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A measure of emergency remote teaching: development and validation of a teacher self-efficacy scale

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Abstract: This study aims to develop and validate a scale measuring emergency remote teaching self-efficacy of teachers. The scale was given to 190 teachers during the scale development stage. Four factors were extracted as a result of exploratory factor analysis. The final 24-item version of the scale was tested on 234 teachers during the scale validation stage. Confirmatory factor analysis validated the four-factor structure of the scale. Cronbach's alpha was calculated to be .88, .88, .89, and .91 for each factor, respectively. Furthermore, the Multivariate Analysis of Variance revealed that emergency remote teaching self-efficacy differed significantly depending on whether teachers received in-service training on emergency remote teaching or not. The results provided some evidence that the Emergency Remote Teaching Self-Efficacy Scale scores were valid and reliable. The Emergency Remote Teaching Self-Efficacy Scale provides information about self-efficacy in student-centered emergency remote teaching, self-efficacy in emergency remote teaching of a curriculum, self-efficacy in online emergency remote teaching, and self-efficacy in emergency remote teaching of students with special needs.

Keywords: Emergency remote teaching self-efficacy, quantitative, scale development, scale validation, teacher.

Highlights

What is already known about this topic:

- Emergency remote teaching self-efficacy is a teacher's confidence in his or her ability to plan and execute the necessary actions to teach remotely in emergencies.
- There is no single measure that can assess teachers' emergency remote teaching self-efficacy.

What this paper contributes:

- The Emergency Remote Teaching Self-Efficacy Scale is a valid and reliable assessment tool.
- The Emergency Remote Teaching Self-Efficacy Scale consists of four factors and 24 items.

Implications for theory, practice and/or policy:

- To measure teachers' self-efficacy in emergency remote teaching, the Emergency Remote Teaching Self-Efficacy Scale can be used.
- Longitudinal research can be carried out to investigate changes in teachers' self-efficacy in emergency remote teaching.

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Introduction

With the arrival of the COVID-19 on the global agenda in 2020, education, like all other fields, has been impacted. It has been reported that the pandemic has disrupted the education of more than 1.5 billion children worldwide (United Nations Educational, Scientific and Cultural Organization [UNESCO], 2020). Most countries have made the mandatory decision to continue with distance education until this emergency passes, in schools that were temporarily closed due to the pandemic. Several countries have been forced to discontinue education in person and shift teaching-learning activities online (Lin, 2021). It has been stated that countries use a variety of remote learning sources including instructional packages (worksheets, printouts and textbooks), radio and television education, and online teaching resources, and that nearly all OECD and partner countries use online platforms during school lockdowns (Reimers & Schleicher, 2020). Following the release of the first COVID-19 case in Türkiye on March 11, 2020, education in person was suspended in universities and all schools affiliated with the Ministry of National Education on March 14, 2020. While a brief recess was announced in educational institutions at the outset, it was anticipated that schools would be unable to open for the spring term due to a growth in the number of deaths from the COVID-19. Distance education has begun in Türkiye, as it has in many other countries, in order not to disrupt the educational process (Eken *et al.*, 2020). The rapid transition of schools to distance education, as well as universities in the aftermath of the COVID-19 pandemic (Bozkurt, 2022), has raised national and global concerns about students' readiness to deal with an emerging new situation (Dorsah, 2021). As a consequence of this situation, educational institutions at all levels have been compelled to work remotely and implement "emergency remote teaching" (Bozkurt & Sharma, 2020).

This sudden and unpredictable transition to "emergency remote teaching" has created an unexpected and unplanned situation for both teachers and students, yielding unsatisfactory results (Lin, 2021). Furthermore, the educational practices used during the crisis differ from online distance education in some ways. There is a distinction to be made between online distance education and "emergency remote teaching" (Bozkurt & Sharma, 2020). "Emergency remote teaching" should be viewed as an interim solution to a pressing issue (Golden, 2020). For example, Hodges *et al.* (2020) stated that emergency remote teaching environments are a reply to the crisis, that "emergency remote teaching" is not planned in advance, that it provides hastily constructed, temporary instructional assistance in a crisis, and that it differs from online learning. According to Iglesias-Pradas *et al.* (2021), emergency distance teaching is "temporary" because it refers to the assumption that once the crisis has passed, teaching will resume in its original format. Online learning, yet, is the result of cautious instructional planning and design, which necessitates an investment in an entire ecosystem of supports for learners that requires time to develop (Hodges *et al.*, 2020). The educators (Hodges *et al.*, 2020; Milman, 2020; Rapanta *et al.*, 2020; UoPeople, 2020) argued that the rapid transition to digital teaching and learning during the pandemic could not be called as online learning, and that a new term should be used for the transition resulting from this emergency, and a consensus was reached on the term "emergency remote teaching" (Iglesias-Pradas *et al.*, 2021).

Literature

Emergency Remote Teaching Self-Efficacy

According to Trust and Whalen (2020), K-12 teachers face challenges in the following areas: access to online educational resources and tools during the emergency remote teaching process, emergency remote teaching strategies, emergency remote teaching materials, online communication tools, local- and national-level directives restricting and preventing "emergency remote teaching", communication with family and students in an "emergency remote teaching", communication between family and students, Internet access of students, obtaining administrative support, prioritizing individual needs, protecting personal health, and having quality Internet access. Crick *et al.* (2020) discovered that

equity of access to technology is one of the key concerns raised, whereas the community of computer science educators in the United Kingdom is more optimistic about the shift to online learning, teaching, and assessment. According to Dulay and Manuel (2021), the most significant issue that STEM teachers face in “emergency remote teaching” is students’ understanding of the lesson and teaching, as well as issues with technology, monitoring and evaluation. The findings of a research by Lipton and Mao (2021) indicated that elementary school teachers' experiences with “emergency remote teaching” are complicated and defined by emotional trauma during the shift, barriers in technology and instruction, and alterations in content, technology, and pedagogy, heavier workload, and good relations with students and colleagues. Sezgin (2021) pointed out that the digital divide is the most prominent reality in terms of major ideas and issues related to “emergency remote teaching”.

