



Readiness of teachers for blended learning: A scale development study

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Abstract

The aim of this study is to create a new scale to assess teachers' readiness for blended learning. There are 317 active teachers volunteering in the study from various educational levels. Exploratory factor analysis was carried out to examine the construct validity of the scale with the data obtained. Following principal component analysis, 6 items were removed from the scale as they spread to different factors, and the remaining 25 items were refactored and grouped into 4 factors. Confirmatory factor analysis was carried out to confirm the factor structures of the scale. The obtained model confirmed the factor structure created in the exploratory factor analysis. Differences between the bottom and top 27% groups were investigated to evaluate item discriminability. For reliability analyses, internal consistency coefficients and stability analyses were performed. A five-point Likert scale with 25 items is used to assess how prepared the teachers are for blended learning. The items are categorized into four factors. The scale's Cronbach alpha coefficient value is 0.943 and McDonald's ω value is .942. Analyses demonstrate that the scale is a valid and reliable tool for assessing teachers' readiness for blended learning.

Keywords Teacher qualifications · Blended learning · Teacher readiness · Scale development

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1 Introduction

Technologies designed to meet different needs are now widely used in education and training. Blended learning (BL) provides the use of methods and techniques that can meet individual learning needs by combining face-to-face learning methods with online distance learning systems (Osguthorpe & Graham, 2003). New developments in technology are best practices for learning beyond traditional boundaries to optimize learning outcomes (Singh & Reed, 2001). According to Graham (2006); four factors, which are time, space, content, and the human-machine ratio, affect traditional face to face and computer-assisted distance learning environments. The main purpose was to create the ideal combination through this interaction. In this regard, different BL models have emerged (Graham, 2006; Hannon & Macken, 2014; Khan, 2005; Staker & Horn, 2012; Teach Thought Staff, 2019). The main purpose of creating these models is to offer different learning activities and different designs so that learners can achieve maximum learning outcomes. BL requires us to consider the features of digital technologies and information and communication technologies in general (Dziuban et al., 2018). It is expected that the term BL will become the most common umbrella term to describe the technology usage for educational purposes and this approach will be widely adopted and accepted as the 'new normal' in education due to its widely accepted benefits (Hrastinski, 2019). Graham (2006) suggests that BL can be practiced at all levels of educational process. Additionally, the fact that blended learning provides personalised, flexible and effective learning experiences provides important educational opportunities for the differentiated needs of students with special educational needs (Schenk, 2023). In blended learning environments, special education teachers provide students with both personalised and individually paced learning opportunities through virtual learning resources and guidance through face-to-face teacher communication, aiming for maximum efficiency in achieving instructional goals (Rivera, 2017; Zavaraki & Schneider, 2019).

Wilson and Smilanich (2005) identified the steps to be followed in designing and implementing blended curricula as 1) identifying the needs, 2) determining the objectives of the program, 3) designing the blended program, 4) creating and coordinating individual learning solutions, 5) implementing the blended program, 6) measuring the results of the program. In step 3 of these designs, the design of the blended program, they stated that there should be a basic definition of each training, factors such as the profile of the learner when choosing the training solutions, the characteristics of the learning content, and a template to help summarize the training program.

Many international and national educational institutions and organizations have incorporated online applications into their training programs, owe to the widespread use of digital technologies. The online and BL guide published by the International Baccalaureate provides examples of content design and assessment steps (Tonbuloğlu & Tonbuloğlu, 2021). Cambridge (2020) organized a study on BL models by bringing together technology experts, education experts and government representatives to discuss the structuring of future education models. In addition, the Ministry of National Education of Türkiye included the qualities of BL in the 2023 Education Vision document at the K-12 level (MEB, 2018).

Teachers need to use educational methods and techniques in accordance with the requirements of the age to be effective and efficient in education. In this direction, in order to fulfil the teaching profession effectively and efficiently in accordance with the requirements of the teaching profession, the Ministry of National Education of Türkiye has determined the general competencies of the teaching profession as "personal and professional values - professional development, student recognition, teaching and learning process, teaching and learning process, monitoring and evaluating learning development, school, family and community relations, program and content knowledge" (MEB, 2017). In the legislative summaries listed under the title "Education, training and youth", which is one of the priorities of the political and policy agenda of the European Union for the years 2019-2024, it is aimed to achieve the goals set under the scope of education and training framework, such as increasing the quality and efficiency of education, developing creativity, innovation, and entrepreneurship (European Union, n.d.). In the world and in Türkiye, efforts are being made to provide efficient and effective educational opportunities through new regulations and training in line with the necessities of the age in education. In this regard, the readiness of teachers for modern methods of education and training is important. BL is a learning method that is used to provide the best learning in accordance with the requirements of the age. Therefore, determining teachers' readiness for this learning method is considered important in terms of organizing and implementing educational activities.

This study aims to fill the gap in the literature by measuring teachers' readiness for blended teaching, thus contributing significantly to the field. The identification of teachers' readiness for blended teaching is a crucial aspect of this study.

