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Reliability and validity of the Turkish version of the teachers' basic ICT competence beliefs scale

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Abstract: The present study seeks to adapt the Teachers' Basic Information Communication Technology (ICT) Competence Beliefs Scale, developed by Rubach and Lazarides (2021), into Turkish and test the adapted scale's validity and reliability. The initial step involved conducting a linguistic equivalence of the scale from English to Turkish with 62 English language teachers in a pre-test. Subsequently, the Turkish version of the scale was administered to 356 teachers (69.7% female, 30.3% male) in Turkey to assess its validity and reliability. Participating teachers were from different subjects (e.g., 9.8% science, 7.9% mathematics, 3.7% social science) and school types (27.5% primary school, 55.3% secondary school, 17.1% others). Results of confirmatory factor analysis indicated the original six-factor structure with three first-order and three second-order factors that best fitted the data. The same competence dimensions were indicated in the Turkish contexts as in the original instrument, i.e., information and data literacy; communication and collaboration; digital content creation; safety and security; problem-solving; analyzing and reflecting. The correlations between all six first-order factors were between $.58 \geq r \geq .79$. All factors showed good reliability indices, i.e., $\alpha > .83$, $\omega > .83$ and $CR > .72$. The adapted instrument was found to be invariant across gender. Mean-level differences among gender groups point to one difference with male teachers reporting higher competence beliefs for digital content creation compared to female teachers. In conclusion, the results of this replication study support the cross-cultural transferability of the original Teachers' Basic ICT Competence Beliefs instrument developed by Rubach and Lazarides (2019).

1. INTRODUCTION

The competence to use Information and Communication Technologies (ICT) is widely recognized as a crucial skill in the current era (Ferrari, 2013; OECD, 2018; Voogt & Roblin, 2012; Wang, Sigerson, & Cheng, 2019). With the rapid advancement of technology in recent decades, society has transformed from an industrial-based society to a digital information society (Anderson, Van Weert, & Duchâteau, 2002; Bayazıt & Seferoğlu, 2009; Parlak, 2017).

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As a result, the educational sector has also been influenced by technological advancements and ICT is seen as a means to further develop, enhance and innovate the learning processes (Kocaman Karoğlu, Bal, & Çimşir, 2020; Parlak, 2017; Redecker & Punie, 2017; Voogt & Roblin, 2012). In response to these changes, ICT has been integrated into educational systems as a crucial learning tool, and the infrastructure of information and communication technologies has been developed in various countries, such as the "2.0 School Program" in Spain, the "Digital School Plan" in Hungary, the "Smart School Program" in Italy (Gil-Flores, Rodríguez-Santero, & Torres-Gordillo, 2017), and in Turkey, the "Education and Information Network (EBA)" and the "Teacher Information Network (ÖBA)" (EBA, 2020; İzmirli, 2015; ÖBA, 2022). Additionally, new technologies such as artificial intelligence and augmented reality have been utilized to support e-learning and digital-based education (Kapur et al., 2018; Kocaman Karoğlu, Bal, & Çimşir, 2020). The integration of technology in education has the potential to improve educational processes and increase learning efficiency, with a focus on students' future professional education and life skills (Seufert, Guggemos, & Sailer, 2021).

The digital transformation and digitalization of education also bring new responsibilities for teachers, including the mastery of digital tools to enhance their teaching and to facilitate their students' ICT competence (Redecker & Punie, 2017; Rubach & Lazarides, 2019; Şad & Nalçacı, 2015; Yurdakul, Dönmez, Altınok, & Odabaşı, 2013). This has given rise to the concept of digital leadership, which requires the adoption and utilization of new technology, the creation and management of technology-related jobs, and the motivation of individuals to achieve their goals in the digital space in order to transform schools into learning spaces suited for the digital age (Asri & Darma, 202; Zhong, 2017). As a result, teachers must be competent in using ICT and fulfil their digital leadership role (Eickelmann & Vennemann, 2017; Hatlevik, Throndsen, Loi, & Gudmundsdottir, 2018). Several frameworks have been introduced to define the basic competencies that teachers should possess in order to fulfil their professional responsibilities. The Technological Pedagogical Content Knowledge (TPACK) model suggests that the best implementation of ICT in the learning and teaching process is achieved through the convergence of technological knowledge, along with pedagogical knowledge, and content knowledge (Mishra & Koehler, 2006; Tondeur, Aesaert, Prestridge, & Consuegra, 2018). The TPACK model is composed of three main components: *technology knowledge, content knowledge, and pedagogy knowledge,* and four sub-components: *technological pedagogical knowledge, technological content knowledge, pedagogical content knowledge,* and *technological pedagogical content knowledge* (Koehler & Mishra, 2005).

Another theoretical approach, as described by Krumsvik (2014) and Rubach and Lazarides (2021), differentiates teachers' ICT competencies into two categories: basic and pedagogical. With regards to educational policy, the Information and Communication Technology Competency Framework for Teachers (ICT-CFT) has been established by the International Society for Technology in Education (ISTE, 2008) and UNESCO (2011). The basic ICT competencies of teachers are categorized as professional competencies, including critical thinking skills, generic skills, ICT skills for professional development, decision-making skills, change management skills, cooperative working skills, and effective communication skills (Anderson, Van Weert, & Duchâteau, 2002; UNESCO, 2011).

Concentrating on the pedagogical ICT competencies of teachers, the International Society for Technology in Education (ISTE, 2008) categorizes these competencies as the orchestration of seven dimensions relevant to teaching and student support. These dimensions include the ability to discover technological innovations for student development, serve as a digital education leader, support students in realizing their responsibilities in the digital world and making positive contributions, collaborate with students and colleagues to use digital resources, create innovative digital learning environments considering individual student differences, facilitate

learning with technology, and analyze data to assist students in reaching their learning goals as an instructional leader. In Turkey, ICT competencies are deemed mandatory for teachers' generic competencies, as per the Ministry of National Education (MoNE, 2006; MoNE, 2017).

The requirement to establish training programs that aim to improve teachers' ICT competencies and to evaluate the effectiveness of these programs is becoming increasingly crucial (Ananiadou & Claro, 2009; Ferrari, 2012; Ilomäki, Paavola, Lakkala et al., 2016; ISTE, 2008; Kultusministerkonferenz, 2016; OECD, 2018; UNESCO, 2011). To evaluate and enhance these programs, the development of valid and reliable evaluation tools to assess teachers' ICT competencies and related competence beliefs is necessary.

In current educational research, instruments aimed at evaluating teachers' competence beliefs, specifically their perceived ICT competencies, have primarily been utilized (Gerick, Eickelmann, & Bos, 2017; Tondeur, Braak, & Valcke, 2007; Tondeur, Aesaert, Prestridge, & Consuegra, 2018). Competence belief has been defined as individuals' assessments of their competencies in various areas (Muenks, Wigfield, & Eccles, 2018). Different theoretical frameworks have differentiated competence beliefs, including specific concepts such as achievement-related expectancies for success (Eccles et al., 1983) and self-efficacy (Bandura, 1977). The underlying theoretical assumption is that competence beliefs, competencies, and related motivational beliefs, such as subjective task values, have an impact on teachers' utilization of ICT in the classroom. Research has shown that basic ICT competence beliefs have a predictive effect on teachers' utilization of ICT, particularly for innovative instruction, whereas pedagogical ICT competence beliefs significantly impact teachers' teaching quality and their ability to incorporate ICT content into their teaching (Angelie & Valanides, 2009; Guggemos & Seufert, 2021; Hatlevik, 2017).