All of the aforementioned issues may lead to teachers feeling insufficient in “emergency remote teaching”. During the pandemic, teachers, according to Lipton and Mao (2021), feel the need to trust themselves in “emergency remote teaching”. While many teachers were given assistance in completing several new tasks, such as communicating with students and parents, establishing online classrooms, and discovering new platforms and applications, some teachers were left to figure out how to deal with this situation on their own. Teachers, it is understandable, require assistance in adapting learning-teaching and measurement-assessment methods and techniques to “emergency remote teaching”. According to Choi *et al.* (2021), it is critical to comprehend the ever-changing nature of digital teaching and learning, and teachers should be trained to support their professional competencies in accordance with the requirements of the digital age. It was critical for teachers to rapidly acquire new skill sets, especially during the pandemic (Allouh *et al.*, 2021). Although teachers find “emergency remote teaching” useful in continuing the teaching and learning process amid the COVID-19 outbreak, teachers should be guided on an instructional design, or framework for the successful implementation of “emergency remote teaching” (Talidong, 2020). Trust and Whalen (2020) discovered that teachers use the following strategies to overcome difficulties in “emergency remote teaching”: obtaining assistance/opinion/resource support from colleagues, conducting Internet research, following educators' social media posts and comments, reviewing the resources provided by the school, reviewing the resources of different institutions, participating in virtual webinars, attending online meetings with information technology experts and colleagues, reading books and articles, requesting assistance/opinion/resource support via social media, requesting assistance/opinion/resource support from administrators.

Teachers' self-confidence in “emergency remote teaching”, for which they are unprepared, is thought to have an impact on their motivation for “emergency remote teaching”. Thus, as a result of a quick systematic review of K-12 research carried out during the COVID-19 pandemic, Bond (2020) concluded that self-efficacy is one of the teacher influential factors on “emergency remote teaching” and learning. This necessitates addressing teachers' self-efficacy in “emergency remote teaching”. Determining the extent and level of competence of teachers in “emergency remote teaching” is critical for teacher education. The self-efficacy theory of Bandura (1977), the teacher self-efficacy construct of Tschannen-Moran *et al.* (1998), and the emergency remote teaching environment framework of Whittle *et al.* (2020) served as theoretical frameworks in this research.

Bandura (1997) defined self-efficacy as confidence in one's capacity to organize and carry out the necessary actions to address potential issues. Bandura (1977) proposed self-efficacy as a unifying theory that explains and predicts behavioural changes. Self-efficacy influences whether or not coping behaviours are used, how much effort is put forth, and how long they are maintained in the face of challenges and discouraging experiences. Bandura (1977) addressed four sources of self-efficacy in the proposed model: “performance accomplishments, vicarious experience, verbal persuasion, and physiological states” (p. 195). Active, indirect, stimulating, and emotional resources are used to influence cognitive processing of self-efficacy.

Tschannen-Moran *et al.* (1998) conceptualized teacher efficacy as a teacher's confidence in his or her ability to plan and carry out the actions necessary to successfully complete a given instructional task in a given context. Teacher efficacy and its consequences are influenced by a teacher's perception of teaching efficacy (including evaluation of internal resources and constraints) as well as beliefs about task needs in a particular instructional context (including evaluation of external resources and constraints). Although teacher efficacy has been shown to be strongly pertaining to a variety of significant educational outcomes, including teachers' perseverance, enthusiasm, dedication, and instructional behaviour, as well as student outcomes like motivation, achievement, and self-efficacy beliefs, a broader range of teaching tasks (teaching strategies, student engagement, and classroom management) were included in teacher self-efficacy, representing the breadth of teachers' work as well as the conditions for effective teaching (Tschannen-Moran & Woolfolk Hoy, 2001).

Whittle *et al.* (2020) created an emergency remote teaching environment framework that teachers can use to plan for learning in emerging environments and that researchers can conceptualize. By putting the teacher in the position of being the initial savior to an educational crisis, they propose a three-step framework for both comprehending and assisting with learning in emergencies: inquiring, categorizing accessible resources as constants and variables, and creating educational experiences. These procedures are iterative because such a design is better at adapting to the unanticipated shifts in resources and objectives that define the crisis, necessitating constant re-evaluation. This study focuses on teachers' beliefs about their ability to organize and take the necessary actions to teach remotely in emergencies, which can be defined as emergency remote teaching self-efficacy.

Research Purpose and Significance

According to the relevant literature, a Likert-type scale was developed to examine the perspectives of university students in Vietnam regarding “emergency remote teaching” (Le & Truong, 2021), a scale was developed to measure teachers' attitudes toward “emergency remote teaching” (Toraman *et al.*, 2021), the Parental Involvement Strategies Scale during Emergency Remote Teaching was developed to determine the strategies teachers use to ensure parental involvement in “emergency remote teaching” (Raguindin *et al.*, 2021), a scale measuring the basic principles of “emergency remote teaching” was developed (Cahyadi *et al.*, 2021), a scale was developed aimed at determining perceptions of “emergency remote teaching” (Guo *et al.*, 2022), and a scale was developed to measure academicians’ attitudes toward “emergency remote teaching” (Çengel *et al.*, 2022). When the studies were examined, no scale that measures the teachers' emergency remote teaching self-efficacy was discovered. Only Allouh *et al.* (2021) developed a scale to measure Qatari elementary school teachers’ levels of self-efficacy for online teaching throughout the pandemic by modifying the Teachers’ Sense of Efficacy Scale (Tschannen-Moran & Woolfolk Hoy, 2001) for online teaching. However, they tried to validate an existing scale independent of the emergency remote teaching environment framework. So, this research appears to be significant in terms of meeting the need for a tool that measures how efficacious teachers perceive themselves in the context of “emergency remote teaching”. Knowing how competent teachers perceive themselves in teaching remotely in cases of emergencies will provide point of departure for developing their emergency remote teaching skills. This study’s primary goal is to develop and validate a teacher self-efficacy scale for remote teaching in emergencies. The following are the research questions addressed: (1) Is the Emergency Remote Teaching Self-Efficacy Scale valid? (2) Is the Emergency Remote Teaching Self-Efficacy Scale reliable?