Cabı and Gülbahar (2013) measured the effectiveness of blended learning environments. Koç (2019) created the interaction value scale for blended learning environments, and Mihçı Türker and Öztürk (2022) adapted the blended teaching readiness scale for pre-service teachers in Turkish. Tang and Chaw (2013) conducted a study on university students' attitudes towards blended learning. Yıldız Durak (2017) adapted the flipped learning readiness scale for Turkish secondary school students. Shakeel et al. (2023) developed a blended learning readiness scale for university students. Los et al. (2021) developed the Online and Blended Teaching Readiness Assessment (OBTRA) study for post-secondary teachers. It is important to note that the OBTRA scale measures different characteristics than those included in K-12 blended teaching preparation, as observed by Graham et al. (2019). The OBTRA scale defines the knowledge, skills, and attitudes necessary for teachers to be effective in blended learning environments. No existing scales in the literature are specifically designed to measure the readiness levels of teachers at all levels of education for developing, implementing, and evaluating blended learning practices. However, it is important to note that measuring teachers' readiness for this innovative learning model is a critical factor in supporting technological transformation in education. Graham et al. (2019) confidently proposed the development of a more concise and current scale to aid teachers in their preparation for blended teaching. The current scale is deemed impractical due to its excessive number of items, and the high correlation between its second-order factors is seen as a limitation. The new scale is expected to be a significant improvement and better serve the needs of educators. This study will measure the competencies of teachers at all levels of education in accordance with current requirements, as well as their readiness to develop, implement,

and evaluate blended learning applications. The results will demonstrate the high level of expertise and capability of teachers in meeting the demands of modern education.

2 Literature review

2.1 Blended learning and blended learning models

It is possible to use online and face to face learning activities together in a BL environment, according to Gülbahar et al. (2020). The definitions of BL in the literature vary widely. According to Eastman (2015) BL is a complete set of educational practices that brings together the face-to-face instruction with computer-based learning tools that may be customized and driven by the learner. BL, according to Hockly (2018), combines the use of online and offline computer technology with face-to-face instruction. BL is identified as a design of modern teaching process by combining distance learning systems and traditional learning processes together (Tonbuloğlu & Tonbuloğlu, 2021). According to Horn and Staker (2017), it is a formal education program where the student is away from home and has at least some elements of time, place, road, and speed control. According to the Oxford Dictionaries definition (2023); it is a cost-effective method of education that combines the subject to be taught in the classroom with the use of various technologies, including online learning. According to Graham (2006), it is a type of education that mixes face-to-face instruction with online learning platforms. The definitions in the literature all agree on one thing: BL strives to combine the best elements of the harmony between face-to-face instruction and digital technologies for student-centered learning.

Various strategies have been created to promote efficient and effective learning in a BL method. As shown in Fig. 1, BL grouped into four separate methods by Horn and Staker (2015). These models are the rotation, the flexible, the personal blended, and the enriched virtual models. The rotation model is also constituted by the Station, laboratory, flipped classroom, and individual rotation models.

BL systems were categorized into various types by Graham (2006). These categories are enabling blending, enhancing blending, and altering blending. Online and offline learning, self-paced and collaborative learning, scheduled and unstructured learning, and tailored and off-the-shelf content are all examples of BL, according to Khan (2005). Three BL methods were illustrated by Hannon and Macken (2014). These concepts include blended block, blended presentation and interactivity, and entirely online. Interactive blended sessions using online resources, training, seminars, and presentations are examples of blended presentation and interaction. The blended block consists of weekly online training, in-person intensive workshops, and internet resources. The fully online model simulates interaction with online resources and learning activities, including asynchronous online lessons, online group projects, discussion forums, and podcasts of brief courses.

Six common BL models are station rotation, laboratory rotation, distance (also known as enriched virtual), flexible, flipped classroom, and individual rotation, according to Teach Thought Staff (2019). Project-based, self-directed, internal-external, completed, mastery-based, and various options are some less well-known BL models. A

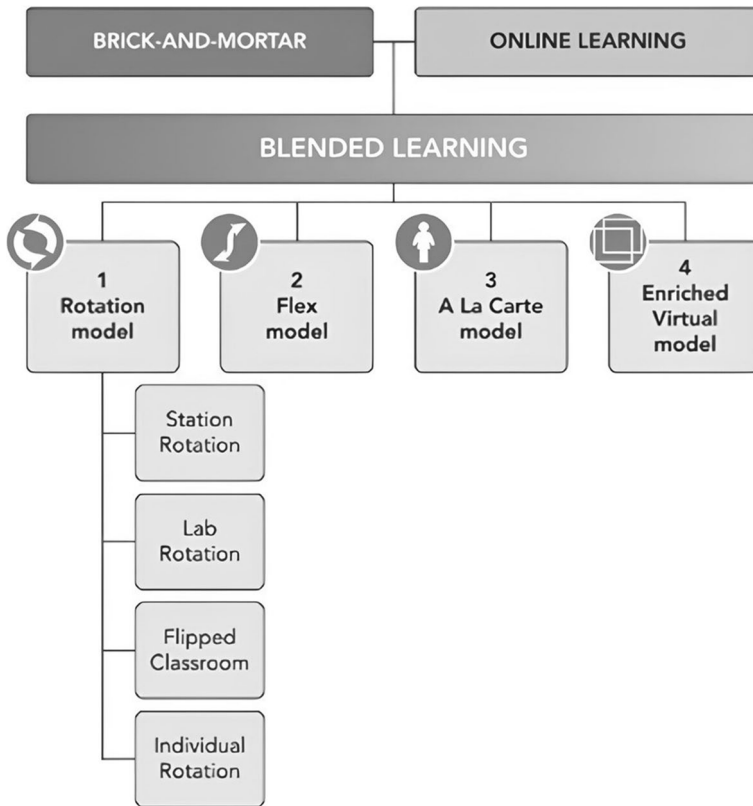


Fig. 1 BL models (Horn & Staker, 2015)

BL model that classifies K–12 BL programs was proposed by Staker and Horn (2012). This model can be divided into four categories: 1) the rotational model, where students alternate between online and traditional learning methods; 2) the flexible model, where content is initially made available online and students advance in accordance with a schedule customized for them; 3) the self-blending model, where students take one or more online courses to finish traditional courses; and 4) the enriched virtual model, where students split their time between face-to-face and online activities. The main goal in developing these models is to provide a variety of designs with a variety of learning activities so that students can attain the best learning results possible.

