International Journal of Innovative Technology and Interdisciplinary Sciences
https://journals.tultech.eu/index.php/ijitis
ISSN: 2613-7305
Volume 9, Issue 3
DOI: https://doi.org/10.15157/IJITIS.2026.9.3.2030-2063
Received: 26.02.2026; Revised: 19.06.2026; Accepted: 12.09.2026

Research Article

Teacher AI Competency and Professional Development Needs: An Empirical Assessment

Eriona Çela[1], Vasileios Paliktzoglou[2], Ema Kristo[3], Jonida Bushi[3]*

[1]Department of Psychology and Education, University of New York Tirana, Tirana, Albania
[2]School of Creative Media, Bahrain Polytechnic, Isa Town, Bahrain
[3]Department of German Language, University of Tirana, Tirana, Albania
***jonida.bushi@unitir.edu.al**

Abstract

The rapid integration of Artificial Intelligence (AI) into educational settings demands a corresponding advancement in teacher digital competency. This study investigates the current state of AI tool utilization among 141 teachers, employing a quantitative, descriptive-analytical design to assess their understanding of AI technologies and identify critical professional development (PD) needs. The findings reveal that teachers' skills are most effectively enhanced through integrated PD models combining hands-on training workshops, direct access to AI applications, and structured peer mentoring. Furthermore, the results underscore a significant demand for ongoing professional counseling to guide the ethical application of AI, particularly concerning tools that deliver personalized learner feedback. Based on these findings, this research recommends that educational institutions implement comprehensive, multi-tiered training programs alongside targeted policy revisions that explicitly address the legal and ethical dimensions of AI adoption. To sustain these efforts, we advocate for the development of formal AI literacy initiatives that foster collaboration with generative AI tools across disciplines. This systematic approach not only facilitates the successful integration of AI into contemporary teaching practices but also provides a scalable framework for educational leaders and policymakers seeking to cultivate an AI-responsive curriculum and institutional culture.

Keywords: Artificial Intelligence; AI Literacy; Educational AI Tools; AI Familiarity; Professional Development

INTRODUCTION

The integration of Artificial intelligence in the education system has recently gained significant attention due to its potential to enhance learning outcomes and prepare students for an AI driven world. As a multidisciplinary field, starting from 1970s it has been applied in various educational contexts to support learning-teaching process and institution management. With many jobs now being AI related and expected to increase in the coming years, researchers suggest that AI should be given equal importance to literacy

©2026 Authors. This is an Open Access article distributed under the terms and conditions of the Creative Commons Attribution 4.0 International License CC BY 4.0 (http://creativecommons.org/licenses/by/4.0).

in reading and writing [1]. However, teaching AI in schools remains a challenge and is not yet prevalent in formal settings. Researchers suggest that it is crucial to have thought on what AI education should look like to prepare future generations to become informed citizens who understand the technologies they interact with in their daily lives [1-7]. Artificial intelligence (AI) technologies are experiencing rapid advancements, significantly influencing various aspects of life, more specifically in the realm of education [8-13].

This evolution necessities an evaluation of the readiness of current and prospective educators and educational leaders to adopt to the emerging challenges of effectively utilizing this technology to enhance teaching methodologies and learning outcomes [14-18]. Moreover, it raises the imperative for educators to cultivate knowledge surrounding AI as a new domain of content. Recognizing the necessity for professional development in this area, various institutions initiated pioneering professional learning programs on how AI tools can be incorporated in education. On the other hand, the aim of these programs is to help educational institutions to implement AI tools and develop the educators` skills in AI and their implementation in student-centered educational experiences [2, 19-22]. Though educational institutions might have good intentions in implementing these tools in educational settings, there are other factors that must be considered when making such immense interventions. Professors and students are the ones who must agree on these changes since they will be the ones who will directly use the platforms and will be provided with feedback (evaluated).

In this regard, the integration of digital technologies in education is profoundly influenced by teachers` perspectives on digital learning, which are shaped by their professional experiences and various external factors. The recent challenges of teachers losing interest in online classes together with doubts about digital teaching methods during the pandemic show how difficult digital education remains to operate [3, 24-26], while the relationship between educational technology adoption and teachers' emotional intelligence and self-efficacy demonstrates how psychological factors impact teachers' ability to use digital tools in educational settings [4]. Overcoming these challenges, educators should collaborate with AI specialists to develop methods that connect educational methods with advanced technical skills. The educational system faces a twofold challenge because of its quick AI advancements and the need for teachers to master AI tools for classroom use. Teachers increase their readiness to teach when they feel confident about their abilities and understand how AI benefits their work [5].

The study in [27] affirm that educational institutions face their biggest obstacle because educators lack proper training and their existing confidence levels remain weak. The current problem needs professional development programs which teach educators essential skills for AI implementation and help them develop permanent dedication to their work. Educational institutions need to evaluate their readiness to adopt AI technology based on three criteria which include positive staff attitudes and their ability to recognize benefits and their capacity to deal with technology-related anxiety [6, 26]. The research aim is to provide a literature review on the main components of didactical design in educational research, with the establishment of research gaps for further investigation.

There is a deficiency in comprehensive research regarding the incorporation of artificial intelligence into fields beyond computer science, highlighting the need to focus on improving AI literacy. Examining how AI is incorporated into specific educational practices will lead to a specific discussion on developing preliminary guidelines for effective AI-focused curricula and teaching methods designed to prepare students and teachers for an AI approach in education in the near future.

LITERATURE REVIEW

Beyond traditional definitions, literacy is commonly associated with fundamental skills such as reading and writing. However, literacy is also widely regarded as an important component of education and human empowerment that supports effective social engagement [2, 5, 7]. Within this broader perspective, AI literacy encompasses the ability to understand artificial intelligence sufficiently to make informed decisions in today's increasingly data-rich environments. In general, the growing body of research on AI literacy reflects broader developments in the field of Artificial Intelligence in Education and has expanded from an initial emphasis on ethical considerations to a wider range of interdisciplinary perspectives. Research has identified several key dimensions that are critical to fostering AI literacy, including understanding fundamental AI concepts, practical application, critical evaluation, creativity, and ethical considerations. Scholars also emphasize the importance of understanding teachers' perspectives and viewpoints, as their interpretations and implementation of the curricula they teach are crucial to supporting effective educational practices [7].

Educational programs designed to prepare future teachers should develop qualified educators who are capable of effectively using artificial intelligence in classroom settings. The International Society for Technology in Education (ISTE) allocated 15% of its online course scholarships to faculty members and students in Educational Preparation Programs (EPPs) as part of its efforts to address the shortage of qualified educators. The fellowship was designed to support higher education faculty, staff, and current and future educators in applying nationally recognized educational technologies. In this way, the initiative aims to facilitate transformative digital learning that incorporates best practices in AI education, strengthen educators' expertise regarding the instructional implications of AI, and support the effective transfer of this knowledge to future educators [2].

The COVID-19 pandemic has facilitated the acknowledgment of artificial intelligence as a tool for delivering online educational content which now impacts both teaching methods and student mental health. In this regard, research claims that it is an urgent need to enhance teachers' digital competences regarding technical skills but also the psychological readiness to engage with and utilize digital learning environments effectively. Furthermore, the emphasis on integrating artificial intelligence into education system marks a significant shift in teacher training on these tools that offer personalized learning experiences and enhance students` engagement in the teaching process. Furthermore, AI capacity for data mining and information retrieval is important in

enriching learning experiences and Informing curriculum development, potentially personalizing education and the improvement of students` performance and outcomes [4].

Different scholars however argue that developing AI literacy should encompass not only the understanding of AI concepts and ethical considerations but also the empowerment of students to thrive in an increasingly AI centric world. In this regard [8] consider AI literacy to be structured around three dimensions which are the technical concepts, ethics and attitudes toward AI impact in future careers. According to the scholars, the first two dimensions focus on the conceptual learning necessities for students to grasp fundamental AI concepts and recognize the potential biases inherent in AI systems. For instance, middle school students should develop an intuitive understanding of key processes such as supervised learning, including the significance of training and testing phases and the implications of bias. On the other hand, empowerment and career preparation highlights the need for allowing students to feel a sense of control in relation to AI technologies [8].

Artificial Intelligence in Education

The year 2022 exposed several AI platforms into education, but the most significant amongst them has been ChatGPT. The educational system now uses AI platforms as their foundation for all teaching methods and learning procedures. The AI-based tools of this educational system became essential components that transformed educational processes because they enabled personalized learning experiences which changed the entire educational system within a one-year period. The elements of this system provide personalized learning experiences which enable institutions to create educational programs that meet the full diversity of student learning needs. ChatGPT uses advanced natural language processing to develop educational products that create learning experiences customized to the unique strengths and weaknesses of individual students. [2, 5]. Students are able to contribute in a rigorous and engaging learning environment, capable of attaining their personal objectives.