Methodology

Research Model/Design

The survey design was utilized in this quantitative research study. A survey is a type of research design that aims to collect data from a sample by asking questions about various aspects of the population (Fraenkel *et al.*, 2011: 419).

Sampling

The study's accessible population consists of all teachers who teach in public and private middle and high schools in Afyonkarahisar, Türkiye. Since both the scale development and validation phases of the study necessitate two data collection procedures, two distinct samples were chosen.

Sample 1

During the scale development phase, data were gathered from 190 volunteer teachers (117 females, 73 males) who were selected by convenience sampling. The ages of these teachers ranged from 23 to 61, with an average age of 36.93 (SD=7.13). The teachers' seniority ranged from 1 to 32 years, with an average of 12.6 years (SD=7.13). Only seven teachers did not specify the year of their seniority. 168 of the teachers stated that they studied at the undergraduate level, 19 at the master's level, two at the doctorate level, and only one at the associate degree level. There were 121 teachers teaching in the province, 33 in towns, and 21 in districts, and 15 in villages. 179 of the teachers said they are employed at a public school, while five said they are employed at a private school. Only six teachers did not indicate the type of school at which they work. 114 of the teachers said they did not receive distance education in-service training, while 76 said they did. 171 of the teachers said they did not receive in-service training on “emergency remote teaching”, while 19 said they did. 96 of the teachers said that almost half of their students, 53 of them half of their students, 30 of them almost all of their students, three of them all their students could attend the synchronous lessons while only two of the teachers said that none of their students could attend. Only six teachers did not specify whether their students would be able to attend the synchronous lessons.

Sample 2

It was noted that the confirmatory factor analysis should be performed on a minimum of 150 cases in order to verify the structure that emerged during the scale development stage (Wolf *et al.*, 2013). During the scale validation phase, data were gathered from 234 volunteer teachers (134 females, 100 males) who were selected by convenience sampling. The ages of these teachers ranged from 23 to 57, with an average age of 37.83 (SD=7.96). The teachers' seniority ranged from 1 to 33 years, with an average seniority of 14.64 years (SD=8.34). Only two teachers failed to state their seniority year. 175 teachers said that they studied at the undergraduate level, 52 at the master's level, four at the doctorate level, and only three at the associate degree level. 135 teachers were teaching in the province, 59 in districts, 20 in towns, and 20 in villages. 228 of the teachers said they are employed at a public school, while six said they are employed at a private school. 118 of the teachers asserted that they did not receive distance education in-service training, while 116 stated that they did. 200 of the teachers said they had no in-service training on “emergency remote teaching”, while 34 said they had. 142 of the teachers said that almost half of their students, 44 of them said half of their students, 29 of them said almost all of their students, five of them said that all of their students could attend the synchronous lessons, and only 14 said that none of their students would be able to attend classes.

Data Collection Tool

During the scale development stage, a 33-item pool was established by reviewing the literature (Rahiem, 2020; Whittle *et al.*, 2020; Yükseköğretim Kurulu, 2020) on "emergency remote teaching". The factors that are anticipated are discussed further below. Table 1 provides examples of scale items.

Table 1. Predicted factors and sample items of the emergency remote teaching self-efficacy scale

Factors	Sample Items
Self-efficacy in student-centered emergency remote teaching	How well can you meet your students' social and emotional needs? How well can you plan online social events for your students (chess tournaments, book discussions, chat hours, expert interviews, and so on)?
Self-efficacy in online emergency remote teaching	How well can you come up with alternative solutions to the problems you encounter in your online courses? How well can you teach live/synchronous lessons?
Self-efficacy in emergency remote teaching of a curriculum	How well can you teach by prioritizing critical curriculum objectives? To what extent can you divide the learning content into smaller chunks to facilitate learning?
Self-efficacy in emergency remote teaching of students with special needs	How well can you teach online lessons taking into account the characteristics of your special-needs students? How well can you take the necessary precautions (additional time, describing graphics, etc.) for your special-needs students in exams?

"Self-efficacy in student-centered emergency remote teaching" refers to the belief in one's ability to plan and take the actions required to do student-centered remote teaching in emergencies. For example, "How well can you meet your students' social and emotional needs?" is one of the items of the "self-efficacy in student-centered emergency remote teaching" sub-scale. "Self-efficacy in online emergency remote teaching" is the belief in one's ability to plan and take the actions required to do online remote teaching in emergencies. For example, "How well can you come up with alternative solutions to the problems you encounter in your online courses?" is one of the items of the "self-efficacy in online emergency remote teaching" sub-scale. "Self-efficacy in emergency remote teaching of a curriculum" stands for the belief in one's ability to plan and take the actions required to do remote teaching of a curriculum in emergencies. For example, "How well can you teach by prioritizing critical curriculum objectives?" is one of the items of the "self-efficacy in emergency remote teaching of a curriculum" sub-scale. "Self-efficacy in emergency remote teaching of students with special needs" is the belief in one's ability to plan and take the actions required to do remote teaching of special-needs students in emergencies. For example, "How well can you teach online lessons taking into account the characteristics of your special-needs students?" is one of the items of the "self-efficacy in emergency remote teaching of students with special needs" sub-scale. A Likert-type scale with nine points (1 = nothing, 9 = a great deal) was developed. The scale was subjected to the review of five experts in measurement and assessment, instructional technology, and Turkish language education and finalized based on their feedback. The scale, which was created on Google Forms, was administered to and piloted with middle and high school teachers in Afyonkarahisar, Türkiye. Teachers were asked whether there was confusion about any items and whether they found any of the items offensive or insulting. The scale was improved upon reviewing the results of the pilot study.