3 Methodology

3.1 Research design

The descriptive survey model was used in this study to develop the teachers' readiness scale for BL. The descriptive survey model was used to attempt to describe the

validity and reliability of the scale. Karasar (2007) defines the descriptive survey model as a model that aims to determine the group traits as they are.

3.2 Participants

The research study included 317 teachers from different branches who were actively working in different provinces of Türkiye in 2022-2023. The study group was determined using the convenient sampling method from the non-probability sampling method. The convenience sampling method considers the suitability and willingness of participants to take part in the study. This method accelerates the study as it is easily accessible (Creswell, 2012/2020: 193). Research participants are 317 teachers. The distribution of the study group by gender, educational status, branch, seniority, teaching level and foreign language level is shown in Table 1.

3.3 Constituting the item pool

The researchers reviewed the relevant literature and analyzed the scales. When the studies for educators were reviewed (Fidan et al., 2020; Korkmaz et al., 2019; Şad et al., 2016; Toker et al., 2021; Yörük & Özçetin, 2021), it was found that there

Table 1 Participants' distribution by gender, branch, seniority, education status, and teaching level

		Frequency	Percent
Gender	Female	152	47.9
	Male	165	52.1
	Total	317	100.0
Branch	Social Sciences	176	55.5
	Science	31	9.8
	Math Sciences	31	9.8
	Vocational Courses	79	24.9
	Total	317	100.0
Seniority	1-5 years	44	13.9
	5-10 years	66	20.8
	10-20 years	114	36.0
	20-25 years	42	13.2
	Over 25 years	51	16.1
Total	317	100.0	
Education Status	Undergraduate Degree	220	69.4
	Postgraduate Degree	87	27.4
	Doctoral Degree	10	3.2
	Total	317	100.0
Teaching Level	Primary School	64	20.2
	Secondary School	110	34.7
	High School	143	45.1
	Total	317	100.0

are studies on digital literacy of teachers, online learning, or development of digital teaching materials. There are also some studies on BL environments (Cabı & Gülbahar, 2013; Koç, 2019; Mıhçı Türker & Öztürk, 2022; Tang & Chaw, 2013). The studies on the readiness for BL with students or teachers at different educational levels were found (Graham et al., 2019; Shakeel et al., 2023; Yıldız Durak, 2017). In this direction, the literature was reviewed, and BL readiness items were written for testing purposes. While writing the items, the item "I have the necessary knowledge to use BL environments" from the scale developed by Koç (2019) was adapted as "I have the competence to use the BL method" and the item "I have the necessary technological facilities to use BL environments" was adapted and added to the item pool as "I have the necessary technological facilities to use the BL method". After the items were formed, two professors and one associate professor, who have expertise in computer and instructional technologies and have studied on blended learning and distance education, were consulted for content validity. In the prepared form, the experts were requested to evaluate each item using one of the following options "appropriate, should be corrected, should be removed" and to write an explanation for the items they did not find appropriate. The experts' views are shown in Table 2.

In agreement with expert views, some items were decided to be corrected. Two items were decided to be removed from the scale. In the item pool of the Teachers' Readiness for BL scale, which was prepared in result of the studies, there are 6 items in the design factor, 7 items in the learning-teaching process factor, 11 items in the competence factor, and 7 items in the management factor. The whole scale item pool was determined to be 31 items. In the items, options were given according to the five-point scoring system to measure the levels. These options were arranged as "(1) Strongly Disagree, (2) Disagree, (3) Partially Agree, (4) Agree, (5) Strongly Agree" and scored accordingly.

3.4 Data analyses

KMO and Bartlett analyses were first used for assessing if factor analysis (FA), based on statistical analyses, could be used to identify the scale's construct validity in the data obtained using the scale. The KMO value should be greater than .60 and the value close to 1 demonstrate that the data set is at a sufficient level to perform FA to be able to perform factorization (Büyüköztürk, 2002; Field, 2013; Russell, 2002). Şencan (2005) formed a KMO value range table to grade the meaning of the values formed in the KMO and Bartlett analysis results and according to this table, while the range of 0.8-0.9 is considered as a good value, values above 0.9 are expressed as excellent level. The values in Bartlett's test demonstrate that the null hypothesis is not accepted at 0.05 level. (Büyüköztürk, 2002).

