Id: 1899174

Participatory Educational Research (PER)
Vol.13(4), pp. 139-150, July 2026
Available online at http://www.perjournal.com
ISSN: 2148-6123
http://dx.doi.org/10.17275/per.26.52.13.4

The Mediating Role of Technology Beliefs in the Relationship Between Preschool Teachers' Self-Efficacy and Technological Pedagogical Knowledge

Fatih Saltan *
Department Of Computer Education & Instructional Technology, Amasya University, Amasya, Türkiye
ORCID: 0000-0002-9806-3514

Article history
Received:
27.11.2025

Received in revised form:
01.03.2026

Accepted:
23.03.2026

Key words:
preschool teachers, self-efficacy, technological pedagogical knowledge, technology beliefs

The preschool period, in particular, is a sensitive stage where technology is seen as both an opportunity and a risk. It is important to examine how preschool teachers' proficiency in integrating technology with pedagogy influences their confidence in the classroom. Furthermore, it is essential to determine how their personal beliefs relate to these factors. The primary objective of this study is to examine whether preschool teachers' self-efficacy beliefs exert a direct positive influence on positive beliefs toward educational technology and a direct negative influence on negative beliefs. In order to achieve this objective, the study tested a structural model employing a cross-sectional survey design with a sample of 112 preschool teachers. Parallel mediation analysis using Hayes PROCESS macro (Model 4) with bootstrapping revealed that self-efficacy had a statistically significant positive effect on TPK. However, results from the parallel mediation analysis demonstrated that this relationship is fully mediated by two cognitive pathways: positive and negative beliefs regarding educational technology. Specifically, self-efficacy was found to significantly strengthen educational technology beliefs while concurrently mitigating negative educational technology beliefs. Results showed that positive educational technology beliefs strongly predicted TPK, whereas negative beliefs exerted a significant negative effect. Notably, after the inclusion of these mediators, the direct effect of self-efficacy on TPK became non-significant, indicating a full mediation effect. These findings suggest that self-efficacy does not directly enhance TPK; rather, it functions by fostering positive attitudes toward educational technology and mitigating perceived cognitive barriers.

Introduction

As conventional teaching methods give way to dynamic processes blended with digital tools, teachers are undoubtedly the most critical actors in this change (Mishra and Koehler, 2006). The preschool period, which covers the early years of life, is a stage where the foundations of children's relationship with technology are laid and their cognitive development rapidly takes shape. During this period, it is not only the presence of technology that matters, but also how it is used for pedagogical purposes. The use of technology in preschool education is highlighted in academic literature as a critical period because it has the

* Correspondency: fsaltan@gmail.com

potential to shape children's cognitive architecture at a stage when neuroplasticity is at its peak (Wang, Qian, Li, and Wu 2023). A recent meta-analysis study on cognitive gains at this early stage of learning shows that Information and Communication Technologies (ICT) have a moderately significant positive effect on early childhood learning outcomes, particularly that interactive e-books and digital storytelling are effective in language development and subject knowledge acquisition (Ruijia, Wenling and Xuemei , 2025). Furthermore, touchscreens and action-based digital games can enhance children's visual-spatial abilities, fine motor skills, and rapid information processing capacities. However, these potential gains also carry serious risks, as screen time may replace nurturing activities such as reading, physical play, and face-to-face interaction. It is emphasized that uncontrolled use can lead to physical and psychosocial problems in children, such as shortened attention spans, cognitive overload, decreased sleep quality, aggressive behavior, and obesity (Clemente-Suárez et al., 2024). In this regard, authorities such as the WHO and The American Academy of Pediatrics (AAP) recommend avoiding screen use for children under 18-24 months and limiting screen time to 1 hour per day for the 2-5 age group, which must be supervised by an adult and presented as a social experience.

On the other hand, the success of technology in early childhood education is determined by the balance between the teacher's pedagogical intent, the quality of the content, and the child's active participation, rather than the number of devices (Aslıyüksek, Taş, Türkoğlu, & Sezer, 2023). Therefore, the integration of digital tools in childhood environments requires a balanced, evidence-based approach (Clemente-Suárez et al., 2024). To optimize developmental outcomes, stakeholders must shift from passive consumption toward mediated, intentional interaction.