Data Analysis

Exploratory factor analysis (EFA) (Çokluk *et al.*, 2010; Tabachnick & Fidell, 2013) was performed on the data gathered during the scale development phase, whereas confirmatory factor analysis (CFA) (Jöreskog & Sörbom, 1993; Kline, 2005) was done on the data collected from the different sample during the scale validation phase. Then, the reliability coefficients for each sub-scale were determined. Whether emergency remote teaching self-efficacy levels of teachers differed significantly depending on the fixed independent variable (participation of teachers in in-service training on "emergency remote teaching") was tested performing one of the parametric tests, i.e. multivariate analysis of

variance (MANOVA) to provide additional proof of validity. All of these analyses were carried out using statistical software, and the level of significance was set at .05.

Ethical Considerations

Following the acquisition of the necessary permissions from a public university's institutional review board (Date: October 27, 2020, Number: 2020/181) and one of the provincial directorates of national education, the scale administration took about 30 minutes during the scale development phase and about 15 minutes during the scale validation phase. The teachers who took part in the study were informed about the purpose of the research and told that their information would be kept private.

Findings and Discussions

Findings

Because the research was conducted in two stages, the results are divided into two sections: "Stage 1: Development of an emergency remote teaching self-efficacy scale" and "Stage 2: Validation of an emergency remote teaching self-efficacy scale."

Stage 1: Development of an Emergency Remote Teaching Self-Efficacy Scale

During the scale development phase, the data gathered from 190 middle and high school teachers was first subjected to missing data analysis, which revealed that there was no data loss. To ascertain the factor number of the scale and what items were loaded onto which factor (Çokluk *et al.*, 2010; Tabachnick & Fidell, 2013), EFA was used on 190 teachers' data. The EFA assumptions (presence of metric/continuous variables, correlation between scale items greater than .30, Bartlett sphericity test, Kaiser-Mayer Olkin (KMO) value, multivariate normality, and absence of extreme values) (Hair *et al.*, 2009) were checked. The Emergency Remote Teaching Self-Efficacy Scale is a 9-point Likert-type scale and the responses to its items are metric/continuous variables that show the level of agreement with the scale items. As a result of EFA, the Barlett sphericity test was statistically significant [$\chi^2_{(528)}$=6121.77, p<.001], with maximum likelihood (Costello & Osborne, 2005; Fabrigar *et al.*, 1999) and direct oblimin oblique rotation (Preacher & MacCallum, 2003, p. 25) methods. In other words, the correlation matrix is significantly different from the identity matrix. When the correlation matrix showing the correlation between the scale items was examined, the correlation coefficients were mostly greater than .30. The KMO value was determined to be .942. A KMO value greater than .60 indicated that the sample was sufficiently large for EFA (Hair *et al.*, 2009). These results suggest that the scale is suitable for EFA (Tabachnick & Fidell, 2013). The first EFA resulted in the formation of a four-factor structure. The following seven items, however, were excluded from the scale because they were loaded on multiple factors: 3, 7, 11, 12, 14, 17, and 27. The number of scale items was lowered from 33 to 26. EFA was performed again, and the second EFA produced a 26-item, four-factor structure. However, two items (items 2 and 32) were removed from the scale because their item-total correlations were less than .70, and they increased the Cronbach alpha reliability coefficients of the loaded factors when removed. As a result, the number of items was reduced to 24. EFA was reperformed, and the third and final EFA resulted in the formation of a 24-item, four-factor structure. The four factors explained 75.65% of the total variance. The factor number of the scale was determined by examining whether the eigenvalues were greater than one, Cattell's scree plot (Figure 1), and the explained total variance (Stevens, 2002).

Figure 1. Cattell's scree plot.

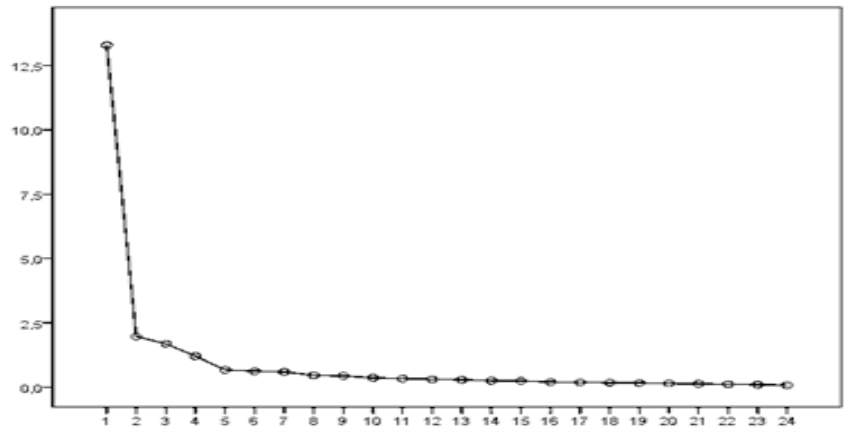


Table 2 displays all of the scale's factor loadings.

