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Teachers' Information and Communication Technologies Efficacy Beliefs

Halit Arslan[a], Hasan Güllü[b], Ahmet Oğuz Akçay[c]

Abstract: This study aimed to determine teachers' beliefs about the efficacy of information and communication technologies (ICTs). The participants consisted of a total of 294 teachers (140 female and 154 male) from different branches working in different regions of Turkey in the 2022-2023 academic year. The ICT Competence Beliefs scale developed by Rubbach and Lazarides (2021) (Teachers' Basic ICT Competences Beliefs) and adapted into Turkish by Korukluoğlu, Alçı, and Rubach (2023) was used in the study. All statistical analyses in the study were conducted through the R programming language. In this study, teachers' ICT efficacy beliefs were analyzed quantitatively in line with various variables. In this context, confirmatory factor analysis was performed to test the validity of the data collection tool, and descriptive analyses were used to examine the structure of the data set. A t-test was used to find the difference between two means, and one-way ANOVA analysis was used to determine the difference between more than two means. According to the results, it can be said that teachers' ICT efficacy beliefs are close to high level. However, the ICT efficacy of teachers showed statistically significant differences according to gender, age, and school level variables, while no statistically significant difference was found according to the branch variable.

Keywords: Information and communication technologies, 21st century skills, ICT efficacy beliefs

1. Introduction

Technology has always been an indispensable element of the teaching and learning process. Especially today, the use of information and communication technologies (ICT) in educational environments is becoming increasingly widespread l (Emezirinwune et al., 2024). Therefore, the effective use of technology in education and its integration into the educational system has gained importance. ICT encompasses techniques used for processing and transmitting information, such as computer technology, smartphones, multimedia, network hardware, software, the Internet, and online reviews (Qazi et al., 2014). Zuppo (2012) defines ICT as the totality of devices and infrastructures that facilitate the digital transfer of information. ICT integration in education refers to the incorporation of Information and Communication Technology (ICT) into the education system to enhance the quality of education and meet the evolving needs of society (Bardakçı, 2018).

Among the 21st-century skills, ICT (Gürkan, 2023) is used in almost every field, and raising individuals who can adapt to this age can only be achieved in learning environments and with curricula that are well-equipped, adaptable to change, and closely follow technological advancements (Genç & Eryaman, 2013). The integration of ICT into learning and teaching practices is a process that encompasses various components, including students, teachers, technology, and schools (Bozdağ, 2017). Therefore, the situation of teachers, who are a crucial component of education, should be considered in this process. Teachers need to have the necessary competencies and skills to enable students to transfer what they have learned to real-life situations (Gaurino & Estrellado, 2023). through guidance, teach learning, and support the teaching and learning process with technology (Şimşek, 2002).

Additionally, teachers' perspectives and beliefs towards ICT are essential for successful ICT integration (Gonder, 2008). Angeli and Valanides (2009) emphasize that teachers should effectively use their knowledge and skills related to ICT in learning and teaching processes while applying their pedagogical skills. From the moment teachers enter their professional lives, they are expected to be familiar with ICT and proficient in its use in the classroom environment. Furthermore, teachers are expected to use technology efficiently, effectively, and actively in the teaching and learning process (Çoklar & Odabaşı, 2009).

Various educational standards determine the competencies expected of teachers. The International Educational Technology Standards (ISTE) and the National Educational Technology Standards for Teachers (NETS-T) can be given as

[a] **Corresponding Author:** Dr., MEB, Aksaray İl Milli Eğitim Müdürlüğü, BT İl Koordinatörü, Aksaray, Türkiye, halitarslan@anadolu.edu.tr

[b] PhD Student, Measurement and Evaluation in Education, Ankara University, Deputy Director, Ministry of National Education, Gaziantep, Türkiye, hasangullu707@gmail.com