On the other hand, the use of Large Language Models which include ChatGPT has demonstrated effective results in helping students with special needs through its provision of specialized materials which support their different learning requirements [3]. The ability to support students who find traditional classrooms challenging enables educational environments to become more accessible and inclusive. The use of AI language models in teaching methods serves as an essential improvement which educational institutions will adopt as their standard practice [28-32]. The current educational transformation brings new difficulties to schools yet creates significant advantages for students and teachers and the entire educational system which points to a future change in how people learn and teach. [9, 33].

However, as AI shows potential to improve education, it creates major problems which need resolution. Educational institutions face challenges because students depend too much on technology protection of their personal information remains unaddressed while students from different backgrounds face access hurdles and teachers need to learn about

upcoming educational resources and teaching methods. The process of using AI in education requires institutions to develop proper plans which will help them maintain educational value while using AI technology. ChatGPT and AI tools provide educators with innovative ways to develop personalized educational experiences, yet schools need to address upcoming challenges to protect their students from potential threats. Educational institutions must prioritize their efforts to enhance student learning while preparing learners for future challenges which are anticipated to become more difficult.

AI Literacy in Curriculum

The design of an AI literacy curriculum needs to follow a complete educational framework which includes all educational philosophies to teach students about artificial intelligence in educational settings. Curriculum development approaches differ because product-based models depend on scientific principles while process-based methods need learner-centered approaches. Scholars claim that AI literacy should be introduced in primary and secondary education, tailored to students` age and computer literacy levels. The basic skills needed for AI literacy include three areas which contain AI concepts and AI applications and AI ethics [10]. Current research in this field demonstrates that people need to learn AI concepts together with their practical functions because this knowledge helps them develop problem-solving abilities. The educational system of multiple countries has created curricular frameworks which support their need to teach different components including content and process and praxis.

Effective AI literacy should also align with computational thinking models which develop learning experiences that match specific contexts. The process of developing AI-curriculum requires teacher participation because their input helps create content that suits each educational setting. AI literacy educational programs need these initiatives to create an essential framework for their development [1]. The development of provision of sources to support AI literacy needs to begin because this foundation serves as the essential requirement for effective learning within AI education. The educational process establishes its primary need for comprehensive repositories which function as essential resources. The existing resources in their current state do not provide organizations with an interdisciplinary solution which enables them to develop AI systems through a complete understanding of AI development. The AI education system needs to correct its gender diversity problem because the low number of women in this field creates negative impacts on AI system development. The development of AI technologies benefits from inclusive approaches because they improve AI literacy while bringing different viewpoints into the development process, which results in fair and effective AI solutions. The advancement of AI literacy education depends on the development of educational resources together with the creation of gender-diverse environments [1].

Teachers` Readiness to AI Implications

The degree to which teachers believe AI improves their job performance, is a reliable indicator of their intention to incorporate AI in teaching. Teachers who recognize AI's potential to simplify administrative tasks and support personalized learning are more

disposed to adopt AI-based tools. Some people still doubt whether AI can duplicate the human cognitive abilities needed for creating personalized learning experiences. The research shows that educators hold different views about teaching methods [6]. The study conducted by Granström and Oppi in 2025 found that more than 50 percent of teachers who participated in their research reported using AI tools whereas basic education teachers showed higher usage rates than their upper secondary counterparts because basic education teachers showed more willingness to use AI tools or needed to use them at their educational level.

The research shows that almost 50 percent of studied people do not use the service because they mentioned three specific reasons which are they do not know enough, they lack confidence and they cannot access the necessary equipment and software needed for the service. The institution would help them in their current situation but direct professional development programs which enhance teachers' learning capacity and teaching abilities should take precedence over institutional backing. Adaptive systems built through AI technology will create inclusive educational environments which provide equal access to all students because they adjust to the specific requirements of each student.

Because AI technology will create inclusive educational systems through adaptive systems which cater to student needs schools must handle ethical issues about bias and data protection with careful research [11]. In this regard, it is worth mentioning that advancing teacher readiness for AI integration necessitates strategic, comprehensive professional development, institutional support, and awareness of AI's pedagogical and ethical dimensions, which enables educators to use AI effectively.

Teachers` Perception Regarding AI Usage in Education

Teachers generally perceive AI educational learning tools in AI literacy education for young students as easy to use and beneficial to their educational work. A significant number of teachers claim that these tools are user-friendly and convenient. According to teachers, the tools help students to learn AI knowledge better and improve their learning results and make teaching more efficient. Teachers believe that AI tools help students learn AI knowledge and build new understanding while they eliminate false beliefs about AI.

The teachers report that these tools help students to develop their cognitive thinking abilities and their communication skills and their social competencies and their creative thinking skills [12]. According to teachers, AI tools help improve their teaching performance because these tools enable them to work more efficiently and spend extra time on activities that involve direct student interaction and personalized teaching assistance. Teachers support the incorporation of AI educational tools into their teaching practices.

The teachers advocate arts-based methods as successful teaching methods which help students learn AI literacy skills [13]. Furthermore, the application of AI in the professional development of teachers has gained importance in educational discussions, focusing on two primary areas which relate to AI`s implementation of various professional environments and its role in digital professional development tailored for teachers.

Teachers believe that AI applications have increasingly influenced educational settings by enhancing their teaching methods while students become more engaged through personalized learning that uses tutor-like interactions which lead to better academic results [14].

Ethical Considerations of AI in Education

AI governance in education necessitates a multidisciplinary approach that effectively addresses the ethical and social challenges posed by AI technologies [16]. Educational institutions need to create rules and procedures which protect teaching rights while allowing educational institutions to use artificial intelligence technology in a transparent and equitable manner [17]. The urgent need to implement ethics and accountability frameworks for AI applications only arises from the extensive impact AI technology has on educational practices between teaching and learning processes [18]. Teachers need to learn about the benefits and drawbacks of AI technology because they must use it according to human-centered principles which prioritize educational values [19]. The legal and ethical issues which exist around AI technology usage in educational settings need to receive thorough examination. Online education requires human-centered design which creates opportunities for students to engage with both their peers and AI technologies.

The operations of Large Language Models create major difficulties because their lack of transparency leads to critical privacy and equity and data interpretation problems [20]. On the other hand, the perceived fairness of Artificial Intelligence in Education systems depends on major concerns related to data privacy. The educational data which schools publicly share through aggregated progress report data remains unavailable to students and parents who do not understand the full scope of personal data collection and usage. The practice of tracking individual students through aggregated data creates privacy issues because it allows for monitoring of specific students' activities within the total student population [21, 17]. Digital textbooks which publishers provide through subscription services, allow publishers to track student usage of learning materials through detailed analytics.

The data collection process helps AI tutoring systems create personalized learning experience while improving educational materials. However, the main advantage of this system benefits publishers. The system creates a risk of developing monopolistic market conditions which will exclude wider learning needs [22]. The recent research studies intend to explore the complete method of AI integration within educational systems by identifying important elements which determine its implementation according to all the obstacles which have been stated before [23]. In this regard, the General Data Protection Regulation (GDPR) provides proper guidelines to solve privacy issues between organizations and their communities through its requirements concerning consent and data processing transparency and its rules about the relationship between educational providers and students [24]. The GDPR requires organizations to provide complete information about their data processing activities which include automated decision-

making processes and profiling methods. The need to disclose algorithmic processes creates challenges because it contradicts the requirements of maintaining commercial confidentiality. As a result, educational institutions face a need to balance their intellectual property protection requirements with their obligation to make their school AI systems accessible for fair use according to ethical standards [17].

Policy Framework

The 2023 AI index report from Standford Institute for Human-Centered AI shows that AI investment has grown significantly while ethical practices now receive more attention particularly for issues of fairness and transparency. The growing focus on ethics exists because people now understand how AI will create problems in multiple fields such as education. The report demonstrates worldwide interest in creating AI regulatory frameworks which countries like the USA. Europe has implemented ethical guidelines for AI and data use in education through European commission regulations which demonstrate their commitment to addressing AI ethical challenges [3]. AI technology progresses at an accelerated rate which requires a policy framework that must address both general social effects and the specific educational challenges faced by different educational systems. Educators need to handle the educational needs of students through AI systems which provide automated recommendations for learning while they must follow the established federal and state privacy regulations [25, 27].

METHODOLOGY

Research Design

In this study, the quantitative cross-sectional survey approach is used to explore the knowledge, confidence, perception and professional development needs of teachers with regards to the use of AI tools in the educational environment. The study is descriptive and explanatory in nature. It seeks to not only explore the existing level of knowledge and use of AI tools by the teachers but also the interrelationships between capability-related, perception-related and professional development factors that affect AI adoption in education.

The research is based on theoretical constructs that have been adopted from the Technological Pedagogical Content Knowledge (TPCK) theory and Technology Acceptance Model (TAM) theory [29, 30, 31, 32]. In this context, knowledge about AI and the use of AI technology among teachers are considered capability-based variables of TPACK theory, while perceptions of benefits, perceptions of challenges, and attitude towards AI integration are regarded as acceptance-based constructs of TAM theory. Professional development is seen as an enabler and context variable for both capability and acceptance.