Numerous studies have noted the disparity in the characterization of ICT competencies across various frameworks (Fraillon et al., 2014; Koh et al., 2013; Scherer et al., 2017; Vanderlinde & Van Braak, 2010). The European Digital Competences Framework (Digcomp-Ferrari, 2012) differentiated ICT competencies into six dimensions, namely: information and data literacy, communication and collaboration, digital content creation, safety and security, problem-solving, and analysis and reflection. Furthermore, it introduced a pedagogical ICT license aimed at enhancing teachers' pedagogical competencies. In a recent study, Rubach and Lazarides (2021) developed and validated a scale to assess teachers' basic ICT competence beliefs across various competence dimensions. The scale was designed based on the European Digital Competence Framework (Ferrari, 2012) and the German educational policy framework (Kultusministerkonferenz, 2016) and consisted of six factors that capture the competence dimensions described in previous studies (Rubach & Lazarides, 2021; Ferrari, 2013). These factors include *information and data literacy* (second-order factors: searching, storing and organization), *communication and collaboration*, *digital content creation*, *safety and security*, *problem-solving* (second-order factors: operation and usage, comprehension and development), and *analysis and reflection* (second-order factors: analysis of distribution and risk, analysis of business activities).

Despite the emphasis placed on ICT competencies for teachers by the Ministry of National Education (MoNE) in Turkey, a valid and reliable instrument is still needed that can be used to investigate all assumed dimensions of teachers' basic ICT competence beliefs in the Turkish context. Previous instruments used in Turkey to assess ICT competencies have limitations, such as being primarily designed for pre-service teachers and focusing only on the level of ICT usage rather than competence beliefs (Anagün et al., 2016; Gökçearslan et al., 2019; Kutluca et al., 2010; Türel et al., 2017). Moreover, instruments guided by the Technological Pedagogical Content Knowledge-Practice (TPACK Pratik) model tend to only measure the use of ICT with more general TPACK features (Ay et al., 2015). Therefore, there is a need for an instrument

that measures the full range of relevant ICT skills required for competent usage.

The instrument developed by Rubach & Lazarides (2019) addresses this need but was developed for the German context. Thus, this study aimed to validate the instrument for the Turkish context. The instrument developed by Rubach and Lazarides (2021) is deemed appropriate for validation in Turkey for several reasons, including its emphasis on the necessary items for the competence beliefs of in-service teachers and the factors and sub-factors were created in alignment with current, need-oriented comprehensive scientific research (Ferrari, 2013). Furthermore, the adaptation of this instrument to the Turkish context and investigation of its validity and reliability is expected to contribute to the professional development of both teacher candidates and working teachers in Turkey, as it will provide a means of identifying ICT training needs in the 21st century that meet international criteria (Ferrari, 2013). Thus, we assume the same proposed structure as in Rubach and Lazarides (2021).

The significance of the examination of ICT competence in teachers is widely acknowledged on a transnational level, as it is considered to be a crucial component of effective teaching practices in the 21st century (Parlak, 2017; Palvia et al., 2018). 21st century ICT competence of teachers is indispensable in creating an effective teaching environment (Fraillon et al., 2014). This viewpoint is supported by the Ministry of National Education (MoNE) in Turkey, which recognizes the importance of ICT competencies in teacher training and professional development (MoNE, 2006; MoNE, 2017). Professional development training and its evaluation are needed for teachers beyond country borders to increase their competency by adopting ICT in the classroom (Galanouli et al., 2004). Thus, it is helpful to use the same instrument to compare the motivational traits of teachers across countries. Hence, scale adaptation studies in this subject are essential for repeating and comparing cross-cultural studies. Ensuring the scales' validity in different cultures makes it possible to prepare international education programs.

In light of these considerations, this study aims to adapt the "Teachers' Basic ICT Competence Beliefs" instrument developed by Rubach and Lazarides (2021) into Turkish and test its validity and reliability in the Turkish context. The following research questions guided the study:

RQ 1: Is the Turkish version of the "Teachers' Basic ICT Competence Beliefs" instrument valid?
RQ 2: Is the Turkish version of the "Teachers' Basic ICT Competence Beliefs" instrument reliable?

2. METHOD

2.1. Participants

The sample for the study was drawn from the central districts of Bursa, Turkey and was obtained through the method of convenience sampling, which is a type of purposive sampling. This method was chosen as it allows for the acquisition of relevant data in a timely manner (Patton, 2018). The sample for the pretest consisted of 62 English Language Teachers, with 58.1% of the participants being female and 41.9% being male. A demographic analysis of the pre-test participants is presented in Table 1, which indicates that 12.9% of the teachers were under 26 years of age, 22.6% were between 26-34 years old, 45.2% were between 35-44 years old, and 19.4% were between 45-54 years old.

Table 1. *Demographic Information of the Pre-test Participants.*

		n	%
Gender	Female	36	58.1
	Male	26	41.9
Age	25 and under	8	12.9
	26-34	14	22.6
	35-44	28	45.2
	45-54	12	19.4
Subject	English language	62	100
Total		62	100

Table 2. *Demographic Information of the Main Study Participants.*

		n	%
Gender	Female	248	69.7
	Male	108	30.3
Age	25 and under	4	1.1
	26-34	96	27.0
	35-44	145	40.7
	45-54	89	25.0
	55 and above	22	6.2
Subject	Pre-school Teachers	25	7.0
	Primary School Teachers	82	23.0
	Turkish Language	37	10.4
	Mathematics	28	7.9
	Science	35	9.8
	Social Science	13	3.7
	English Language	28	7.9
	Visual Art	9	2.5
	Technology and Design	8	2.2
	Physical Education	15	4.2
	Religious Culture and Ethics Music Teacher	20 10	5.6 2.8
	School Guidance Counselors	22	6.2
	Information Technology	7	2.0
	Philosophy	5	1.4
	History	5	1.4
	Literature	3	.8
	Vocational Training Teachers	4	1.1
School type	Pre-school	24	6.7
	Primary school	98	27.5
	Secondary school	157	55.3
	High school	37	10.4
TOTAL		356	100

The sample for the main study consisted of 356 teachers, with 69.7% being female and 30.3% being male. The sample size of 356 participants was deemed sufficient for conducting factor analysis in the scale adaptation study. Field (2018) and Tabachnick and Fidell (2013), emphasized that the sample size for such studies should be at least 300 cases in order to ensure the reliability of the instruments. The demographic characteristics of the sample are detailed in Table 2, which highlights the age distribution of the participants, with 4 (1.1%) being less than 25 years old, 96 (27%) being between 26 and 34 years old, 145 (40.7%) being between 35 and 44 years old, 89 (25%) being between 45 and 54 years old, and 22 (6.2%) being older than 55 years old. In terms of their teaching roles, 6.7% of the participants were pre-school teachers, 27.5% were primary school teachers, 55.3% were secondary school teachers, and 10.4% were high school teachers.

2.2. Instruments

The "Teachers' Basic ICT Competence Beliefs" instrument was developed by Rubach and Lazarides (2021) and consists of 32 items divided into six competence domains: *information data literacy* (6 items), *communication and collaboration* (6 items), *digital content creation* (4 items), *safety and security* (4 items), *problem-solving* (7 items), and *analyzing and reflecting* (5 items). Three of the competence domains possess a second-order structure: *information data literacy* (searching, storing, and organization), *problem-solving* (operation and usage, comprehension and development), and *analyzing and reflecting* (analysis of distribution and risk, analysis of business activities). The data fit was analyzed using statistical indices such as the Kaiser-Meyer-Olkin coefficient (KMO = .93) and Bartlett's Test of Sphericity (x^2 [1378] = 9290.98, p <.0001) in the exploratory factor analysis (EFA), and x^2/df= 1.48 [654.73/441], CFI = .96, RMSEA= .04 in the confirmatory factor analysis (CFA) which indicated a good fit. The reliability of the instrument was supported with values of McDonald's omega (ω) ranging between $.63 \geq \omega \geq .93$. The original scale utilized the five-point Likert type, ranging from 1 (strongly disagree) to 5 (strongly agree), with no reverse items. In this study, the 32 items were translated into Turkish and the same Likert scale was used as in the original instrument.