The Technological Pedagogical Content Knowledge (TPACK) framework, developed for the successful integration of technology, argues that digital tools should not be viewed as skills independent of pedagogy and content, but rather that effective learning can be achieved through the synthesis of these three areas (Mishra and Koehler, 2006). However, within the Technology Acceptance Model (TAM) conceptualized by Davis (1989), teachers' beliefs emerge as decisive antecedent variables in the technology integration process. It is important to examine how preschool teachers' proficiency in integrating technological resources with pedagogy influences their confidence in the classroom. Furthermore, it is essential to determine how their personal perspectives relate to these factors to overcome the 'second-order' barriers identified by Ertmer (1999). TPACK has also been useful in explaining the complex and dynamic interaction of the types of knowledge teachers need to successfully integrate technology into education. This developed model argues that technology (TK), pedagogy (PK), and content knowledge (CK) should not be treated as independent areas of expertise, but rather as a holistic structure based on the intersections of these components: Technological Content Knowledge (TCK), Pedagogical Content Knowledge (PCK), and Technological Pedagogical Knowledge (TPK). In this context, it is considered that the fundamental key to a qualitative transformation in education is for teachers to go beyond their technical skills in digital tools and understand how technology changes the way specific content is taught and offers new pedagogical opportunities.

Considering the concrete learning needs of preschool children and screen time restrictions, it appears that teacher competencies should be shaped around digital pedagogical competence and belief in its pedagogical value, rather than technological literacy (Plowman & Stephen, 2003). The focus of a preschool teacher's practice should be on the ability to use technology to support play-based discovery, encourage creativity, and provide active interaction rather

than passive consumption. As stated by Tondeur and colleagues (2012), technology integration in early childhood education is directly related to the teacher's perception of self-efficacy, attitude toward technology, and pedagogical beliefs about the impact of these tools on the social-emotional development of young children. From this perspective, developing the technological competence of preschool teachers should include not only technical training but also an in-depth pedagogical understanding of how technology can be meaningfully incorporated into play-based learning environments.

Ultimately, a preschool teacher's internalization of technology in their classroom practices is closely tied not only to their technical or pedagogical skills but also to their beliefs regarding constructivist or traditional educational philosophies that technology will benefit their students by developing their social and cognitive skills, as well as to their deeply rooted belief system regarding constructivist or traditional educational philosophy. Although this situation may seem complex, it highlights the need for a holistic strategy that aims to first understand and then transform teachers' perceptions of the pedagogical value of technology. Undoubtedly, for this process to be implemented effectively, research is needed to understand these variables and the relationships between them.

Aim of the Research

The primary aim of this study is to examine whether self-efficacy beliefs directly influence both positive and negative beliefs toward educational technology, and if these beliefs significantly predict TPK. Furthermore, the study seeks to determine whether positive and negative beliefs serve a mediating role in the relationship between self-efficacy and TPK. To achieve this, the following questions were addressed in this study:

(1) Do self-efficacy beliefs significantly predict positive and negative beliefs toward educational technology?
(2) Do positive and negative beliefs toward educational technology significantly predict techno-pedagogical knowledge?
(3) Do self-efficacy beliefs significantly predict techno-pedagogical knowledge?
(4) Do positive and negative beliefs play a mediating role in the relationship between self-efficacy beliefs and TPK?

The theoretical model of this study is based on the direct effect of self-efficacy on TPACK and the indirect effect mediated by positive and negative beliefs toward technology (Figure 1).