Both exploratory and confirmatory factor analyses were conducted. The scale was factorized using principal component analysis. Factor loadings (FL) were assessed using varimax vertical rotation. The results of the FA required that items with FL below 0.40 and items with a .10 difference between the loadings on two factors were excluded from the analysis. It is expected that the loadings between two factors should be as high as possible and it is recommended that the difference between

Table 2 Expert views on the item pool

Expert	Form Item	Evaluation	Explanation
Expert 1	I can produce lecture podcasts and online resources	should be corrected	While other items are related to general design, this item includes the design of a very specific environment. Perhaps it could be revised as; "I can produce a variety of multimedia materials to support BL."
Expert 2	I can manage rotations in different learning activities.	should be corrected	Managing rotations is not clear.
Expert 3	I can design blended teaching materials	should be corrected	I can design teaching materials suitable for BL environments.

these values should be at least .10 (Büyüköztürk, 2002; Howard, 2016). Hinkin (1995) stated that the generally acceptable factor loading in FA studies is 0.40, but items with FL up to 0.30 can also be included in the scales. On the other hand, FL above 0.50 are also considered to be quite good (Büyüköztürk, 2002). According to the results of the analyses, the lowest factor loading was calculated as .587 and the highest factor loading was calculated as .834. Accordingly, all the items had excellent FL (Çokluk et al., 2010).

According to the completed items and factor structures produced by the exploratory FA, confirmatory FA was performed. To ascertain whether the chosen measurement models are supported by the data, confirmatory FA technique is the preferable analysis technique (Byrne, 2016; Gürbüz, 2021).

3.5 Ethical authorization of research

The study collected data from teachers who are adult individuals teaching in educational institutions in different cities across Türkiye. As participation was voluntary, no approval from any institution or organization was necessary.

3.6 Findings

3.6.1 Findings related to the validity of the scale

For the validity of the Teachers' Readiness for BL scale, the construct validity analysis, item-total correlation analysis and item discrimination analysis were held, and the findings are shown below.

Findings related to exploratory FA To determine the construct validity of the Teachers' Readiness for BL scale, Kaiser-Meyer-Olkin (KMO) and Bartlett tests were performed with the data obtained and $KMO=0.951$; Bartlett test value was determined as $\chi^2=6930.134$; $sd=465$ ($p=0.000$). These values showed that FA could be applicable for the 31-item scale.

Firstly, the dimensions of the scale were defined using principal component analysis. The varimax vertical rotation technique was used for this analysis. The results of the analysis show that 6 items whose item loadings were distributed across different factors were excluded from the scale, and then FA was performed again on the remaining 25 items. The Teachers' Readiness for BL scale covers teachers' ability to improve, implement and evaluate BL practices. As a result of the analyses, the final 25 items of the scale were distributed across four factors. In this final version it was concluded that the KMO value of the 25-item scale was 0.943; Bartlett value $\chi^2=5306.341$; $sd=300$; $p<0.000$. The FL of the items without rotation were found between .515 and .809; the FL of the items rotated using the varimax vertical rotation technique were found between .623 and .834. Table 3 shows the results of the factor analysis conducted on 25 items, indicating the variances explained by the components.

Table 3 Total variance explained

Component	Initial Eigenvalues		Extraction Sums of Squared Loadings		Rotation Sums of Squared Loadings	
	Total	% of Variance	Total	% of Variance	Total	% of Variance
1	11.531	46.123	11.531	46.123	5.664	22.658
2	1.925	7.701	1.925	7.701	4.967	19.868
3	1.827	7.307	1.827	7.307	4.074	16.298
4	1.294	5.176	1.294	5.176	1.871	7.483
5	1.001	4.003				
6	.771	3.082				
7	.663	2.652				
8	.572	2.287				
9	.553	2.213				
10	.501	2.002				
11	.456	1.823				
12	.433	1.733				
13	.389	1.555				
14	.364	1.454				
15	.335	1.342				
16	.304	1.215				
17	.291	1.164				
18	.283	1.132				
19	.272	1.088				
20	.249	.996				
21	.235	.939				
22	.218	.871				
23	.189	.757				
		46.123		46.123		22.658
		53.824		53.824		42.526
		61.131		61.131		58.823
		66.306		66.306		66.306
		70.310				
		73.92				
		76.044				
		78.331				
		80.545				
		82.547				
		84.370				
		86.103				
		87.658				
		89.112				
		90.454				
		91.669				
		92.832				
		93.964				
		95.052				
		96.048				
		96.987				
		97.858				
		98.615				

Table 3 (continued)

Component	Initial Eigenvalues		Extraction Sums of Squared Loadings		Rotation Sums of Squared Loadings		
	Total	% of Variance	Total	% of Variance	Total	% of Variance	Cumulative %
24	.186	.742					99.357
25	.161	.643					100.000

Table 3 shows the factor loadings for each of the four factors. The first factor had a loading of 22.65, the second factor had a loading of 19.86, the third factor had a loading of 16.29, and the fourth factor had a loading of 7.48. The scale's items and factors accounted for 66.30% of the total variance. The factors resulting from the analyses were found to be consistent with the sub-skills identified during the creation of the item pool. However, items created for the identified skills were also distributed across different factors. Specifically, three items originally intended for the competence factor, which was supposed to have 11 items according to the item pool, were instead placed under the teaching and learning process factor. The study collected 5 items under the 'Designing' factor, 10 items under the 'Teaching and Learning Process' factor, 3 items under the 'Competence' factor, and 7 items under the 'Management' factor. The scree accumulation graph used to determine the final number of factors (Fig. 2) indicates that the scale has 4 factors.

The results of the analyses regarding the item loadings of the remaining 25 items in terms of factors, the factors' eigenvalues and the variance amount explanations are shown in Table 4.