2.3. Procedure and Data Analysis

The translation of the "Teachers' Basic ICT Competence Beliefs" instrument from English to Turkish was carried out using a forward-backward translation technique. Initially, three English language teachers in Turkey were tasked with translating the English version of the instrument into Turkish. These teachers then collaborated to reconcile any differences in their translations and arrived at a consensus for the final version of the Turkish translation. The final version of the Turkish instrument was reviewed for linguistic and cultural appropriateness by an expert in linguistics who is proficient in both English and Turkish. The Turkish version of the instrument was then back-translated into English by two academics working at a university's English preparatory school, and the two back-translations were compared for word compatibility and cultural-linguistic equivalence.

In the pre-test phase, the equivalence of the original and translated versions of the scale was assessed through the completion of both the English and Turkish versions of the instrument by teachers. Correlation coefficients between the original and the translated versions of the scale and paired-samples t-test were analyzed. For the main study, a second sample of teachers was recruited to evaluate the validity and reliability of the Turkish version of the instrument. The analysis was performed using various software and techniques. Using SPSS 23.0 and SPSS AMOS 26.0, Exploratory Factor Analysis (EFA) and Confirmatory Factor Analysis (CFA) were conducted as well as reliability indices Cronbach Alpha (α), McDonald's (ω), Mplus 8.1 were utilized to test measurement invariance across gender groups and Microsoft Excel was utilized to calculate the Composite Reliability (CR) coefficient. The study adhered to the

"Guidelines for Translating and Adapting Tests" (IJATE, 2014).

The study utilized Exploratory Factor Analysis (EFA) to examine the number of factors and factor loadings of the items in the scale and their relationships. The sample size was analyzed using the Kaiser Meyer Olkin (KMO= .95) coefficient, and the data for factor analysis was analyzed using Barlett's Sphericity test value (χ^2= 10052.01, *df*= 406, $p \leq .001$) with maximum-likelihood estimation and a normal covariance matrix. Factor loadings and variances were used to assess the appropriateness of factors and items, and multicollinearity between factors was examined based on factor correlation, the Variance Magnification Factor (VIF), and tolerance values. The normality assumption of the data was indicated by examining skewness and kurtosis.

Confirmatory Factor Analysis (CFA) was employed to verify the appropriateness of the original instrument's structure after translation and adaptation to a different language and culture (Seçer, 2018; Tabachnick & Fidell, 2013). The fit of the model to the data indicated by CFA was evaluated using various fit indices (Hu & Bentler, 1999), including Comparative Fit Index (CFI), Tucker-Lewis Index (TLI), Incremental Fit Index (IFI), and Root Mean Square Error of Approximation (RMSEA). The study also calculated reliability indices such as Cronbach Alpha (α), McDanold's omega (ω), and Composite Reliability (CR). In order for the scale to have qualities such as validity and reliability, it is considered appropriate to test the quality of each item of the scale with item analysis (Tekindal, 2015). Thus, item analyses were carried out to estimate item-total correlation values; the difference between the mean scores of the lower 27% and upper 27% groups of the total scores of the scale was examined with independent t-tests.

The study also tested the measurement invariance across gender groups using Mplus 8.1 (Muthén & Muthén, 1998-2016). We conducted analyses of the measurement invariance as a robustness check to replicate finding on gender differences and similarities reported by Rubach & Lazarides (2021). In order to examine the robustness of the instrument and to replicate the findings of gender differences and similarities reported by Rubach & Lazarides (2021), a measurement invariance analysis was conducted. The configural, metric, and scalar invariance were examined by systematically constraining the factor loadings and item intercepts to equality across males and females. Testing measurement invariance enables to determine similarities and differences across groups and thus tests the robustness of the instrument, e.g., across groups or time. That is, the measurement invariance tests indicated if the expected scores of individuals were independent of group membership or time (Chen, 2007; Wicherts, 2007). Cut-off values for sample sizes n > 300 were used to indicate insignificant changes in the more restrictive model: $\Delta CFI \leq -.010$ and $\Delta RMSEA \leq .015$, or $\Delta SRMR \leq .030$ for step 1 (configural invariance) and values of $\Delta CFI \leq -0.010$ and $\Delta RMSEA \leq 0.015$ or $\Delta SRMR \leq .010$ for step 2 (metric and scalar invariance) (Chen, 2007).

2.4. Ethical Considerations

As scientific professionals, it is incumbent upon us to ensure the accuracy and reliability of the information we generate and disseminate for the betterment of society. To this end, it is imperative that we adhere to established ethical principles throughout all stages of the scientific research process (TÜBA, 2008). This study was undertaken with due regard for ethical considerations, starting with obtaining permission from the owner of the measurement instrument in accordance with scientific ethical guidelines. Participants in the study were provided with an informed consent form, and their participation was strictly voluntary. No personal information was solicited through the instrument, and the data collected was solely intended for scientific purposes. The analysis, interpretation, and reporting of these data were guided by ethical principles, and the study was approved by the Yildiz Technical University Humanities and Social Sciences Research Academic Ethics Committee (Approval no: 2021/01, dated 21.03.2021) prior to its implementation.

3. RESULTS

3.1. Linguistic Equivalence

The linguistic equivalence stage of this study involved administering both the English and Turkish versions of the scale as an online form at one-week intervals. This methodology is in line with previous studies (Baş & Balaman, 2021; Dündar et al., 2008; Kılıç & Alcı, 2022) which have also employed the application of the original scale and its target language equivalent to a sample group of proficient bilinguals at one-week intervals. It was seen that approximately 30 bilinguals were employed in the studies indicated for this stage. In this study, a sample of 62 participants was recruited for the linguistic equivalence assessment, yielding a sufficient sample size. The associations between the total scores of the scale and the total scores of its factors and second-order factors were then investigated for both the Turkish and English versions, as shown in Table 3. The correlation coefficients (r) between the scores were found to be greater than .84, indicating strong correlations (Büyüköztürk, 2011). Based on these findings, it can be concluded that linguistic equivalence was achieved between the English and Turkish versions of the scale.

Table 3. *Correlation Coefficient between Turkish and English Versions.*

Factors/Second-order factors	*r*
Factor 1: Information and data literacy	.92**
Second-order factor (Factor 1.1): Searching	.91**
Second-order factor (Factor 1.2): Storing and organizing	.88**
Factor 2: Communication and collaboration	.89**
Factor 3: Digital content creation	.88**
Factor 4: Safety and security	.90**
Factor 5: Problem-solving	.95**
Second-order factor (Factor 5.1): Operation and usage	.88**
Second-order factor (Factor 5.2): Comprehension and development	.94**
Factor 6: Analyzing and reflecting	.88**
Second-order factor (Factor 6.1): Analysis of distribution and risks	.84**
Second-order factor (Factor 6.2): Analysis of business activities	.85**
TOTAL	.97**

Note. **$p < .001$

Results on mean differences of factors and second-order factors between the Turkish and English versions are presented in Table 4.

Table 4. *Paired-samples t-test Values between Turkish and English Versions.*

	Language	N	*SS*	X	*t*-test	
					t	*p*
TOTAL	English	62	17.75	126.09	-1.06	.28
	Turkish	62	20.23	126.77		

Note. $p>.05$

The results showed no significant difference between the two versions of the scale. In addition, inter-factors correlation coefficients of the Turkish and English versions are shown in Table 5.