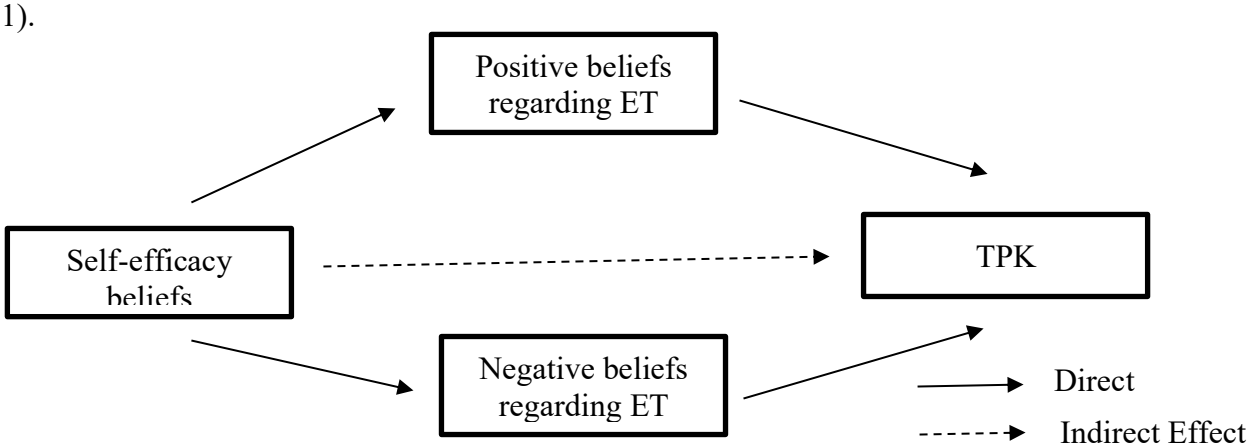

Figure 1. The theoretical model

Methodology

Research design

This study employed a cross-sectional correlational design and tested a mediation model using regression-based path analysis to investigate the relationship between preschool teachers' self-efficacy beliefs, positive/negative beliefs toward technology, and their techno-pedagogical knowledge. A cross-sectional survey design was used to examine variables at a single point in time, with research data collected from the participants at a single point in time (Büyüköztürk et al., 2012). The research design incorporates correlational analysis to determine the predictive power of the variables. Specifically, the study aimed to test a structural model to identify whether positive and negative technology beliefs mediate the relationship between teachers' self-efficacy and their techno-pedagogical knowledge.

Sample

The study group for this research consisted of 112 preschool teachers working in public schools. When forming the study group, teachers were recruited through convenience sampling. Although the number of preschool teachers working in public schools is increasing year by year, it remains low compared to other branches due to the duration of training Convenience sampling allows researchers to obtain accessible data until they reach the required sample size (Fraenkel, Wallen & Hyun, 2012). All preschool teachers included in the study were women, and their years of professional experience are presented in Table 1.

Table 1. Professional Experience of Preschool Teachers

Experience	f	%
<1 year	51	45.5
1-3 year	24	21.4
3-5 year	15	13.4
5-10 year	6	5.4
> 10 year	16	14.3
Total	112	100

Data collection instruments

The Scale for Preschool Teachers' Self Efficacy Beliefs : It is a scale consisting of 37 items, was utilized as a five-point Likert-type instrument with response options ranging from "Never" to "Completely." Developed by Tepe and Demir during the 2010–2011 academic year with a study group of 862 preschool teachers, the scale's reliability was substantiated through Cronbach's Alpha internal consistency and Composite Reliability (CR) coefficients. While the internal consistency for the single-dimensional form was calculated at 0.97, all composite reliability coefficients were found to be above the 0.70 threshold. The factor structure of the scale comprises six dimensions: Learning-Teaching Process , Communication Skills , Family Participation , Planning , Organization of Learning Environments, and Classroom Management.

Preschool Teachers' Belief Scale Regarding Educational Technologies: It was developed by Balaban Dağal et al. (2022), to measure beliefs of preschool teachers toward educational technologies. The scale was developed with the participation of 376 individuals and is structured as a five-point Likert-type instrument. The internal consistency coefficient for the entire scale was reported as 0.80. The scale consists of 35 items distributed across five sub-dimensions, reflecting both positive and negative orientations: "Belief in the Contribution of Educational Technologies to Personal and Instructional Skills" (10 items), "Belief in the

Methodical Contribution of Educational Technologies" (7 items), "Belief in Benefits of Educational Technologies" (6 items), "Negative Belief in the Use of Educational Technologies" (6 items), and "Belief in the Negative Effects of Educational Technologies" (6 items).

Technological Pedagogical Content Knowledge Instrument: The Technological Pedagogical Content Knowledge (TPACK) Scale, originally developed by Schmidt et al. and adapted into Turkish by Öztürk and Horzum (2011), was employed to assess teachers' techno-pedagogical knowledge. The Turkish version was deemed equivalent to the original English form, with a high correlation coefficient of 0.98 between the two. Validity and reliability studies were conducted with a group of 291 teachers, and both exploratory and confirmatory factor analyses confirmed a seven-factor structure for the scale. For the purpose of the current study, only the Technological Pedagogical Knowledge (TPK) sub-scale, which consists of five items, was utilized.

Data collection

The present study was carried out in strict adherence to the ethical framework of the 1995 Declaration of Helsinki and the ethical guidelines established by the American Psychological Association (APA). Initially, formal institutional permissions and ethics committee approvals were secured to ensure the research compliance with professional standards. Subsequent to obtaining the necessary ethical clearances, an online survey instrument integrating the three measurement scales was administered. The data collection phase was conducted over a period of approximately three months, resulting in a final dataset comprising 114 preschool teachers participated voluntarily. During data cleaning, two participants were excluded because their responses showed evidence of straight-lining, indicating a lack of engagement with the survey questions. Consequently, the final sample size was determined to be 112 participants. Although the sample size of 112 preschool teachers might be considered relatively small, it is deemed acceptable for conducting a mediation analysis via Hayes' PROCESS Macro (Model 4) due to several methodological justifications. First, the use of non-parametric bootstrapping significantly enhances statistical power and provides robust results for indirect effects even in small to moderate samples, as it does not rely on the assumption of normal distribution (Hayes, 2017; Preacher & Hayes, 2008). Furthermore, according to Fritz and MacKinnon (2007), a sample size of approximately 115 is sufficient to detect mediated effects with a power of 0.80 when both the 'a' and 'b' paths exhibit medium to large effect sizes, which aligns with the strong coefficients observed in the current study model.

