

Teachers' technopedagogical competence and perspectives on artificial intelligence use in education

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Highlights

- Teachers' AI-related technopedagogical skills remain at a low-to-moderate level.
- Age, seniority, and prior AI experience significantly influence AI integration.
- Teachers view AI as a complementary tool rather than a human replacement.

Abstract

Digitalization has made technology-supported materials essential, yet their practical use remains inefficient. This study investigates the link between teachers' technopedagogical competencies and their perspectives on integrating artificial intelligence (AI) into education. Using an explanatory sequential mixed-methods approach, research was conducted with 297 teachers in Gaziantep during the 2024–2025 academic year. Quantitative data was collected via an Intelligent TPACK framework scale, while qualitative insights were gathered through semi-structured interviews with 10 participants. Data analysis included t-tests, ANOVA, Scheffé post hoc tests, and content analysis. Results indicate that teachers' AI-related technopedagogical skills are at a low-to-moderate level. While gender showed no significant difference, variables such as age, seniority and prior experience with Web 2.0 or AI tools caused notable differences. Qualitatively, teachers reported using AI for instructional design, assessment efficiency, and professional development. However, concerns were raised regarding data security, overreliance, and the lack of emotional depth in AI interactions. Ultimately, the study concludes that AI should serve as a complementary tool rather than a replacement for teachers.

Article Info: Research Article

Keywords: AI tools, use of AI in education, teacher perspectives

1. Introduction

Since the early ages, human society has been in a state of constant evolution. This progress has been incessantly affecting every part of life and leaving a permanent mark on every aspect of life. Today, artificial intelligence (AI) appears as one of the most significant technological developments, bringing about remarkable changes in how people live and work (Nabiyev, 2012; Obschonka & Audretsch, 2020). What makes AI different from the innovations of the past is its capacity to perform tasks that were once unique to humans, such as logical thinking, learning from experience, and making independent decisions (Copeland, 1998; Nabiyev, 2012). The influence of AI is felt not just in peoples' daily routines but across almost every professional field, and education is no exception. Recent research indicates that AI has the power to transform the learning experience by providing personalized environments that address the specific needs of each student (Chai et al., 2023; Yan et al., 2024). Features like tracking student performance in real-time and providing immediate feedback are making AI-based tools a more common part of the classroom (Bayne, 2015; Heffernan & Heffernan, 2014). However, integrating these tools into the teaching and learning environment successfully is not just about having the technology; it depends heavily on the teachers who use them. In fact, how well these technologies work in practice is closely linked

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to teachers' technopedagogical skills and their personal attitudes toward using such tools (Koehler & Mishra, 2009; Meço & Coştu, 2022).

2. Literature

Education is a broad system that provides development chances for the individual and the society. It is not just about academic facts; but it also includes growing mentally, socially, and emotionally. Dewey (1916) described education as an active process based on experience, while Freire (1978) saw it as a way for people to gain freedom and change the world. Both thinkers believe that learning never stops and goes far beyond the walls of a classroom. Similarly, UNESCO (2020) says education is about gaining the skills needed to help society, which shows how important it is for both personal and social growth. Education helps people become thinkers who can solve problems and act as responsible citizens. Today, this goal of giving everyone an equal chance in education is increasingly supported by new technologies. In line with this, in the 21st century, new technologies have quickly changed how teaching and learning is applied. These tools have made it much easier to reach information and have made classrooms more interesting. One of the biggest changes is the use of AI, which can change how lessons are handled and how student progress is followed (Firmin & Genesi, 2013). This means AI is no longer just a simple tool for teachers; it is also a partner that helps them make their teaching more understandable and accessible for the learners.

Specifically, AI-supported systems enable personalized learning by adapting education to each student's pace, style, and needs. Therefore, AI is both a technology and a pedagogical tool. It helps reduce teachers' workload, provides instant feedback at learning gaps, and tracks student progress. Additionally, AI offers valuable opportunities to support the active participation of students with special needs in learning (Hussein, Hussein, & Al-Hendawi, 2025). These technological developments directly correspond to broader educational demands. According to OECD (2015), technological advances have raised demand for complex, high-level skills in the labor market. This requires education systems to adopt a competency-based approach. Interdisciplinary talents such as critical thinking, problem-solving, and digital literacy are now important goals. AI technologies serve as powerful tools to help educators achieve these aims. Consequently, AI has the potential to play a key role in shaping both current and future teaching and learning paradigms.

2.1. Explaining Technopedagogical Competence via the Intelligent TPACK Framework

To systematically analyze a teacher's capacity to navigate the opportunities and disruptions of artificial intelligence, Intelligent TPACK Framework is mostly used as the main theoretical base for such researches. Developed as a paradigm shift from Koehler and Mishra's (2009) traditional TPACK model, the Intelligent TPACK construct (Çelik, 2023) directly addresses the unique attributes of machine intelligence. Unlike static software or hardware tools, AI operates with a distinct digital agency—executing adaptive behaviors, generating novel content, and introducing complex ethical challenges. Consequently, this framework expands the teacher competence construct into five specialized dimensions: Technological Knowledge of AI, Technopedagogical Knowledge, Technological Content Knowledge, Technopedagogical Content Knowledge, and Ethical Competency. This study employs this structured model to operationalize and interpret the complex skill sets required by contemporary secondary educators.