Table 2. Factor loadings of the emergency remote teaching self-efficacy scale

	F1	F2	F3	F4
IT19	72			
IT21	72			
IT20	70			
IT22	67			
IT13	65			
IT15	61			
IT1	55			
IT26		- 93		
IT28		-.93		
IT25		- 81		
IT23		- 57		
IT24		-.56		
IT18		- 52		
IT4			83	
IT5			.77	
IT8			.69	
IT6			68	
IT9			66	
IT10			55	
IT16			49	
IT30				-.92
IT29				-.80
IT31				- 68
IT33				- 65

Note. F1: “Self-efficacy in student-centered emergency remote teaching”; F2: “Self-efficacy in emergency remote teaching of a curriculum”; F3: “Self-efficacy in online emergency remote teaching”; F4: “Self-efficacy in emergency remote teaching of students with special needs”

Accepting the lower cut-off point of .40 for factor loadings, we determined which item loaded on which factor (Field, 2009). Factor 1 was renamed "self-efficacy in student-centered emergency remote teaching": 7 items – IT1, IT13, IT15, IT19, IT20, IT21, and IT22. (IT1: How well can you provide feedback to students using a variety of strategies?) Factor 2 was designated "self-efficacy in emergency remote teaching of a curriculum": 6 items – IT18, IT23, IT24, IT25, IT26, and IT28. (IT26: How well can you teach by prioritizing critical curriculum objectives?) Factor 3 was dubbed "self-efficacy in online emergency remote teaching": 7 items – IT4, IT5, IT6, IT8, IT9, IT10, and IT16. (IT9: How well can you use e-learning materials to promote active learning?) Factor 4 is titled "self-efficacy in emergency remote teaching of students with special needs": 4 items – IT29, IT30, IT31, and IT33. (IT31: How well can you provide open access to measurement and assessment tools (multiple-choice test, performance task, etc.) for students with special needs based on their disability?). The scale's reliability was then assessed. The corrected item-total correlation values of all items on the scale ranged between .59 and .80, which is greater than .30 (Hair *et al.*, 2009). Cronbach alpha reliability coefficients were calculated to be .92, .93, .93, and .92 for the four sub-scales, respectively, and .96 for the whole scale. The developed scale is considered reliable with its Cronbach alpha reliability coefficient greater than .70 (Nunnally, 1978).

Stage 2: Validation of an Emergency Remote Teaching Self-Efficacy Scale

To validate the four-factor structure of the revised 24-item 9-point Likert-type Emergency Remote Teaching Self-Efficacy Scale, it was given to 234 middle and high school teachers. To validate the model proposed by the EFA (Jöreskog & Sörbom, 1993, Kline, 2005), data were subjected to CFA through LISREL 8.7 (Jöreskog & Sörbom, 2004). The data prior to CFA were subjected to missing data analysis, and no data loss was discovered. The assumptions of CFA (multicollinearity, univariate and multivariate normality, and extreme values) (Flora *et al.*, 2012) were checked and met. The skewness and kurtosis values of each item, as well as the Q-Q plots, were examined for univariate normality. The fact that the skewness value of each item is in the range of ±2 and the kurtosis value is in the range of ±4 indicates that the univariate normality assumption is met since a normal distribution has a skewness value of no more than three and a kurtosis value of no more than ten (Kline, 2005). That the majority of the data is distributed along a line that forms a 45-degree angle with the horizontal on the Q-Q plots is a demonstration of the univariate normal distribution (Tabachnick & Fidell, 2013). Multivariate normality was assumed because Mardia's normalized multivariate kurtosis coefficient (53.8514) is less than the critical value (624; p = number of items on the scale = 24) determined by the p(p+2) equation (Raykov & Marcoulides, 2008). By calculating the correlation values between the items, the existence of multicollinearity among the items was tested. Because the correlation values between the items were found to be between .19 and .84 and were less than the recommended threshold value of .90 (Kline, 2005), it was determined that the data were not multicollinear.
Table 3 shows the descriptive statistics values determined for the overall, sub-dimensions, and items of the Emergency Remote Teaching Self-Efficacy Scale.

Table 3. Descriptive statistics values calculated for the overall scale, sub-dimensions, and items

Sub-dimensions and items	M	SD	Minimum	Maximum	Skewness	Kurtosis
F1	7.15	1.08	3.9	9	-0.12	-0.39
F2	7.63	0.98	4.8	9	-0.39	-0.57
F3	7.78	0.96	5	9	-0.57	-0.39
F4	7.28	1.35	1	9	-0.98	1.75
Overall	7.48	0.93	5.4	9	-0.16	-0.81
IT1	6.96	1.45	2	9	-0.43	0.02
IT4	7.92	1.24	1	9	-1.55	3.73
IT5	7.92	1.24	4	9	-1.12	0.67
IT6	7.67	1.20	4	9	-0.71	-0.01
IT8	7.88	1.22	3	9	-1.07	0.88
IT9	7.66	1.22	3	9	-0.86	0.90
IT10	8.1	1.09	4	9	-1.18	0.95
IT13	6.78	1.76	1	9	-0.80	0.64
IT15	7.23	1.34	4	9	-0.32	-0.68
IT16	7.31	1.36	4	9	-0.41	-0.71
IT18	7.33	1.29	4	9	-0.40	-0.45
IT19	7.47	1.28	1	9	-0.78	1.60
IT20	7.39	1.29	3	9	-0.54	-0.15
IT21	7.29	1.31	3	9	-0.67	0.28
IT22	6.96	1.47	1	9	-0.67	0.74
IT23	7.52	1.34	3	9	-0.81	0.52
IT24	7.28	1.44	1	9	-1.02	1.68
IT25	7.68	1.12	5	9	-0.54	-0.45
IT26	7.94	1.08	5	9	-0.76	-0.29
IT28	8.01	1.08	4	9	-0.94	0.31
IT29	7.41	1.48	1	9	-0.94	1.08
IT30	7.26	1.48	1	9	-0.81	0.79
IT31	7.34	1.45	1	9	-1.01	1.42
IT33	7.11	1.64	1	9	-0.87	0.91