Data analysis

To analyze the descriptive, correlational, and multivariate relationships of the data, the analyses were conducted using SPSS 27 and SPSS PROCESS MACRO analysis programs. Table 2 presents the descriptive statistics of the scores of the three scales obtained by preschool teachers.

Table 2. Descriptive Statistics of the Factors Measured by the Scales

	N	*Min*	*Max*	$\bar{X}$	*sd*
Self Efficacy Beliefs	112	3.20	5.00	4.70	.37
Learning-Teaching Process	112	3.44	5.00	4.71	.39
Communication Skills	112	3.57	5.00	4.78	.34
Family Participation	112	2.00	5.00	4.56	.55
Planning	112	3.17	5.00	4.71	.43

Organization of Learning Environment	112	3.00	5.00	4.73	.44
Classroom Management	112	3.00	5.00	4.68	.43
Positive Belief Regarding ET	112	2.00	5.00	4.22	.70
Personal and Instructional Skills	112	1.80	5.00	4.15	.79
Methodical Contribution	112	2.14	5.00	4.36	.73
Belief in Benefits	112	1.80	5.00	4.14	.79
Negative Belief Regarding ET	112	1.00	4.70	2.69	.85
Negativity Regarding Usage	112	1.00	5.00	2.43	.94
Beliefs About Negative Effects	112	1.00	4.83	2.93	.97
Technological Pedagogical Knowledge	112	1.60	5.00	4.11	.69

During the data analysis process, the distribution characteristics of the research variables were first examined, and skewness and kurtosis values were calculated to determine whether they exhibited a normal distribution. According to George and Mallery (2010), skewness and kurtosis values the ±2 range indicate that the data are normally distributed. When examining the analysis results presented in Table 3, it was found that the kurtosis and skewness values for all variables were within the ±2 range. Therefore, it was concluded that the data met the assumption of normality.

Table 3. Descriptive Statistics for Research Variables used in Mediation Analyses

	N	Min	Max	$\bar{X}$	sd	Skewness	Kurtosis
Self Efficacy Beliefs	112	3.20	5.00	4.70	.37	-1.465	1.827
Positive Belief Regarding ET	112	2.00	5.00	4.22	.70	-1.070	.627
Negative Belief Regarding ET	112	1.00	4.70	2.69	.85	.215	-.373
Technological Pedagogical Knowledge	112	1.60	5.00	4.11	.69	-.899	1.151

Before testing the mediation analyses, the relationships among the research variables were examined using Pearson correlation analysis. Subsequently, parallel mediation analysis was conducted using the PROCESS macro (Model 4) developed by Hayes (2017). To test the significance of indirect effects, the 5,000 bootstrap resampling method was applied. Bootstrap confidence intervals not containing the zero value indicate that the indirect effect is statistically significant (Preacher & Hayes, 2008). The SPSS 27.0 package program was used to analyze the data obtained in the study.

Results

Relationships among variables

The results of the Pearson correlation analysis conducted to examine the relationships among the variables are presented in Table 4.

Table 4. Correlation Analysis Results

Variables	(1)	(2)	(3)	(4)
(1) Self Efficacy Beliefs	-			
(2) Positive Belief Regarding ET	.432**	-		
(3) Negative Belief Regarding ET	-.210*	-.414**	-	
(4) TPK	.260**	.498**	-.191*	-

N=112. *p<.05; **p<.01

Table 4 shows that there was a moderate positive and statistically significant relationship between the preschool teachers' self-efficacy beliefs and their positive beliefs regarding ET (r= .432;p< .01). A weak negative and statistically significant relationship was found between self-efficacy beliefs and negative beliefs regarding ET (r= -.210;p< .05). Similarly, there is a positive and significant relationship between self-efficacy beliefs and technological pedagogical knowledge (r= .260; p< .01). There was a moderate negative relationship between positive beliefs regarding ET and negative belief regarding ET (r= -.414;p< .01). A relatively strong positive relationship was determined between positive beliefs regarding ET and technological pedagogical knowledge (r= .498; p< .01), while a weak negative relationship was found between negative beliefs regarding ET thecnological pedagogical knowledge (r= -.191;p< .05).

