




Original Article

Development and Validation of an Artificial Intelligence Awareness, Knowledge, Attitude, and Confidence Survey Among Physiotherapy Students

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ABSTRACT

Objectives: This study aimed to develop and validate a scale assessing physiotherapy students' knowledge, awareness, attitudes, and confidence toward artificial intelligence (AI), and to examine associations with demographic variables.

Material and Method: A cross-sectional survey was conducted in Istanbul, Türkiye (February 2024-May 2025), in accordance with CROSS and CHERRIES guidelines. Item generation involved a literature review and expert feedback. A pilot study with 150 students evaluated clarity, content validity, and reliability. Based on analysis, 22 items across three subscales (knowledge, awareness, attitude-confidence) were retained. The final survey was distributed via Google Forms to 300 physiotherapy students from four universities. Reliability was determined using Cronbach's alpha, and construct validity was assessed via confirmatory factor analysis (CFA) and structural equation modelling (SEM).

Results: The scale showed high internal consistency ($\alpha = 0.914$), with subscale alphas between 0.689 and 0.892. CFA and SEM demonstrated acceptable model fit (CFI = 0.916, TLI = 0.904, RMSEA = 0.070). Knowledge scores were relatively low, whereas awareness and confidence were higher. Age, academic year, and prior technical background significantly influenced knowledge and awareness, while attitudes and confidence differed by institution.

Conclusion: The developed instrument is reliable and valid for evaluating AI-related perceptions in physiotherapy education. Results emphasize the need for structured AI literacy and ethics training to align high confidence and awareness with actual knowledge.

Keywords: Digital competence, Digital health, E-health literacy, Health occupations, Physiotherapy education

INTRODUCTION

Artificial intelligence (AI) has created transformative impacts in healthcare, as in many other fields, in recent years. First defined in 1956 by John McCarthy as “the science and engineering of making intelligent machines,” AI today refers to systems capable of performing tasks that require human intelligence, such as visual perception, speech recognition, decision-making, and natural language processing.^[1,2] In healthcare, AI has a wide range of applications, from diagnostic processes and patient monitoring to personalized treatment approaches and reducing error rates in medical imaging. Particularly in fields such as radiology and

diagnostic imaging, AI algorithms with high sensitivity have been reported to produce meaningful improvements in clinical outcomes.^[3,4]

The impact of AI is not limited to medicine alone; it has increasingly been felt in physiotherapy practices, including motion analysis, monitoring rehabilitation processes, the use of robotic rehabilitation devices, and the design of individualized treatment plans.^[5-8] These systems, operating with layered algorithmic architectures, go beyond pattern recognition and association functions to assist healthcare professionals in processes such as test guidance, patient screening, and treatment planning.^[9]

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The effective use of AI technologies largely depends on healthcare professionals' levels of knowledge, awareness, and attitudes toward technology.

Global studies indicate that health sciences students generally hold positive attitudes toward the use of AI in healthcare, although their technical knowledge often remains limited.^[10,11] Some students perceive AI as a potential threat to their professions; nevertheless, they consider the inclusion of basic AI education in curricula beneficial.^[3] Cross-national comparative research further shows that students question the potential impact of AI on professional roles, yet remain willing to integrate this technology into practice when appropriate training is provided.^[12]

Although the role of AI in disciplines such as physiotherapy and rehabilitation, where patient-centred care and manual practices are central, remains debated, its potential contributions in these areas are becoming increasingly evident. The literature highlights a scarcity of studies focusing specifically on physiotherapy students' knowledge, awareness, attitudes, and confidence regarding AI. However, these factors have the potential to shape the future direction of clinical practice and directly influence the integration of technology into healthcare delivery.^[3,13,14]

This study aims to evaluate physiotherapy and rehabilitation students' levels of knowledge, awareness, attitudes, and confidence regarding AI and to examine the relationships among these variables. The findings are expected to contribute to the development of physiotherapy education programs in terms of AI integration and to inform strategies for enhancing students' confidence toward technology. Based on this rationale, we hypothesized that physiotherapy and rehabilitation students' levels of knowledge, awareness, and attitude-confidence regarding artificial intelligence would be significantly interrelated; that these levels would vary according to demographic factors such as age, gender, grade level, and technological experience; and that students who had received AI-related training would demonstrate significantly higher levels compared to their peers without such training.

MATERIAL AND METHODS

This research was designed as a cross-sectional and descriptive survey study. The study methodology was developed in accordance with the "Checklist for Reporting of Survey Studies (CROSS)" and the "Checklist for Reporting Results of Internet E-Surveys (CHERRIES)" guidelines, and it was conducted in Istanbul between February 2024 and May 2025. Ethical approval for this study was obtained from the Non-Interventional Scientific Research Ethics Committee of Istanbul Atlas University (decision no: 05/24, dated 26 May 2025). The study was conducted in accordance with the

ethical principles of the Declaration of Helsinki. Informed consent was obtained digitally via Google Forms from all participants prior to data collection.

Development of the scale items and the construction process

In this study, a scale was developed to measure physiotherapy and rehabilitation undergraduate students' use of artificial intelligence, as well as their knowledge, awareness, attitudes, and confidence levels. The scale development process followed a systematic approach based on both literature review and expert opinion. In the first stage, a comprehensive literature review was conducted, covering not only studies in the field of physiotherapy and rehabilitation but also research involving other health-related student and professional groups.^[15-17] During this review, items used in existing scales, research methods, and measurement dimensions were carefully analysed, and based on the findings, an original item pool was created in line with the objectives of the study.