2.2. Benefits and Drawbacks

Artificial intelligence (AI) is becoming a more common and effective tool in education. The core goal of education, helping individuals gain knowledge, skills, attitudes, and values, is evolving with technological advances (Dewey, 1916; Freire, 1978; UNESCO, 2020). AI-supported systems improve learning by making it more personal. These tools create classroom environments that are more effective, flexible, and lasting (Firmin & Genesi, 2013). However, this change also brings some challenges regarding ethics, social life, and technological infrastructure. That's why AI's development and its different roles in education from many points of view need to be considered.

The concept of artificial intelligence was first explained in 1956 by John McCarthy as "the science of making smart computer programs" (McCarthy, 2004). Today, AI is at the heart of the digital revolution,

including areas like machine learning and smart algorithms (Schwab, 2018). AI has developed in three main steps: Narrow AI (ANI), which does specific jobs; General AI (AGI), which can think like a human (Gottfredson, 1997); and Super AI (ASI), which are systems that go beyond human intelligence (Bostrom, 2006). This progress is changing technology, jobs, and economy by creating new types of work (Buttazzo, 2023).

Using AI in schools actually goes back to 1950s and has changed a lot since then. It began with simple computer lessons, but now it supports student-centered learning through "Intelligent Tutoring Systems" (ITS) (Nwana, 1990). These systems combine psychology and engineering to adopt each lesson to each student's speed and style. They give instant feedback and keep track of how a student learns (Chen, Chen, & Lin, 2020). This helps teachers make better choices for their students.

Another big boost for AI in education comes from Web 2.0 tools. Smart programs like ChatGPT and various simulations help students learn actively and help teachers prepare their lessons (Humble & Mozeliuss, 2019). For example, tools like MathGPTPro help with math, while TalkPal or Pi.ai are used for languages. Fun platforms like Kahoot or Padlet, and science tools like ChemCollective make lessons more exciting and motivating. These tools help teachers teach their topic better and keep students motivated (Firmin & Genesi, 2013).

The benefits of AI in education are quite clear. Personal lessons fit each student's needs, making learning much faster (Chen et al., 2020). These systems adjust in real-time to close learning gaps. Also, AI can handle tasks like grading and tracking assignments, which thus gives teachers more free time. It even helps students in remote areas get a good education, making things more fair (Qiu, 2020). In this way, AI helps make education more equal for everyone (Dishon, 2017).

On the other hand, AI has some downsides and ethical problems. Not everyone has the same internet or computer facilities, which can create a gap between students (Buttazzo, 2023). Keeping student data private and safe is also a major concern (Bodó et al., 2017). Also, if a student spends too much time with AI, they might not feel the need to talk to their friends, which results in the regression of social skills. Therefore, being open, responsible, and protecting human rights is very important when using AI. So as to use AI appropriately, not only technology, but also social and ethical rules must be taken into consideration.

2.3. Problem Statement

Research on AI in education looks at how it affects teachers, students, and the learning process from many different aspects. Studies show that AI is changing how teaching is carried out and how schools are managed. Generally, teachers have a positive view toward AI and are ready to use it (Kaya, 2023), but they still need more digital training to fill their skill gaps. Researchers like Çelik et al. (2022) point out that teachers are not just users; they are active guides for these AI systems. Also, Chan and Louisa (2023) found that AI helps people work together and supports teachers instead of replacing them. Interestingly, while younger Generation Z teachers are very positive about AI, older generations (X and Y) focus more on the ethical side of teaching (Chan & Lee, 2023). Even with AI's growth, experts agree that teachers will always be the primary guides in the classroom (Mujiono, 2023).

Because of the Fourth Industrial Revolution, AI has created new types of jobs and skills. This means people need to keep learning throughout their lives. Scholars like Aktaş (2022) suggest that education systems must adapt to these changes with the right rules in place. Even though teachers are becoming more aware of AI, they still need ongoing support and professional development to keep up with the new developments (Chounta et al., 2022). It is also seen that teachers have a positive view of Web 2.0 tools for social interaction and creativity (Çalışkan et al., 2019). The pandemic made AI tools even more important globally, showing that teacher training must be increased (İşler & Kılıç, 2021).