Mediation Analysis

To examine the mediating role of positive and negative beliefs regarding ET in the relationship between self-efficacy beliefs and technological pedagogical knowledge (TPK), a parallel multiple mediation analysis was conducted using Hayes' (2018) PROCESS macro (Model 4). In the first stage, the effect of self-efficacy beliefs on technological pedagogical knowledge was examined; this effect was found to be positive and statistically significant (β = .26;p < .01). According to the parallel mediation analysis, self-efficacy beliefs had a positive and significant effect on positive beliefs regarding ET (β = .43;p < .01) and a negative effect on negative beliefs regarding ET (β = -.21;p < .05). When the effects of the mediating variables were examined, it was found that positive beliefs regarding ET had a positive and significant effect on TPK (β = .52;p < .01), while negative belief had a negative and significant effect on TPK (β = -0.25;p < .01). The direct effect of self-efficacy beliefs on technological pedagogical knowledge, however, became non-significant (β = 0.1;p > 0.05).

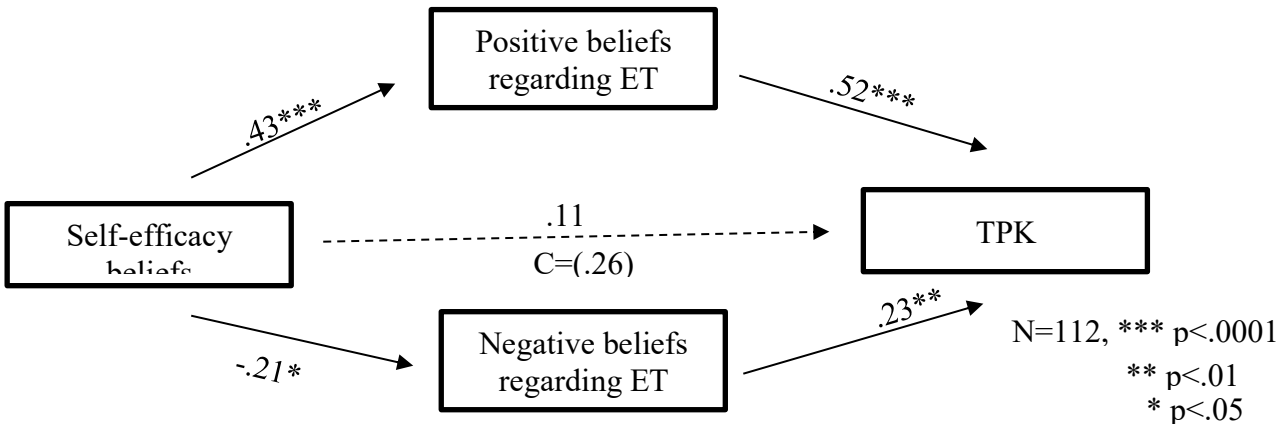

Figure 1. The Mediation model.

Table 5. Indirect, Direct, and Total Effects

Effect Type	Path	β	SE	*t*	p	%95 LLCI	%95 ULCI
Total Effects	Self-efficacy beliefs→ TPK	0.48	0.17	2.82	.005	0.1434	0.8222
Direct Effect	Self-efficacy beliefs→ TPK	0.12	0.17	0.71	.480	-0.2128	0.4489
Total Indirect Effect	Self-efficacy beliefs→ TPK	0.36	0.09	-	-	0.1655	0.5571
Indirect Effect 1	Self-efficacy beliefs→ Positive beliefs regarding ET→ TPK	0.45	0.11	-	-	0.2539	0.6897
Indirect Effect 2	Self-efficacy beliefs→ Negative beliefs regarding ET→ TPK	-0.09	0.07	-	-	-0.2590	-0.0017

When Table 5 is examined, the direct effect of self-efficacy beliefs on technological pedagogical knowledge is insignificant (β = 0.12; p = .481; 95% CI [-0.213, 0.449]), while the total effect (β = 0.48; p = .006; 95% CI [0.143, 0.822]) and indirect effect (β = 0.37; 95% CI [0.166, 0.557]) on technological pedagogical knowledge is significant. When examining indirect effects, the indirect effect of self-efficacy on technological pedagogical knowledge through positive beliefs regarding ET was found to be significant (β = 0.45; 95% CI [0.254, 0.690]). Accordingly, as the level of self-efficacy increases, the level of positive belief regarding ET increases, and this increase positively affects technological pedagogical knowledge. The indirect effect of self-efficacy beliefs on technological pedagogical knowledge through negative belief regarding ET was also found to be significant (β = -0.09; 95% CI [-0.259, -0.002]). Accordingly, as self-efficacy increases, the level of negative beliefs decreases, and this decrease positively affects technological pedagogical domain knowledge. Overall, the findings indicate that both positive and negative beliefs play a full mediating role in the relationship between self-efficacy and technological pedagogical domain knowledge.