As shown in Table 4, there are 10 items in the teaching and the process of learning factor of the scale, and the FL range from .587 to .760. While the TLP factor's eigenvalue in whole scale is 11.53, its total effect to variance is 46.1%. There are 7 items in the management factor. The FL of these items ranges from .623 to .834. While factor's eigen value in the whole scale is 1.92, its effect to the total variance is 7.7%. There are 5 items in the "Design" factor. The FL of the items ranges from .634 to .786. While factor's eigen value in the whole scale is 1.82, its effect to the total variance is 7.3%. There are 3 items in the factor "Competence". The FL of the items range between .738 and .785. While the factor's eigenvalue in the whole scale

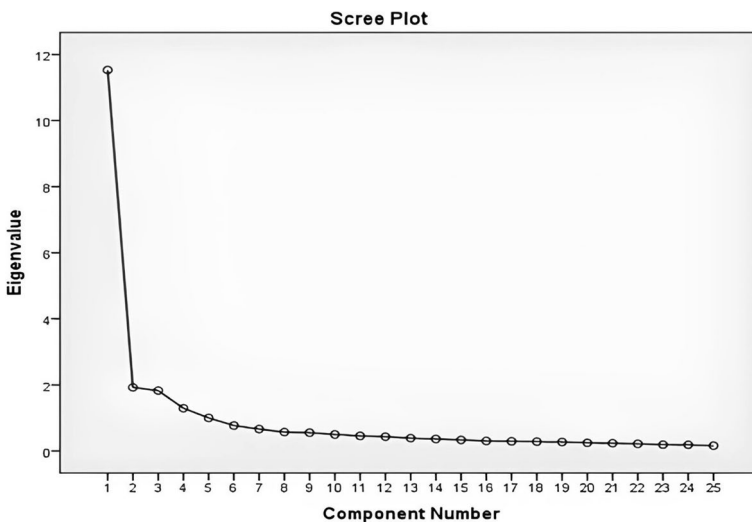


Fig. 2 Scree plot

Table 4 FA results of the scale by factors

Items		Com. Factor	F1	F2	F3	F4
Teaching and Learning process	T4	By using the BL model, I contribute to the development of the students.	.694	.760		
	P7	I can improve my interaction with students by using the BL model.	.649	.734		
	T3	In the BL model, I can ensure the active participation of students.	.611	.729		
	P8	I can improve the interaction between students by using the BL model.	.620	.717		
	T1	I can draw the student's attention to the subject in BL environments.	.615	.669		
	T6	I contribute to students' time management in BL environments.	.614	.669		
	T7	I can create an effective learning environment using the BL model.	.698	.664		
	T5	I can evaluate the effectiveness of the blended instruction that I designed.	.695	.646		
Management	T2	I provide opportunities for my students to blend the BL environments I design according to their own needs.	.542	.596		
	P1	I can determine the blended teaching model suitable for the content I will teach.	.560	.587		
	Ma4	I can find solutions to technical problems that students may encounter in BL environments.	.761		.834	
	Ma3	I can solve possible problems that may occur in synchronous or asynchronous digital environments in the BL environment.	.724		.807	
	Ma5	I can guide students to use and manage their online accounts.	.701		.764	
	Ma7	I can manage transitions to different learning activities in a BL environment.	.764		.747	
Designing	Ma2	I can manage students' behaviors in digital learning systems in a BL environment.	.682		.725	
	Ma6	I can manage group work such as online collaboration, discussion forums, etc.	.649		.709	
	Ma1	I can guide students in using different teaching materials in BL model.	.635		.623	
	D3	I can design BL environments suitable for various learning needs.	.733		.786	
	D1	I can design teaching materials suitable for BL environments.	.754		.763	
	D4	I can design instruction for BL in line with the individual needs of my students.	.729		.727	
	D2	I can prepare course materials suitable for synchronous or asynchronous learning environments.	.720		.721	
	D6	I can create online resources with different communication tools to support BL.	.633		.634	

Table 4 (continued)

Items		Com. Factor	F1	F2	F3	F4
Proficiency	P2	I think I am insufficient in using different BL models.	.649			.785
	P6	I lack the necessary technological facilities to use the BL model.	.587			.756
	P9	I think it is difficult to perform the BL model in teaching.	.558			.738
Eigenvalue			11.53	1.92	1.82	1.29
Explained variance			46.1	7.7	7.3	5.1

is 1.29, its effect to the total variance is 5.1. As all items in this factor are inverted, they are to be reverse coded.

Findings on confirmatory FA For confirming the scale's factor structure, the available data was used in a confirmatory FA, which revealed that the scale was grouped into 4 factors in result of the exploratory FA. The result of the confirmatory FA performed with the maximum likelihood technique demonstrate that the value of the 3 items of competence was far from .70. However, it was not removed from the scale on the grounds that there were 3 items in the competence factor and therefore it might negatively affect the content validity. The estimate values of the items were found between .525 and .865.

When the goodness of fit values were analyzed; it is evident that $\chi^2(sd=265, N=325)= 5632.871, p<.0001, CMIN/DF=2.247, RMSEA= 0.064, RMR= 0.031, SRMR=0.457, GFI= 0.868, AGFI= 0.838, CFI= 0.938$ and $IFI= 0.938$. These values show that the goodness of fit indices is compatible at a reasonable level according to the threshold values (Gürbüz, 2021). The obtained model reveals that it confirms the factor structure created in the exploratory FA. In this direction, scale's factorial model is shown in Fig. 3.