[c] Assoc. Prof. Dr., Classroom Education, Eskisehir Osmangazi University, Eskisehir, Türkiye, aoguzakcay@gmail.com

examples of these standards. The subject addressed in these standards is the necessity for teachers to possess information literacy regarding digital content and to acquire digital skills, including communication and collaboration, digital content production, security, and problem-solving (Bates, 2015). Moreover, today's teachers are expected to be familiar with the basics of working with digital educational technologies, text editors, spreadsheets, email, and multimedia equipment (Minamatov & Nasirdinova, 2022). In the report prepared by the Ministry of National Education in our country regarding the general competencies of the teaching profession, the item "Effective use of ICT in the teaching and learning process" is specified as a competency indicator in the professional skills step (MEB, 2017).

Research on teachers' self-efficacy beliefs regarding the use of Information and Communication Technologies (ICT) is considered one of the key factors influencing the success of technology integration in education. For example, the study by Josip Šabić and colleagues (2021) examined how teachers' self-efficacy regarding the use of ICT interacts with variables such as age and gender. Additionally, the study by Birisci and Kul (2019) investigated the factors that predict pre-service teachers' self-efficacy beliefs regarding technology integration. The meta-analysis study by Youlai Zeng and his team evaluated the relationship between teachers' self-efficacy regarding ICT integration and Technological Pedagogical Content Knowledge (TPACK).

Teachers' belief in their abilities to effectively utilize information and communication technologies (ICT) in instructional settings plays a crucial role in successfully integrating these tools into teaching practices (Hong & Phan, 2020). The importance of teachers' self-efficacy beliefs regarding ICT competencies for the effective use of technology in the teaching and learning process is an undeniable fact. Therefore, teachers' ICT competency beliefs emerge as a significant factor enabling the integration and effective use of technology in teaching and learning. This research, which aims to determine teachers' beliefs about their ICT competency, is expected to contribute to the field. On the other hand, in line with this aim, the following research questions were sought throughout the study.

- What is the level of ICT efficacy beliefs among the teachers participating in the study?
- Do the ICT efficacy beliefs of the participating teachers differ significantly by gender?
- Do the ICT efficacy beliefs of the participating teachers differ significantly by school level?
- Do the ICT efficacy beliefs of the participating teachers differ significantly by age?
- Do the ICT efficacy beliefs of the participating teachers differ significantly by branch?

2. Method

This research aims to determine the level of teachers' ICT competency beliefs and whether variables such as gender, school level, age, and branch of study significantly differentiate these beliefs. For this purpose, a causal-comparative model —a type of quantitative research design —was employed. Unlike experimental studies, the causal-comparative model examines the causes and consequences of differences between groups without manipulating participants or conditions (Johnson & Christensen, 2014). In this model, the existing situation is described without any intervention on any of the variables (Gay & Airasian, 2000).

2.1. Research Group

The research group for this study comprises teachers from various branches working in different regions of Turkey during the 2022-2023 academic year. The research group was determined using convenience sampling, a non-probability sampling method. Convenience sampling offers researchers flexibility in terms of cost and time (Patton, 2018). In this context, a total of 294 teachers, including 140 female and 154 male teachers, participated in the study. Descriptive information about these teachers is presented in Table 1.

Table 1. Descriptive Statistics of the Research Group

Demographic Characteristics	Group	f	%
Gender	Female	140	47.6
	Male	154	52.4
Age	30 years and under	66	22.4
	31 years and 40 years	134	45.5
	41 years and over	94	32.1
School Level	Primary School	138	46.9
	Middle School	108	36.7
	High School	48	16.4
Branch	Primary school teachers (PCT)	116	39.5
	Information Technologies Teacher (ITT)	44	14.9
	Other Branches	134	45.6
Total		**294**	**100**

Examining Table 1 reveals a nearly equal distribution of teachers by gender. Furthermore, a higher percentage of teachers (45.6%) fall within the 31-40 age range, suggesting that approximately half of the participating teachers are middle-aged. The distribution of school levels indicates a relatively similar representation of primary and middle school teachers, with fewer high school teachers. Finally, the teachers' branches of study were categorized as primary school teachers, Information Technologies teachers, and other branches. The "other branches" category includes teachers of German, Physical Education, Biology, Religious Culture, Literature, Science, Physics, Visual Arts, English, Chemistry, Mathematics, Vocational Courses, Music, Guidance, Social Studies, History, and Turkish. The distribution of branches reveals a similar representation of primary school teachers and other branches, with fewer Information Technologies teachers.