Table 5. *Inter-factor Correlation Coefficients of Turkish Version and English Version.*

	Factor 1		Factor 2		Factor 3		Factor 4		Factor 5		Factor 6	
	Turk.	Eng.	Turk.	Eng.	Turk.	Eng.	Turk.	Eng.	Turk.	Eng.	Turk.	Eng.
Factor 1	1	1	.74**	.58**	.64**	.52**	.69**	.56**	.68**	.60**	.74**	.63**
Factor 2			1	1	.82**	.75**	.71**	.51**	.76**	.61**	.75**	.60**
Factor 3					1	1	.58**	.49**	.83**	.75**	.67**	.53**
Factor 4							1	1	.68**	.55**	.68**	.53**
Factor 5									1	1	.81**	.69**
Factor 6											1	1

Note. **p<.001, Factor 1 = Information and data literacy, Factor 2 = Communication and collaboration, Factor 3 = Digital content creation, Factor 4 = Safety and security, Factor 5 = Problem-solving, Factor 6 = Analyzing and reflecting.

Table 5 reveals the absence of significant differences in the correlation values between the two scale factors, thereby providing evidence for the reliability of the Turkish translation of the scale.

3.2. Validity Study

3.2.1. *Exploratory Factor Analysis (EFA)*

This study employed Exploratory Factor Analysis (EFA) to evaluate the structural validity of the scale. The results of the Kaiser Meyer Olkin coefficient indicated that the sample size was adequate (KMO=.95 > .70); The Barlett's test of Sphericity (χ^2 = 10052.01 > .5; *df*= 406; $p \leq$ .001) confirmed the suitability of the data for factor analysis (Hutcheson & Sofroniou, 1999). In addition, our results were similar to the EFA results of the original scale (KMO = .93; Bartlett's Test of Sphericity= x^2 [1378] =9290.98, $p \leq .001$) (Rubach & Lazarides, 2021).

The EFA, performed using oblique rotation on all 32 items, revealed that three items were double-loaded (item3 in factor1, item12 in factor2, item13 in factor 3; see Table 6). The oblique rotation method rotates factors independently, which does not alter the ratio of total variance explained by the factors (Tabachnick & Fidell, 2013). Consequently, these three items were removed from the scale to avoid overlap (Seçer, 2018). This outcome may be due to differences in understanding or attitudes among teachers in the sample group (Buabeng-Andoh, 2012), or to intercultural differences in individual responses to these items (Ay et al., 2015).

Table 6. *Excluded Items.*

Excluded item no	Factor No	Excluded items (Original version)	Excluded items (Turkish Version)
Item 3	Factor 1.1	I am critical about information, sources and data in digital environments	Dijital ortamdaki bilgi, veri ve kaynaklar konusunda eleştirel bir yapıdayım.
Item 12	Factor 2	I can share my experiences with digital media in interactions with others	Dijital medya ile ilgili deneyimlerimi, başkalarıyla etkileşim halinde paylaşabilirim.
Item 13	Factor 3	I can use familiar apps and programs according to my needs.	İhtiyaçlarım doğrultusunda, aşina olduğum uygulama ve programları kullanabilirim

Finally, a six-factor solution, consisting of three first-order factors with two second-order factors each (29 items), was subjected to analysis (as depicted in Table 7). The factor loadings range between .46 ≥ λ ≥ .93, with a loading value of λ ≥ .45 considered as appropriate, and a threshold value of .30 considered acceptable in some cases (Büyüköztürk, 2011; Tabachnick &

Fidell, 2013). The common variance values of the factors, as specified in Table 7, show that the variance of the factors ranges from .75 to .92, with a factor variance above .66 considered a proper solution (Büyüköztürk, 2011; Tavşancıl, 2014). Additionally, an explained variance of .30 or above is considered adequate for scales with one factor, while a higher explained variance is expected for scales with multiple factors (Büyüköztürk, 2011; Çokluk et al., 2010; Tabachnick & Fidell, 2013). The explained variance of the scale in this study is 83.89%, suggesting a sound structure.

Table 7. *Factor Loadings and Factor Variance.*

Items	Factor Loadings									Factor Variance
	Factor 1.1	Factor 1.2	Factor 2	Factor 3	Factor 4	Factor 5.1	Factor 5.2	Factor 6.1	Factor 6.2	
1	.90									.87
2	.79									.86
3		.93								.76
4		.83								.90
5		.73								.87
6			.65							.80
7			.63							.82
8			.59							.82
9			.58							.77
10			.48							.75
11				.90						.88
12				.86						.92
13				.84						.90
14					.83					.80
15					.80					.85
16					.70					.77
17					.51					.80
18						.67				.82
19						.60				.81
20						.60				.85
21						.55				.81
22							.78			.82
23							.74			.83
24							.74			.81
25								.53		.83
26								.53		.86
27								.46		.81
28									.85	.91
29									.83	.90

Note. Total Variance Explained: %83.89, Factor 1 = Information and data literacy, Factor 2 = Communication and collaboration, Factor 3 = Digital content creation, Factor 4 = Safety and security, Factor 5 = Problem-solving, Factor 6 = Analyzing and reflecting.

The correlation coefficients between the factors were below 0.80, which suggests that no multicollinearity problem was present (Büyüköztürk, 2011). To further verify this, the Variance Magnification Factor (VIF) was calculated. The criteria established by Tabachnick and Fidell (2013) dictate that if the VIF value is higher than 10, there is multicollinearity between

variables. Besides this, tolerance values less than 0.10 indicate collinearity (Daoud, 2017). The VIF values for the present study, ranging from 2.483 to 4.937 (VIF<10), suggesting that there was no multicollinearity between the factors (Büyüköztürk, 2011). Moreover, the tolerance values for each factor, ranging from 0.20 to 0.40 (the values > .10), supported this conclusion.

3.2.2. *Normal Distribution Analysis*

The univariate normal distribution of the data was evaluated by means of the skewness and kurtosis values, as proposed by Tabachnick and Fidell (2013). The normality of the data was assessed for each item and factor based on the skewness and kurtosis values, as demonstrated in Table 8. The analysis of normality revealed that the obtained data had a skewness of -.268 and a kurtosis of -.445, which indicated a normal distribution within the bounds of ±3, according to the criteria established by Tabachnick and Fidell (2013) and Trochim and Donnelly (2006). Another cut off to determine substantial non-normality is either an absolute skew value larger than 2 or an absolute kurtosis larger than 7 (Kim, 2013). As reported in Table 8, values for kurtosis and skewness showed normality for 29 items and each factor.

Table 8. *Normality of Data Results.*

Item/Factor	N	Skewness	Kurtosis
Factor 1	356	-.526	-.498
Item 1	356	-.883	-.209
Item 2	356	-.836	.053
Item 3	356	-.568	-.497
Item 4	356	-.589	-.442
Item 5	356	-.507	-.687
Factor 2	356	-.812	.029
Item 6	356	-.991	.292
Item 7	356	-.985	.368
Item 8	356	-.683	-.391
Item 9	356	-.786	-.081
Item 10	356	-.767	-.279
Factor 3	356	-.227	-.888
Item 11	356	-.227	-.937
Item 12	356	-.274	-.969
Item 13	356	-.349	-.820
Factor 4	356	-.693	-.245
Item 14	356	-.920	.271
Item 15	356	-.646	-.404
Item 16	356	-.644	-.389
Item 17	356	-.958	.296
Factor 5	356	-.324	-.253
Item 18	356	-1.250	1.365
Item 19	356	-.913	.330
Item 20	356	-.805	.210
Item 21	356	-.444	-.375
Item 22	356	-.052	-.721
Item 23	356	-.151	-.836
Item 24	356	.347	-.870

Factor 6	356	-.325	-.311
Item 25	356	-.333	-.639
Item 26	356	-.411	-.396
Item 27	356	-.491	-.266
Item 28	356	-.338	-.596
Item 29	356	-.278	-.596
Total	356	-.445	-.268

Note. Factor 1 = Information and data literacy, Factor 2 = Communication and collaboration, Factor 3 = Digital content creation, Factor 4 = Safety and security, Factor 5 = Problem-solving, Factor 6 = Analyzing and reflecting.