Discussion and Conclusions

The professional competencies of preschool teachers continue to evolve and flux, undergoing modifications in accordance with contemporary educational approaches. The integration of technology into educational environments has necessitated a redefinition of teachers' pedagogical and technological knowledge and skills. This study employed a cross-sectional survey strategy to systematically gather data, thereby enabling a comprehensive investigation into the interrelationships among self-efficacy beliefs, technology-related beliefs, and techno-pedagogical knowledge in preschool teachers. A quantitative survey approach was implemented to assess these constructs. This approach entailed the administration of self-administered Likert-type questionnaires. The questionnaires enabled the examination of associations among variables. The correlational survey research design is particularly well-suited for examining relationships between variables without making inferences about causation. This approach is consistent with studies exploring self-efficacy and technology use among educators. The findings of the correlation analysis provided preliminary support for the hypothesized model, revealing significant interrelationships among the study variables. Specifically, a moderate positive and significant relationship was observed between preschool teachers' self-efficacy beliefs and their positive beliefs regarding ET while a low-level negative relationship was found with negative beliefs regarding ET.

These results are consistent with the existing literature, suggesting that teachers who possess higher levels of self-efficacy tend to develop more favorable attitudes and lower levels of resistance toward integrating technology into their pedagogical practices. Beliefs about technology encompass teachers' attitudes, perceptions, and motivations toward using technology in educational settings. Research conducted within the Technology Acceptance Model (TAM) framework has shown that the extent to which teachers find technology useful and easy to use directly influences their intention to use it (Hong et al., 2021). Similar results have been obtained in qualitative studies on innovative applications such as robotics education in the preschool period (Erdoğmuş, 2021). Teachers have a positive attitude towards robotics education; however, they emphasize the need for teacher training, material support, curriculum alignment, and technical infrastructure for the application to be implemented ideally. Furthermore, the relatively strong positive correlation between positive beliefs regarding ET and technological pedagogical knowledge underscores the critical role of cognitive-affective evaluations in the development of technological competencies. A study examining the relationship between self-efficacy beliefs and pedagogical content knowledge, conducted with geography teachers, found that teachers with high levels of pedagogical content knowledge also had significantly higher self-efficacy (Patra & Guha, 2017). Furthermore, a positive relationship was found between self-efficacy and teacher effectiveness. This finding shows that pedagogical content knowledge is not limited to technical knowledge; it also forms the basis of professional self-confidence (Patra & Guha, 2017).

To further examine the underlying mechanism of these relationships, a parallel mediation analysis was conducted using the PROCESS macro (Model 4) developed by Hayes (2017). The results of the 5000-bootstrap resampling method indicated that the indirect effects were statistically significant, as the bootstrap confidence intervals did not contain zero (Preacher & Hayes, 2008). This finding demonstrates that both positive and negative beliefs regarding ET serve as significant parallel mediators in the link between preschool teachers' self-efficacy and their technological pedagogical knowledge. Specifically, the results suggest that self-efficacy not only influences pedagogical knowledge directly but also operates through the enhancement of positive beliefs and the reduction of negative perceptions regarding technology. These findings highlight the necessity of addressing teachers' internal belief systems in professional development programs aimed at increasing technological integration in early childhood education. A comparative analysis of self-efficacy beliefs across various academic disciplines reveals consistent outcomes. A recent study in visual arts indicated that preschool teachers' visual arts self-efficacy exerts a direct influence on their professional practices. The study's findings suggest that childhood experiences, pre-service training, and epistemological beliefs play a pivotal role in this process (Denee et al., 2023). Additionally, the importance of practical interaction with materials, continuous professional learning opportunities, and trust-based leadership support for positive self-efficacy development was underscored. The success of digital transformation in education hinges on teachers who not only use technology, but also master it and embrace innovation. Education strategies must be consistent and aligned with national development goals. To this end, education curricula should be modernised in collaboration with organisations that have a local technology vision and focus on the country's needs (Gök, Turan & Oyman, 2011).

The results of this study provide a comprehensive understanding of the mechanisms through which preschool teachers' self-efficacy beliefs influence their TPK. The parallel mediation analysis confirmed that self-efficacy does not operate in a vacuum; rather, its impact on TPK is fully mediated by the teachers' internal belief systems regarding educational technology

