefits of AIEd, AI and big data, development and use of AI technologies, and ethical and legal dimensions is at a medium level. This indicates that teachers have sufficient knowledge to understand and use AI applications and technologies, but they must acquire more learning and experience to advance this knowledge.

Differences have been observed in teachers' practical knowledge of AI concerning years of service, age, and educational background. Among teachers classified as the "new generation" with 1-20 years of work experience, their practical knowledge of AI is higher than that of those with 21-40 years of experience. Furthermore, differences have been noted based on the age variable. In the age variable, a significant difference was found in teachers' total scores of AI awareness. While there is no variance in the practical knowledge of AI among teachers aged 25-40 and 41-49, there is a distinction between both age groups and those aged 50-64. The findings of this study are consistent with the research conducted by Chan and Lee (2023). Chan and Lee (2023) reported that Gen Z students have a more positive view of using AIEd, while Gen X and Y teachers are more cautious. This supports our findings that teacher awareness of AI varies by age.

This may stem from younger teachers being more familiar with technology and having more up-to-date knowledge and skills in AI. Younger teachers may use technology more in their educational processes and personal lives, contributing to their higher awareness of AI. Furthermore, the higher awareness of AI among teachers aged 41-49 compared to those aged 50-64 suggests that this group is in a balanced position regarding both experience and adaptability to technology. Middle-aged teachers may not adapt to technology and AI as quickly as younger teachers but may have higher awareness than teachers aged 50-64. These results indicate a decrease in teachers' awareness levels of AI as age advances, with teachers aged 50-64 needing more support and training. Customizing educational programs according to age groups and providing more resources and training opportunities for older teachers may help increase awareness of AI. According to Hinojo-Lucena et al. (2019), the advancement of technology is associated with a decrease in teachers' awareness of AI, indicating that age may influence teachers' awareness of AI.

It has been concluded that teachers' practical knowledge levels of AI vary according to their educational backgrounds. Teachers who have pursued postgraduate education, such as obtaining a doctoral or master's degree, exhibit higher practical knowledge of AI than teachers with bachelor's degrees. This could be attributed to the advanced and specialized training that postgraduate and doctoral programs provide, allowing teachers to delve deeper into the intricacies of AI. The rigorous academic environment and research opportunities in postgraduate studies may equip teachers with a more comprehensive understanding of AI concepts and applications, leading to enhanced practical knowledge in this field. Additionally, exposure to cutting-edge research and advanced coursework in postgraduate education could contribute to a more nuanced and sophisticated grasp of AI among teachers with higher academic qualifications. This finding is consistent with the research conducted by Shi (2024). Shi (2024) found that the AI literacy levels of teacher candidates vary by department, with those studying in scientific disciplines having higher knowledge levels. Similarly, Ng et al. (2023) and Khabib (2022) found that teachers with higher academic levels possess more excellent knowledge and practical skills in AI.

When examining the descriptive findings of the teachers' beliefs and attitudes towards AI subtest of the Teachers' Artificial Intelligence Awareness Scale, it can be stated that teachers' beliefs and attitudes towards AI are at a moderate level. Additionally, it was concluded that there are no significant differences among teachers in the beliefs and attitudes subtest based on experience, age, and graduation status. Concerns about AI's ethical and security aspects and uncertainties regarding how to effectively implement AI in education can cause teachers to be hesitant about using this technology. The fear that AI might lead to the disappearance of certain professions can also make teachers reluctant to support this technology. In the study conducted by Strzelecki (2024), it was stated that providing training on AI to teachers can alleviate their concerns about AI.

The results of the study conducted by Pöln et al. (2024) align with the finding that teachers' beliefs and attitudes towards AI are balanced. In the research, Pöln et al. (2024) investigated the attitudes and expectations of digitally skilled K-12 mathematics teachers (N = 85) regarding the role of artificial intelligence in the classroom. The study, which conducted a web-based survey among Swedish and Finnish-speaking mathematics teachers, reported moderate teacher

attitudes towards AI tools in schools.

The level of teachers' ability to relate AI concepts and knowledge to various contexts and applications, as assessed by the sub-test on integration ability, is moderate. Furthermore, there are no significant differences between teachers' integration ability with AI based on age, experience, or graduation status. The integration ability of teachers in AI is at an intermediate level, suggesting a foundational understanding that requires further development to incorporate AI into educational practices effectively. Educational programs and professional development opportunities should target enhancing teachers' competencies in integrating AI concepts into various educational contexts. Similarly, Khabib (2022) highlighted the need for more knowledge among teachers regarding proficiency in integrating AI into educational practices and utilizing AI-based digital writing assistants, attributing it to insufficient training and guidance. This underscores the necessity for further development in this area (Khabib, 2022).

In summary, the results of this research indicate that teachers exhibit a moderate level of AI awareness, with notable discrepancies based on factors such as age, years of experience, and educational background. Younger educators and those with higher academic qualifications tend to possess more excellent practical knowledge and awareness of AI. At the same time, older teachers and individuals with less formal education may benefit from additional support and training. This underscores the importance of tailored educational initiatives and resources to enhance AI awareness among teachers from diverse backgrounds. Furthermore, the moderate levels of belief and attitude towards AI and the integration ability of AI suggest that teachers are generally receptive to and capable of incorporating AI into their teaching practices, albeit with room for improvement. Therefore, ongoing professional development and customized training programs are crucial in enhancing teachers' AI skills, ensuring they are proficient in effectively utilizing AI technologies in their educational endeavours.

5 Recommendations

Based on the data collected from 147 teachers to determine their awareness of AI, it was found that their awareness is moderate and varies according to age. Providing in-service training for teachers to use AI applications effectively is recommended. Additionally, it is suggested that teachers be offered training on adapting AI applications and technology in the classroom. In subsequent studies, interviews or focus group discussions can be conducted to understand better why teachers' awareness of AI is at a moderate level and why it differs by age. Research can also be conducted on how teachers use AI technologies in the classroom, the integration and usage scenarios of these technologies, and the challenges and opportunities encountered in integrating AI into teaching processes. Longitudinal studies can be conducted to examine how teachers' awareness of AI changes over time. Additionally, studies can be conducted to investigate the impact of teachers' awareness of AI on student performance. This can help to understand the effects of AI awareness on educational outcomes.

6 Limitations

The study was limited to 147 teachers, which may restrict the generalizability of the findings to a broader population of educators. The study assumed that participants provided accurate and truthful responses to the scale, which could introduce response bias and affect the reliability of the results. Teachers' access to and opportunities to use AI technologies may vary. This can affect their levels of awareness.

Conflicts of interest

The authors declare that they have no conflict of interest.

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