3.2.3. *Confirmatory Factor Analysis (CFA)*

The Maximum-Likelihood estimation was utilized to test the same Confirmatory Factor Analysis (CFA) model as presented in Rubach and Lazarides (2021). Based on the 32-item CFA, the results χ^2 (438) = 1266.01; CFI = .92, TLI = .91, RMSEA = .073, SRMR = .07. However, examination of the exploratory factor analysis (EFA) indicated the presence of double-loaded items. Consequently, a CFA was conducted using the 29 item solution, which was determined to be an appropriate model with acceptable model fit indices, as shown in Figure 1.

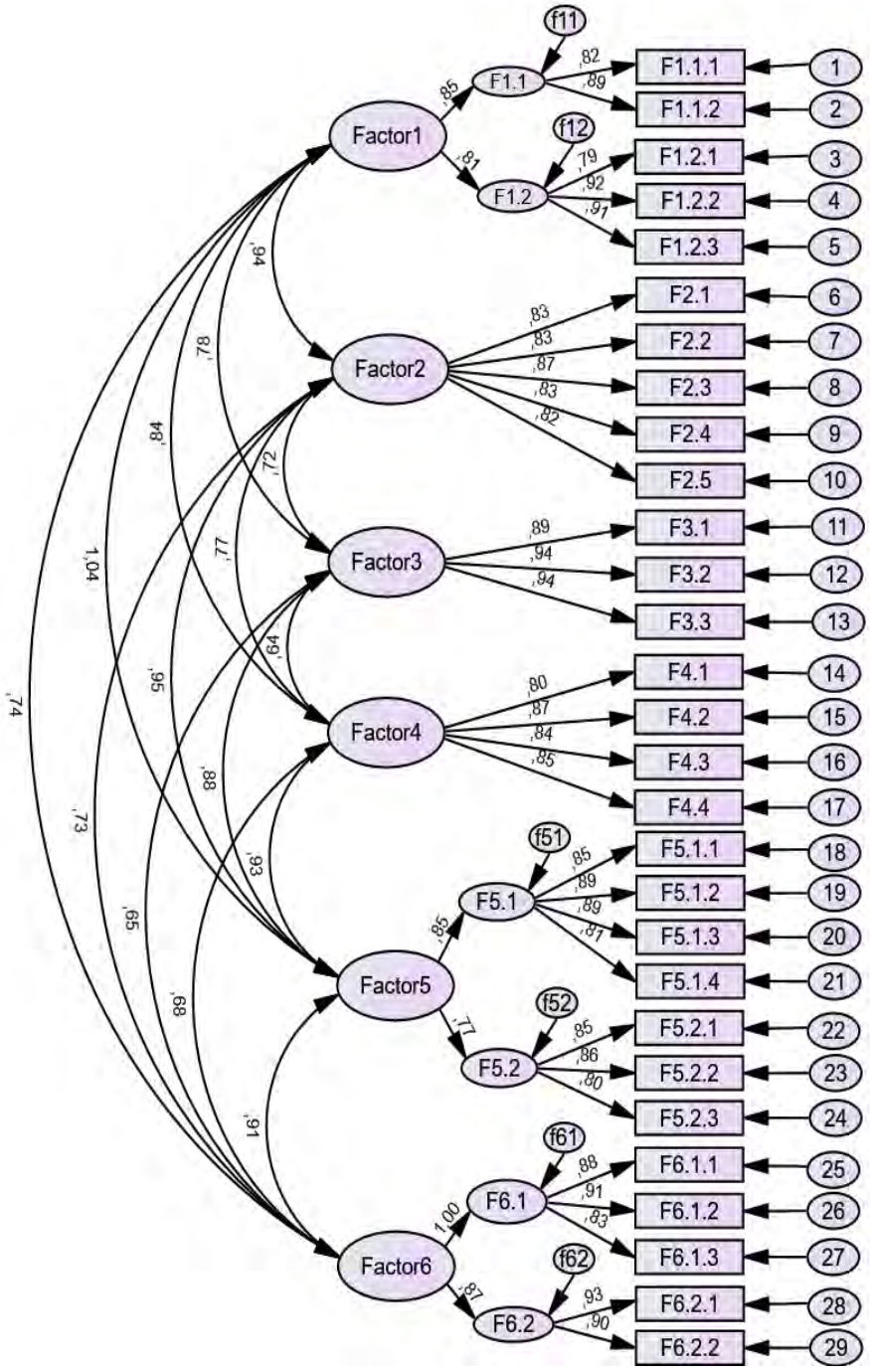
The results of the values obtained from the CFA are revealed in Table 9.

Table 9. *CFA Fit Indices and CFA Results.*

Fit Indices	Perfect Fit	Acceptable Fit	Model fit indices (Rubach & Lazarides)	Model fit indices (Turkish version)
χ^2/df	$0 \leq \chi^2/df \leq 2$	$2 \leq \chi^2/df \leq 3$	1.48	2.96
RMSEA	0≤RMSEA≤ .05	.05 ≤RMSEA≤ .08	.04	.07
CFI	.95 ≤CFI ≤1	.90 ≤CFI ≤ .95	.96	.93
TLI	.95 ≤TLI ≤1	.90 ≤TLI ≤ .95	.95	.92
IFI	.95 ≤IFI ≤1	.90 ≤IFI ≤ .95	--	.93

In Figure 1, it is observed that the factor structure of the Turkish version is consistent with the German version proposed by Rubach & Lazarides (2021). The 29-item solution was found to comprise six second-order factors, which encompass *information and data literacy* (comprising searching, storing and organization), *communication and collaboration*, *digital content creation*, *safety and security*, *problem-solving* (encompassing operation and usage, comprehension and development), and *analyzing and reflecting* (encompassing analysis of distribution and risk, analysis of business activities).

Figure 1. *CFA Model.*



3.3. Reliability Study

The examination of internal consistency was performed through the utilization of three measures: the Cronbach Alpha Coefficient (α) (Cronbach, 1951), McDonald's Omega (ω) (McDonald, 1999), and the Composite Reliability Coefficient (CR) (Bacon, Sauer, & Young, 1995) (see Table 10 for further details).

Table 10. *Cronbach Alpha (α), McDonald's omega (ω), Composite Reliability (CR) of the Scale Factors*

	Turkish version				Original version (Rubach & Lazarides, 2021)
	α	ω	Cr	Number of Items	ω
Factor 1	.89	.89	.92	5	-
Second-order factor (Factor 1.1)	.83	.83	-	2	.81
Second-order factor (Factor 1.2)	.90	.91	-	3	.63
Factor 2	.92	.92	.72	5	.86
Factor 3	.94	.94	.90	3	.91
Factor 4	.90	.90	.80	4	.87
Factor 5	.90	.89	.85	7	-
Second-order factor (Factor 5.1)	.91	.91	-	4	.91
Second-order factor (Factor 5.2)	.87	.87	-	3	.85
Factor 6	.93	.92	.78	5	-
Second-order factor (Factor 6.1)	.90	.90	-	3	.86
Second-order factor (Factor 6.2)	.91	.91	-	2	.93
TOTAL	.97	.97	.96	29	

Note. Factor 1 = Information and data literacy, Factor 2 = Communication and collaboration, Factor 3 = Digital content creation, Factor 4 = Safety and security, Factor 5 = Problem-solving, Factor 6 = Analyzing and reflecting.