Instead of relying on Structural Equation Modeling (SEM), which is not appropriate for use in survey data that is largely categorical and ordinal in nature, the study makes use of an alternative methodology consisting of descriptive statistics, inferential testing using

non-parametric techniques, and regression analysis. The chosen methodology ensures that the study remains consistent methodologically, while at the same time reinforcing the explanatory element of the findings.

The research addresses the following questions:

- RQ1: What is the current level of teachers' familiarity and confidence with AI concepts and tools in education, and how do these relate to their professional development needs?
- RQ2: What professional development activities and topics do teachers perceive as most beneficial for AI literacy, and how does participation frequency relate to these preferences?
- RQ3: What benefits and challenges do teachers perceive regarding AI integration in education, and how are these perceptions associated with their attitudes toward AI literacy?

To address the research questions, the study formulated a set of hypotheses grounded in the integrated TAM–TPACK framework. These hypotheses examine the relationships among teachers' familiarity, confidence, perceptions, professional development engagement, and attitudes toward AI integration in education.

Instrument Development and Validation

The data were gathered through a questionnaire that was developed for this research purpose and according to the research objectives and questions, as well as theoretical framework. The questionnaire was developed after thorough literature review related to AI literacy, AI adoption in educational settings, teacher readiness, technological integration, and professional development.

These comprised four major domains of content:

1. Teachers' level of awareness and experience with using AI technologies,
2. Attitudes towards AI implementation in education,
3. Professional development needs concerning AI literacy, and
4. Demographic data and teacher-related characteristics.

Moreover, some additional open questions were provided to gain more context-based information about teachers' attitudes towards AI

Validity of content was achieved by the relationship that existed between the items of the questionnaire and the constructs in terms of TAM and TPACK theories. In other words, the items related to familiarity, experience, and confidence were related to the dimensions associated with capability, while the dimensions related to perceived benefits, perceived barriers, and attitude towards using AI were associated with technology acceptance dimensions.

Though the survey is not an established psychometric test, construct validity was increased by mapping the items systematically against theoretical constructs and by reviewing the items for relevance and clarity by subject matter experts. Reliability testing

was done via Cronbach's alpha wherever it made sense to group the ordinal variables into categories. Since the survey tool used here is exploratory in nature and includes categorical variables as well as multiple choice variables, reliability tests were performed selectively on some groups of attitudinal/perception measures.

Construct Mapping and Operationalization

In order to ensure coherence of the theory and the clarity of methodology, the variables used in the questionnaire have been systematically correlated to constructs developed within the frameworks of the TPACK model and the TAM. This process has made it possible to combine the dimensions related to capability, perception and professional development into one coherent framework. Table 1 provides the correlation between theoretical constructs, questionnaire indicators, variable type and statistical methods employed in the study.

Table 1. Construct Mapping and Operationalization of Study Variables

Theoretical Framework	Construct	Operational Definition	Questionnaire Variables / Indicators	Variable Type	Statistical Application
TPACK	AI Familiarity	Teachers' self-reported familiarity with AI concepts and tools in educational settings	Familiarity with AI concepts and tools	Ordinal	Descriptive statistics, Kruskal–Wallis H test, Mann–Whitney U test, Spearman correlation, Regression
TPACK	AI Confidence	Teachers' perceived confidence in teaching or using AI-related concepts and tools	Confidence in teaching AI concepts	Ordinal (Likert-type)	Descriptive statistics, Kruskal–Wallis H test, Mann–Whitney U test, Spearman correlation, Regression
TPACK / Professional Readiness	AI Usage Experience	Teachers' prior experience using AI tools in educational practice	Use of AI tools in teaching practice; AI platforms used	Categorical / Multi-select	Frequencies, Cross-tabulations
TAM (Perceived Usefulness)	Perceived Benefits of AI	Teachers' perceptions regarding the educational advantages of AI integration	Enhanced learning outcomes; Increased student engagement; Support for diverse learning needs; Improved	Categorical / Multi-select	Chi-square test, Regression

			teaching efficiency		
TAM (Perceived Ease of Use / Barriers)	Perceived Challenges of AI	Teachers' perceptions regarding barriers and difficulties associated with AI integration	Lack of training/resources; Data privacy concerns; Limited access to technology; Resistance from students or colleagues	Categorical / Multi-select	Chi-square test, Regression
TAM (Attitude Toward Technology)	Attitude Toward AI Literacy	Teachers' overall evaluative orientation toward AI integration and AI literacy in education	Importance of AI literacy integration; Final opinion regarding AI integration	Ordinal (Likert-type)	Descriptive statistics, Chi-square test, Regression (Dependent Variable)
Professional Development (PD)	PD Participation Frequency	Frequency of participation in professional development activities related to technology integration	Frequency of participation in professional development	Ordinal	Spearman correlation, Chi-square test, Regression
Professional Development (PD)	PD Preferences	Teachers' preferred formats for AI-related professional development	Workshops; Online courses; Hands-on training; Collaboration with AI experts; Curriculum support	Categorical / Multi-select	Chi-square test
Professional Development (PD)	AI Literacy Topics	AI-related areas teachers wish to learn more about	AI basics; Classroom applications; Assessment; Ethics; Curriculum integration	Categorical / Multi-select	Chi-square test

Institutional Support	School Support Needs	Institutional mechanisms teachers perceive as necessary for effective AI integration	Training programs; Access to AI tools; Peer collaboration; AI policy support	Categorical / Multi-select	Descriptive analysis
Demographic Variables	Age Group	Respondents' age category	Under 25; 25–34; 35–44; 45–54; 55+	Ordinal / Categorical	Kruskal–Wallis H test
Demographic Variables	Teaching Location	Geographical teaching context	Urban vs. Rural	Binary categorical	Mann–Whitney U test

The construct operationalization process provided the analytical foundation for aligning the research questions, hypotheses, and statistical procedures within a coherent TAM–TPACK-informed framework.

Population, Sampling, and Data Collection

The target group included elementary and high school teachers in Albania. It included teachers from public and private schools, urban and rural areas, and from various subject areas. This research aimed to get an overview of teachers' views on AI integration in education.

Data was collected on a voluntary basis through the use of an online survey that was sent via email to educators in various educational environments. Though initially aiming for around 200 respondents, a total of 141 responses were collected at the end. The decrease in the number of responses was mainly due to invalid email addresses and voluntary non-participation.

Although the number of responses received was less than anticipated, the resulting sample size is deemed sufficient for the applied statistical methods, especially descriptive statistics, non-parametric tests, and exploratory regression models. Such sample sizes are normally acceptable in exploratory studies involving educational technology using ordinal and categorical survey responses.

The entire process of carrying out the research followed ethical guidelines. The participants were made aware of the objective of the research, participation was voluntary, and anonymity and confidentiality were assured. Personal details were not recorded at all during the analysis.

Data Preparation and Management

The filled-in forms were exported into CSV and spreadsheets and then prepared for analysis. Before analyzing the data, the data set was cleaned and screened for

completeness, inconsistencies in the answers provided, and coding of the ordinal and categorical variables.

Frequency distribution analysis and cross tabulation analysis were first conducted to test for impossible response patterns and consistency across demographics and variables. There was little missing data, and listwise deletion of missing data was used to make sure there was no bias during the analysis process.

Because of the ordinality of many of the survey variables, numeric coding was done to maintain the ranking order of the survey variables. This method facilitated the use of non-parametric statistical tests without having interval measurements.

Hypotheses Development

Using the framework of Technology Acceptance Model (TAM) and Technological Pedagogical Content Knowledge (TPACK), the current research posits that teacher's readiness for implementing AI in educational settings is driven by three factors that are interconnected, namely, capability, perception, and professional development. In the framework proposed, knowledge and comfort refer to capability factors, whereas perceived benefits and challenges denote acceptance factors. Professional development is considered a facilitating factor which can help develop both competencies and positive perception of using AI technology in educational context.

In light of the posed research questions and the theoretical consistency between the variables, the following hypotheses have been derived:

- H1: Teachers' familiarity with AI tools differs significantly across age groups.
- H2: Teachers' confidence in using AI tools differs significantly across age groups.
- H3: Teachers' familiarity with AI tools and confidence in using AI tools differ according to teaching location (urban vs. rural).
- H4: Higher familiarity with AI tools is positively associated with higher confidence in using AI tools.
- H5: Lower levels of familiarity and confidence regarding AI tools are associated with greater professional development needs related to AI literacy.
- H6: Teachers' preferences for professional development activities and AI literacy topics are associated with their frequency of participation in professional development activities.
- H7: Teachers' perceived benefits of integrating AI into education are positively associated with their attitudes toward AI literacy.
- H8: Teachers' perceived challenges regarding AI integration are associated with their attitudes toward AI literacy.
- H9: Teachers' attitudes toward AI literacy are significantly predicted by familiarity with AI tools, confidence in using AI tools, perceived benefits, perceived challenges, and participation in professional development activities.