The developed scale consisted of three sub-dimensions: knowledge, awareness, and attitude-confidence. The questionnaire was structured into four sections:

1. Section 1: Sixteen questions regarding demographic characteristics of the participants,
2. Section 2: Nine questions measuring the level of knowledge on AI use in physiotherapy,
3. Section 3: Nine questions evaluating AI awareness levels,
4. Section 4: Eleven questions assessing attitudes and confidence toward AI use in physiotherapy.

The knowledge, awareness, and attitude-confidence subscales were scored using a 5-point Likert scale. In the second stage, the item pool was converted into an "expert opinion evaluation form" and submitted to expert physiotherapists holding at least a doctoral degree in the field. Feedback from experts was assessed in terms of content validity, clarity of expression, and comprehensibility. Necessary revisions were made, and the first version of the scale was prepared. In the third stage, a pilot study was conducted to obtain the final version of the questionnaire.

Pilot study, validity, and reliability analysis

A pilot application was carried out to evaluate the comprehensibility of the developed items and to identify unclear or ambiguous questions. For determining the sample size, a probability-based calculation approach recommended in survey studies was used. Viechtbauer *et al.*^[18] suggested that, to detect the presence of at least one problematic item with 95% confidence, the required sample size can be calculated using the following formula:

$$n = \frac{\ln(1-\gamma)}{\ln(1-\Pi)}$$

Where:

n : required sample size,

γ : confidence level (0.95),

π : probability of a problematic response per participant (0.05).

$$n = \frac{\ln(1-0.95)}{\ln(1-0.05)} = \frac{\ln(1-0.05)}{\ln(1-0.95)} \approx \frac{-2.9957}{-0.0513} \approx 58.4$$

Since the study aimed to calculate Cronbach's alpha reliability coefficient and to assess construct validity through confirmatory factor analysis (CFA), a larger sample size was planned, considering the number of items in the scale (22 questions). In the literature, it is generally recommended to include 5-10 participants per item for CFA.^[19,20] Accordingly, the minimum required sample size for the pilot study was calculated as at least 145 participants, and the pilot study was carried out with a total of 150 participants. The pilot sample consisted of physiotherapy and rehabilitation students from a university not included in the main study.

Following the pilot analysis, one item from the knowledge section, four items from the awareness section, and two items from the attitude-confidence section were removed. As a result, the final version of the scale consisted of 22 items across the three subscales. The finalized questionnaire is provided in Appendix 1.

Participants

Students enrolled in the Physiotherapy and Rehabilitation Departments at universities in Istanbul were invited to participate in the study. The invitation was distributed through social media channels (WhatsApp groups, Telegram channels). Eligible participants were students from any academic year of physiotherapy and rehabilitation programs, of either gender, and literate in Turkish. Individuals who had discontinued their physiotherapy education, were younger than 18 years of age, or had transferred to other health-related disciplines were excluded from the study. Since the sample consisted of student groups accessible to the researchers, a convenience sampling method was applied.^[21] Based on a 95% confidence level, a 5% margin of error, and an expected response rate of 50%, the required sample size was calculated as 300 students.

Participant information and data collection

The survey instruments were created using the Google Forms platform, and a link to the questionnaire was generated. The

link was initially tested by the researchers and then distributed to potential participants via social media channels. Upon accessing the survey, participants were first presented with an introductory page describing the study title, objectives, and information regarding the voluntary nature of participation. They were then asked to provide their consent by ticking a digital checkbox before proceeding to the questionnaire. To ensure data security and anonymity, the survey was designed so that participants did not need to provide personally identifiable information such as their names or email addresses. To prevent duplicate responses, access to the questionnaire was restricted to a single submission per participant. For homogeneity of the sample, the survey link was shared exclusively within closed groups (WhatsApp or Telegram) managed by faculty members or class representatives of the respective departments. Completing the form took approximately 15-20 min. All collected data were stored securely in a cloud-based storage system (Google Drive) accessible only to the researchers. The study followed the CHERRIES (Checklist for Reporting Results of Internet E-surveys) guidelines for reporting internet-based surveys.^[22]

Statistical methods

Data were analysed using IBM SPSS Statistics version 27 and IBM SPSS AMOS version 23. Descriptive statistics were calculated, and the internal consistency of the scale was assessed using Cronbach's alpha coefficient. Normality tests were conducted to determine the distributional characteristics of the data. In cases where the assumption of normality was not met, non-parametric tests (Mann-Whitney U and Kruskal-Wallis tests) were employed for group comparisons. Confirmatory factor analysis (CFA) was performed to examine structural validity, and model fit was evaluated using established fit indices. A significance level of $p < 0.05$ was considered statistically significant. No missing data were observed in the survey responses.

Reliability analysis

Scale reliability was assessed using Cronbach's alpha coefficient. The overall internal consistency of the scale was found to be high ($\alpha = 0.914$). Cronbach's alpha values for the subscales were as follows: knowledge level ($\alpha = 0.888$), awareness level ($\alpha = 0.689$), and attitude-confidence level ($\alpha = 0.892$). These results indicate that each subscale demonstrated an adequate level of internal consistency.