The internal consistency of the data was evaluated using the Cronbach's Alpha Coefficient (α) and McDonald's Omega (ω) and the Composite Reliability (CR) (Cronbach, 1951; McDonald, 1999; Bacon, Sauer, & Young, 1995). According to George & Mallery (2003) and Kılıç (2016), the acceptable range of α is $0.6 \leq \alpha < 0.7$, good range is $0.7 \leq \alpha < 0.9$, and excellent when $\alpha \geq 0.9$. The results showed that the overall Cronbach's Alpha coefficient was .97, indicating excellent reliability, and the Cronbach's Alpha coefficients for all factors were between $.83 \leq \alpha < .94$. The results also indicated excellent reliability for McDonald's Omega with an overall coefficient of .97 and a range between $.83 \leq \omega < .94$. These values are consistent with the findings of Rubach and Lazarides (2021), who reported McDonald's Omega coefficients ranging between $.63 \leq \omega < .93$. The Composite Reliability coefficient, calculated for each factor CR>.72 and the total scale, was found to be reliable with a value of CR = .96, demonstrating structural equality (Bacon, Sauer, & Young, 1995).

Furthermore, inter-factor correlation coefficients (*r*) were analyzed and presented in Table 11 for both the Turkish and German versions.

Table 11. *Inter-factor Correlation Coefficients between factors for the Turkish Version (before the slash) and the original version by Rubach & Lazarides (2021, behind slash).*

	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5	Factor 6
Factor 1	1/ 1	.79**/.95**	.65**/.68**	.71**/.81**	.76**/.74**	.60**/.71**
Factor 2		1/ 1	.67**/.66**	.70**/.67**	.76**/.66**	.66**/.62**
Factor 3			1/ 1	.58**/.72**	.75**/.88**	.60**/.53**
Factor 4				1/ 1	.74**/.76**	.63**/.70**
Factor 5					1/ 1	.76**/.67**
Factor 6						1/ 1

Note. **p<.001, Factor 1 = Information and data literacy, Factor 2 = Communication and collaboration, Factor 3 = Digital content creation, Factor 4 = Safety and security, Factor 5 = Problem-solving, Factor 6 = Analyzing and reflecting.

Table 11 presents the results of the inter-factor correlation analysis, with the coefficients ranging from .58 to .79, which are statistically significant (.58 < *r* < .79; *p*< .001). As per Büyüköztürk (2011) and Dancey and Reidy (2007), correlation coefficients between .30 and .70 reflect a moderate correlation, whereas coefficients greater than .70 indicate a strong correlation. The inter-factor correlation coefficients in Table 11 demonstrate close values to those reported in Rubach and Lazarides (2021) for the original scales.

3.4. Item Analysis

The intent of further item analysis was achieved through an examination of the difference between the lower and upper 27% of the sample by computing the item-total correlation. The relationship between the item scores in the 27% groups and the total scale scores was analyzed in accordance with established literature on the subject (Büyüköztürk, 2011; Tavşancıl, 2014; Tezbaşaran, 2008).

Positive and high correlations indicate that the internal consistency of the scale is maintained and that items can effectively discriminate when the correlation value (r) is greater than or equal to .30, while the significance of the t-test results confirms internal consistency (Büyüköztürk, 2011; Tavşancıl, 2014). T-tests were also used to evaluate mean level differences (Büyüköztürk, 2011; Tezbaşaran, 2008). The results of the correlations and t-tests, which demonstrate the relationship between the item-total correlation values and the lower and upper 27% groups, are presented in Table 12. The item-total correlation values range between .62 ≥ *r* ≥ .79 and the mean scores for the lower 27% (N=96) and upper 27% (N=96) groups were found to be statistically significant for each item according to the results of the independent t-test (*p*<.001). These results indicate that the scales are reliable and discriminate effectively.

Table 12. *Item Analysis Results.*

Factors	Second-order Factors	Item	Item Total Correlation (*r*)	Lower 27% -Upper 27% T-Test
Factor 1	F 1.1	1	.66	14.96*
		2	.72	18.39*
	F 1.2	3	.70	19.63*
		4	.69	18.16*
		5	.73	19.26*
Factor 2	-	6	.72	18.23*
		7	.73	16.82*
		8	.78	22.23*
		9	.74	19.23*
		10	.76	21.94*
Factor3	-	11	.73	17.85*
		12	.74	18.29*
		13	.78	20.27*
Factor 4	-	14	.67	15.03*
		15	.71	18.77*
		16	.71	21.68*
		17	.75	18.69*
Factor 5	F 5.1	18	.73	17.72*
		19	.79	21.50*
		20	.77	20.55*
		21	.77	20.99*

	F 5.2	22	.69	16.10*
		23	.72	17.07*
		24	.62	14.06*
Factor 6	F 6.1	25	.73	18.66*
		26	.76	18.74*
		27	.73	18.40*
	F 6.2	28	.67	16.26*
		29	.69	15.54*

Note. *p<.001, Factor 1 = Information and data literacy, Factor 2 = Communication and collaboration, Factor 3 = Digital content creation, Factor 4 = Safety and security, Factor 5 = Problem-solving, Factor 6 = Analyzing and reflecting.

3.5. Measurement Invariance

The following step involved evaluating the invariance of the instrument across gender groups (as presented in Table 13). Results of the configural invariance analysis in Table 13 indicate that the adapted instrument maintained a consistent structure across gender groups. Additionally, the factor loadings were found to be equivalent across groups, which supports the metric invariance of the items. The scalar invariance of the instrument was determined by evaluating the equivalence of the values of the subjects in regards to the implicit structure and the observed values (Başusta & Gelbal, 2015). Based on changes in the values of CFI, RMSEA/SRMR, it was concluded that the Turkish version of the instrument demonstrated scalar invariance across gender, as reflected by the invariance of the structure, factor loadings, and item intercepts. To determine the significance of these changes, ΔCFI, ΔRMSEA and ΔSRMR values were compared to established thresholds. We considered values of ΔCFI ≤ -.010 and ΔRMSEA ≤ 0.015, or ΔSRMR ≤ 0.030 for step 1 and values of ΔCFI ≤ - 0.010 and ΔRMSEA ≤ 0.015 or ΔSRMR ≤ .010 for step 2 to indicate insignificant changes in the more restrictive model (Chen, 2007).

Table 13. *Indices analyzing measurement invariance of the final factor model.*

	x^2	*df*	CFI	TLI	RMEAS	SRMR
Configural invariance	1484.565	702	.925	.913	.079	.050
Metric invariance	1533.747	725	.922	.913	.079	.061
Scalar invariance	1571.534	748	.921	.914	.079	.063

The multi-group model was established with the objective of determining scalar invariance, which involves the assessment of equivalence in factor structure, factor loadings, and item intercepts. In light of the absence of a specific hypothesis or need to test strict invariance, no such assessment was conducted (Scherer et al., 2017). The results of gender differences for each factor are presented in Table 14.

Based on the probability values, difference for only one competence dimension was determined between male and female teachers in their basic ICT competence beliefs – Male teachers reported higher competence beliefs for digital content creation compared to female teachers.