(ET). Specifically, high self-efficacy serves as a catalyst that bolsters positive beliefs and mitigates negative perceptions. The fact that the direct effect of self-efficacy became insignificant in the presence of these mediators highlights that belief transformation is the primary pathway for developing technological competence. In line with Abbitt (2021), these results imply that while confidence is a prerequisite, its ultimate success in increasing TPACK levels depends on how effectively that confidence translates into positive pedagogical attitudes and the mitigation of technological anxiety. A body of research has examined relationship among teachers' technology usage time and experience and their self-efficacy beliefs. The findings of these studies indicate that these two variables mutually reinforce each other. For instance, Kazu and Erten's research suggests that teachers' perceptions of self-efficacy regarding TPACK and its sub-dimensions are, in general, high; however, there are significant differences in the dimensions of technology knowledge (TK) and pedagogical content knowledge (PCK) depending on age and years of service (Kazu & Erten, 2014). The significance of self-efficacy beliefs in technology integration has been highlighted in numerous studies. Mishne's study indicates that technology knowledge is a significant predictor of overall technology competence. However, teacher self-efficacy and experience do not have a direct meaningful effect (Mishne, 2012). In his study (2019), Ozel examined the self-efficacy beliefs of early-career kindergarten teachers regarding technology and their classroom technology integration practices. The findings indicated that teachers' high self-efficacy beliefs regarding technology positively influenced their classroom technology use.

In summary, the present study demonstrates that self-efficacy serves as a fundamental precursor to technological pedagogical knowledge among early childhood educators. However, its influence is entirely contingent upon the mediation of internal belief systems. The findings indicate a full mediation model in which the enhancement of positive beliefs regarding educational technology and the concurrent mitigation of negative instructional technology perceptions function as the primary mechanisms for professional competence. The findings of this study imply that in the context of early childhood education, enhancing teacher confidence alone is inadequate to address the underlying pedagogical anxieties and negative attitudes toward digital integration that persist. Consequently, the cultivation of a developmentally appropriate digital culture necessitates a dual-pronged strategy: the empowerment of educators to experiment with technology, while concurrently addressing the cognitive barriers that impede the adoption of digital tools in sensitive early learning environments. It is important to prioritize these attitudinal shifts to ensure that technology serves as a constructive catalyst for childhood cognitive development rather than a source of pedagogical friction.

Limitations

The relatively small sample size, the high proportion of early-career teachers, and the all-female sample may limit the generalizability of the findings.

Declarations

Acknowledgments: *I sincerely thank the preschool teachers who volunteered to participate in the study.*

Funding: *The authors declare that they have not received any financial support for this research from official or private organization.*

Ethics Statements: *This research was conducted with the permission obtained by the Amasya University Scientific Research and Publication Ethics Social and Human*

Sciences Board's decision dated 17.06.2025 and numbered E-30640013-108.01-267663.
Conflict of Interest: *Authors declare no conflicts of interest.*
Informed Consent: *Participants were informed about the purpose of the research, the procedures, and their rights. Informed consent was obtained from the participants. The confidentiality of the participants was protected throughout the research.*
Data availability*: Research data are available from the authors upon reasonable request.*

References

Abbitt, J. T. (2021). An investigation of the relationship between self-efficacy beliefs about technology integration and technological pedagogical content knowledge (TPACK) among teacher candidates. *Journal of Digital Learning in Teacher Education, 27*(4), 134–143. https://doi.org/10.1080/21532974.2011.10784670

Aslıyüksek, M., Taş, V. O., Türkoğlu, E., & Sezer, C. (2023). Okul öncesi öğretmenlerinin dijital teknoloji kullanımı ve etkileri [Preschool teachers' use of digital technology and its effects]. *International Academic Social Resources Journal*, *8*(53), 3766–3775. http://doi.org/10.29228/ASRJOURNAL.72305

Büyüköztürk, Ş., Kılıç Çakmak, E., Akgün, Ö. E., Karadeniz, Ş., & Demirel, F. (2012). *Bilimsel araştırma yöntemleri* [Scientific research methods] (11th ed.). Pegem Akademi.

Clemente-Suárez, V. J., Beltrán-Velasco, A. I., Herrero-Roldán, S., Rodriguez-Besteiro, S., Martínez-Guardado, I., Martín-Rodríguez, A., & Tornero-Aguilera, J. F. (2024). Digital device usage and childhood cognitive development: Exploring effects on cognitive abilities. *Children, 11*(11), 1299. https://doi.org/10.3390/children11111299

Dağal, A. B., Dörterler, S. Ö., Kanburoğlu, V., Yağcı, M., & Uyanık, G. (2022). Developing preschool teachers' belief scale regarding educational technologies: A validity and reliability study. *Southeast Asia Early Childhood Journal, 11*(2), 136–151. https://doi.org/10.37134/saecj.vol11.2.9.2022

Davis, F. D. (1989). Perceived usefulness, perceived ease of use, and user acceptance of information technology. *MIS Quarterly, 13*(3), 319–340. https://doi.org/10.2307/249008