Structural equation modelling (SEM)

Model fit indices

Structural equation modelling was conducted, and the goodness-of-fit indices for the proposed model are presented

below. The Chi-square statistic was found to be significant ($\chi^2(202) = 495.99, p < 0.001$); however, given the sensitivity of this test to sample size, other fit indices were considered. The model demonstrated an overall acceptable fit to the data (CFI = 0.916, TLI = 0.904, RMSEA = 0.070). Although the GFI (0.865) and AGFI (0.830) values were slightly below the conventional threshold of 0.90, they were close to the acceptable lower limit of 0.85. Thus, the model was considered marginally but acceptably fitting in these indices. Taken together with the other indices, the results suggest that the model demonstrated an overall valid and adequate fit [Table 1].

Results of the measurement model

The analysis revealed that the factor loadings of all observed variables on the latent constructs were statistically significant ($p < 0.001$), with most values exceeding 0.50. These findings indicate that the measurement model was adequate [Figure 1].

The model included three latent variables (knowledge, awareness, and attitude/confidence), each represented by their respective observed indicators. Items associated with the Knowledge construct demonstrated strong factor loadings, whereas some items under the Awareness construct showed relatively lower loadings. Significant positive correlations were identified among the latent variables. In particular, a very strong relationship was observed between Knowledge and Awareness ($r = 0.93$).

RESULTS

A total of 300 students participated in the study, the majority of whom were female ($n = 218, 72.7\%$). Of the participants, 96% ($n = 288$) reported that they had not received any education on artificial intelligence either before or during their physiotherapy training, and 80.3% ($n = 241$) stated that they had not previously received any education in computer

science, statistics, or mathematics. Only 7.3% ($n = 22$) of the participants reported having a family member (parent or sibling) who had received education related to artificial intelligence [Table 2].

Among the artificial intelligence tools most frequently recognized by the participants, ChatGPT ranked first with 31.09%, followed by Apple's Siri application with 23.42% [Figure 2]. In addition to ChatGPT and Apple's Siri, students reported familiarity with several other AI tools, including Google Gemini (10.19%), Amazon Alexa (9.66%), Microsoft Azure AI (6.93%), and Grammarly (3.89%). Less frequently recognized tools included DALL·E (1.37%), while 4.05% of participants reported awareness of other AI-based applications. In terms of frequency of use, 33% of the students ($n = 99$) reported using AI frequently in daily life, whereas 37.3% ($n = 112$) stated that they used it rarely.

In Table 3, the mean, standard deviation, median, and interquartile range values of the total scores obtained from the 5-point Likert-type questions measuring participants' knowledge levels regarding artificial intelligence in the field of physiotherapy are presented according to sociodemographic variables. The analysis revealed statistically significant differences in the median knowledge scores according to age group (<20 vs. ≥ 20 years), year of study, and prior education or background in computer science, mathematics, or statistics.

Specifically, participants aged ≥ 20 years had higher mean knowledge scores (2.14 ± 0.70) compared to those aged <20 years (1.86 ± 0.63). When evaluated by year of study, knowledge scores increased progressively with higher class levels (1st year: 1.95 ± 0.68 , 2nd year: 1.89 ± 0.66 , 3rd year: 2.31 ± 0.64 , 4th year: 2.49 ± 0.63).

In addition, participants with prior education/background in computer science, mathematics, or statistics (2.35 ± 0.82) scored higher than those without such background (2.01 ± 0.65). No significant differences were observed in relation to other demographic variables.

Table 4 presents the mean and standard deviation values of participants' total awareness scores regarding artificial intelligence in the field of physiotherapy, according to demographic variables. The analysis indicated statistically significant differences in awareness scores based on age group (<20 vs. ≥ 20 years), year of study, and prior education/background in computer science, mathematics, or statistics. By age group, participants aged ≥ 20 years had higher mean awareness scores (2.65 ± 0.72) compared to those aged <20 years (2.43 ± 0.67). When analysed by year of study, awareness scores showed a progressive increase with advancing class levels (1st year: 2.56 ± 0.75 , 2nd year: 2.48 ± 0.74 , 3rd year: 2.64 ± 0.67 , 4th year: 2.88 ± 0.49). First-year physiotherapy

Table 1: Model fit indices

Conformity criterion	Value			
χ^2/DF	2.455			
CFI	0.916			
TLI	0.904			
RMSEA	0.070			
Model	CMIN	DF	<i>p</i>	CMIN/DF
Default model	495,991	202	<0.001	2,455
Saturated model	,000	0		
Independence model	3718,147	231	<0.001	16,096

p <0.05 statistically significant. χ^2/DF : Chi-square divided by degrees of freedom, CFI: Comparative fit index, TLI: Tucker-Lewis Index, RMSEA: Root Mean Square Error of Approximation, CMIN: Minimum drug concentration, DF: Degrees of freedom.