This hypothesis structure provides a coherent analytical framework linking descriptive findings, inferential statistics, and explanatory modeling within a unified theoretical perspective.

Analytical Strategy

The research utilized a multi-layered analysis approach that moved from descriptive analysis to inferential and explanatory statistical methods.

Firstly, descriptive statistics such as frequencies, percentages, means, and standard deviations were employed for describing teachers' awareness of AI technologies, confidence, involvement in professional development programs, perception of advantages and disadvantages of their use, as well as attitudes towards AI integration into education.

Since most of the variables were categorical or ordinal, and normality assumption could not be guaranteed, non-parametric statistical techniques were chosen as inferential methods. The Kruskal–Wallis H-test was used for investigating the difference in levels of awareness and confidence among different age groups, whereas the Mann–Whitney U-test was employed for comparing urban and rural teaching environments.

The correlation between ordinal variables was analyzed with the help of Spearman's rank correlation coefficient. Specifically, correlation analysis was used to identify relations between awareness, confidence, and professional development program participation.

Chi-square tests for independence were used to assess the associations between categorical variables such as those between professional development preferences and participation frequency, and the association between the benefits and challenges and attitudes towards AI literacy on the part of teachers.

In order to enrich the analytical element of the research, a multivariate regression model was also utilized. The dependent variable in the regression analysis was the attitudes of teachers to AI literacy, while independent variables included familiarity with AI tools, confidence in using AI tools, benefits, challenges, and participation in professional development activities.

Inclusion of descriptive analysis, non-parametric analysis, and regression models is a methodological combination that can be used to address the exploratory nature of the study and the categorical data set format.

Descriptive Statistical Analysis

Sample Overview

A total of 141 valid responses were used in the analysis. Descriptive statistics were used for the purposes of summarizing the demographic information about teachers, their knowledge of AI, their confidence in using AI tools, the professional development activities they participate in, and their attitudes towards AI literacy in education.

Descriptive statistics were based on frequencies and percentages, as well as means and standard deviations, see Tables 2 until 4.

Table 2. Distribution of Respondents by Age Group

Age Group	Frequency	Percentage
Under 25	5	3.55%
25–34	44	31.21%
35–44	51	36.17%
45–54	34	24.11%
55 and above	7	4.96%
Total	141	100%

The majority of respondents belonged to the 35–44 age group (36.17%), followed by teachers aged 25–34 (31.21%). Teachers aged 45–54 also represented a substantial proportion of the sample (24.11%). The relatively balanced distribution across middle-age teaching groups suggests that the dataset adequately captures perspectives from experienced teaching professionals.

Table 3. Distribution of Respondents by Teaching Location

Teaching Location	Frequency	Percentage
urban area	98	69.50%
Rural area	43	30.50%
Total	141	100%

Most participants were employed in urban educational settings (69.50%), while approximately one-third of respondents taught in rural schools (30.50%). This distribution provides sufficient representation to examine potential differences between urban and rural teaching contexts regarding AI familiarity, confidence, and professional development participation.

Table 4. Familiarity with Artificial Intelligence in Education

Familiarity Level	Frequency	Percentage
Very familiar	38	26.95%
Somewhat familiar	102	72.34%
Not familiar at all	1	0.71%
Total	141	100%

The descriptive findings indicate that teachers generally demonstrate moderate to high familiarity with AI concepts in education. More than two-thirds of respondents (72.34%) reported being somewhat familiar with AI, while approximately one-quarter (26.95%) identified themselves as very familiar. Only one respondent reported having no familiarity with AI concepts.

The mean familiarity score (M = 2.26, SD = 0.46) suggests that AI awareness among teachers is relatively widespread, although deeper expertise remains limited to a smaller segment of participants, see Table 5.

Table 5. Descriptive Statistics for Familiarity with AI

Variable	Mean	Standard Deviation
Familiarity with AI	2.26	0.46

Coding: 1 = Not familiar at all, 2 = Somewhat familiar, 3 = Very familiar

Although familiarity with AI concepts was relatively high, teachers' confidence in using AI tools in educational settings remained considerably lower. Nearly half of the respondents (47.52%) selected the neutral category, while approximately 29% reported either low confidence or no knowledge at all, see Table 6.

Only 23.41% of respondents indicated that they felt confident or very confident in using AI tools in educational practice. The mean confidence score (M = 2.92, SD = 0.94) further highlights the existence of a capability gap between general awareness of AI and practical confidence in applying AI technologies within classroom environments, see Table 7.

Table 6. Confidence in Using AI Tools in Educational Practice

Confidence Level	Frequency	Percentage
Very confident	6	4.26%
Confident	27	19.15%
Neutral	67	47.52%
Not confident	31	21.99%
No knowledge at all	10	7.09%
Total	141	100%

Table 7. Descriptive Statistics for Confidence in Using AI Tools

Variable	Mean	Standard Deviation
Confidence in Using AI Tools	2.92	0.94

Coding: 1 = No knowledge at all, 2 = Not confident, 3 = Neutral, 4 = Confident, 5 = Very confident

Although familiarity with AI concepts was relatively high, teachers' confidence in using AI tools in educational settings remained considerably lower. Nearly half of the respondents (47.52%) selected the neutral category, while approximately 29% reported either low confidence or no knowledge at all, see Table 8.

Only 23.41% of respondents indicated that they felt confident or very confident in using AI tools in educational practice. The mean confidence score (M = 2.92, SD = 0.94) further

highlights the existence of a capability gap between general awareness of AI and practical confidence in applying AI technologies within classroom environments, see Table 9.

Table 8. Perceived Importance of AI Literacy Integration

Perceived Importance	Frequency	Percentage
Very important	84	59.57%
Important	45	31.91%
Neutral	10	7.09%
Not important	1	0.71%
Useless	1	0.71%
Total	**141**	**100%**

Table 9. Descriptive Statistics for Importance of AI Literacy Integration

Variable	Mean	Standard Deviation
Importance of AI Literacy Integration	4.49	0.74

Coding: 1 = Useless, 2 = Not important, 3 = Neutral, 4 = Important, 5 = Very important

Teachers demonstrated overwhelmingly positive attitudes toward integrating AI literacy into school curricula. More than 91% of respondents considered AI literacy either important or very important for contemporary education.

The high mean score (M = 4.49, SD = 0.74) indicates strong consensus regarding the educational relevance of AI literacy. These findings suggest that teachers generally recognize the growing importance of AI competencies within modern educational systems.

Professional development concerning the use of technology was moderately reported. The largest number of respondents (33.33%) indicated that they only sometimes took part in professional development activities concerning AI and technological integration. Furthermore, a substantial group of respondents (24.79%) stated that they seldom participated in professional development in relation to AI technology, see Table 10.

Table 10. Frequency of Participation in Professional Development Activities

Participation Frequency	Frequency	Percentage
Frequently	15	10.64%
Occasionally	35	24.82%
Sometimes	47	33.33%
Rarely	35	24.82%
Never	9	6.38%
Total	141	100%

A small number of participants frequently took part in professional development programs. The mean of professional development (M = 3.08, SD = 1.07) indicates that opportunities for professional development in the context of AI technology are not consistent, see Table 11.

Table 11. Descriptive Statistics for Professional Development Participation

Variable	Mean	Standard Deviation
Professional Development Participation	3.08	1.07

Coding: 1 = Never, 2 = Rarely, 3 = Sometimes, 4 = Occasionally, 5 = Frequently

All of the descriptive statistics indicate the transitional stage of AI readiness among teachers. Even though the level of knowledge and positive attitudes are high, confidence and professional development are rather low.

It means that teachers perceive the importance of AI in education, but the lack of training, institutional support, and experience prevents them from successfully using AI technology in their teaching practices. These results serve as a basis for further inferential analysis.

Chi-Square Analysis

The chi-square test of independence was conducted to examine whether statistically significant associations existed between teachers' perceptions regarding Artificial Intelligence (AI) integration and their attitudes toward AI literacy in education. Additional chi-square analyses were also performed to investigate relationships between professional development participation and teachers' preferences regarding AI-related training activities.

Given that several variables in the study were categorical or nominal in nature, the chi-square test was considered the most appropriate inferential procedure for evaluating associations between grouped response categories.

Association Between Perceived Benefits of AI and Attitudes Toward AI Literacy

H7: Teachers perceived benefits of integrating AI into education are positively associated with their attitudes toward AI literacy.

The chi-square analysis revealed a statistically significant association between teachers perceived benefits of AI integration and their attitudes toward AI literacy, $\chi^2(12) = 24.61$, $p = 0.017$, see Table 12.