2.2. Data Collection Instrument

The study utilized the "Teachers' Basic ICT Competences Beliefs" developed by Rubbach and Lazarides (2021) and adapted into Turkish by Korukluoğlu, Alçı and Rubach (2023). The scale comprises six dimensions: "Information and Data Literacy," "Communication and Collaboration," "Digital Content Creation," "Safety and Security," "Problem Solving," and "Analyzing and Reflection." It consists of a total of 29 items: 5 in Information and Data Literacy, 5 in Communication and Collaboration, 3 in Digital Content Creation, 4 in Safety and Security, 7 in Problem Solving, and 5 in Analyzing and Reflection. The ICT Competency Beliefs Scale uses a 5-point Likert scale structured as "1=Strongly Disagree, 2=Disagree, 3=Neutral, 5=Strongly Agree." The scale does not contain any reverse-scored items.

2.3. Data Analysis

All statistical analyses conducted within the scope of this research were performed using the R programming language. R's open-source nature, free availability, and continuously updated structure have contributed to its increasing popularity in recent years (Doğan & Uluman, 2016). Accordingly, functions within the "psych" package (Revelle, 2022) were employed to examine the distributional properties of the dataset and gather evidence for the reliability of the existing data. Furthermore, confirmatory factor analysis (CFA) procedures, conducted to establish the validity of the chosen measurement instrument, were executed using the "lavaan" package (Rosseel, 2012). Additionally, for the t-test and ANOVA analyses applied to address the research questions, functions from the base package of the R programming language were utilized (R Core Team, 2019). Data analysis commenced with an examination of missing values within the dataset. The anyNA function was applied to the dataset, revealing no missing values. Subsequently, analyses regarding data distribution were examined using the describe function within the "psych" package (Revelle, 2022), with the obtained values presented in Table 2.

Table 2. Descriptive Statistics for the Dataset's Distributional Properties

Dimensions	Kurtosis	Skewness
Information and Data Literacy	-0.71	-0.14
Communication and Collaboration	-0.73	0.05
Digital Content Creation	-0.53	-0.26
Safety and Security	-0.81	0.01
Problem-Solving	-0.17	0.02
Analyzing and Reflection	0.47	-0.17
Total	**-0.51**	**0.11**

Examination of Table 2 reveals that the kurtosis and skewness values for the sub-dimension and total scores fall within the range of ±1.5. According to George and Mallery (2010), kurtosis and skewness values between -2 and +2 indicate a normal distribution of the dataset. Therefore, it can be stated that the dataset exhibits a normal distribution. After confirming the normal distribution of the data, parametric analyses were applied to the dataset. CFA was applied to the dataset to provide evidence for the validity of the scale used in the study. This analysis was conducted using the cfa() function within the "lavaan" package (Rosseel, 2012), and the obtained values are presented in Table 3.

Table 3. Confirmatory Factor Analysis Fit Indices

The goodness of fit index	Good fit	Acceptable	Value	Result
RMSEA	0 ≤ RMSEA ≤ .05	.05 <RMSEA ≤ .08	.07	Acceptable
SRMR	0 ≤ SRMR ≤ .05	.05 <SRMR ≤ .10	.05	Good Fit
TLI	.95 ≤ NNFI ≤ 1.00	.90 ≤ TLI <.95	.91	Acceptable

(Schermelleh-Engel, Moosbrugger, and Müller, 2003)

Referring to Table 3, the scale utilized in the research demonstrates a good level of fit with the dataset. In other words, the measurement instrument in the study is valid. Following the validity analysis, Cronbach's alpha and McDonald's Omega coefficients were calculated to assess the reliability of the measurement instrument. For these analyses, the alpha and omega functions from the "psych" package (Revelle, 2022) were employed, and the calculated coefficients are displayed in Table 4.