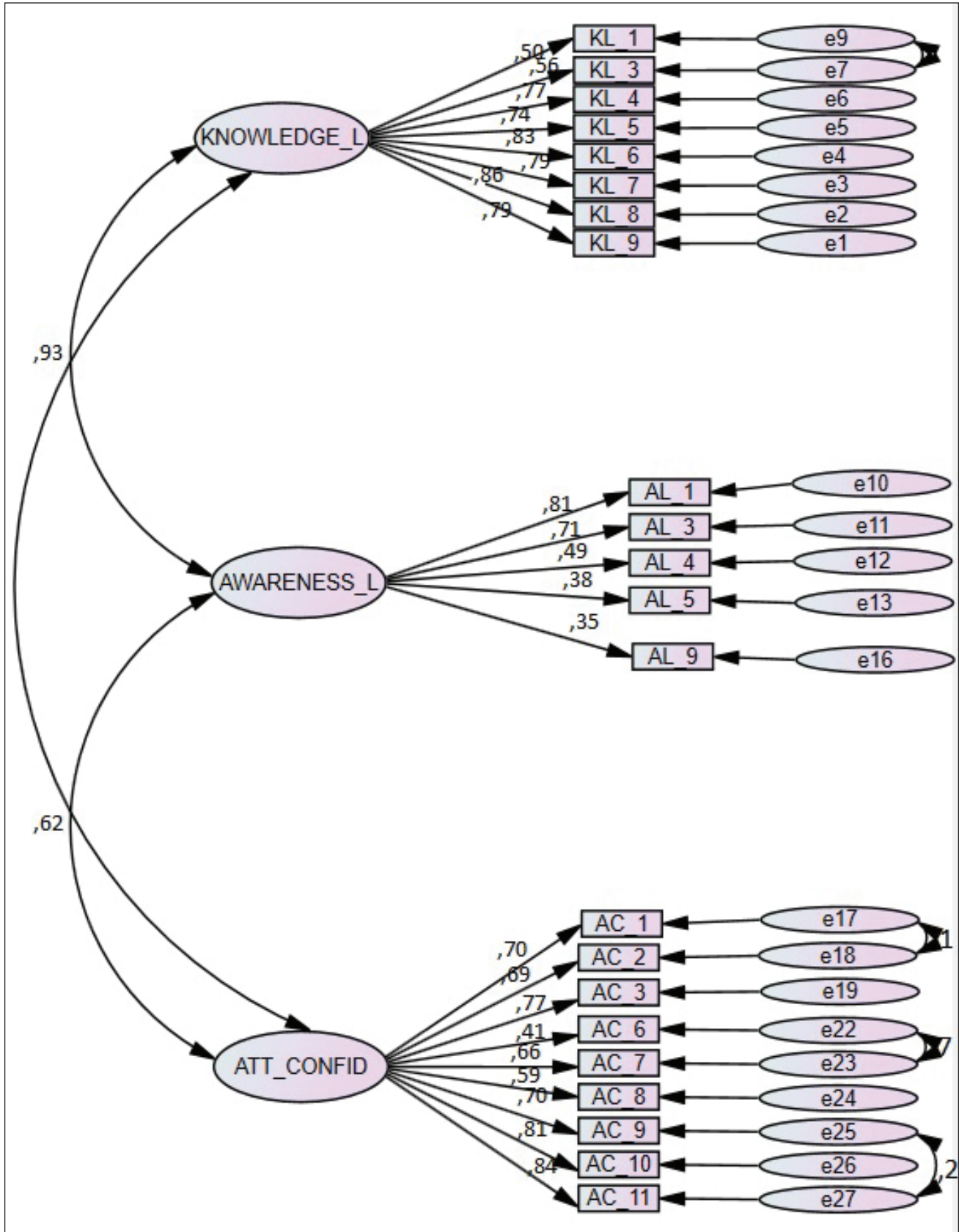


Figure 1: Confirmatory factor analysis results for the three-factor model.

Table 2: Demographic characteristics of the study participants

Variables	Descriptive statistics (%)
Sex	
Female	218 (72.7)
Male	82 (27.3)
Age	
Average	21.66 ± 3.90
Median (Q1-Q3)	20,22
Min. - Max. values	17,52
Age groups	
<20	69 (23)
≥20	231 (77)
Grade	
1 st year	123 (41)
2 nd year	80 (26.6)
3 th year	56 (18.7)
4 th year	41 (13.7)
Did you receive any formal training on artificial intelligence before or during your physiotherapy education?	
Yes	12 (4)
No	288 (96)
Do you have any education/background in computer science, mathematics, or statistics?	
Yes	59 (19.7)
No	241 (80.3)
Do you have a parent or sibling who has been educated in the field of artificial intelligence?	
Yes	22 (7.3)
No	278 (92.7)
How often do you use artificial intelligence in your daily life?	
Very rarely	28 (9.3)
Rarely	28 (9.3)
Seldom	112 (37.3)
Frequently	99 (33)
Very frequently	33 (11)
Do you think artificial intelligence is a bad technology?	
Yes	16 (5.3)
No	188 (62.7)
Not Sure	96 (32)
Which AI tools have you heard of?	
ChatGPT	296 (31.09)
Apple Siri	223 (23.42)
Google Gemini	97 (10.19)
Microsoft Azure AI	66 (6.93)
Alexa (Amazon)	92 (9.66)
DALL - E	13 (1.37)
Grammarly	37 (3.89)
Others	40 (4.05)
AI: Artificial intelligence.	

Table 3: Distribution of total knowledge level scores for artificial intelligence in the field of physiotherapy according to demographic variables