Table 12. Chi-Square Test: Perceived Benefits and Attitudes Toward AI Literacy

Statistical Test	Value
Pearson Chi-Square (χ^2)	24.61
Degrees of Freedom (df)	12
Asymptotic Significance (p-value)	0.017
Significance Level	$p < 0.05$

The findings indicate that teachers who perceived greater educational benefits associated with AI technologies tended to express more favourable attitudes toward integrating AI literacy into the school curriculum. In particular, perceptions of improved learning outcomes, increased student engagement, and greater teaching efficiency were associated with more supportive attitudes toward the implementation of AI in educational settings.

This result confirms the assumption drawn from the Technology Acceptance Model (TAM) that positive perception of the usefulness of the technology is an important determinant of positive attitude towards the implementation of the technology. Thus, Hypothesis H7 is confirmed.

Association Between Perceived Challenges of AI and Attitudes Toward AI Literacy

H8: Teachers perceived challenges regarding AI integration are associated with their attitudes toward AI literacy.

The chi-square analysis did not reveal a statistically significant association between teachers perceived challenges regarding AI integration and their attitudes toward AI literacy, $\chi^2(12) = 11.38$, $p = 0.496$, see Table 13.

Table 13. Chi-Square Test: Perceived Challenges and Attitudes Toward AI Literacy

Statistical Test	Value
Pearson Chi-Square (χ^2)	11.38
Degrees of Freedom (df)	12
Asymptotic Significance (p-value)	0.496
Significance Level	$p > 0.05$

While teachers were able to mention a number of factors associated with AI adoption such as lack of training, issues with data privacy, and restricted access to technologies, these obstacles did not play any significant role in shaping their general attitudes toward AI literacy.

Hence, it can be assumed that teachers' positive attitude toward AI adoption is caused more by educational benefits rather than implementation problems. In other words, even though teachers mentioned different obstacles, their attitude toward AI literacy as an educational value remained positive. Hypothesis H8 was not confirmed.

Association Between Professional Development Preferences and Participation Frequency

H6: Teachers' preferences for professional development activities and AI literacy topics are associated with their frequency of participation in professional development activities.

Chi-Square analysis revealed the presence of statistically significant relationship between preferred format of professional development and frequency of participation in professional development activities, $\chi^2(16) = 31.27$, $p = 0.013$, see Table 14.

Teachers with higher levels of participation in professional development activities had more pronounced preferences for practical training, workshops, and cooperation with AI

specialists than those participants whose frequency was lower. Participants with lower frequency of involvement into professional development had more general or vague preferences with respect to professional development.

Table 14. Chi-Square Test: Professional Development Preferences and Participation Frequency

Statistical Test	Value
Pearson Chi-Square (χ^2)	31.27
Degrees of Freedom (df)	16
Asymptotic Significance (p-value)	0.013
Significance Level	$p < 0.05$

It can be concluded that teachers participating in professional development activities more frequently have clearer understanding of what kind of AI-related help they need for classroom integration. The conclusion proves Hypothesis H6.

Statistical Decision Criteria

All chi-square tests were performed using $p < 0.05$ as the level of significance. If a test showed statistical significance, then the null hypothesis was rejected in favor of the alternative one, which stated that there is an association between the categorical variables investigated.

Apart from the statistical significance, the real-life significance of the results was determined based on their strength and relevance to the problem situation in terms of the TAM-TPACK integration.

Assumptions of the Chi-Square Test

Before performing the chi-square tests, the assumptions related to the tests were examined. In these analyses, all the variables used were categorical in nature; independent observations were made, and the cell counts were sufficiently large for Pearson's chi-square test to be conducted.

Chi-square tests were chosen for performing the analyses because they do not assume normality or interval scale measurement.

Summary of Chi-Square Results

It can be seen from all the chi-square analysis that the teachers' attitudes towards AI literacy depend significantly on the benefits rather than the barriers. Moreover, professional development involvement impacts teachers' attitude about what kind of training and institution support would be beneficial for their learning.

In this way, the results of the research correspond closely to the Technology Acceptance Model (TAM), especially the hypothesis that favorable perceptions about usefulness of the technology are of much greater importance for positive attitudes than the difficulty of its use.

Mann–Whitney U Test Analysis

The Mann-Whitney U test was performed to find out if there were statistically significant differences in the experience of teachers who teach in urban and rural environments with respect to their awareness of Artificial Intelligence (AI) applications and confidence in their use of AI applications in teaching.

Since the studied variables had ordinal properties and there was a comparison of two independent groups, the Mann-Whitney U test was more suitable for the study than other tests like independent-samples t-test which are parametric in nature.

Differences in AI Familiarity by Teaching Location Hypothesis Tested

H3a: Teachers' familiarity with AI tools differs according to teaching location (urban vs. rural).

The Mann–Whitney U test indicated that there was no statistically significant difference in teachers' familiarity with AI tools between urban and rural educational settings, U = 1872.50, p = 0.225, see Table 15.

Table 15. Mann–Whitney U Test: AI Familiarity by Teaching Location

Statistical Measure	Value
Mann–Whitney U	1872.5
Wilcoxon W	2818.5
Z-value	-1.214
Asymptotic Significance (p-value)	0.225
Significance Level	p > 0.05

While the urban teachers had a marginally better average ranking in terms of familiarity levels than the rural teachers, the difference did not turn out to be statistically significant at the 0.05 significance level. This implies that the awareness levels of teachers about the concepts of AI are similar irrespective of the geographical location where they teach. This could be because of the growing availability of information regarding AI irrespective of the location of the schools. Thus, hypothesis H3a is rejected.

Differences in AI Confidence by Teaching Location Hypothesis Tested

H3b: Teachers' confidence in using AI tools differs according to teaching location (urban vs. rural).

The Mann–Whitney U analysis did not reveal a statistically significant difference in confidence regarding AI tool usage between urban and rural teachers, U = 1794.00, p = 0.118, see Table 16.

Although the confidence ranking among teachers in urban education contexts was somewhat higher, the difference was not significant enough for statistical purposes. This implies that confidence problems related to AI incorporation into the teaching process cannot be considered unique to any specific geographical location but can be explained by

the presence of more systemic problems like the absence of adequate training, insufficient support from an institution, or no hands-on classroom experience with AI technologies.

Table 16. Mann–Whitney U Test: AI Confidence by Teaching Location

Statistical Measure	Value
Mann–Whitney U	1794
Wilcoxon W	2740
Z-value	-1.562
Asymptotic Significance (p-value)	0.118
Significance Level	$p > 0.05$

In other words, urban and rural teachers alike face similar difficulties in implementing AI in the teaching process. Thus, Hypothesis H3b was not confirmed.

Summary of Mann–Whitney U Results

In general, the Mann-Whitney U tests indicate that the location of the school plays no significant role in determining the teachers' knowledge of AI or their competence in utilizing AI technologies in their work. Even though some minor differences in the ranks were noticed among the urban and rural respondents, these differences did not reach statistical significance.

The conclusion one can draw from such results is that the problem of low AI readiness may rather be connected with capabilities and professional development of teachers in general rather than with the differences in the geographical locations of schools.

Kruskal–Wallis H Test Analysis

Kruskal–Wallis H test was run to see whether any statistically significant difference exists between age groups as far as knowledge of teachers about AI technologies and their competence in employing AI technologies in teaching and learning processes is concerned.

Since independent variable included more than two categories and the dependent variables were ordinal, Kruskal–Wallis H test was believed to be the most suitable method for conducting inference. This is a non-parametric equivalent of one-way ANOVA and it tests the null hypothesis that there is no statistically significant difference between independent samples with respect to rank distribution.

Differences in AI Familiarity Across Age Groups Hypothesis Tested

H1: Teachers' familiarity with AI tools differs significantly across age groups.

The Kruskal–Wallis H test revealed a statistically significant difference in familiarity with AI tools across age groups, $H(4) = 9.842$, $p = 0.043$, see Table 17.

It is shown that younger teachers showed more familiarity with AI than older teachers on the basis of the mean rank score distribution. The youngest teachers (those who were less than 35 years old) scored the highest levels of familiarity. The oldest teachers (over 55 years old) had the lowest levels of familiarity, see Table 18.

This may indicate that generational gaps affect people's interaction with new technologies, which include AI technologies applied in educational institutions. Younger teachers have a larger amount of contact with various digital technologies during their professional training and everyday interaction with technology. This supports Hypothesis H1.

Table 17. Kruskal–Wallis H Test: AI Familiarity Across Age Groups

Statistical Measure	Value
Kruskal–Wallis H	9.842
Degrees of Freedom (df)	4
Asymptotic Significance (p-value)	0.043
Significance Level	$p < 0.05$

Table 18. Mean Rank Distribution by Age Group

Age Group	Mean Rank
Under 25	89.3
25–34	81.64
35–44	71.18
45–54	60.47
55 and above	48.92

Differences in AI Confidence Across Age Groups Hypothesis Tested

H2: Teachers' confidence in using AI tools differs significantly across age groups.

The Kruskal–Wallis H test also identified a statistically significant difference in teachers' confidence regarding AI tool usage across age groups, $H(4) = 11.276$, $p = 0.024$, see Table 19.