3.7 Item-factor correlation values

In this part, item-factor correlation values were calculated from the scores gained from the items of the scale and four factors. The level of conformity of each item to the overall purpose was tested. Table 5 shows the item-factor correlation values for each of the items.

As shown in Table 5 item-test correlation coefficients ranged from .715 to .844 for the TLP, between .779 and .874, for the management, from .824 to .879 for the design, and from .709 to .821 for the competence factor. All items show a positive and significant relationship with all factors ($p<0.000$). In this regard, each item can be stated to serve both the factor in which it is located and the overall goal of scale.

3.8 Item discrimination

The item scores were ranked from higher to lower and 84 lower and upper groups were formed, including the bottom 27% and the top 27% groups to calculate discrimination power of the scale items. Independent groups t-test values were measured in line with the total scores in lower and upper 27%. Table 6 shows the results of the t-tests and the levels of significance of the discrimination powers.

As shown in Table 6, the independent sample t-test values for the 25 items, factors and total score in the scale were found to be from 3.614 to 16.175. The t-value for the overall scale was 29.480. The level of each of the differences determined because of the analysis is significant ($p<0.001$). According to these values, it is evident that overall

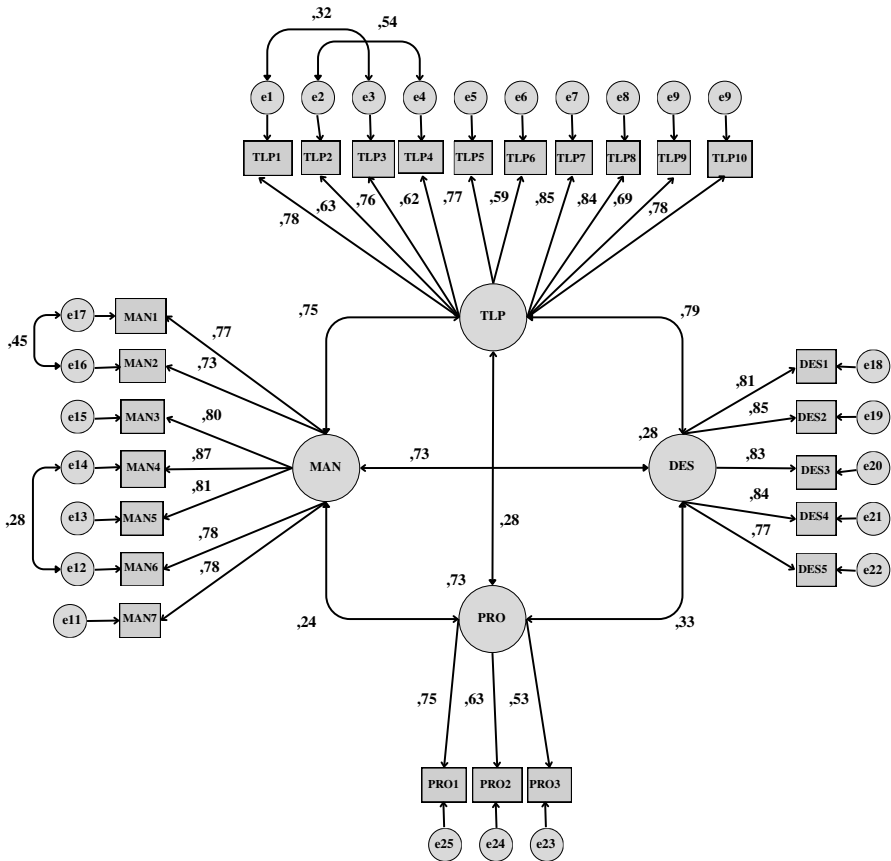


Fig. 3 Confirmatory FA diagram of the scale

scale and each scale item have high discrimination. However, the discrimination level of the competence factor was found to be lower than the other factors.

3.9 Findings on the reliability of the scale

Internal consistency and consistency analyses were held to calculate the scale's reliability. The findings reached because of the analyses are shown below.

3.10 Internal consistency level

Reliability analyses for the whole scale and its factors were calculated using Cronbach's Alpha and McDonald's ω reliability coefficient. Reliability analysis values for each of the factors and the overall scale are given in Table 7

According to the values shown in Table 7, the Cronbach's Alpha value of the scale, which includes four factors and a total of 25 items, is .943 and McDonald's ω

Table 5 Item-factor correlation values

F1 Teaching and Learning Process		F2 Management		F3 Designing		F4 Proficiency	
I	r	I	r	I	r	I	r
BTeach1	.824**	BMana1	.850**	BDes1	.855**	BProf1	.821**
BTeach2	.720**	BMana2	.824**	BDes2	.879**	BProf2	.787**
BTeach3	.769**	BMana3	.837**	BDes3	.855**	BProf3	.709**
BTeach4	.715**	BMana4	.874**	BDes4	.877**		
BTeach5	.779**	BMana5	.831**	BDes5	.824**		
BTeach6	.804**	BMana6	.815**				
BTeach7	.844**	BMana7	.779**				
BTeach8	.835**						
BTeach9	.732**						
BTeach10	.771**						

N=309

**= $p < .001$

Table 6 Item discrimination power

F1 Teaching and Learning Process		F2 Management		F3 Designing		F4 Proficiency	
I	t	I	t	I	t	I	t
BTeach1	12.218	BMana1	12.304	BDes1	13.866	BProf1	5.359
BTeach2	11.065	BMana2	14.049	BDes2	15.676	BProf2	4.524
BTeach3	11.321	BMana3	15.474	BDes3	15.389	BProf3	3.614
BTeach4	9.829	BMana4	16.175	BDes4	15.581		
BTeach5	10.762	BMana5	13.777	BDes5	15.776		
BTeach6	11.740	BMana6	13.334				
BTeach7	15.189	BMana7	15.711				
BTeach8	14.509						
BTeach9	11.074						
BTeach10	13.765					HTop1	29.480
F1	19.303	F2	20.728	F3	20.330	F4	9.564

df:166

$p < .001$

value is .942. The results of the analyses according to the factors showed that Cronbach’s Alpha values ranged between .664 and .928 and McDonald’s ω value ranged between .680 and .928. Based on this, it can be stated that consistent measurements were made for the overall scale and each factor.