Although artificial intelligence tools are spreading fast in schools, we still do not know enough about how teachers' technopedagogical knowledge changes with these smart tools. Traditional models, like the classic TPACK, usually view technology as a simple, passive tool like a smartboard. However, AI is fundamentally different because it can create content and make choices on its own. For this reason, we need to look at this

issue through the 'Intelligent TPACK' framework (Çelik, 2023). While contemporary research highlights the potential of large language models to provide personalized environments (Yan et al., 2024), recent studies show that using these tools effectively requires moving past basic digital skills toward stronger AI literacy and deep digital proficiency (Hava & Babayiğit, 2025). Consequently, there remains a critical gap in the literature regarding how secondary school teachers' integrated technopedagogical knowledge structurally adapts to these autonomous technologies over time. Most existing studies treat AI integration as an isolated technical skill or focus strictly on general student perspectives (Hwang et al., 2020), ignoring the multi-dimensional training, technical confidence, and ethical responsibility that teachers actually need during professional development programs (Hussein et al., 2026). In an increasingly digitalized educational landscape, determining teachers' readiness for this shift is crucial, serving not only to assess the current state of the system but also to provide information about the possible future teacher-training policies (Sarıbaş & Babadağ, 2015; Saniel, 2017). Furthermore, the difficulties faced when bringing AI tools into the classroom are often about pedagogical adaptation rather than just technical issues; therefore, it is important for teachers to see technology as a force that can truly change the way they teach (Tuğluk & Gök-Çolak, 2019). Within the scope of the Intelligent TPACK framework, specific demographic and professional variables—such as gender, age, seniority, and educational attainment—were chosen systematically to represent a teacher's professional background and technological openness.

To address this gap in the literature, this study aims to examine teachers' AI-related technopedagogical competencies and their professional perspectives on integrating artificial intelligence into teaching and learning processes. For this purpose, teachers' competencies and perspectives were comprehensively analyzed according to specific demographic and professional variables, including gender, age, seniority, educational attainment, prior experience in using AI tools, and prior experience in using Web 2.0 tools.

2.4. Research Model / Design

This study uses a mixed-methods research design, which allows for the use of both quantitative and qualitative data. The research is based on a pragmatic approach. This perspective is helpful because it combines different points of view to answer research questions more fully, especially when one single method might not be enough (Bryman, 2012; Creswell & Clark, 2007). Explanatory sequential design has been used as the model of the study. In the first part of the study, quantitative data were obtained to see how confident teachers feel with technology and to analyze their general attitudes toward AI (Dawadi et al., 2021; Terrell, 2012). To get a better and deeper understanding of what teachers really think about AI tools, semi-structured interviews with teachers were held. In this study, the explanatory sequential design was chosen to create a clear bridge between the two phases. First, the quantitative phase helped us see the general level of teachers' skills and how these skills change according to demographic variables. Then, the qualitative phase was used to explain the reasons behind these statistical results, especially the low-to-moderate competency levels found in the first part (Creswell & Clark, 2007).

2.5. Data Collecting Tools

Intelligent TPACK Scale: Quantitative data were collected using the 27-item “Intelligent TPACK (Technological Pedagogical Content Knowledge) Scale,” a 7-point Likert-type tool developed by Çelik (2023) to assess technopedagogical competencies. Administered via Google Forms to 297 teachers, the scale includes five subdimensions: technological, technopedagogical, technological content, technopedagogical content knowledge, and ethical competency. Although the scale consists of these five subdimensions, the analysis in this study was conducted using the overall total score of the scale, as suggested in similar technology integration literature. The construct validity of the scale for our sample was supported by a high overall internal consistency coefficient (Cronbach's $\alpha = .987$), confirming the reliability of using the total score to measure general AI competency.

Interview Form: Qualitative data were collected using a 12-item interview form designed to elicit teachers' perspectives on the use of artificial intelligence in education. The interview form was developed by researchers through a systematic process that included a comprehensive literature review, consultation with experts, and a pilot study.

2.6. Study Group

The quantitative part of the research included 297 teachers working in high schools in the center of Gaziantep during the 2024–2025 school year. The personal and professional details of these participants can be found in Table 1 below.

Table 1.

Descriptive characteristics of the teachers who participated in the study.

		N	%
Gender	Female	135	45.4
	Male	162	54.5
Age	21-30	51	17.2
	31-40	131	44.2
	41 and over	114	38.5
Seniority	0-5	57	19.1
	6-10	74	24.9
	11-15	59	19.8
	16-20	59	19.8
	21 and over	48	16.1
Educational attainment	Bachelor's Degree	249	83.8
	Postgraduate Degree	48	16.2
Previous experience using AI tools	Yes	69	23.3
	No	228	76.7
Previous experience using Web 2.0 tools	Yes	76	25.5
	No	220	74.5

For the qualitative part of the study, 10 teachers were selected from the original group using criterion sampling. These 10 participants were specifically selected from the main group because they had real experience using generative AI or Web 2.0 tools in their classrooms. This specific criterion was established to ensure that the participants possessed sufficient practical experience and pedagogical familiarity with AI, which is essential in qualitative research for obtaining rich, in-depth, and meaningful perspectives rather than hypothetical opinions. By interviewing these teachers, we aimed to deeply understand and explain the quantitative patterns we found in the wider group (Bryman, 2012). The group consisted of three female and seven male teachers. Their ages were fairly distributed: three were between 21 and 30, four were between 31 and 40, and three were aged 41 or older. Their professional experience also varied, with three teachers having 0–5 years in the field, three having 6–10 years, and four having 11 to 21 or more years of experience. Regarding their education, seven held bachelor's degrees while three had completed postgraduate studies. This was important to mention because our quantitative results showed that educational attainment significantly affects teachers' technopedagogical skills, and we wanted to see how this difference is reflected in their qualitative opinions.