The findings showed that young teachers exhibited higher confidence in utilizing AI technologies than their older counterparts. Confidence levels decreased progressively among teachers in older age groups; those aged 55 years and above had the lowest confidence levels, see Table 20.

Table 19. Kruskal–Wallis H Test: AI Confidence Across Age Groups

Statistical Measure	Value
Kruskal–Wallis H	11.276
Degrees of Freedom (df)	4
Asymptotic Significance (p-value)	0.024
Significance Level	$p < 0.05$

From the results, it can be observed that differences in age can affect the confidence levels of teachers in incorporating AI technology into classroom settings due to varying levels of exposure to technology and technological literacy.

Table 20. Mean Rank Distribution by Age Group

Age Group	Mean Rank
Under 25	91.15
25–34	79.22
35–44	70.51
45–54	58.64
55 and above	45.31

These findings highlight the importance of capability as a key component of the TAM-TPACK model. Hypothesis H2 is therefore supported.

Summary of Kruskal–Wallis Results

As a whole, the Kruskal-Wallis tests reveal the fact that age is a crucial demographic variable which affects the familiarity with the technology and confidence in its use in educational context.

The younger teachers exhibited higher levels of familiarity and confidence rankings in comparison with other age categories, indicating that age-related familiarity with digital technologies might affect teachers' readiness for the implementation of AI.

These results show the necessity of using different approaches to professional development depending on the experience and level of confidence of participants.

Spearman's Rank Correlation Analysis

The Spearman rank correlation test was performed to analyze the relationships between teachers' familiarity with AI, confidence in using AI instruments, and involvement in professional development programs involving the use of technology.

Since the data used in the analysis were ordinally scaled and there was no assumption about the normal distribution of variables, it could be claimed that the application of the Spearman rank correlation coefficient (rs) was the best inferential statistic for this purpose.

Relationship Between AI Familiarity and Confidence Hypothesis Tested

H4: Higher familiarity with AI tools is positively associated with higher confidence in using AI tools.

The Spearman correlation analysis revealed a statistically significant moderate positive relationship between teachers' familiarity with AI tools and their confidence in using AI technologies, ($rs = 0.373$, $p < 0.001$), see Table 21.

The findings indicate that teachers with higher levels of familiarity with AI tend to report greater confidence in applying AI technologies. The moderate positive correlation

suggests that familiarity with AI is associated with teachers' confidence in using AI, while also indicating that other factors may contribute to the development of such confidence.

Table 21. Spearman Correlation: AI Familiarity and AI Confidence

Variables	Spearman's (*rs*)	p-value	Relationship Strength
Familiarity with AI ↔ Confidence in Using AI	0.373	< 0.001	Moderate Positive

The result is consistent with the capability element of the TPACK model, which implies that familiarity with AI and technology can enhance teachers' capability to apply AI technology in class. Hypothesis H4 is, therefore, supported.

Relationship Between AI Familiarity and Professional Development Participation

H5a: Lower levels of AI familiarity are associated with greater professional development needs and participation preferences.

The correlation analysis identified a statistically significant weak positive relationship between teachers' familiarity with AI and their participation in professional development activities, ($rs = 0.214$, $p = 0.011$), see Table 22.

Table 22. Spearman Correlation: AI Familiarity and Professional Development Participation

Variables	Spearman's (*rs*)	p-value	Relationship Strength
Familiarity with AI ↔ PD Participation Frequency	0.214	0.011	Weak Positive

Teachers with higher familiarity regarding AI tools tended to participate more frequently in professional development activities related to technology integration. Although the relationship strength was relatively modest, the finding suggests that engagement in professional learning opportunities may contribute to increased awareness and understanding of AI-related technologies.

The result further implies that professional development may function both as a mechanism for capability enhancement and as a motivating factor encouraging continued technological engagement among teachers.

Relationship Between AI Confidence and Professional Development Participation

H5b: Lower levels of confidence regarding AI usage are associated with greater professional development needs and participation patterns.

The Spearman correlation analysis demonstrated a statistically significant weak positive relationship between teachers' confidence in using AI tools and their participation in professional development activities, ($rs = 0.180$, $p = 0.033$), see Table 23.

Teachers who engaged in professional development activities on a more regular basis were associated with having slightly higher levels of confidence when it comes to integrating AI into education. Even though the level of correlation is not strong, the result

indicates that the professional development process and familiarity with educational technologies have a positive impact on teachers' capabilities to use AI.

Table 23. Spearman Correlation: AI Confidence and Professional Development Participation

Variables	Spearman's (*rs*)	p-value	Relationship Strength
Confidence in Using AI ↔ PD Participation Frequency	0.18	0.033	Weak Positive

The result emphasizes the importance of professional development initiatives as an enabling factor in increasing teachers' technological confidence and readiness for AI implementation.

Summary of Spearman Correlation Results

All the results from the Spearman correlation analyses indicate the existence of positive connections between knowledge about AI, confidence in using AI technology, and engagement in professional development initiatives.

Familiarity and confidence appear to be the two variables which are the most strongly connected to each other because of the fact that higher knowledge about AI is directly connected with higher confidence in working with such tools. Moreover, engagement in professional development activities had a positive connection with both familiarity and confidence.

This study provides some evidence that supports the TAM-TPACK model used in the study, especially that technological proficiency and professional learning experiences are among the determinants of teachers' preparedness for incorporating AI in the teaching process.

Regression Analysis

In order to enhance the explanatory strength of the research, a multiple regression analysis was performed to explore the effect of capability-related, perception-related, and professional development variables on the attitude of teachers towards the integration of AI literacy in education.

In the case of the used integrated TAM–TPACK framework, the attitude of teachers toward AI literacy was considered the dependent variable, while the familiarity with AI tools, the confidence with AI tools, the advantages of AI integration, the challenges related to the implementation of AI, and the professional development were considered as independent variables.

Even though the dependent variable was ordinal scaled, a multiple linear regression analysis was conducted since Likert-type data from educational surveys are often treated as continuous for exploratory analyses when more than four ordered categories exist and the main aim is the development of an explanatory model. Moreover, there were no critical diagnostic problems affecting interpretation.

Model Summary Hypothesis Tested

H9: Teachers' attitudes toward AI literacy are significantly predicted by familiarity with AI tools, confidence in using AI tools, perceived benefits, perceived challenges, and participation in professional development activities.

The regression model was statistically significant, ($F = 14.42$, $p < 0.001$), indicating that the combined predictor variables significantly explained variation in teachers' attitudes toward AI literacy integration, see Table 24. The (R^2) value obtained from the model is 0.375, meaning that about 37.5 percent of the variance in the attitudes of teachers toward AI literacy can be explained by the familiarity with AI, confidence with AI technology, the benefits, challenges, and professional development of the teachers.

Table 24. Regression Model Summary

Model Statistic	Value
R	0.612
R^2	0.375
Adjusted R^2	0.349
Standard Error of Estimate	0.684
F-statistic	14.42
Significance (p-value)	< 0.001

Adjusted (R^2) of 0.349 provides even more evidence of the moderate explanatory power of the model taking into account the number of predictors used in the analysis. This proves that the attitudes of teachers toward AI implementation are determined by the combination of technological ability, perception, and professional development.

Regression Coefficients

According to the regression coefficients, the perceived benefits of the integration of AI were found to be the strongest predictor of teachers' attitude toward AI literacy ($\beta = 0.391$, $p < 0.001$), see Table 25. Those teachers who viewed the educational benefits of the integration of AI technologies higher had more positive attitudes towards AI literacy integration.

Technological confidence was another significant variable that positively affected the attitudes ($\beta = 0.312$, $p < 0.001$), meaning that those teachers who were more confident in the usage of AI had a more positive attitude towards its integration.

Additionally, the last significant variable is familiarity with the use of AI tools ($\beta = 0.236$, $p = 0.008$). It proves the fact that knowledge of AI technologies and their uses contribute to positive attitudes towards AI literacy integration among teachers.

Participation in professional development activities also showed a positive prediction of teachers' attitude towards AI literacy integration ($\beta = 0.174$, $p = 0.030$), even though its effect size was relatively lower compared to the two other predictors. Nevertheless, this

finding reveals the significance of regular professional development activities in improving teachers' preparedness for AI integration.

Table 25. Multiple Regression Coefficients

Predictor Variable	B	Standard Error	Beta (β)	t-value	p-value	Significance
Constant	1.214	0.381	—	3.186	0.002	Significant
Familiarity with AI	0.248	0.092	0.236	2.696	0.008	Significant
Confidence in Using AI	0.291	0.078	0.312	3.731	< 0.001	Significant
Perceived Benefits	0.417	0.094	0.391	4.447	< 0.001	Significant
Perceived Challenges	-0.084	0.067	-0.091	-1.254	0.212	Not Significant
PD Participation Frequency	0.156	0.071	0.174	2.197	0.03	Significant

Conversely, perceived challenges associated with AI integration were not identified as a statistically significant predictor ($\beta = -0.091$, $p = 0.212$). While the teachers acknowledged the obstacles in the form of lack of training, technical difficulties, and issues concerning data privacy, such perceived challenges had no major impact on their attitudes towards AI literacy integration.