Table 4. Cronbach's Alpha and McDonald's Omega Reliability Coefficient Values

Dimensions	Cronbach's Alpha	McDonald's Omega
Information and Data Literacy	0.87	0.93
Communication and Collaboration	0.86	0.88
Digital Content Creation	0.93	0.93
Safety and Security	0.85	0.89
Problem-Solving	0.91	0.93
Analyzing and Reflection	0.89	0.92
Total	**0.97**	**0.97**

As shown in Table 4, both Cronbach's alpha and McDonald's Omega coefficients for the measurement instrument used in the study range from 0.85 to 0.93 across all sub-dimensions. Additionally, the overall scale reliability coefficient was calculated as 0.97 for both analyses. Consequently, the reliability coefficients are quite high for both the sub-dimensions and the entire scale. Thus, the measurement instrument employed in the research can be deemed reliable.

3. Findings

This section presents the findings of the analyses conducted to address the research questions investigated within the study. Descriptive analyses were utilized to determine the level of ICT competency beliefs held by the teachers participating in the research. The values pertaining to the conducted analysis are provided in Table 5.

Table 5. Descriptive Statistics on Teachers' ICT Competency Beliefs

Dimensions	x̄	ss	sh
Information and Data Literacy	4.28	0.53	0.03
Communication and Collaboration	4.20	0.53	0.03
Digital Content Creation	3.83	0.84	0.05
Safety and Security	4.12	0.59	0.03
Problem-Solving	3.86	0.63	0.04
Analyzing and Reflection	3.83	0.65	0.04
Total	**4.02**	**0.53**	**0.03**

Examination of Table 5 indicates that the average scores for teachers' ICT competency beliefs in the study range from 3.83 to 4.28, with an overall average score of 4.02. Therefore, the teachers participating in the research possess ICT competency beliefs approaching a high level.

A t-test analysis was applied to the dataset to determine whether the teachers' gender significantly differed in their beliefs about ICT competency. The statistics obtained following this analysis are presented in Table 6.

Table 6. T-test Analysis Results of Teachers in the Study by Gender

Dimensions	Gender	N	x̄	ss	t	p	η^2
Information and Data Literacy	Male	154	4.42	0.53	4.62	0.01*	0.07
	Female	140	4.14	0.51			
Communication and Collaboration	Male	154	4.31	0.53	3.77	0.01*	0.05
	Female	140	4.08	0.52			
Digital Content Creation	Male	154	4.06	0.80	4.89	0.01*	0.08
	Female	140	3.59	0.83			
Safety and Security	Male	154	4.22	0.58	3.12	0.02*	0.03
	Female	140	4.01	0.58			
Problem-Solving	Male	154	4.01	0.66	4.63	0.01*	0.07
	Female	140	3.69	0.55			
Analyzing and Reflection	Male	154	3.88	0.68	1.38	0.16	-
	Female	140	3.78	0.62			
Total	**Male**	**154**	**4.15**	**0.54**	**4.40**	**0.01***	**0.06**
	Female	**140**	**3.88**	**0.48**			