2.7. Data Analysis

Quantitative data were analyzed using SPSS 25 software. Initial normality tests confirmed that the data followed a normal distribution, justifying the use of parametric tests, including independent samples t-tests, one-way ANOVA, and the Scheffé post-hoc test. Although the demographic subgroups had unequal sample sizes, the assumptions of normality (with skewness and kurtosis values within acceptable ranges) and homogeneity of variances (verified via Levene's test, $p > .05$) were fully met across all groups. Furthermore, the Scheffé post-hoc test was specifically selected for multiple comparisons, as it is highly robust and statistically recommended for controlling Type I error rates when dealing with unequal group sizes.

For the qualitative data, MAXQDA software was utilized for systematic content analysis. To ensure inter-coder reliability, two researchers coded the data independently. Using the formula by Miles and Huberman (1994), the inter-coder agreement was calculated as .92. Any discrepancies in coding were resolved through discussion to reach a consensus. The analysis involved the development of specific codes, sub-themes, and themes, supplemented by direct quotations to accurately reflect the participants' "voices" and perspectives.

2.8. Validity and Reliability

To ensure the reliability of the quantitative phase, internal consistency was calculated. While the original "Intelligent TPACK Scale" reported a Cronbach's alpha coefficient of .868, the current study yielded a reliability coefficient of .987, indicating high internal consistency (DeVellis & Thorpe, 2021).

In the qualitative phase, several strategies were employed to ensure the trustworthiness and content validity of the research instrument. The interview questions were initially reviewed by three subject matter experts to evaluate their alignment with the research goals. Additionally, two language specialists provided feedback on the clarity and formatting of the items. Following these expert consultations, a pilot study was conducted with a small group of teachers to test the flow and comprehensibility of the questions. Based on the pilot results, minor adjustments were made, and the interview protocol was finalized for the main data collection phase.

2.9. Research Procedures

Following formal approval from the Gaziantep Provincial Directorate of National Education, data collection was conducted over a two-month period based on voluntary participation. Specifically, for the qualitative phase, first teachers who met the criteria were identified, and among those eligible, only the ones who volunteered to participate were interviewed. In the quantitative phase, the "Intelligent TPACK Scale" was administered to 297 teachers via Google Forms. For the qualitative phase, face-to-face, audio-recorded interviews were conducted with 10 teachers who possessed both experience and training in AI tools. Each interview lasted approximately 25 minutes, with participants selected from diverse academic backgrounds to capture a broad range of perspectives. The interviews were conducted directly by the researcher, who acted as an objective facilitator. To ensure bias-free data collection, the researcher avoided sharing personal opinions during the sessions and focused solely on guiding the conversation based on the semi-structured interview guide. The research strictly adhered to ethical principles, ensuring participant confidentiality and data security. All participants were anonymized using codes (e.g., T1, T2, T3) to protect their identities.

3. Findings

The findings obtained from the study are presented under two main headings: quantitative findings and qualitative findings. To follow the explanatory sequential design, the quantitative findings are presented first to establish the general patterns of teachers' Intelligent TPACK skills. These statistical paths will then be directly cross-examined and explained by the qualitative insights in the next section, linking what the data shows with why it happens.

3.1. Quantitative Findings

The findings related to the technopedagogical competencies of teachers regarding the use of AI in teaching and learning processes are presented in Table 2.

Table 2.

Teachers' Technopedagogical Competencies Regarding the Use of AI in Teaching and Learning Processes.

	N	Minimum	Maximum	$\bar{X}$	S
AI competency scores	297	27	189	79.77	39.07

As shown in Table 2, teachers' technopedagogical competency with AI tools is at a low-to-moderate level with scores ranging from 27 to 189 and an average of 79.77. This suggests teachers' familiarity with AI but also need for improvement. The study aims to examine how these competencies vary across different variables. The findings related to the gender variable are presented in Table 3.

Table 3.

Independent Samples t-Test Results of Technopedagogical Competencies in Using AI Tools by Gender.

Gender	N	$\bar{X}$	S	t	df	p
Female	135	79.2	37.2	0.22	295	0.82
Male	162	80.2	40.6	0.22	292	

As indicated in Table 3, teachers' technopedagogical competencies regarding the use of AI tools in education do not differ significantly in terms of gender ($t = 0.22$, $p > .05$). The findings related to the age variable are presented in Table 4.

Table 4.

One-Way ANOVA Results of Technopedagogical Competencies in Using AI Tools by Age.