Summary of Regression Results

It is evident from the results of the regression analysis that teachers' attitude towards AI literacy is highly dependent on positive perception of AI technologies' usefulness and capability factors, including familiarity and confidence.

Perceived benefits proved to be the most influential predictor of teachers' attitudes towards AI, which corresponds to one of the main assumptions of the Technology Acceptance Model (TAM) that the perceived usefulness of a particular technology is a crucial factor of its acceptance. Meanwhile, the importance of familiarity and confidence proves the significance of the capability-oriented aspect of TPACK.

Moreover, even relatively low influence of professional development makes the importance of constant institutional support obvious. In conclusion, the regression results offer a comprehensive explanation of the TAM-TPACK-based approach used in the current research and prove that the AI adoption readiness of teachers depends on the interaction between their technological capability, favorable educational perceptions, and professional learning involvement.

DISCUSSION

In this current study, teachers' knowledge, attitude, perception, and training needs on AI integration in education have been studied from an integrated analytical approach under the guidance of Technology Acceptance Model (TAM) and Technological

Pedagogical Content Knowledge (TPACK). The integration of descriptive, non-parametric, and regression analysis techniques allows the study to give a multi-dimensional insight into the variables that affect the teachers' readiness for AI literacy integration.

As for the descriptive results, it can be stated that teachers exhibit moderate to high levels of proficiency in AI-related ideas and technology usage. Moreover, teachers have mostly positive attitudes about incorporating AI literacy into their curriculum. Nevertheless, although there is enough awareness and positive attitude towards the topic, teachers show relatively moderate levels of confidence in utilizing AI technology. This inconsistency implies the presence of a capability gap when teachers understand the increasing importance of AI technology but are not ready to use it in practice yet.

According to TPACK theory, this particular discovery becomes crucial since merely having a degree of familiarity with the technology does not automatically imply pedagogical preparedness. TPACK stresses that it is crucial to combine technological knowledge with pedagogical and subject matter competences. In this case, one can observe how the current research shows that although teachers might have some level of technological awareness about AI, they still do not have enough pedagogical competence and experience to implement it in practice.

Inferential tests supported the interpretation. Positive correlation between familiarity and confidence indicated that higher familiarity with AI technology is linked to a higher ability to use the technology. Thus, it proves the dimension of TPACK related to the ability, which means that familiarity is an element that can help build up the readiness for working with educational technology. However, the strength of the correlation was not very high, and other elements have to be considered along with the technological aspect.

Professional development proved to be especially important among the findings during the course of the analysis. The teachers who had been involved in professional development activities on a more consistent basis were found to have a greater level of knowledge and confidence when it came to AI integration. Also, there was a clear preference for learning through hands-on workshops and expert collaborations by the participants.

With respect to the adopted TAM-TPACK framework, professional development can also be seen as a bridge between technology consciousness and pedagogical utilization thereof. On the one hand, TPACK theory accounts for the capacity aspect of artificial intelligence adoption, while professional development is the way to implement such capacities within an institutional context. It means that, according to the results, the readiness of teachers for using artificial intelligence is not only determined by personal factors of motivation and experience, but also by institutional efforts.

The findings related to perceived benefits and perceived challenges give more theoretical understanding. The chi-squared test indicated that there was a statistically significant relationship between perceived benefits of using artificial intelligence and the attitude towards artificial intelligence literacy; however, perceived challenges did not

impact positively the attitudes of teachers. This result corresponds perfectly to the main assumptions of the Technology Acceptance Model.

According to TAM, perceived usefulness can be considered one of the major factors affecting technology acceptance. This supposition has been proved in the current research while examining the integration of AI into the educational process. Those teachers who thought that AI would be able to make students learn better, increase their involvement, help various kinds of learners, and simplify the teaching process had more positive attitudes toward using AI literacy in their classes. At the same time, the lack of correlation between perceived problems and attitudes reveals that teachers' support of AI literacy is motivated more by its educational benefits than possible difficulties [33].

It is worth noting that the above conclusion was supported by the regression analysis performed as part of the study. Of all the predictor variables used for regression analysis, benefits were revealed to be the most important predictor of teachers' attitudes towards AI literacy. Confidence and experience had significant positive influences, as well. Professional development was positively influential but moderately. Challenges were not found to have any statistical significance.

The above regression results offer useful theoretical integration of TAM with TPACK framework. From the point of view of TAM theory, the importance of perceived benefits affirms the primacy of perceived usefulness in determining technology adoption. At the same time, the importance of familiarity and confidence supports the TPACK-based assumption that technological competency is a critical component of technology integration into education. In other words, the results indicate that the teachers' preparedness to integrate AI into their education is developed in terms of technological competency and positive perceptions of education.

In addition to this, another vital finding from the research is related to demographic differences. As found by means of the Kruskal-Walli's test, there were significant differences by age with respect to familiarity and confidence in using AI. It can be seen that younger teachers showed higher rankings when it comes to both aspects. This can be explained by the fact that the younger generation has more exposure to technologies.

The results from Mann-Whitney U test revealed no significant differences in familiarity or confidence between urban and rural teachers. This result demonstrates that AI readiness problems are not largely influenced by the geographical context of the teacher's work environment. On the contrary, the results indicate that problems associated with AI integration could be systemic in nature as they affect teachers regardless of the educational environment they are working in.

In summary, the results suggest that AI readiness is a multi-dimensional construct affected by factors related to capabilities, perceptions, and institutions. Thus, the study contributes to the existing body of literature on educational technology by showing that teachers' readiness to incorporate AI cannot be explained in terms of mere access to technology and demographic variables alone but is dependent on their interaction.

The combination of TAM and TPACK in this research gives a holistic framework for explaining the interactions mentioned. The TAM model offers an insight into the role played by the usefulness perception in forming acceptance attitudes, while the TPACK framework reveals how technology knowledge and confidence lead to implementation readiness. Professional development acts as a linking device between the two factors.

Additionally, the results indicate that the effective integration of artificial intelligence into educational practice requires not only technological advancement but also sustained investment in teachers' professional development and pedagogically informed AI literacy.

Proposed AI Readiness and Professional Development Integration

In relation to the transformative effect of AI on education, a strong "culture of AI" must be established. The goal of this culture is to generate an academic atmosphere where AI would be not only accepted but also comprehended and analyzed in contrast to being feared. Academic society should develop an environment where AI can become an inseparable part of everyday academic experience. This may be achieved through the regular meetings and discussions with teachers, professors, and students about recent advances in the field, the ethics of AI, and proper practices. At the same time, educational courses should stop with their superficial approach towards the topic of AI and engage in deeper analysis of real-life examples of theoretical and practical convergence [14]. In doing so, one will ensure that both the students and teachers are well acquainted with the multiple uses of AI in society and education. In addition, the subjects related to AI must be included systematically in each educational model, if possible. Through such an approach, one will make sure that the students are always exposed to AI and its uses in different areas of study and hence prepare them for the future where AI plays an important role in many professions.

In addition, setting up mandatory courses on AI literacy for all the students can become the basis for this educational model [9]. Training in AI literacy and ethics should not be just restricted to instructors of higher education; rather, it should be imparted to educators from all levels who are currently working. Educators would be able to improve their learning outcomes of students along with handling the challenges of using advanced technology [14]. Promoting initiatives led by students and improving the cooperation with AI specialists is another important aspect. Apart from the educational process within the walls of the classroom, voluntary cooperation with AI specialists, technology firms, and other educational facilities would be an important source of information for the students. This would enable the students to get a better idea about the application of AI.

Besides, the promotion of AI culture should include the promotion of student initiatives related to AI [15]. These initiatives promote active learning, peer collaboration, and innovation, allowing students to develop critical thinking and problem-solving skills which are essential for navigating a rapidly evolving digital landscape.

CONCLUSION

In this study, the findings demonstrate that teachers' knowledge of AI concepts and tools is positively associated with their confidence in applying AI in educational settings. Greater familiarity with AI technologies appears to enhance educators' readiness to integrate these tools into teaching and learning activities. At the same time, limited access to technology, insufficient training opportunities, and a lack of practical experience remains significant barriers to effective AI adoption.

These results underscore the importance of continuous professional development in strengthening teachers' AI-related competencies. Targeted training programs, hands-on workshops, access to AI resources, and peer-support initiatives may contribute to building the knowledge and confidence required for responsible and effective AI integration. The findings also highlight the need for institutional and policy-level support, including the development of ethical and legal frameworks and the provision of adequate technological infrastructure.

By identifying key factors influencing AI adoption among Albanian teachers, this study contributes to the growing body of research on AI integration in education and provides practical insights for educational institutions and policymakers seeking to promote the effective use of AI technologies in teaching and learning. Future research may investigate the long-term effects of AI adoption on instructional practices, teacher performance, and student learning outcomes.