Table 14. *Gender Differences.*

	Male (n = 108)			Female (n = 248)			*t*	*df*	*p*	*d*	95% CI	
	M	*SD*	95% CI	M	*SD*	95% CI						
Factor 1	4.15	.77	[4.01; 4.29]	4.00	.79	[3.90; 4.10]	-1.62	354	.11	-.19	[-.418;	.035]
Factor 2	4.16	.79	[4.02; 4.31]	4.04	.87	[3.93; 4.16]	-1.22	354	.22	-.14	[-.368;	.084]
Factor 3	3.61	1.15	[3.42; 3.84]	3.32	1.18	[3.16; 3.46]	-2.13	354	.03	-.25	[-.474;	-.021]
Factor 4	3.95	.87	[3.80; 4.12]	4.01	.91	[3.89; 4.12]	0.53	354	.60	.07	[-.159;	.293]
Factor 5	3.64	.86	[3.49; 3.82]	3.50	.86	[3.35; 3.61]	-1.36	354	.18	-.16	[-.389;	.063]
Factor 6	3.65	.97	[3.46; 3.83]	3.44	1.00	[3.30; 3.58]	-1.83	354	.07	-.21	[-.438;	.015]

Factor 1 = Information and data literacy, Factor 2 = Communication and collaboration, Factor 3 = Digital content creation, Factor 4 = Safety and security, Factor 5 = Problem-solving, Factor 6 = Analyzing and reflecting.

4. DISCUSSION and CONCLUSION

This study aimed to validate the Turkish version of the “Teachers’ Basic ICT Competence Beliefs” instrument developed by Rubach and Lazarides (2021). The underlying structure proposed by Rubach and Lazarides (2021) was adopted as the theoretical framework for this study. Confirmatory factor analysis (CFA) was employed to determine the validity of the Turkish version of the instrument and replicate the six-factor structure, including the second-order structure of three factors.

The subsequent confirmatory analysis revealed that the 29-item Turkish version of the "Teachers' Basic ICT Competence Beliefs" instrument demonstrated acceptable agreement with the original model, as evidenced by high reliability indices. The validity and reliability values of the Turkish scale were comparable to those of the original scale (Rubach & Lazarides, 2021), implying intercultural compatibility for future research. The items of the scale were deemed reliable and distinct for both upper and lower groups, thus suggesting potential benefits for the professional development of in-service and pre-service teachers according to international standards.

Three items from the original scale were removed in the Turkish version as they were found to be inconsistent with the data collected. This discrepancy might be attributed to individuals expressing themselves differently due to intercultural language differences (Ay et al., 2015). Furthermore, variations in factors such as digital technology literacy, access to technology, and usage habits may have contributed to disparities in responses compared to the German sample as described by Koehler & Mishra (2005) and Tondeur, Valcke, & Van Braak (2008). Additionally, personal factors such as attitudes, characteristics, and experiences regarding the utilization of digital technology could also play a role in shaping an individual's ICT (Buabeng-Andoh, 2012). Future research should aim to further understand the psychological processes and similarities and differences in competence beliefs across different cultures, such as Germany and Turkey.

Gender is a crucial individual characteristic that may impact ICT competence beliefs. Thus, it is important to first estimate the invariance of the measurement instrument across gender groups. The results of this study indicated that scalar measurement invariance was approved across gender groups, consistent with the findings of Rubach and Lazarides (2019). In the subsequent analysis, mean-level differences in ICT competence beliefs between male and female teachers were investigated. The results revealed a single difference, with male teachers exhibiting higher competence beliefs in the digital content creation dimension compared to female teachers. Although this difference was observed, it was of a small effect size, which is typical in studies examining gender differences. In the German context, Rubach and Lazarides (2019) found no significant gender differences for the dimensions of information and data literacy, as well as communication and collaboration, but for the dimensions of digital content

creation, security, problem solving, and analysis and reflection, male teachers consistently demonstrated higher competence beliefs. These results highlight the potential for intercultural differences in teachers' ICT competence beliefs according to gender. A meta-analysis study by Cai et al., (2017) found that men exhibited more positive attitudes and self-efficacy towards technology use compared to women. It is suggested that future research should further explore the psychological processes and similarities and differences in competence beliefs across different cultures and teacher groups, particularly in the context of the successful use of ICT in education.

The present study has some limitations that need to be considered. Firstly, the sample of teachers was drawn from a single city (Bursa) in Turkey, limiting the generalizability of the results. Furthermore, previous studies that aimed to develop and/or validate instruments in Turkey have mostly focused on pre-service teachers and focused on the level of ICT use, while this study focuses on in-service teachers (Anagün et al., 2016; Gökçearslan et al., 2019; Kutluca et al., 2010; Türel et al., 2017). In the adaptation of the Technological Pedagogical Content Knowledge-Application (TPACKPratik) model for the Turkish culture, items measuring general ICT use were utilized (Ay, Karadağ & Acat, 2015). Future work would benefit from measuring ICT competence beliefs of both in-service and pre-service teachers in line with international criteria.

Secondly, reliability of the instrument was estimated using the Cronbach Alpha Coefficient, the McDonald's Omega, and the Composite Reliability (CR) coefficient. While these coefficients point to acceptable levels of reliability, recent discussions have highlighted the higher value obtained using HTMT2 instead of CR (Roemer et al., 2021). Therefore, future studies might consider the calculation of HTMT2 to increase the robustness of the findings. Additionally, it may be recommended to examine item reliability and assess for different values in multicollinearity in similar studies.

However, despite these limitations, the present study holds significant value in that it has established the validity of the ICT competence beliefs scale as a tool to capture the basic ICT competence beliefs of teachers in Turkey.The present study has found that the ICT competence beliefs scale is a valid instrument to measure teachers' basic ICT competence beliefs in the Turkish context. This result highlights the significance of basic ICT competence beliefs in the utilization of technology in the classroom, as highlighted by various studies (Guggemos & Seufert, 2021; Hatlevik & Hatlevik, 2018; Quast, Rubach, & Lazarides, 2021). The instrument can be used in future research in Turkey to examine the relationship between basic ICT competence beliefs and the actual use of technology by teachers in their professional setting. Additionally, The instrument can be utilized in the realm of teacher education in Turkey to assess existing initiatives aimed at preparing student teachers for the integration of information and communication technology (ICT) in their instructional practices. This will enable the determination of teacher training needs related to ICT, based on international standards. It is necessary to accurately determine educational needs for the enhancement of teachers' beliefs regarding ICT competence, which plays a crucial role in the successful integration of technology in the classroom (Mishra & Koehler, 2006; Yurdakul, Odabasi, Kilicer, Coklar, Birinci, & Kurt, 2012). Consequently, the utilization of this instrument for the needs assessment of current educational programs can aid in the development of effective and efficient programs aimed at enhancing technology integration in the classroom.

Our replication of the six-factor solution of the instrument substantiated its utility in evaluating teachers' fundamental beliefs regarding information and communication technology (ICT) competence in Turkey. Consequently, the adaptation of the instrument into Turkish language has been validated and demonstrated reliability.

Declaration of Conflicting Interests and Ethics

The authors declare no conflict of interest. This research study complies with research publishing ethics. The scientific and legal responsibility for manuscripts published in IJATE belongs to the author(s). **Ethics Committee Number**: Yildiz Technical University, Social and Human Sciences Research Ethics Committee, 2021/0l.

Authorship Contribution Statement

Pinar Korukluoglu: Conceptualization, Methodology, Validation, Formal analysis, Resources, Data Curation, Writing - Original Draft, Writing - Review & Editing. **Bulent Alci:** Conceptualization, Methodology, Validation, Formal analysis, Data Curation, Writing - Original Draft, Writing - Review & Editing. **Charlott Rubach:** Conceptualization, Methodology, Validation, Formal analysis, Data Curation, Writing - Review & Editing.

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APPENDIX

Translation of All Items for Each Basic ICT Competence Dimension.