Group	N	$\bar{X}$	S	F	P	Scheffé
21-30	51	105.2	40.25	15.834	0.00	21-30, 31-40
31-40	131	78.36	36.93			21-30, 41+
41 and more	114	69.94	36.34			

As seen in Table 4, a significant difference was found between the 21–30 and 31–40 age groups, as well as between the 21–30 and 41 and older age groups [$F(2,293)=15.834$, $p<.05$]. This significant difference was in favor of the 21–30 age group in both comparisons. This higher performance in the 21-30 age group shows that younger educators naturally adapt quicker to the complex technical dimensions of the Intelligent TPACK model, as they are more open to prompt engineering and algorithm navigation. The findings related to the variable of seniority are presented in Table 5.

Table 5.

One-Way ANOVA Results of Technopedagogical Competencies Related to AI Tools Usage by Seniority.

Group	N	$\bar{X}$	S	F	P	Scheffé
0-5 years	57	103.15	37.98	7.940	0.00	0-5, 6-10
6-10 years	74	76.87	37.58			0-5, 11-15
11-15 years	59	70.95	37.12			0-5, 16-20
16-20 years	59	68.26	36.62			
21 and more	48	81.48	37.44			

As seen in Table 5, a significant difference was found between teachers with 0–5 years of experience and those with 6–10, 11–15, and 16–20 years of experience [$F(4,292)=7.940$, $p<.05$]. This significant difference was in favor of the group with 0–5 years of experience in all three comparisons. Similarly, the lower scores among senior teachers highlight a clear need for framework-driven training, as traditional technology integration habits are often insufficient for managing the autonomous nature of artificial intelligence. The findings related to the educational attainment variable are presented in Table 6.

Table 6.

Independent Samples t-Test Results of Technopedagogical Competencies Related to the Use of AI Tools by Educational Attainment.

Educational Att.	N	$\bar{X}$	S	t	df	p
Bachelor's Degree	249	76.29	37.0	-3.5	295	0.027
Postgraduate Degree	48	97.83	44.59			

According to the analysis based on educational attainment, teachers with postgraduate degrees were found to have higher technopedagogical competency scores compared to those with only undergraduate degrees ($t = -3.5$, $p < .05$). The findings related to the variable of prior use of AI tools for educational purposes are presented in Table 7.

Table 7.

Independent Samples t-Test Results for Technopedagogical Competencies Related to the Use of AI Tools According to Prior Use of AI Tools for Educational Purposes.

Prior Use of AI Tools	N	$\bar{X}$	S	t	df	p
Yes	69	120.29	33.9	11.96	295	0.00
No	228	67.51	31.54			

When Table 7 is examined, it is observed that teachers who have previously used AI tools for educational purposes have significantly higher technopedagogical competence levels compared to those who have not

used such tools ($t=11.96$, $p<.05$). The findings related to the variable of having previously used Web 2.0 tools for educational purposes are presented in Table 8.

Table 8.

Independent Samples T-Test Results of Technopedagogical Competencies Regarding the Use of AI Tools According to Previous Use of Web 2.0 Tools for Educational Purposes.

Prior Use of Web 2.0 tools	N	$\bar{X}$	S	t	df	p
Yes	76	116.24	34.34	11.24	294	0.00
No	220	67.20	32.23			

As seen in Table 8, teachers who have previously used Web 2.0 tools for educational purposes have significantly higher levels of technopedagogical competence regarding the use of AI tools compared to those who have never used such tools ($t = 11.24$, $p < .05$).

3.2. Qualitative Findings

Under this heading, findings related to teachers' purposes for using AI and AI-supported Web 2.0 tools, their opinions about the use of AI in education, their suggestions, and their expectations regarding the future role of AI are presented. Teachers' purposes for using AI tools are shown in Table 9.

Table 9.

Teachers' Purposes for Using AI Tools.

Theme	Codes	Participant Codes
Designing Instruction	Professional development	T1, T3, T5, T7, T9
	Writing questions	T2
	Preparing presentations	T6
Individual Use	Scientific research	T1, T4, T10
	Computer games	T3, T8
	Software learning	T6
	Language learning	T7

Teachers' purposes for using AI tools are categorized under designing instruction and individual use. In terms of designing instruction, teachers such as T1, T3, T5, T7, and T9 utilize AI tools primarily for their professional development, while others like T2 and T6 benefit from these technologies to write exam questions or prepare classroom presentations. For individual use, participants engage with AI for diverse personal activities. Specifically, T1, T4, and T10 use AI to facilitate scientific research, while T3 and T8 use it for computer games. Additionally, T6 employs AI for software learning, and T7 uses it for language learning. These patterns indicate how teachers organically integrate these tools into both their academic workloads and personal growth. Regarding individual use, T1 explained how AI tools directly assist in the academic research process as follows: “...For example, we use tools while writing scientific papers—tools for literature review, tools for finding articles, or even just tools to format our Word documents...” When discussing how AI contributes to teaching and lesson design, T3, a mathematics teacher, emphasized its role in professional development by stating: “...Especially developments related to AI, various innovations made possible by AI, and how algorithms work and what principles they follow. All of these contribute to my professional life. As a mathematics teacher, I benefit from AI in many areas that make my job easier.” The views of the participants regarding the use of AI in teaching and learning are presented in Table 10.