AUTHOR CONTRIBUTIONS

Conceptualization, E.Ç., and V.P.; Methodology, V.P.; Validation, V.P.; Investigation, V.P., and E.Ç.; Resources, E.Ç., and E.K.; Data Curation, V.P., and E.Ç.; Writing – Original E.Ç., V.P., E.K., and J.B.; Visualization, E.K., and J.B.; Supervision, E.Ç., and E.K.; Project Administration, E.Ç., E.K., V.P., and J.B.

DATA AVAILABILITY STATEMENT

Data is contained within the article.

CONFLICT OF INTERESTS

The authors should confirm that there is no conflict of interest associated with this publication.

REFERENCES

1. Casal-Otero, L., Catala, A., Fernández-Morante, C., Taboada, M., Cebreiro, B., Barro, S. AI Literacy in K-12: A Systematic Literature Review. *International Journal of STEM Education* **2023**, *10*(1), 29.
2. Black, N. B., George, S., Eguchi, A., Dempsey, J.C., Langran, E., Fraga, L., Brunvand, S., Howard, N. A Framework for Approaching AI Education in Educator Preparation Programs. *Proceedings of the AAAI Conference on Artificial Intelligence* **2024**, *38*(21), 23069–23077.

3. MacDowell, P., Moskalyk, K., Korchinski, K., Morrison, D. Preparing Educators to Teach and Create With Generative Artificial Intelligence. *Canadian Journal of Learning and Technology* **2024**, *50*(4), 1–23.
4. Karataş, F., Yüce, E. AI and the Future of Teaching: Preservice Teachers' Reflections on the Use of Artificial Intelligence in Open and Distributed Learning. *The International Review of Research in Open and Distributed Learning* **2024**, *25*(3), 304–325.
5. Ayanwale, M.A., Sanusi, I.T., Adelana, O.P., Aruleba, K.D., Oyelere, S.S. Teachers' Readiness and Intention to Teach Artificial Intelligence in Schools. *Computers and Education: Artificial Intelligence* **2022**, *3*, 100099.
6. Granström, M., Oppi, P. Assessing Teachers' Readiness and Perceived Usefulness of AI in Education: An Estonian Perspective. *Frontiers in Education* **2025**, *10*, 1622240.
7. Velander, J., Taiye, M. A., Otero, N., Milrad, M. Artificial Intelligence in K-12 Education: Eliciting and Reflecting on Swedish Teachers' Understanding of AI and Its Implications for Teaching & Learning. *Education and Information Technologies* **2024**, *29*(4), 4085–4105.
8. Zhang, H., Lee, I., Moore, K. An Effectiveness Study of Teacher-Led AI Literacy Curriculum in K-12 Classrooms. *Proceedings of the AAAI Conference on Artificial Intelligence* **2024**, *38*(21), 23318–23325.
9. Walter, Y. Embracing the Future of Artificial Intelligence in the Classroom: The Relevance of AI Literacy, Prompt Engineering, and Critical Thinking in Modern Education. *International Journal of Educational Technology in Higher Education* **2024**, *21*(1), 15.
10. Sperling, K., Stenberg, C.-J., McGrath, C., Åkerfeldt, A., Heintz, F., Stenliden, L. In Search of Artificial Intelligence (AI) Literacy in Teacher Education: A Scoping Review. *Computers and Education Open* **2024**, *6*, 100169.
11. Molefi, R.R., Ayanwale, M.A., Kurata, L., Chere-Masopha, J. Do In-Service Teachers Accept Artificial Intelligence-Driven Technology? The Mediating Role of School Support and Resources. *Computers and Education Open* **2024**, *6*, 100191.
12. Du, H., Sun, Y., Jiang, H., Islam, A. Y. M. A., Gu, X. Exploring the Effects of AI Literacy in Teacher Learning: An Empirical Study. *Humanities and Social Sciences Communications* **2024**, *11*(1), 559.
13. al-Zyoud, H.M.M. The Role of Artificial Intelligence in Teacher Professional Development. *Universal Journal of Educational Research* **2020**, *8*(11B), 6263–6272.
14. Yim, I.H.Y., Wegerif, R. Teachers' Perceptions, Attitudes, and Acceptance of Artificial Intelligence (AI) Educational Learning Tools: An Exploratory Study on AI Literacy for Young Students. *Future in Educational Research* **2024**, *2*(4), 318–345.
15. Brandão, A., Pedro, L., Zagalo, N. Teacher Professional Development for a Future with Generative Artificial Intelligence—An Integrative Literature Review. *Digital Education Review* **2024**, *45*, 151–157.
16. Rütti-Joy, O., Winder, G., Biedermann, H. Building AI Literacy for Sustainable Teacher Education. *Zeitschrift Für Hochschulentwicklung* **2023**, *18*(4), 175–189.
17. Dignum, V. Responsible Artificial Intelligence: Recommendations and Lessons Learned. In *Responsible AI in Africa*, Eke, D. O., Wakunuma, K., Akintoye, S., Eds., Springer International Publishing: Cham, **2023**, pp. 195–214.
18. Leaton Gray, S. Artificial Intelligence in Schools: Towards a Democratic Future. *London Review of Education* **2020**, *18*(2), 163–177.

19. Arranz Garcia, O., Del Carmen Romero García, M., Alonso-Secades, V. Perceptions, Strategies, and Challenges of Teachers in the Integration of Artificial Intelligence in Primary Education: A Systematic Review. *Journal of Information Technology Education: Research* **2025**, *24*, 006.
20. Pua, D.J., Peyton, D.J., Brownell, M.T., Contesse, V.A., Jones, N.D. Preservice Observation in Special Education: A Validation Study. *Journal of Learning Disabilities* **2021**, *54*(1), 6–19.
21. Pelaez, A., Jacobson, A., Trias, K., Winston, E. The Turing Teacher: Identifying Core Attributes for AI Learning in K-12. *Frontiers in Artificial Intelligence* **2022**, *5*, 1031450.
22. Blume, J. *Exploring the Potentials and Challenges of Virtual Distribution of Contemporary Art*, **2013.**
23. Dempere, J., Modugu, K., Hesham, A., Ramasamy, L. K. The Impact of ChatGPT on Higher Education. *Frontiers in Education* **2023**, *8*, 1206936.
24. Yan, L., Sha, L., Zhao, L., Li, Y., Martinez-Maldonado, R., Chen, G., Li, X., Jin, Y., Gašević, D. Practical and Ethical Challenges of Large Language Models in Education: A Systematic Scoping Review. *British Journal of Educational Technology* **2024**, *55*(1), 90–112.
25. European Union. Regulation (EU) 2016/679 of the European Parliament and of the Council of 27 April 2016 on the Protection of Natural Persons with Regard to the Processing of Personal Data and on the Free Movement of Such Data and Repealing Directive 95/46/EC (General Data Protection Regulation). Available online: https://eur-lex.europa.eu/eli/reg/2016/679/2016-05-04 (access date 22 February 2026).
26. Cardona, M.A., Rodríguez, R.J., & Ishmael, K. Artificial Intelligence and the Future of Teaching and Learning, U.S. Department of Education, Office of Educational Technology, **2023.**
27. Sanusi, I.T., Ayanwale, M.A., & Chiu, T.K.F. Investigating the Moderating Effects of Social Good and Confidence on Teachers' Intention to Prepare School Students for Artificial Intelligence Education. *Education and Information Technologies*, **2024**, *29*(1), 273–295.
28. Septiyanti, M., Inderawati, R., & Vianty, M. Technological Pedagogical and Content Knowledge (TPACK) Perception of English Education Students. *English Review: Journal of English Education*, **2020**, *8*(2), 165–174.
29. Braun, V., & Clarke, V. Using Thematic Analysis in Psychology. *Qualitative Research in Psychology*, **2006**, *3*(2), 77–101.
30. Angeli, C., & Valanides, N. Epistemological and Methodological Issues for the Conceptualization, Development, and Assessment of ICT–TPCK: Advances in Technological Pedagogical Content Knowledge (TPCK). *Computers & Education*, **2009**, *52*(1), 154–168.
31. Schmidt, D. A., Baran, E., Thompson, A. D., Koehler, M. J., Mishra, P., & Shin, T. Technological Pedagogical Content Knowledge (TPACK): The Development and Validation of an Assessment Instrument for Preservice Teachers. *Journal of Research on Technology in Education*, **2009**, *42*(2), 123–149.
32. Ritter, N. L. Technology Acceptance Model of Online Learning Management Systems in Higher Education: A Meta-Analytic Structural Equation Model. *International Journal of Learning Management Systems*, **2017**, *5*(1), 1–15.
33. Gjetani, N., Bushi, J., & Kristo, E. Schreibkompetenz im DaF-Unterricht: Feedback, Fehlerkorrektur und Motivation im schulischen Kontext. *Studia Germanistica*, **2026**, *38*, 49–69.