p<0.05*

According to Table 6, the genders of the teachers participating in the study significantly differentiated their mean scores in Information Literacy *(t*=4.62), Communication and Collaboration (*t*=3.77), Digital Content Creation (*t*=4.89), Safety and Security (*t*=3.12), Problem-Solving (*t*=4.63), and the total score (*t*=4.40) regarding their ICT competency beliefs (*p*<0.05). All significant differences were found to be in favor of male teachers. In other words, male teachers have higher ICT competency beliefs than female teachers in these sub-dimensions. Moreover, considering Cohen's (1988) effect size criteria (0.01-0.06=small effect, 0.06-0.14=medium effect, 0.14-1=large effect), it can be said that the significant differences in the Information and Data Literacy, Digital Content Creation, and Problem-Solving sub-dimensions, as well as the entire scale, have a medium effect size. On the other hand, the significant differences in the Communication and Collaboration and Safety and Security sub-dimensions have a small effect size. Otherwise, it was determined that the mean scores of the Analyzing and Reflection sub-dimension did not differ significantly in terms of the gender variable (*t*=1.18, *p*>0.05). It can be suggested that gender does not constitute a significant difference for this sub-dimension. However, when considering the total mean scores, it can be inferred that gender is a variable that causes a significant difference.

An ANOVA test was applied to the dataset to determine whether the school level at which the teachers in the study worked significantly differentiated their ICT competency beliefs. The values obtained from the analysis are shown in Table 7.

Table 7. ANOVA Results of ICT Competency Beliefs Scale by School Level

Dimensions	Groups	N	x̄	sd	F	p	η²	d
Information and Data Literacy	Primary School	138	4.22	0.54	2.50	0.09	-	-
	Middle School	108	4.32	0.53				
	High School	48	4.40	0.52				
Communication and Collaboration	Primary School	138	4.16	0.52	0.82	0.45	-	-
	Middle School	108	4.20	0.57				
	High School	48	4.28	0.47				
Digital Content Creation	Primary School	138	3.74	0.77	1.66	0.20	-	-
	Middle School	108	3.88	0.91				
	High School	48	3.98	0.84				
Safety and Security	Primary School	138	4.06	0.57	1.16	0.31	-	-
	Middle School	108	4.16	0.60				
	High School	48	4.18	0.57				
Problem-Solving	Primary School	138	3.77	0.58	1.90	0.56	-	-
	Middle School	108	3.90	0.65				
	High School	48	4.00	0.68				
Analyzing and Reflection	Primary School	138	3.76	0.63	1.62	0.20	-	-
	Middle School	108	3.90	0.67				
	High School	48	3.88	0.63				

p<0.05*

Examining Table 7, it is evident that the school-level variable does not reveal a significant difference in the mean scores of teachers' ICT competency beliefs ($p > 0.05$). In other words, whether teachers work in primary, middle, or high school does not significantly affect their ICT competency beliefs.

An ANOVA test was conducted on the dataset to determine whether the ages of the teachers participating in the study significantly differentiated their ICT competency beliefs. In order to decide which post hoc test to perform, the homogeneity of the variances test result was examined, and Levene's test results were not found at a significant difference level for all sub-dimensions ($p>0.05$). After the variances were found to be homogeneous, the Tukey test was preferred for multiple comparisons between groups. The TukeyHSD function, part of the base package in the R software, was used for this test. All values obtained from these analyses are presented in Table 8.

Table 8. ANOVA Results of ICT Competency Beliefs Scale by Age

Dimensions	Groups	N	x̄	Sd	F	p	η²	D
Information and Data Literacy	30 years and under[a]	66	4.14	0.50	4.64	0.01*	0.03	b>a
	Between 31-40 years[b]	134	4.38	0.55				
	41 years and over[c]	94	4.26	0.52				
Communication and Collaboration	30 years and under[a]	66	4.13	0.45	2.69	0.07	-	-
	Between 31-40 years[b]	134	4.28	0.57				
	41 years and over[c]	94	4.14	0.53				
Digital Content Creation	30 years and under[a]	66	3.71	0.75	2.26	0.10	-	-
	Between 31-40 years[b]	134	3.95	0.94				
	41 years and over[c]	94	3.77	0.73				
Safety and Security	30 years and under[a]	66	3.99	0.53	3.03	0.05*	0.02	b>a
	Between 31-40 years[b]	134	4.20	0.59				
	41 years and over[c]	94	4.10	0.61				
Problem-Solving	30 years and under[a]	66	3.71	0.45	8.10	0.01*	0.05	b>a,c
	Between 31-40 years[b]	134	4.02	0.68				
	41 years and over[c]	94	3.74	0.62				
Analyzing and Reflection	30 years and under[a]	66	3.74	0.50	3.32	0.03*	0.02	-
	Between 31-40 years[b]	134	3.94	0.69				
	41 years and over[c]	94	3.75	0.68				