Table 10.

Teachers' Views on the Use of AI Tools.

Theme	Sub theme	Code	Participant Codes	
Teacher Dimension	Contribution and Usage	Should be used more effectively	T1, T2, T3, T4, T6, T7, T9, T10	
		Makes the job easier	T1, T2, T3, T5, T7, T9, T10	
		Researching innovations in the AI field	T4, T7, T10	
	Challenges	Teachers above a certain age being distant from technology	T1, T2, T5, T6, T8, T10	
		Low technological literacy	T3, T5, T8, T9	
		Requires preparation	T1, T2, T7	
		Resistance to innovation	T8	
		Slows down / dulls	T5	
		Needs	Need for self-improvement	T1, T3, T4, T6, T7, T9
			Need for face-to-face in-service training	T2
	Need for more opportunities		T10	
	Should play a guiding role		T3, T9	
	Need for teachers who actively use AI		T10	
	Student Dimension	Positive Effects	Increases motivation	T1, T2, T3, T4, T5, T6, T7, T8, T9, T10
High AI awareness			T1, T3, T4, T7, T10	
Beneficial for conscious students			T2, T9	
Increases readiness			T6	
Negative Effects		Prevents/delays socialization	T1, T2, T3, T5, T8, T10	
		Leads to dependency on ready-made answers	T1, T2, T5, T8, T9	
		Used for entertainment purposes	T3, T4, T6, T8, T10	
		Limits imagination	T5, T8, T9	
		Risk of accessing different (negative) platforms	T2, T10	
		Reduces attention	T7	
		Awareness and Ethical Issues	Low AI awareness for educational purposes	T1, T2, T5, T8, T9
Low ethical consideration in AI use			T10	
Teaching-Learning Process Dimension			Easiness and Effectiveness	Provides variety of materials
		Practicality		T3, T4, T6, T9
	Provides easy and accurate feedback	T3, T9		
	Becomes more interactive	T6, T7		
	Facilitates access to information	T10		
	Ensures permanent learning	T1		
	Accessibility	T4		
	Risks and Negative Aspects	Cannot address affective/emotional dimension	T1, T2, T3, T5, T7, T8, T9, T10	
		Can give incorrect results	T1, T4, T5, T9, T10	
		Insufficient infrastructure in classrooms	T2, T3, T6, T8, T10	
	Causes technology addiction	T1, T5, T8, T10		
	Needs more controlled use	T4, T7, T9		

According to Table 10, the views of teachers are grouped into three main categories: teacher dimension, student dimension, and teaching-learning process. In the teacher dimension, participants like T9 and T10

shared that AI tools make their job easier. However, teachers also highlighted several challenges. For example, T5, T8, and T9 pointed out that some older teachers remain distant from technology due to low digital literacy. To overcome these barriers, teachers like T4 emphasized that educators need to improve themselves and actively use these tools. Highlighting the positive impact on workload, T9 explained: *"...It makes the work of teachers much easier. We can receive immediate feedback from students, quickly identify what they are struggling with, and intervene accordingly."* Similarly, T4 expressed strong interest in exploring new AI systems for professional growth by stating: *"...I'm really curious about these tools. For instance, when ChatGPT was released, I checked it out right away. I would definitely try the professional version, even if only for a month, I would be willing to pay for it. When Gemini came out, I looked into how it differs from ChatGPT and explored other possible alternatives."* In the student dimension, teachers observed both positive and negative outcomes. While all ten participants agreed that AI increases student motivation, they also expressed concerns about its impact on students' personal development. Teachers like T8 warned that excessive screen time might harm social skills, while T5 argued that relying on ready-made answers limits students' imagination. Regarding social concerns, T8 noted: *"...The time spent in front of screens is increasing. Unlike before, children no longer go outside to play or socialize."* Discussing the cognitive effects, T5 pointed out how AI might affect student creativity: *"...It inevitably sets a boundary around imagination, because instead of using your own imagination, you end up relying on the machine's."* In the teaching-learning process dimension, AI is appreciated for its practical benefits, such as offering diverse teaching materials. However, participants also identified technical and pedagogical risks. Teachers like T10 expressed concerns about the accuracy of information provided by AI, while others mentioned poor school infrastructure. Focusing on the challenge of data reliability, T10 stated: *"...Since AI may directly collect information from various sources, it can sometimes be difficult to evaluate its accuracy, and students may not be able to judge whether the information is correct or not."* Conversely, describing how AI can bring positive energy to classroom activities, T6 added: *"...I think it's already easy and fun to use because it helps break the monotony of lessons."*

When we evaluate these qualitative insights together with the quantitative baseline, a clear picture emerges. The low-to-moderate competence scores in Phase 1 are not caused by a rejection of AI, but by a lack of balanced training. Teachers explicitly note that while AI brings speed and material variety, it completely lacks the emotional and affective depth needed for real teaching. Therefore, the resistance, especially among older teachers, is a pedagogical and ethical concern rather than a simple technical phobia. Teachers' suggestions regarding the use of AI tools and their expectations about the future role of AI in education are presented in Table 11.