Variables	n (%)	Mean ± SD	Median (IQR)	Min, Max	p
Gender					
Female	218 (72.7)	2.09 ± 0.66	2 (1.13)	1,4	0.34 ^a
Male	82 (27.3)	2.04 ± 0.78	2 (1.38)	1,4.5	
Age					
< 20 years	69 (23)	1.86 ± 0.63	1.63 (0.88)	1,3.63	0.003^a
≥ 20 years	231 (77)	2.14 ± 0.70	2.13 (1.25)	1,4.5	
Year of physiotherapy study					
P1	121 (40.3)	1.95 ± 0.68	1.75 (1.06)	1,4	<0.001^b
P2	80 (26.6)	1.89 ± 0.66	1.75 (0.88)	1,4.5	
P3	56 (18.7)	2.31 ± 0.64	2.38 (1.13)	1.25,3.5	
P4	43 (14.4)	2.49 ± 0.63	2.50 (1.06)	1.25,4	
Did you receive any formal training in artificial intelligence before or during your physiotherapy training?					
Yes	12 (4)	2.21 ± 1.093	1.94 (1.66)	1,4.5	0.97 ^a
No	288 (96)	2.07 ± 0.68	2 (1.13)	1,4	
Do you have any training/background in computer science, mathematics, or statistics?					
Yes	59 (19.7)	2.35 ± 0.82	2.38 (1.25)	1,4.5	0.004^a
No	241 (80.3)	2.01 ± 0.65	2 (1.19)	1,4	
Do you have a parent or sibling trained in artificial intelligence?					
Yes	22 (7.3)	2.20 ± 0.74	2.25 (1.28)	1,3.13	0.30 ^a
No	278 (92.7)	2.07 ± 0.69	2 (1.13)	1,4.5	

a represents Mann-Whitney U test, b represents Kruskal-Wallis test. Figures in bold represent significance ($p < 0.005$) SD: Standard deviation, IQR: Interquartile range.

students demonstrated one of the lowest knowledge and awareness scores compared to upper-year students, suggesting limited familiarity with AI tools during the early stages of physiotherapy education. In addition, participants with prior education/background in computer science, mathematics, or

Table 4: Distribution of total scores of awareness level towards artificial intelligence in the field of physiotherapy according to demographic variables

Variables	n (%)	Mean ± SD	Median (IQR)	Min, Max	p
Gender					
Female	218 (72.7)	2.61 ± 0.66	2.6 (0.85)	1,4	0.42 ^a
Male	82 (27.3)	2.57 ± 0.83	2.6 (1)	1,4.8	
Age					
< 20 years	69 (23)	2.43 ± 0.67	2.6 (1)	1,3.6	0.04 ^a
≥ 20 years	231 (77)	2.65 ± 0.72	2.6 (1)	1,4.8	
Year of physiotherapy study					
P1	121 (40.3)	2.56 ± 0.75	2.6 (1)	1,4.8	0.03 ^b
P2	80 (26.6)	2.48 ± 0.74	2.4 (1)	1,4.6	
P3	56 (18.7)	2.64 ± 0.67	2.6 (1)	1,2.4	
P4	43 (14.4)	2.88 ± 0.49	2.8 (0.7)	2,3.8	
Did you receive any formal training in artificial intelligence before or during your physiotherapy training?					
Yes	12 (4)	2.73 ± 1.17	2.7 (1.55)	1,4.6	0.71 ^a
No	288 (96)	2.59 ± 0.69	2.6 (0.8)	1,4.8	
Do you have any training/background in computer science, mathematics, or statistics?					
Yes	59 (19.7)	2.82 ± 0.71	2.8 (0.8)	1,4.6	0.006 ^a
No	241 (80.3)	2.54 ± 0.70	2.6 (1)	1,2.8	
Do you have a parent or sibling trained in artificial intelligence?					
Yes	22 (7.3)	2.59 ± 0.77	2.6 (1.05)	1,3.8	0.84 ^a
No	278 (92.7)	2.50 ± 0.71	2.6 (0.8)	1,4.8	

a represents Mann-Whitney U test, b represents Kruskal-Wallis test. SD: Standard deviation, IQR: Interquartile range.

statistics (2.82 ± 0.71) scored higher than those without such background (2.54 ± 0.70).

These findings suggest that age, class level, and academic background may have an influence on artificial intelligence awareness.

Table 5 presents the distribution of participants' total attitude and confidence scores toward artificial intelligence in the field of physiotherapy according to demographic variables. The analyses revealed no statistically significant differences among the variables.

DISCUSSION

In this study, the levels of knowledge, awareness, attitudes, and confidence regarding artificial intelligence (AI) among physiotherapy and rehabilitation students in Türkiye were examined, and the relationships between these parameters were explored. The findings indicated that the majority of

Table 5: Distribution of total scores of attitudes and trust levels towards artificial intelligence in the field of physiotherapy according to demographic variables

Variables	n (%)	Mean ± SD	Median (IQR)	Min, Max	p
Gender					
Female	218 (72.7%)	2.85 ± 0.61	2.89 (0.67)	1,4.22	0.31 ^a
Male	82 (27.3%)	2.78 ± 0.80	2.89 (0.92)	1,4.44	
Age					
< 20 years	69 (23%)	2.76 ± 0.71	2.89 (0.89)	1,4.11	0.41 ^a
≥ 20 years	231 (77%)	2.85 ± 0.66	2.89 (0.67)	1,4.44	
Year of physiotherapy study					
P1	121 (40.3%)	2.80 ± 0.72	2.89 (1)	1,4.22	0.79 ^b
P2	80 (26.6%)	2.83 ± 0.74	2.89 (0.81)	1,4.44	
P3	56 (18.7%)	2.81 ± 0.55	2.89 (0.64)	1.33, 4.11	
P4	43 (14.4%)	2.97 ± 0.49	3 (0.67)	2,4	
Did you receive any formal training in artificial intelligence before or during your physiotherapy training?					
Yes	12 (4%)	2.46 ± 1.18	2.44 (2.44)	1,4.33	0.21 ^a
No	288 (96%)	2.85 ± 0.64	2.89 (0.75)	1,4.44	
Do you have any training/background in computer science, mathematics, or statistics?					
Yes	59 (19.7%)	2.89 ± 0.73	3 (0.89)	1,4.33	0.23 ^a
No	241 (80.3%)	2.82 ± 0.66	2.89 (0.67)	1,4.44	
Do you have a parent or sibling trained in artificial intelligence?					
Yes	22 (7.3%)	2.80 ± 0.84	2.94 (1)	1,4.11	0.96 ^a
No	278 (92.7%)	2.84 ± 0.66	2.89 (2.78)	1,4.44	

a represents Mann-Whitney U test, b represents Kruskal-Wallis test. SD: Standard deviation, IQR: Interquartile range.