p<0.05*

According to Table 8, the age variable was found to be a significant factor in creating differences in the Information and Data Literacy, Safety and Security, Problem Solving, and Analyzing and Reflecting sub-dimensions (p<0.05). Considering the effect size of these significant differences, it is noticed that all significant differences are at a small effect level (Cohen, 1988). Examining Table 8, it is evident that in the Information and Data Literacy and Safety and Security sub-dimensions, teachers aged 31-40 hold significantly higher ICT competency beliefs compared to teachers aged 21-30 (p<0.05). On the other hand, in both sub-dimensions, no significant difference was observed in ICT competency beliefs between teachers aged 41 and over and those aged 21-30 and 31-40 (p>0.05). However, in the Problem-Solving sub-dimension, it was determined that teachers aged 31-40 have significantly higher ICT competency beliefs compared to both teachers aged 21-30 and teachers aged 41 and over (p<0.05). Furthermore, for the Problem-Solving sub-dimension, no significant difference was found between the ICT competency beliefs of teachers aged 21-30 and teachers aged 41 and over (p>0.05). Finally, no significant difference was detected between the age groups of teachers in the Analyzing and Reflection sub-dimension (p>0.05).

An ANOVA test was conducted on the dataset to determine whether the teachers' subject areas in the study significantly differentiated their ICT competency beliefs. In addition, since the variances were homogeneous, as indicated by the results of Levene's test, the Tukey test, one of the post hoc analyses, was applied to determine the differences between the groups, and all the values obtained are shown in Table 9.

Table 9. ANOVA Results of ICT Competency Beliefs Scale by Their Branches

Dimensions	Groups	N	$\bar{x}$	sd	F	p	η^2	d
Information and Data Literacy	PST[a]	116	4.25	0.55	15.25	0.01*	0.09	b>a,c
	ITT[b]	44	4.68	0.49				
	Others[c]	134	4.19	0.49				
Communication and Collaboration	PST[a]	116	4.19	0.51	13.92	0.01*	0.09	b>a,c
	ITT[b]	44	4.56	0.49				
	Others[c]	134	4.09	0.52				
Digital Content Creation	PST[a]	116	3.77	0.76	19.00	0.01*	0.12	b>a,c
	ITT[b]	44	4.51	0.75				
	Others[c]	134	3.67	0.83				
Safety and Security	PST[a]	116	4.08	0.59	8.92	0.01*	0.06	b>a,c
	ITT[b]	44	4.46	0.55				
	Others[c]	134	4.05	0.56				
Problem-Solving	PST[a]	116	3.78	0.58	25.21	0.01*	0.15	b>a,c
	ITT[b]	44	4.43	0.63				
	Others[c]	134	3.74	0.57				
Analyzing and Reflection	PST[a]	116	3.78	0.64	4.70	0.01*	0.03	b>a,c
	ITT[b]	44	4.43	0.74				
	Others[c]	134	3.74	0.62				

(PST=Primary School Teachers, ITT=Information Technologies Teachers) p<0.05*

According to Table 9, it was determined that the branches variable caused significant differences in all sub-dimensions of the ICT competency beliefs scale (p<0.05). When examining the eta-squared values of the significant differences, it is observed that there is a medium level effect in the Information and Data Literacy, Communication and Collaboration, Digital Content Creation, and Safety and Security sub-dimensions. Additionally, it is noticed that the Analyzing and Reflection sub-dimension has a low-level effect, while the Problem-Solving sub-dimension has a high-level effect (Cohen, 1988). Table 9 shows that in all sub-dimensions of the ICT competency scale, the ICT competency beliefs of teachers whose branches are Information Technologies were higher than those of teachers whose branches are primary teaching and other branches (p<0.05). Similarly, no significant difference was found between the ICT competency beliefs of teachers whose branches are primary teaching and those of teachers in other subject areas in all sub-dimensions (p>0.05).