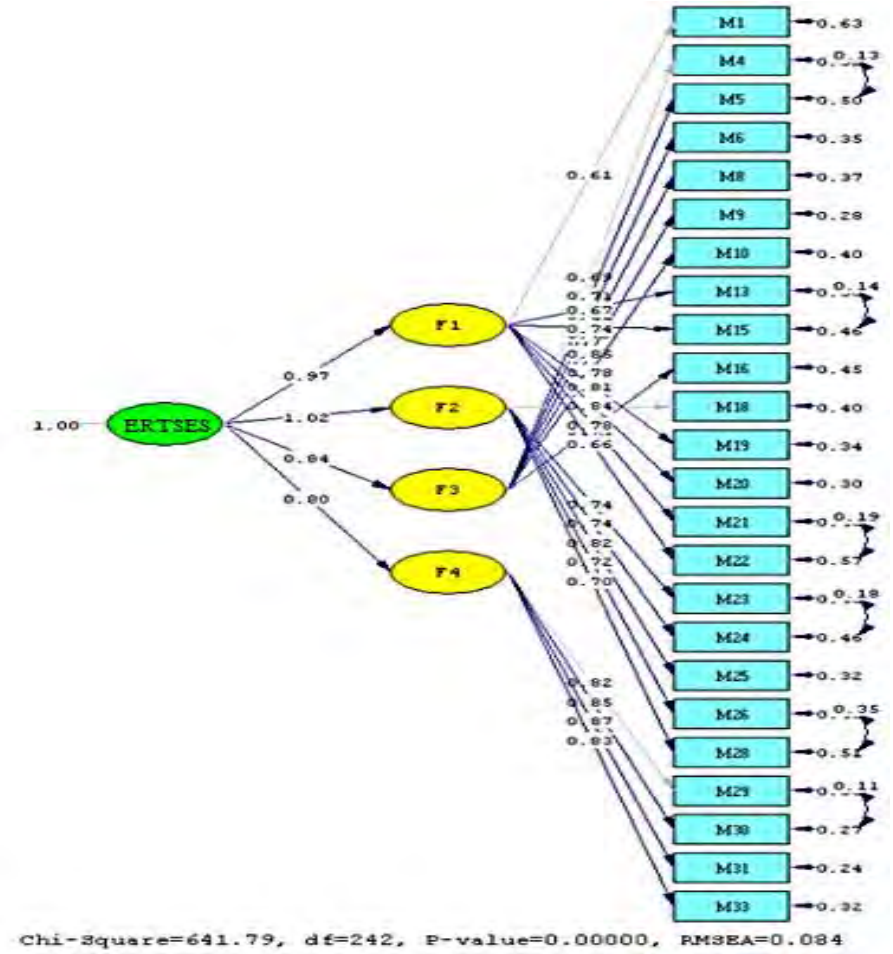
It was discovered that the middle and high school teachers thought they were efficacious in “emergency remote teaching” (M=7.48, SD=0.93). Middle and high school teachers perceived themselves to be efficacious in the following dimensions respectively: “self-efficacy in online emergency remote teaching” (M=7.78, SD=0.96), “self-efficacy in emergency remote teaching of a

curriculum" (M=7.63, SD=0.98), "self-efficacy in emergency remote teaching of students with special needs" (M=7.28, SD=0.96), and "self-efficacy in student-centered emergency remote teaching" (M=7.15, SD=1.08). While "online emergency remote teaching" is the dimension in which middle and high school teachers perceive themselves most efficacious, "student-centered emergency remote teaching" is the dimension in which they perceive themselves least efficacious.

CFA was performed to analyse data from 234 middle and high school teachers. The scale's four-factor structure was tested, with each item corresponding to the relevant factor. Chi-square/degrees of freedom ratio (χ^2/df), adjusted goodness of fit index (AGFI), root mean square error of approximation (RMSEA), non-normed fit index (NNFI), comparative fit index (CFI), and standardized root mean squared residual (SRMR) indices were examined and it was decided whether the model was compatible or not. The model fits well if the AGFI, NNFI, and CFI values are greater than .90 (Jöreskog & Sörbom, 1993; Kline, 2005). If the χ^2/df value is less than 2 or 3, it denotes that the model fit is acceptable (Schreiber *et al.*, 2006). When the RMR and SRMR values are less than.05, it indicates a good fit (Jöreskog & Sörbom, 1993; Kline, 2005). If the RMSEA value is less than .05, the fit is good; between .05 and .08, the fit is medium; and greater than .10, the fit is poor (Browne & Cudeck, 1993).

According to the CFA results (χ^2/df = 3.82, RMSEA = 0.11, GFI = 0.75, AGFI = 0.69, SRMR = 0.071, NNFI = 0.96, CFI = 0.96), the calculated initial fit indices were not at the expected level. The error covariances between IT28-IT26, IT22-IT21, IT24-IT23, IT15-IT13, IT30-IT29, and IT5-IT4 were released after the modification indices were examined. The repeated DFA results were calculated as χ^2/df = 2.65, AGFI = 0.77, RMSEA = 0.084, NNFI = 0.97, CFI = 0.97, and SRMR = 0.063. These indices provide a better fit. Figure 2 depicts each item's loadings on the relevant factor.

Figure 2. A path diagram for the emergency remote teaching self-efficacy scale.



Note. M: IT (item). F: Factor. For example, M1 stands for IT1. F1 stands for Factor 1.

Figure 2 depicts that the factor loadings of the items range from .61 to.87. DFA confirmed the four-factor structure of the Emergency Remote Teaching Self-Efficacy Scale:

- Factor 1 ("Self-efficacy in student-centered emergency remote teaching" – 7 items): IT1, IT13, IT15, IT19, IT20, IT21, IT22.
- Factor 2 ("Self-efficacy in emergency remote teaching of a curriculum" – 6 items): IT18, IT23, IT24, IT25, IT26, IT28.
- Factor 3 ("Self-efficacy in online emergency remote teaching" – 7 items): IT4, IT5, IT6, IT8, IT9, IT10, IT16.
- Factor 4 ("Self-efficacy in emergency remote teaching of students with special needs" – 4 items): IT29, IT30, IT31, IT33.