Table 7 Reliability analyses of the whole scale and its factors

Factor	Number of items	Cronbach's Alpha	McDonald's ω
Teaching & Learning Process	10	.928	.928
Management	7	.924	.924
Designing	5	.910	.910
Proficiency	3	.664	.680
Total	25	.943	.942

3.11 Consistency level

The scale's stability has been calculated with test-retest method. Scale's final version which consists of 25 items was performed to the 21 participants after four weeks. The relationship between the scores gained in result of the two applications was analyzed both for all items as a whole and for each item. Thus, the performance of both the scale as a whole and each item within the scale was analyzed for stable measurement. The findings related to these analyses are shown in Table 8.

Table 8 demonstrate that the scale items' correlation coefficients obtained by test-retest method range from .007 to .658. It was seen that three items under the TLP factor, three items under the management factor, one item under the design factor had low correlation level and the correlation coefficient of the sixth item under the management factor was .007 and there was no significant relationship. The other

Table 8 Test-retest results of the scale items

F1 Teaching and Learning Process		F2 Management		F3 Designing		F4 Proficiency	
I	r	I	r	I	r	I	r
BTeach1	.621**	BMana1	.552**	BDes1	.469**	BProf1	.584**
BTeach2	.600**	BMana2	.658**	BDes2	.478**	BProf2	.568**
BTeach3	.435**	BMana3	.404*	BDes3	.380*	BProf3	.541**
BTeach4	.321*	BMana4	.379*	BDes4	.495**		
BTeach5	.151*	BMana5	.511**	BDes5	.152*		
BTeach6	.477**	BMana6	.007*				
BTeach7	.188*	BMana7	.336*				
BTeach8	.690**						
BTeach9	.443**						
BTeach10	.313*					HTop1	.657
F1	.491**	F2	.616**	F3	.444**	F4	.529**

N:21

*= $p > 0.05$ **= $p < 0.05$

eighteen items were found to have a moderate correlation. The correlation coefficients for the factors ranged between .444 and .616, and the correlation for the total score was .657. Although the stability level of the sixth item under the management factor was low, since the overall stability level of the factor was high, this item was not extracted from the scale not to disturb the content validity of the scale. It can be said that factors' stability levels and the total score are high.

4 Result and discussion

In the study, a new scale was developed for defining teachers' readiness levels on BL. The BL readiness scale consists of four factors and 25 items determined as a five-point Likert-type scale. The items in the scale were scaled as (1) Strongly Disagree, (2) Disagree, (3) Partially Agree, (4) Agree, (5) Strongly Agree. The validity of the scale was tested through FA and discriminant properties.

According to factor items' FL, the factors' eigenvalues and the variance ratios explained, it can be stated that the scale's construct validity is appropriate. Exploratory FA demonstrate that the scale was grouped under 4 factors. For validating the determined factor structures, confirmatory FA was used. The results of the confirmatory FA demonstrate that scale model's observed values revealed the consistency of data at a valid level.

Item-total correlations were calculated to determine the level at which the items in the scale can measure the factors they are included in and the characteristics that are tried to be measured. According to the results, the items and factors in the scale contributed significantly to the purpose of measuring the characteristics that the scale was intended to measure. Additionally, the discrimination levels of the items were determined by analyzing the t-values for the difference between the top 27% groups and the bottom 27% groups. According to the values obtained, the overall scale and the discrimination of each item were found high. However, the level of discrimination of the Competence factor was found lower than that of the other factors. The internal consistency coefficients of the scale were obtained by means of Cronbach's alpha and McDonald's ω . The obtained values demonstrate that the total and each factor of the scale can provide consistent measurements. The test-retest method was used at different times to test the invariance of the scale over time. According to the correlation of the total score obtained from the scale, it was concluded that it could make consistent measurements with respect to time invariance.

The scale items were formed within the framework of a four-factor structure. Construct validity analyses shows that a four-factor structure emerged in a way to confirm this four-factor structure. These factors are TLP, management, designing and competence. According to the construct validity analyses, it was seen that three items under the competence factor were distributed under the TLP factor. It appears that competences are a concept used to indicate what teachers and prospective teachers can do and this concept is expressed as standards in English-speaking countries (Alan & Güven, 2022). In this direction, it was decided to maintain the four-factor structure consisting of TLP, management, designing

and competence, which was formed by considering that it would not be wrong to evaluate the competence items within the TLP. The four-factor structure can be explained as follows:

Teaching and learning process It is the process of including the knowledge, skills, behaviors, and attitudes aimed to be gained by the students in the programs by considering the characteristics of the target group (Gökçe, 2014). There are two different conceptions of teaching and learning in education: traditional and constructivist (Chan & Elliott, 2004). Because of these understandings, the TLP should be shaped in line with the characteristics of the target group. The quality of teaching is improved by creating a technologically rich TLP (Horton & Horton, 2003). Therefore, the efficiency of TLP is one of the important factors affecting the quality of education.