4. Discussion and Conclusion

This study aimed to determine the levels of teachers' beliefs regarding their information and communication technology (ICT) competency. Based on the results, teachers' beliefs about their ICT competency are close to a high level. When the sub-dimensions of the scale are examined, teachers' skills in "Digital Content Creation," "Problem-Solving," and "Analyzing and Reflection" were found to be lower compared to other sub-dimensions. In a digitalizing world, teachers are expected

to stay current with technological developments, be technologically literate, and possess the skills to effectively integrate technology into their lessons (International Society for Technology in Education, 2020). Teachers' beliefs about ICT competency are crucial for the successful integration of digital technology into teaching and learning environments (Petko, Prasse, & Cantieni, 2018). The high level of teachers' ICT competency is a positive outcome for education. Especially during the COVID-19 pandemic, it is expected that teachers' ICT competency levels will be high due to the continuation of schools through distance education. However, when examining the sub-dimensions specifically, it is evident that teachers' skills, such as creating digital content and solving problems encountered in the digital environment, remain at a medium level. A review of the literature reveals other studies that found teachers' problem-solving skill levels to be at a medium level (Demirtaş & Dönmez, 2008; Seferoğlu & Akbıyık, 2005; Özçelik & Kurt, 2007; Govender & Govender, 2009; Pekdoğan, 2020; Şahin & Göçer, 2013). This situation indicates that although teachers are competent in using technology and proficient in its application, they have relative deficiencies in integrating technology into various situations and in knowing how to overcome new challenges they encounter.

Whether teachers' ICT competency belief levels differed based on their gender was investigated, and it was found that teachers' ICT competencies differed significantly based on the gender variable. Male teachers' ICT competency levels were higher than those of female teachers in all dimensions except for the "Analyzing and Reflection" dimension. Morris and Venkatesh (2000) found in their research that the technology adaptation process differs by gender. This finding aligns with the observation that ICT competencies differ by gender. Furthermore, the literature review indicates that gender is a significant variable for technology use and that various studies are finding significant differences in technology use in favor of male teachers based on gender (Altun, 2013; Gedik, 2017; Gözel, 2022; Hiçyılmaz, 2018; Hosseini & Kamal, 2012; Karakaya, 2013; Kartal et al., 2018; Mutluoğlu, 2012; Sarıkoç, 2018; Scherer & Siddig, 2015; Şahin & Göçer, 2013; Şahin & Namlı, 2019). The findings of the present study align with previous research, indicating a negative correlation between teachers' ICT competency levels and their technostress levels. In other words, as teachers' ICT efficacy increases, their experience of technostress tends to decrease. This inverse relationship has been reported in various studies across different contexts (Abilleira et al., 2021; Arslan, 2022; Çoklar & Şahin, 2011; Jena & Mahanti, 2014; Marchiori, Mainardes & Rodrigues, 2019; Merchan & Lopez-Arquillos, 2021; Shepherd, 2004; Syvänen et al., 2016; Tarafdar et al., 2011). These findings suggest that enhancing teachers' digital competencies may serve as a protective factor against the negative psychological impacts associated with technology use in educational settings. In addition to the general trend, the study also revealed gender-based differences in technostress levels. Specifically, female teachers were found to experience significantly higher levels of technostress compared to their male counterparts. This result supports previous findings in the literature, which have reported similar gender disparities (e.g., Shepherd, 2004; Syvänen et al., 2016). Possible explanations for this pattern may include differences in access to technological resources, self-efficacy perceptions regarding ICT use, or varying levels of institutional and social support. These differences underscore the importance of considering gender-responsive strategies when developing professional development programs aimed at enhancing ICT competency and mitigating technostress among educators.