It also reveals that the correlation coefficients between the four factors range from .57 to.82. For discriminant validity, Kline (2005) stated that the correlation between factors should not exceed .85. Cronbach alpha reliability coefficients for the four sub-scales were calculated as .88, .88, .89, and .91, respectively, and .95 for the entire scale. The presence of Cronbach alpha reliability coefficients greater than .70 indicates that the scale with confirmed factor structure is reliable (Nunnally, 1978).
To provide additional evidence for validity, a test of differences between groups was performed (Crocker & Algina, 1986; Tezbaşaran, 2008). While the four factors of the Emergency Remote Teaching Self-Efficacy Scale are dependent variables, the independent variable is whether or not to receive in-service training on "emergency remote teaching". MANOVA was used to test whether middle and high school teachers' self-efficacy for "emergency remote teaching" differ depending on whether they receive in-service training on "emergency remote teaching". Before performing the analysis, the MANOVA postulates were double-checked. The results revealed that the homogeneity of covariance assumption was not met (Box's M = 28.02, $p<.05$). As a result, Pillai's Trace, a more robust statistic, was chosen for reporting. According to Levene test results, the assumption of homogeneity of variances is met for "self-efficacy in student-centered emergency remote teaching" [$F_{(1, 232)} = .56$, $p > .05$], "self-efficacy in emergency remote teaching of a curriculum" [$F_{(1, 232)} = .34$, $p > .05$], "self-efficacy in online emergency remote teaching" [$F_{(1, 232)} = 1.51$, $p > .05$], and "self-efficacy in emergency remote teaching of students with special needs" [$F_{(1, 232)} = .40$, $p > .05$]. The results of multivariate and univariate analyses of variance are shown in Table 4.

Table 4. Results of multivariate and univariate analyses of variance

			ANOVA							
	MANOVA		Self-efficacy in student-centered emergency remote teaching		Self-efficacy in emergency remote teaching of a curriculum		Self-efficacy in online emergency remote teaching		Self-efficacy in emergency remote teaching of students with special needs	
	$F_{(4, 229)}$	Partial η^2	$F_{(1, 232)}$	Partial η^2	$F_{(1, 232)}$	Partial η^2	$F_{(1, 232)}$	Partial η^2	$F_{(1, 232)}$	Partial η^2
In-service training on emergency remote teaching	5.4*	.09	21.7**	.09	14.6**	.06	9.3**	.04	9.5**	.04

*p < .05, **p < .0125

MANOVA results revealed significant differences in the self-efficacy perceptions of middle and high school teachers who received and did not receive in-service training on "emergency remote teaching" (Pillai's Trace = .09, $F_{(4, 229)} = 5.4$, $p<.05$, partial $\eta^2 = .09$). According to generally accepted criteria (Cohen, 1988), the size of the effect ranged from moderate to large. For the calculation of univariate F statistics, the Bonferroni correction was used, and the significance value of .05 was divided by four, which is the number of dependent variables. As a result, the F statistics were assessed at a significance level of .0125. According to the ANOVA results, middle and high school teachers' "self-

efficacy in student-centered emergency remote teaching" ($F_{(1, 232)}$ = 21.7, p<.0125, partial η^2 = .09), "self-efficacy in emergency remote teaching of a curriculum" ($F_{(1, 232)}$ = 14.6, p<.0125, partial η^2 = .06), "self-efficacy in online emergency remote teaching" ($F_{(1, 232)}$ = 9.3, p<.0125, partial η^2 = .04), "self-efficacy in emergency remote teaching of students with special needs" ($F_{(1, 232)}$ = 9.5, p<.0125, partial η^2 = .04) varied significantly depending on whether they received in-service training on "emergency remote teaching". The findings indicate that significant differences exist in the levels of "self-efficacy in student-centered emergency remote teaching", "self-efficacy in emergency remote teaching of a curriculum", "self-efficacy in online emergency remote teaching", and "self-efficacy in emergency remote teaching of students with special needs" among middle and high school teachers who receive or do not receive in-service training on "emergency remote teaching" (p<.0125). According to the findings of the Bonferroni test for multiple comparisons, the levels of "self-efficacy in student-centered emergency remote teaching" of middle and high school teachers who received in-service training on "emergency remote teaching" (M=7.92, SD=1.04) are higher than those who did not receive any in-service training on "emergency remote teaching" (M=7.03, SD=1.03). Middle and high school teachers who received in-service training on "emergency remote teaching" had higher levels of "self-efficacy in emergency remote teaching of a curriculum" (M=8.21, SD=.85) than those who did not receive any in-service training on "emergency remote teaching" (M=7.53, SD=.97). Middle and high school teachers who received in-service training on "emergency remote teaching" (M=8.24, SD=.78) had higher levels of "self-efficacy in online emergency remote teaching" than those who did not receive any in-service training (M=7.7, SD=.97). Middle and high school teachers who received in-service training on "emergency remote teaching" (M=7.93, SD=1.27) had higher levels of "self-efficacy in emergency remote teaching of students with special needs" than those who did not receive any in-service training on "emergency remote teaching" (M=7.17, SD=1.33).

Conclusions and Discussion

The pandemic has had a devastating impact on education at all levels, shifting face-to-face lessons to virtual lessons. Technology-based learning has influenced how teachers deliver lessons, how pupils interact in this context, and how school tasks are performed (Cabero Almenara & Valencia, 2020). Schleicher (2020) emphasized in the OECD report that teachers needed to adapt to new pedagogical concepts and teaching styles throughout the pandemic. During the COVID-19 lockdown, their second commonest need for information and communication technology (ICT) skills has become clear, right after teaching students with special needs (Schleicher, 2020). It is critical for teachers to successfully integrate technology into online lessons (Lestiyanawati & Widyantoro, 2020). Furthermore, Rahim (2020) described what should be taken into account when conducting online assessments in "emergency remote teaching" as follows: Evaluation of the prerequisites for the implementation of the online assessment; synchronization of assessment with intended learning outcomes; consideration of students' differences; balancing formative and summative assessments; promoting learning through online assessment; adjusting exam times to account for format; open communication with students on assessment-related issues; providing high-quality feedback; and consideration of threats to assessment validity.