ITEM WORDING IN GERMAN (original version)	ITEM WORDING IN ENGLISH (original version)	ITEM WORDING IN TURKISH
	Factor 1: Information and data literacy	**Boyut 1: Bilgi Veri Okuryazarlığı**
Ich kann auf Grundlage meiner Suchinteressen relevante Quellen in digitalen Umgebungen identifizieren und nutzen.	I can identify and use appropriate sources in digital environments based on my information needs.	Dijital ortamdaki kaynakları bilgi ihtiyacıma göre belirleyip uygun bir şekilde kullanabilirim
Ich kann Suchstrategien im digitalen Raum nutzen.	I can use my search strategies in digital environments.	Araştırma stratejilerimi dijital ortamda kullanabilirim
Ich kann Informationen, Informationsquellen und Daten im digitalen Raum kritisch bewerten.	I am critical about information, sources and data in digital environments.	*Excluded from scale*
Ich kann digital Informationen und Daten sicher speichern.	I can store digital information and data securely.	Dijital bilgi ve verileri güvenli bir şekilde depolayabilirim.
Ich kann Informationen, die ich gespeichert habe, wiederfinden.	I can retrieve the information that I have stored.	Depoladığım bilgileri geri getirebilirim.
Ich kann Informationen, die ich gespeichert habe, von verschiedenen Orten abrufen.	I can retrieve information that I have stored from different environments.	Farklı ortamlardan depoladığım bilgileri geri getirebilirim.
	Factor 2: Communication and collaboration	**Boyut 2: İletişim ve İşbirliği**
Ich kann mit Hilfe verschiedener digitaler Medien kommunizieren.	I can communicate using different digital media.	Farklı dijital medyaları kullanarak iletişim kurabilirim
Ich kann Informationen und Dateien aus dem digitalen Raum zitieren.	I can cite information and files from digital environments.	Dijital ortamlardan bilgi ve dosya alıntılayabilirim
Ich kann digitale Medien nutzen, um gemeinsam mit anderen Dateien und Dokumente zu bearbeiten.	I can edit files and documents collaboratively with others using digital media	Dijital ortamları kullanarak, dosyaları ve belgeleri başkalarıyla birlikte düzenleyebilirim
Ich kann Verhaltensregeln bei digitalen Interaktionen und Kooperationen anwenden.	I can apply behavioral rules in digital interactions and collaborations.	Dijital etkileşim ve işbirliği konularında davranışsal kuralları uygulayabilirim
Ich kann mit Hilfe digitaler Medien aktiv an der Gesellschaft teilhaben.	I can actively participate in society using digital media.	Dijital medyayı kullanarak, topluma aktif bir şekilde katılabilirim.
Ich kann meine Medienerfahrungen in Interaktion mit anderen weitergeben.	I can share my experiences with digital media in interactions with others	*Excluded from scale*
	Factor 3: Digital content creation	**Boyut 3: Dijital İçerik Oluşturma**
Ich kann mir bekannte Apps und Programme bedarfsgerecht anwenden.	I can use familiar apps and programs according to my needs.	*Excluded from scale*
Ich kann eigene digitale Produkte in verschiedenen Formaten gestalten.	I can design my digital products in various formats.	Dijital ürünlerimi çeşitli formatlarda tasarlayabilirim.
Ich kann digitale Inhalte in verschiedenen Formaten bearbeiten und zusammenführen	I can edit and merge digital content in different formats	Dijital içerikleri, farklı formatlarda düzenleyebilir ve birleştirebilirim

Ich kann digitale Inhalte in verschiedenen Formaten pr¨asentieren.	I can present digital content in different formats.	Dijital içeriği farklı formatlarda sunabilirim
	Factor 4: Safety and security	**Boyut 4: Emniyet ve Güvenlik**
Ich kenne die Gefahren und Risiken in digitalen Umgebungen und berücksichtige diese.	I know about the dangers and risks in digital environments and consider them.	Dijital ortamlardaki tehlike ve riskleri bilir ve bunları dikkate alırım.
Ich kann meine Privatsph¨are in digitalen Umgebungen durch geeignete Maßnahmen schützen.	I can protect my privacy in digital environments through appropriate measures.	Dijital ortamlarda gizliliğimi gerekli önlemler aracılığıyla koruyabilirim
Ich kann meine Sicherheitseinstellungen regelm¨aßig aktualisieren.	I can regularly update my security settings.	Güvenlik ayarlarımı düzenli olarak güncelleyebilirim.
Ich kann digitale Technologien gesundheits- und umweltbewusst nutzen.	I can use digital technologies in a healthy and environmentally sound way.	Dijital teknolojileri sağlıklı ve çevreye duyarlı bir şekilde kullanabilirim
	Factor 5: Problem Solving	**Boyut 5: Problem Çözme**
Ich kann digitale Werkzeuge, Tools und Plattformen bedarfsgerecht einsetzen	I can use digital tools and platforms according to my needs.	Dijital araç ve platformları ihtiyaçlarım doğrultusunda kullanabilirim
Ich kann digitale Werkzeuge zum pers¨onlichen Gebrauch anpassen	I can adapt digital tools for personal use.	Dijital araçları kişisel kullanımıma göre uyarlayabilirim
Ich kann digitale Lernm¨oglichkeiten und dafür geeignete Tools selbstst¨andig nutzen.	I can independently use digital learning opportunities and appropriate tools	Dijital öğrenme imkanlarını ve uygun araçları bağımsız bir şekilde kullanabilirim.
Ich kann digitale Lernressourcen selbstst¨andig organisieren.	I can organize digital learning resources independently.	Dijital öğrenme kaynaklarını bağımsız bir şekilde düzenleyebilirim
Ich kann L¨osungen für technische Probleme entwickeln.	I can develop solutions for technical problems.	Teknik sorunlara karşı çözüm üretebilirim.
Ich kenne Funktionsweisen und grundlegende Prinzipien des digitalen Raumes.	I know about the functioning and basic principles of digital systems.	Dijital sistemlerin işleyişi ve temel ilkeleri hakkında bilgiye sahibim.
Ich erkenne algorithmische Strukturen bei genutzten Tools.	I identify algorithmic structures in the tools I use.	Kullandığım araçlardaki algoritmik yapıları tanımlarım.
	Factor 6: Analyzing and reflecting	**Boyut 6: İnceleme ve Yansıtma**
Ich kann die Wirkung von Medien im digitalen Raum analysieren.	I can analyze the effect of media in digital environments.	Dijital ortamlarda medyanın etkisini analiz edebilirim
Ich kann eine interessengeleitete Verbreitungen und die Dominanz von Themen im digitalen Raum beurteilen.	I can evaluate interest-driven dissemination and the dominance of topics in digital space.	Dijital alanda ilgi odaklı bilgi yayılmasını ve konu baskınlığını değerlendirebilirim
Ich kann Chancen und Risiken des Mediengebrauchs für meinen eigenen Mediengebrauch reflektieren.	I can reflect on the opportunities and risks of media use for my own media use.	Kişisel medya kullanımım için medya kullanımına dair imkan ve riskleri iyi bir şekilde değerlendirebilirim
Ich kann Vorteile von Gesch¨aftsaktivit¨aten und Services im digitalen Raum analysieren	I can analyze the benefits of business activities and services in digital environments.	Dijital ortamlardaki ticari faaliyetlerin ve hizmetlerin faydalarını analiz edebilirim
Ich kann Risiken von Gesch¨aftsaktivit¨aten und Services im digitalen Raum analysieren.	I can analyze the risks of business activities and services in the digital space.	Dijital ortamlardaki ticari faaliyetlerin ve hizmetlerin risklerini analiz edebilirim

Note: (Original version: Rubach & Lazarides, 2021)