Table 11.

Suggestions for the Use of AI Tools and Future Expectations Regarding the Role of AI in Education.

Theme	Sub-theme	Code	Participant Codes
Suggestions	Individual Development and Education	Teachers using AI tools more effectively	T1, T2, T3, T4, T5, T6, T7, T9
		Teachers improving themselves	T1, T3, T4, T6, T7, T9
		Teacher training in the AI field	T1, T2, T4, T5, T10
		Providing more opportunities for teachers	T10
	Integration into the Education Process	Introducing AI tools to students	T3, T6, T7
		Inclusion in textbooks	T8, T10
		Inclusion in annual plans	T8
		Integration into courses at education faculties	T5
	Principles and Approaches	More controlled use	T4, T7, T9
		Teacher acting as a guide	T3, T9
		AI as a tool, not a goal	T5
Expectations	Limitations	Remaining as a tool, not completely replacing the teacher	T1, T2, T3, T4, T5, T7, T8, T9, T10
		Inability to meet the affective/emotional dimension in education	T1, T2, T3, T5, T7, T8, T9, T10
	Effects	Making the teaching-learning process more interactive	T6, T7
		Replacing the teacher	T10

According to Table 11, teachers' suggestions are grouped under three main themes: individual development and education, integration into the education process, and principles and approaches. To make AI tools more effective in schools, participants suggested prioritizing teacher training and self-improvement. For example, T1, T2, T4, T5, and T10 emphasized the necessity of structured training programs in the field of AI. Discussing the rapid changes in technology and the clear need for ongoing professional support, T1 shared: *"I definitely think we need support when it comes to AI. Because every day something new emerges. AI is a concept we've only recently encountered—something we've only just started to hear about and get used to."* To achieve effective integration, T4 also pointed out the importance of learning how to locate and use these tools: *"At this point, I think it needs to be used more effectively. But I also believe that we can only use it effectively if we learn how to access it."* In terms of integrating AI into the wider education system, participants proposed introducing these tools directly to students and incorporating them into curriculum resources. T6 suggested that teachers should take the lead in presenting these tools, while T8 and T10 recommended including AI applications in textbooks. Explaining how teachers can actively guide students to educational tools, T6 stated: *"If there's something useful out there, you're usually the first to discover it, teacher. Actually, we can be the ones to introduce educational tools, and once we introduce them, students can continue using them at home."* Furthermore, T8 emphasized the need for formal curriculum integration by suggesting: *"There should be direct integration into subject-specific textbooks. In my opinion, the Ministry of National Education should ensure that Web 2.0 tools are used. Their names can be explicitly included—like: 'use this tool to prepare a presentation,' 'use this one to design a logo,' or 'use that to create a quiz.' That would help make their use more efficient."* When looking at the future of AI in education, a strong consensus emerged among nearly all participants regarding the limitations of technology. The vast majority of teachers, including T1, T2, T3, T4, T5, T7, T8, T9, and T10, firmly believe that AI should remain a supplementary tool and can never fully replace human educators. This perspective is primarily based on the belief that machines cannot replicate human emotional intelligence, individual guidance, and unique classroom interactions.

4. Discussion

The primary finding of this study reveals that teachers' AI-related technopedagogical competencies are at a low-to-moderate level, a trend that is thoroughly contextualized by the qualitative insights. In the quantitative phase, the general Intelligent TPACK score emerged as remarkably limited, which directly corresponds to the qualitative findings where teachers admitted to using AI tools almost exclusively for basic operational tasks—such as automated lesson planning, generating presentation slides, and creating baseline quizzes. This pattern aligns with the findings of Moore-Hayes (2011) and Sirakaya (2019), who argued that while digital awareness spreads rapidly, systemic technopedagogical implementation remains superficial without structured institutional training. Qualitatively, although participants highlighted that AI reduces their administrative workload, saves preparation time, and expands material variety—echoing the supportive case studies published by UNOWA (2026)—their real-world usage did not translate into high competency scores. The qualitative data explicitly decodes this paradox: teachers' self-assessed limitations are not driven by a rejection of technology, but by critical professional anxieties regarding data reliability, algorithmic hallucinations, and the ethical implications of AI deployment. This supports Celik's (2023a) assertion that true readiness is a multi-dimensional construct where technical competence must be balanced with critical pedagogical evaluation.