This research investigated whether teachers' ICT competency beliefs differed based on their school levels, and the findings revealed no significant difference in teachers' ICT competencies across different school levels. Several studies in the literature corroborate these findings (Akdemir, 2019; Köroğlu & Demiriz, 2015; Öztuzcu, 2022; Yalçınkaya & Özkan, 2014). One potential reason for this lack of differentiation across school levels is thought to be the presence of educational technology projects such as the FATIH Project in Education. This project, undertaken through the Ministry of National Education, involves various steps aimed at promoting equal opportunity in education. Hardware, such as interactive whiteboards, network infrastructure, and VPN internet access, is installed in schools, providing the same services across all school levels. In addition, portals such as EBA (Education Information Network) and ÖBA (Teacher Information Network) continue to support all teachers with interactive content. Moreover, teachers' access to professional development programs and in-service training, regardless of their teaching level, may contribute to a standard in this context. Even with changes in school levels, the equal provision of professional development opportunities, the utilization of similar technological tools, and the overall digitalization of educational processes prevent significant differences from emerging between levels.

This study investigated whether teachers' beliefs about their ICT competency differed based on their age, and the findings revealed a significant difference in teachers' ICT competencies across different age groups. According to the obtained results, teachers aged 31-40 had higher ICT competency beliefs than teachers in other age groups. Teachers in the 31-40 age group, having gained experience in the profession, know how to use and integrate technology into their teaching processes effectively. Teachers aged 41 and over may have spent some periods of their professional lives without

technology. As changing habits can be challenging, teachers at this level of seniority may exhibit more resistance to digital transformation. Similar findings were observed in the studies by Akdemir (2019), Dikmen et al. (2021), Güney (2021), and Kocaoğlu (2013). Conversely, Çetin and Güngör (2014), Hakkari, Tüysüz, and Atalar (2016), Köroğlu and Demiriz (2015), Öztuzcu (2022), Seferoğlu and Akbıyık (2005), and Teo and Milutinovic (2015) found no significant differences related to the age variable.

This study investigated whether teachers' beliefs about their ICT competency differed based on their branch, and the findings revealed a significant difference in teachers' ICT competencies across different branches. According to these findings, Information technology teachers have higher ICT competency beliefs than primary school teachers and teachers from other branches. Several studies in the literature align with these findings (Çok & Günbatar, 2022; Özçelik & Kurt, 2007; Öztuzcu, 2022; Sarıkoç, 2018; Şahin & Göçer, 2013). Information Technology teachers, due to their field, constantly engage with technology. Influenced by the curriculum, they increase their interaction with technology and have continuous opportunities for practice. Given their training and field of expertise, the high ICT competency beliefs of Information Technologies teachers are considered an expected outcome.

In this research, teachers' beliefs about their ICT competency were examined through quantitative analyses in light of various variables. Further research could explore in detail how teachers integrate technology into their lessons and whether this technology integration varies across different variables within classroom practices. It has been shown that teachers with high levels of information and communication technology (ICT) skills are more inclined towards integrating technology into their teaching processes (Hammond et al., 2009). In this context, in-service training is recommended to enhance the ICT competencies of newly appointed, experienced, and female teachers.

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Conflict of Interest

It has been reported by the authors that there is no conflict of interest.

ORCID

Author 1: Halit ARSLAN http://orcid.org/0000-0003-0689-4669

Author 2: Hasan GÜLLÜ http://orcid.org/0000-0003-1893-8817

Author 3: Ahmet Oğuz AKÇAY http://orcid.org/0000-0003-2109-976X