students had no prior educational background related to AI. However, demographic variables such as age, year of study, and history of computer/mathematics-based courses were found to have significant effects on students' knowledge and awareness levels. Notably, 51% of students reported being unfamiliar with AI-supported software systems for patient

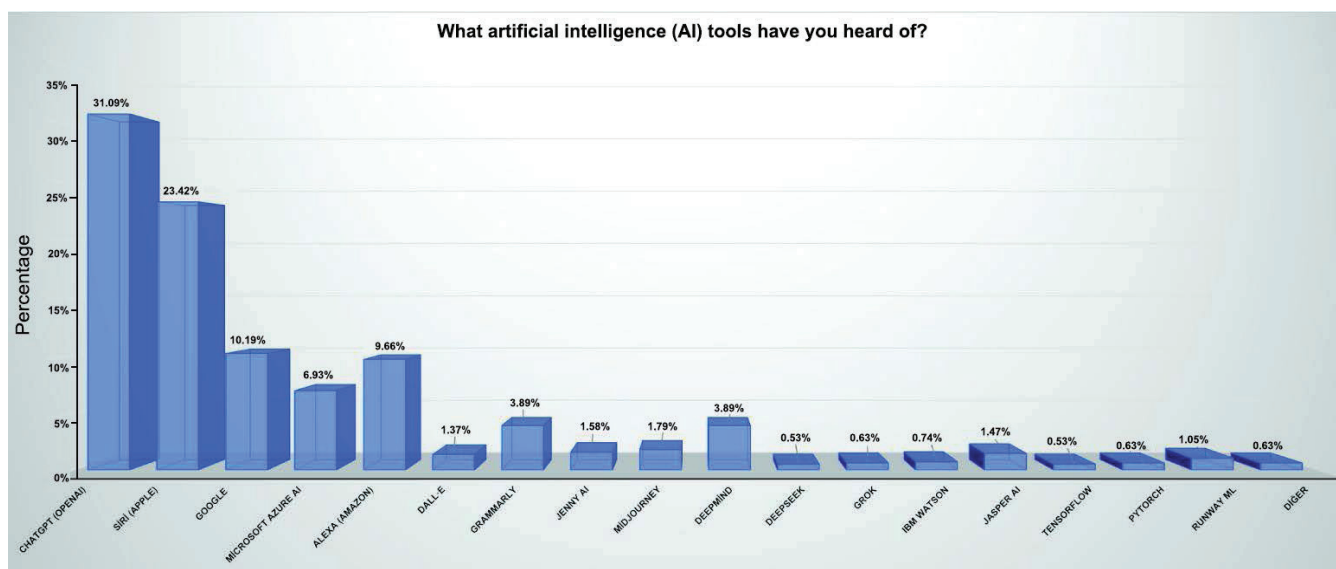


Figure 2: Distribution of artificial intelligence tools recognized by participants.

assessment, monitoring, or remote follow-up, and only 4% had received any AI-related education.

While students' knowledge levels were relatively limited, their awareness and confidence levels were found to be high. Another important finding was the increase in knowledge and awareness with advancing age and academic year. These findings point to a gap in physiotherapy curricula, as the lack of AI training may reflect a structural educational shortcoming. Considering that rehabilitation outcomes are increasingly linked to technology-based systems such as long-term monitoring, patient adherence, and continuous follow-up, insufficient training may pose risks for future clinical practice. The strong relationship observed between awareness and confidence, despite limited knowledge, may be attributed to students' perception that AI could strengthen their profession and should be integrated into education. Differences across demographic groups, particularly age and class level, suggest that exposure to clinical practice and employment concerns may enhance students' recognition of AI's potential benefits, including improved diagnostic accuracy, better access to healthcare, and reduced workload. The fact that most knowledge acquisition seems to occur through self-directed learning and digital resources, rather than formal education, highlights a need for structured integration of AI into physiotherapy training.

The results of this study are consistent with previous research reporting limited AI knowledge among health sciences students. Amiri *et al.*^[23] demonstrated that students across disciplines had low levels of AI-related knowledge, while Dashti *et al.*^[24] reported similar findings among dental

students. Our results also align with Bozdemir-Özel and Yakut-Özdemir,^[15] who emphasized that clinicians' uncertainty and anxiety toward AI often stem from insufficient foundational knowledge. Likewise, Topol *et al.*^[10] and Bisdas *et al.*^[25] argued that without basic AI literacy, healthcare professionals may adopt a passive role in clinical decision-making processes.

Despite limited knowledge, the relatively high levels of awareness and confidence observed in our study are consistent with reports indicating that students generally perceive AI as a supportive and augmentative tool rather than a replacement for healthcare professionals.^[17,26-28] This apparent discrepancy between knowledge and confidence has also been reported in imaging-related disciplines. For example, a quantitative review by Bhandari *et al.*^[28] showed that while students and clinicians in radiology often view AI optimistically as a diagnostic aid, students simultaneously express anxiety regarding future job prospects, suggesting that confidence may coexist with uncertainty when formal training is lacking.