Management In blended teaching processes, teachers are an important part of the process (Bonk & Graham, 2004). From the learner's point of view, it can be seen as a challenging process to manage and take responsibility for one's own work in a flexible working environment independent of time and space in BL (Vaughan, 2007; Welker & Berardino, 2005). Managing a relational process with learners is important for the effectiveness and efficiency of the course (Moore & Kearsley, 2004 cited in Göksel, 2015). For these reasons, the most efficient learning and teaching in BL environments is possible with the correct management of the process.

Designing Designing the instruction is among the most important factors that determine the efficiency of the teaching process. Designing online and face-to-face environments together in the BL process is known as an important factor (Cabı & Gülbahar, 2013). Fresen (2007) stated that instructional design factor is among the success factors of web supported learning.

Proficiency Processes involve a process with different variables. In this direction, technology competences of instructors and their online environment experiences are important factors affecting the quality of learning environments (Wheeler, 2001). Bandura (1997) states that teachers' perceptions of efficacy are more important than professional content knowledge and teaching efficacy.

Therefore, it can be concluded that a valid and reliable scale exists for determining teachers' readiness levels for blended learning. The scale's results allow teachers to identify areas where they need improvement, and educational institutions can plan effective support and training programs to address these areas of weakness. When teachers face obstacles in adopting the blended learning method due to a lack of technological competencies, application difficulties, or insufficient institutional support, continuous training programs and strengthened technological infrastructure can be helpful. As no measurement tool has been found in the related literature to assess the readiness levels of teachers at all educational levels for creating, implementing, and evaluating blended learning applications, it is believed that the developed tool can make a significant contribution to the literature.

5 Limitations

Exploratory FA was performed with the data gathered right after the scale form was performed to the teachers. Afterwards, confirmatory FA was performed to confirm the scale's factor structures, which was determined to consist of four factors and 25 items according to FA with the data available without the second application.

Annex

Items	Teachers' Readiness Scale for Blended Teaching	Strongly Disagree	Disagree	Partly Agree	Agree	Strongly Agree
Teaching and Learning process						
1.	By using the BL model, I contribute to the development of the students.	(1)	(2)	(3)	(4)	(5)
2.	I can improve my interaction with students by using the BL model.	(1)	(2)	(3)	(4)	(5)
3.	In the BL model, I can ensure the active participation of students.	(1)	(2)	(3)	(4)	(5)
4.	I can improve the interaction between students by using the BL model.	(1)	(2)	(3)	(4)	(5)
5.	I can draw the student's attention to the subject in BL environments.	(1)	(2)	(3)	(4)	(5)
6.	I contribute to students' time management in BL environments.	(1)	(2)	(3)	(4)	(5)
7.	I can create an effective learning environment using the BL model.	(1)	(2)	(3)	(4)	(5)
8.	I can evaluate the effectiveness of the blended instruction that I designed.	(1)	(2)	(3)	(4)	(5)
9.	I provide opportunities for my students to blend the BL environments I design according to their own needs.	(1)	(2)	(3)	(4)	(5)
10.	I can determine the blended teaching model suitable for the content I will teach.	(1)	(2)	(3)	(4)	(5)
Management						
11.	I can find solutions to technical problems that students may encounter in BL environments.	(1)	(2)	(3)	(4)	(5)
12.	I can solve possible problems that may occur in synchronous or asynchronous digital environments in the BL environment.	(1)	(2)	(3)	(4)	(5)

Items	Teachers' Readiness Scale for Blended Teaching	Strongly Disagree	Disagree	Partly Agree	Agree	Strongly Agree
13.	I can guide students to use and manage their online accounts.	(1)	(2)	(3)	(4)	(5)
14.	I can manage transitions to different learning activities in a BL environment.	(1)	(2)	(3)	(4)	(5)
15.	I can manage students' behaviors in digital learning systems in a BL environment.	(1)	(2)	(3)	(4)	(5)
16.	I can manage group work such as online collaboration, discussion forums, etc.	(1)	(2)	(3)	(4)	(5)
17.	I can guide students in using different teaching materials in BL model.	(1)	(2)	(3)	(4)	(5)
Designing						
18.	I can design BL environments suitable for various learning needs.	(1)	(2)	(3)	(4)	(5)
19.	I can design teaching materials suitable for BL environments.	(1)	(2)	(3)	(4)	(5)
20.	I can design instruction for BL in line with the individual needs of my students.	(1)	(2)	(3)	(4)	(5)
21.	I can prepare course materials suitable for synchronous or asynchronous learning environments.	(1)	(2)	(3)	(4)	(5)
22.	I can create online resources with different communication tools to support BL.	(1)	(2)	(3)	(4)	(5)
Proficiency						
23.	I think I am insufficient in using different BL models.	(1)	(2)	(3)	(4)	(5)
24.	I lack the necessary technological facilities to use the BL model.	(1)	(2)	(3)	(4)	(5)
25.	I think it is difficult to perform the BL model in teaching.	(1)	(2)	(3)	(4)	(5)

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Data availability No additional data is associated with this paper.

Declarations

Competing interests There are no competing interests.

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