The second major finding addresses the significant impact of age, seniority, and educational attainment on teachers' technopedagogical adaptation, illustrating a clear demographic and professional divergence. Quantitatively, younger teachers (aged 21–30) and those in the early stages of their careers (0–5 years of service) achieved significantly higher Intelligent TPACK scores than older, senior educators. The qualitative interviews strongly justified this generational gap; participants explicitly noted that senior teachers frequently remain distant from generative technologies due to lower baseline digital literacy and a deeply rooted professional resistance to structural pedagogical innovation. This dual-method validation perfectly mirrors the arguments of Afshari et al. (2008), Shin (2015), and the Digital Education Council (2026), which position youth and low seniority as natural facilitators for rapid algorithmic navigation and prompt engineering. Conversely, the lower scores among senior educators highlight that traditional technology integration habits (such as utilizing static Web 2.0 applications or interactive smartboards) are fundamentally insufficient for managing the autonomous, generative nature of artificial intelligence, as previously warned by Baek et al. (2008). Furthermore, the quantitative phase demonstrated that educational attainment plays a decisive role, with postgraduate degree holders achieving significantly higher competency scores than undergraduate holders. This finding is structurally supported by the research of Stergaki et al. (2025), confirming that advanced academic training fosters deeper reflective practices and methodological openness, allowing educators to systematically analyze algorithmic bias and handle the complex ethical subdimensions of the Intelligent TPACK model.

The third crucial finding explores the pedagogical consequences of AI integration on the student dimension and the teaching-learning process, highlighting a strict consensus on the limitations of machine intelligence. Quantitatively, prior experience with AI and Web 2.0 tools acted as the strongest statistical predictors of high technopedagogical competence, confirming the practical utility of technological familiarity (Guillén-Gámez et al., 2021). However, the qualitative insights revealed that even highly experienced teachers maintain a deeply cautious approach toward full integration due to severe student-related risks. Teachers strongly emphasized that excessive student reliance on smart models triggers "cognitive offloading"—a phenomenon conceptualized by Gerlich (2025) where learners delegate foundational critical thinking tasks to automated systems, thereby limiting independent imagination and analytical development. Furthermore, all ten interview participants explicitly warned that AI systems are structurally incapable of addressing the affective and emotional dimensions of classroom dynamics. The qualitative narratives firmly conclude that while AI serves as an exceptionally efficient material generator, it cannot replace the human teacher's role in delivering empathy, tailored psychological motivation, and nuanced individual guidance. This integrated outcome powerfully substantiates the core philosophy of the Intelligent TPACK framework (Çelik, 2023b), proving that sustainable technology integration is not an end goal, but a strictly guided, human-centric

pedagogical partnership where the educator must remain the ultimate autonomous evaluator of the automated educational environment.

5. Conclusion and Suggestions

As the conclusion of the study, it was determined that teachers' technopedagogical competencies related to the use of AI tools in teaching and learning processes are at a low-to-moderate level. The study also found that this competency level did not significantly differ by gender; however, AI use in education was generally higher among younger teachers, those new to the profession, teachers with graduate-level education, and those who had previous experience using AI and Web 2.0 tools.

The qualitative findings showed that teachers use AI tools for both professional and individual development. The research further revealed that AI tools need to be utilized more effectively in educational settings, that teachers lack sufficient competence in this area, and that technological literacy among teachers tends to decrease with advancing age. Lastly, concerns were raised by the participants that students mostly use AI for entertainment purposes and that these tools are insufficient in meeting emotional or social needs.

Considering teachers' limited technopedagogical competencies with AI, AI literacy training should be expanded and integrated into teacher education, especially targeting older teachers to boost adaptation and motivation. As AI tools are perceived by teachers to have a positive potential on student engagement, their controlled integration into textbooks and lesson plans could be evaluated. Furthermore, because teachers observed that students often focus on using AI for entertainment, future research is needed to explore how to effectively promote and guide its academic use in secondary education.

Studies in educational psychology could also look into how AI supports students' emotional and social needs, and future research should examine teacher-AI collaboration, accepting that AI will not fully replace teachers.

In terms of educational technology, this study shows that future research and policies should stop viewing AI as a simple replacement for human teachers. Theoretically, teacher training needs to move beyond basic digital skills. Instead, it should focus on structured frameworks like Intelligent TPACK, training teachers on how to handle algorithmic bias and verify data accuracy. Practically, schools should skip generic workshops and instead weave specific AI tools directly into subject curricula and textbooks. This turns AI into a controlled teaching partner that supports active learning while keeping the human connection in the classroom. Since this study only focused on high school teachers in Gaziantep, the findings might not apply everywhere. Therefore, future research should look at teachers' Intelligent TPACK skills in other regions and school types to get a broader picture.

Ethics Approval Statement

Ethical approval for this study was obtained from the Social and Human Sciences Scientific Research and Publication Ethics Committee of Gaziantep University (Date: June 5, 2025; Decision/Document No: E-87841438-302.08.01-667883).

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Declaration of generative AI and AI-assisted technologies in the writing process

During the preparation of this work, the author utilized ChatGPT (OpenAI) and Gemini (Google) for translation purposes. The author subsequently reviewed the translated text to ensure accuracy and takes full responsibility for the final content of the article.

This article has been derived from the first author's master's thesis conducted under the supervision of the corresponding author and was presented in abstract form at the 7th International Bursa Scientific Research Congress (June 13–15, 2025, Bursa, Türkiye).

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