Recent large-scale studies among medical and radiography students further support these findings. Allam *et al.*^[29] and Jebreen *et al.*^[30] reported substantial gaps in AI knowledge and training among medical students, alongside strong support for the integration of AI into undergraduate curricula. Interestingly, students with higher AI knowledge in some studies were more likely to express concerns regarding workforce displacement, particularly in radiology-focused specialties.^[29] Similar patterns have been observed among radiography students, who generally report positive attitudes toward AI's assistive role but remain uncertain about its implications for job security and professional identity.^[31-33]

These contrasting findings suggest that attitudes toward AI vary not only by discipline but also by the extent to which AI has been formally integrated into education and clinical training. In fields such as radiology, where AI applications are already visible in practice, students may develop heightened awareness of both opportunities and threats. In contrast, in physiotherapy education, where structured AI exposure remains limited, students may demonstrate high confidence and positive expectations without a corresponding depth of knowledge. This interpretation is supported by our findings and underscores the importance of curriculum-based AI literacy in aligning confidence, awareness, and actual competence in future physiotherapy practice.

The increase in knowledge and awareness observed in this study during the academic year is also consistent with Pucchio *et al.*^[16] who found that exposure to AI and awareness rise with training duration, though knowledge gains remain limited.

Limitations and future suggestions

The main limitation of this study is its cross-sectional design, which restricts the ability to establish causal relationships. Additionally, as data were collected through self-report, responses may have been influenced by social desirability bias. Another limitation is that the study included only universities in Istanbul, limiting the generalizability of the findings.

Despite these limitations, the study has notable strengths. It developed a novel scale specifically for physiotherapy students and conducted validity and reliability analyses on a large sample, ensuring methodological rigor. By simultaneously examining students' knowledge, awareness, attitudes, and confidence, the study adopted a multidimensional design that provides a deeper understanding of AI in physiotherapy education. The findings emphasize the need for structured AI education among physiotherapy students. Curricula should incorporate basic AI literacy courses, multidisciplinary seminars, and hands-on workshops. Integration of AI-assisted tools in clinical training, such as motion analysis software and AI-based rehabilitation systems, would facilitate the adoption of these technologies into professional practice. Furthermore, training should address ethical use of AI, patient privacy, and data security.

CONCLUSION

This study highlights physiotherapy students' levels of knowledge, attitudes, and confidence toward artificial intelligence, underscoring its growing importance in professional education. AI may contribute not only to clinical decision support and patient monitoring but also to the development of professional identity and technological

adaptation among students. Systematic integration of AI into curricula by educational institutions and policymakers could advance professional standards and support more effective healthcare delivery.

Future research should go beyond measuring knowledge and attitudes to examine the direct impact of AI-based education on students' clinical decision-making, professional competence, and patient outcomes, thereby providing a more comprehensive understanding of AI's role in physiotherapy education.

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REFERENCES

1. McCarthy J, Minsky ML, Rochester N, Shannon CE. A proposal for the Dartmouth Summer Research Project on Artificial Intelligence, August 31, 1955. *AI Magazine* 2006;27:12-14.
2. Sachdeva A, Ahmed N. Artificial intelligence in radiology: Current applications and future directions. *Medical Letter* 2025;2:22-26.
3. Alzamel LG, Hassouneh L, Jallad ST. Knowledge, perception, and attitude of healthcare students towards artificial intelligence: a multi-center cross sectional study. 2026. doi.org/10.1186/s12909-026-09053-6 [article in press].
4. Thrall JH, Li X, Li Q, Cruz C, Do S, Dreyer K, *et al.* Artificial intelligence and machine learning in radiology: opportunities, challenges, pitfalls, and criteria for success. *J Am Coll Radiol* 2018;15:504-8.
5. Sumner J, Lim HW, Chong LS, Bunde A, Mukhopadhyay A, Kayambu G. Artificial intelligence in physical rehabilitation: A systematic review. *Artif Intell Med* 2023;146:102693.
6. Mahmoud H, Aljaldi F, El-Fiky A, Battecha K, Thabet A, Alayat M, *et al.* Artificial intelligence machine learning and conventional physical therapy for upper limb outcome in patients with stroke: A systematic review and meta-analysis. *Eur Rev Med Pharmacol Sci* 2023;27:4812-27.
7. Abedi A, Colella TJE, Pakosh M, Khan SS. Artificial intelligence-driven virtual rehabilitation for people living in the community: A scoping review. *NPJ Digit Med* 2024;7:25.
8. Khalid UB, Naeem M, Stasolla F, Syed MH, Abbas M, Coronato A. Impact of AI-powered solutions in rehabilitation process: Recent improvements and future trends. *Int J Gen Med* 2024;17:943-69.
9. YiN, Baik D, Baek G. The effects of applying artificial intelligence to triage in the emergency department: A systematic review of prospective studies. *J Nurs Scholarsh* 2025;57:105-18.