Denee, R., Lindsay, G., & Probine, S. (2023). Visual arts self-efficacy: Impacts and supports for early childhood teachers. *Early Childhood Education Journal*. https://doi.org/10.1007/s10643-023-01489-5

Erdoğmuş, F. U. (2021). How do elementary childhood education teachers perceive robotic education in kindergarten? A qualitative study. *Participatory Educational Research, 8*(4), 461–481. https://doi.org/10.17275/per.21.47.8.2

Ertmer, P. A. (1999). Addressing first- and second-order barriers to change: Strategies for technology integration. *Educational Technology Research and Development, 47*(4), 47–61. https://doi.org/10.1007/BF02299573

Fraenkel, J. R., Wallen, N. E., & Hyun, E. (2012). *How to design and evaluate research in education* (8. baskı). McGraw-Hill.

Fritz, M. S., & MacKinnon, D. P. (2007). Required sample size to detect the mediated effect. *Psychological Science, 18*(3), 233–239. https://doi.org/10.1111/j.1467-9280.2007.01882.x

Gök, A., Turan, S., & Oyman, N. (2011). Preschool Teachers' Views on Usage of Information Techonologies. *Pegem Eğitim ve Öğretim Dergisi, 1*(3), 59–66.

Hayes, A. F. (2017). *Introduction to mediation, moderation, and conditional process analysis: A regression-based approach*. Guilford Publications.

Hong, X., Zhang, M., & Liu, Q. (2021). Preschool teachers' technology acceptance during the COVID-19: An adapted technology acceptance model. *Frontiers in Psychology, 12*, 691492. https://doi.org/10.3389/fpsyg.2021.691492

Kazu, I. Y., & Erten, P. (2014). Teachers' technological pedagogical content knowledge self-efficacies. *Journal of Education and Training Studies, 2*(2), 126–144. https://doi.org/10.11114/jets.v2i2.261

Mishne, J. (2012). *An investigation of the relationships between technology use and teachers' self-efficacy, knowledge and experience* [Unpublished doctoral dissertation]. Florida Atlantic University.

Ozel, O. (2019). *An exploration of Turkish kindergarten early career stage teachers' technology beliefs and practices* [Unpublished doctoral dissertation]. University of South Florida.

Patra, A., & Guha, A. (2017). Pedagogical content knowledge (PCK) of geography teachers' and its effect on self-efficacy and teacher effectiveness in West Bengal, India. *IRA International Journal of Education and Multidisciplinary Studies, 6*(3), 199–210. https://doi.org/10.21013/jems.v6.n3.p2

Plowman, L., & Stephen, C. (2003). A 'benign addition'? Research on ICT and pre-school children. *Journal of Computer Assisted Learning, 19*(2), 149–164. https://doi.org/10.1046/j.0266-4909.2003.00016.x

Preacher, K. J., & Hayes, A. F. (2008). Asymptotic and resampling strategies for assessing and comparing indirect effects in multiple mediator models. *Behavior Research Methods, 40*(3), 879–891. https://doi.org/10.3758/BRM.40.3.879

Ruijia, Z., Wenling, L., & Xuemei, Z. (2025). The impact of information and communication technology (ICT) on learning outcomes in early childhood and primary education: A meta-analysis of moderating factors. *Frontiers in Psychology, 16*, 1540169. https://doi.org/10.3389/fpsyg.2025.1540169

Şen-Ersoy, N., & Doğan, Y. (2023). Öğretmen adaylarının bilgi, iletişim ve mobil teknolojileri kullanma becerileri üzerine ilişkisel bir çalışma [A correlational study on pre-service teachers' information, communication and mobile technology usage skills]. *Journal of Computer and Education Research*, *11*(22), 836–865. https://doi.org/10.18009/jcer.1341122

Tepe, D., & Demir, K. (2012). Okul öncesi öğretmenlerinin öz-yeterlik inançları ölçeği [The self-efficacy beliefs scale of pre-school teachers]. *Abant İzzet Baysal Üniversitesi Eğitim Fakültesi Dergisi [Journal of Abant Izzet Baysal University Faculty of Education]*, *12*(2), 137–158.

Tondeur, J., van Braak, J., Sang, G., Voogt, J., Fisser, P., & Ottenbreit-Leftwich, A. (2012). Preparing pre-service teachers to integrate technology in education: A synthesis of qualitative evidence. *Computers & Education, 59*(1), 134–144. https://doi.org/10.1016/j.compedu.2011.10.009

Wang, C., Qian, H., Li, H., & Wu, D. (2023). The status quo, contributors, consequences and models of digital overuse/problematic use in preschoolers: A scoping review. *Frontiers in Psychology, 14*, 1049102. https://doi.org/10.3389/fpsyg.2023.1049102