10. Topol E. Deep medicine: How artificial intelligence can make healthcare human again. New York, NY: Basic Books 2019. Available from: <https://www.scirp.org/reference/referencespapers?referenceid=3758241>. [Last accessed 2025 November 4 2025].
11. Sarwar S, Dent A, Faust K, Richer M, Djuric U, Van Ommeren R, *et al.* Physician perspectives on integration of artificial intelligence into diagnostic pathology. *NPJ Digit Med* 2019;2:28.
12. Duan S, Liu C, Rong T, Zhao Y, Liu B. Integrating AI in medical education: A comprehensive study of medical students' attitudes, concerns, and behavioural intentions. *BMC Med Educ* 2025;25:599.
13. Jackson P, Ponath Sukumaran G, Babu C, Tony MC, Jack DS, Reshma VR, *et al.* Artificial intelligence in medical education – perception among medical students. *BMC Med Educ* 2024;24:804.
14. Ahmed Z, Bhinder KK, Tariq A, Tahir MJ, Mehmood Q, Tabassum MS, *et al.* Knowledge, attitude, and practice of artificial intelligence among doctors and medical students in Pakistan: A cross-sectional online survey. *Ann Med Surg (Lond)* 2022;76:103493.
15. Bozdemir-Özel C, Yakut-Özdemir H. Levels of awareness, readiness, and anxiety of physiotherapists related to artificial intelligence. *J Basic Clin Health Sci* 2024;8:171-80.
16. Pucchio A, Rathagirishnan R, Caton N, Gariscsak PJ, Del Papa J, Nabhen JJ, *et al.* Exploration of exposure to artificial intelligence in undergraduate medical education: A Canadian cross-sectional mixed-methods study. *BMC Med Educ* 2022;22:815.
17. Mousavi Baigi SF, Sarbaz M, Ghaddaripouri K, Ghaddaripouri M, Mousavi AS, Kimiafar K. Attitudes, knowledge, and skills towards artificial intelligence among healthcare students: A systematic review. *Health Sci Rep* 2023;6:e1138.
18. Viechtbauer W, Smits L, Kotz D, Budé L, Spigt M, Serroyen J, *et al.* A simple formula for the calculation of sample size in pilot studies. *J Clin Epidemiol* 2015;68:1375-9.
19. Hair JE, Black WC, Babin BJ, Anderson RE. Multivariate data analysis. 8th edition. Cengage Learning; 2019, p.1-813.
20. Wolf EJ, Harrington KM, Clark SL, Miller MW. Sample size requirements for structural equation models: An evaluation of power, bias, and solution propriety. *Educ Psychol Meas* 2013;76:913-34.
21. Wang X, Cheng Z. Cross-sectional studies: Strengths, weaknesses, and recommendations. *Chest* 2020;158:S65-71.
22. Eysenbach G. Improving the quality of Web surveys: The checklist for reporting results of internet E-surveys (CHERRIES). *J Med Internet Res* 2004;6:e34.
23. Amiri H, Peiravi S, Rezazadeh Shojaee SS, Rouhparvarzamin M, Nateghi MN, Etemadi MH, *et al.* Medical, dental, and nursing students' attitudes and knowledge towards artificial intelligence: A systematic review and meta-analysis. *BMC Med Educ* 2024;24:412.
24. Dashti M, Londono J, Ghasemi S, Khurshid Z, Khosraviani F, Moghaddasi N, *et al.* Attitudes, knowledge, and perceptions of dentists and dental students toward artificial intelligence: A systematic review. *J Taibah Univ Med Sci* 2024;19:327-3.
25. Bisdas S, Topriceanu C-C, Zakrzewska Z, Irimia A-V, Shakallis L, Subhash J, *et al.* Artificial intelligence in medicine: A multinational multi-center survey on the medical and dental students' perception. *Front Public Health* 2021;9:795284.
26. Al Hadithy ZA, Al Lawati A, Al-Zadjali R, Al Sinawi H. Knowledge, attitudes, and perceptions of artificial intelligence in healthcare among medical students at sultan Qaboos university. *Cureus* 2023;15:e44887.
27. Stewart J, Lu J, Gahungu N, Goudie A, Fegan PG, Bennamoun M, *et al.* Western Australian medical students' attitudes towards artificial intelligence in healthcare. *PLoS One* 2023;18:e0290642.
28. Bhandari A, Purchuri SN, Sharma C, Ibrahim M, Prior M. Knowledge and attitudes towards artificial intelligence in imaging: A look at the quantitative survey literature. *Clin Imaging* 2021;80:P413-9.
29. Allam AH, Eltewacy NK, Alabdallat YJ, Owais TA, Salman S, Ebada MA, *et al.* Knowledge, attitude, and perception of Arab medical students towards artificial intelligence in medicine and radiology: A multi-national cross-sectional study. *Eur Radiol* 2024;34:1-14.
30. Jebreen K, Radwan E, Kammoun-Rebai W, Alattar E, Radwan A, Safi W, *et al.* Perceptions of undergraduate medical students on artificial intelligence in medicine: Mixed-methods survey study from Palestine. *BMC Med Educ* 2024;24:507.
31. Pinto dos Santos D, Giese D, Brodehl S, Chon SH, Staab W, Kleinert R, *et al.* Medical students' attitude towards artificial intelligence: A multicentre survey. *Eur Radiol* 2019;29:1640-6.
32. Arruzza E. Radiography students' perceptions of artificial intelligence in medical imaging. *J Med Imaging Radiat Sci* 2024;55:258-263.
33. Pedersen MRV, Kusk MW, Lysdahlgaard S, Mork-Knudsen H, Malamateniou C, Jensen J. Nordic radiographers' and students' perspectives on artificial intelligence - A cross-sectional online survey. *Radiography (Lond)* 2024;30:776-783.

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