Considering all of these factors related to curriculum, pedagogy (teaching/learning), assessment, and students with needs, courses delivered via "emergency remote teaching" must be redesigned differently than in-person courses. This obligation requires teachers to be competent in "emergency remote teaching". Cardullo *et al.* (2021) stated that one of the factors that has an impact on the success of remote teaching and learning is the teachers' perceived level of teaching efficacy. Correspondingly, Knopika and Domagała-Zyśk (2022) found out that one of the best predictors of subjective effectiveness of "emergency remote teaching" is self-efficacy. In light of the literature, the need to measure how competent teachers perceive themselves in the context of "emergency remote teaching" should be met because it is believed that knowing which facets of "emergency remote

teaching" teachers are insufficient at will help provide immediate and appropriate support. For this purpose, this study developed and validated an emergency remote teaching self-efficacy scale.

The findings demonstrated that the Emergency Remote Teaching Self-Efficacy Scale is valid and reliable in measuring teachers' self-efficacy for "emergency remote teaching". The final version of the Emergency Remote Teaching Self-Efficacy Scale consists of 24 items and four factors ("self-efficacy in student-centered emergency remote teaching" – 7 items, "self-efficacy in emergency remote teaching of a curriculum" – 6 items, "self-efficacy in online emergency remote teaching" – 7 items, "self-efficacy in emergency remote teaching of students with special needs" – 4 items). The reliability coefficients for the factors of the Emergency Remote Teaching Self-Efficacy Scale were found to be high (.88, .88, .89, and .91, respectively). Significant differences in emergency remote teaching self-efficacy between middle and high school teachers who received and did not receive "emergency remote teaching" in-service training provided more evidence for its validity. It is a feasible tool as its administration is quick, and the findings are simple to interpret. The 24-item, 9-point Likert-type Emergency Remote Teaching Self-Efficacy Scale can also be considered to be unique in terms of its structure developed upon the emergency remote teaching environment framework of Whittle *et al.* (2020) and its respondents including middle and high school teachers. In fact, Allouh *et al.* (2021) developed a 23-item, 9-point Likert-type scale to measure Qatari elementary school teachers' levels of self-efficacy for online teaching during the COVID-19 outbreak through the modification of the Teachers' Sense of Efficacy Scale (Tschannen-Moran & Woolfolk Hoy, 2001) for online teaching. Different from the scale with three sub-scales, namely "student engagement, instructional strategies, and classroom management" (Allouh *et al.*, 2021, p. 22), the Emergency Remote Teaching Self-Efficacy Scale consists of four sub-scales with higher reliability coefficients.

Recommendations and Limitations

The following are the study's recommendations for further research and practice:

- The Emergency Remote Teaching Self-Efficacy Scale provides information about "self-efficacy in student-centered emergency remote teaching", "self-efficacy in emergency remote teaching of a curriculum", "self-efficacy in online emergency remote teaching", and "self-efficacy in emergency remote teaching of students with special needs". To assess teachers' self-efficacy in "emergency remote teaching", the Emergency Remote Teaching Self-Efficacy Scale can be used. The use of the Emergency Remote Teaching Self-Efficacy Scale can be the prerequisite to developing teachers' emergency remote teaching skills.
- The Emergency Remote Teaching Self-Efficacy Scale can also be utilized to detect whether teachers' self-efficacy in "emergency remote teaching" differs on pre-determined variables such as gender, age, experience, etc.
- Longitudinal research can be carried out to investigate changes in teachers' self-efficacy in "emergency remote teaching".
- The Emergency Remote Teaching Self-Efficacy Scale can also be utilized to collect data from teachers teaching in kindergartens and elementary schools.

Last but not least, it is noteworthy to mention that the Emergency Remote Teaching Self-Efficacy Scale is a self-report scale that assesses teachers' perceptions of emergency remote teaching self-efficacy. It is a limitation that it does not directly measure teachers' self-efficacy in "emergency remote teaching". For this reason, the findings obtained through the scale should be cautiously interpreted, and data can be collected qualitatively to directly measure teachers' emergency remote teaching self-efficacy levels.

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Appendix

Items of the Emergency Remote Teaching Self-Efficacy Scale (translated from Turkish)

Directions: This scale is intended to help us understand your perceived self-efficacy in emergency remote teaching. Please express your thoughts on each of the following items. Please do not leave any out. Your responses will be kept private. Thank you for taking the time to participate!

1	2	3	4	5	6	7	8	9
nothing		very little		some influence		quite a bit		a great deal

IT1. How well can you use a variety of strategies to provide feedback to students?
IT4. How well can you use mobile devices (smartphone, tablet, laptop, smart watch, e-reader, game console, and so on) in your online lessons?
IT5. To what extent can you use social media (Facebook, Twitter, WhatsApp, and so on) in your online lessons?
IT6. How well can you come up with alternative solutions to the problems you encounter in your online courses?
IT8. How well can you teach live/synchronous lessons?
IT9. How well can you use e-learning materials to promote active learning?
IT10. To what extent can you use video conferencing tools (Google Meet, YouTube, Zoom, and so on) in the e-learning process?
IT13. How well can you plan online social events for your students (chess tournaments, book discussions, chat hours, expert interviews, and so on)?
IT15. How well can you teach your students how to use the technology necessary for classroom interaction?
IT16. How well can you teach your students how to use mobile devices and e-learning materials?
IT18. How well can you empower your students to take on their own learning responsibilities in class and at home?
IT19. How well can you organize tasks that will enable your students to relate what they have learned to daily life?
IT20. How well can you use complementary measurement and assessment tools (e-portfolio, e-performance tasks, e-projects, and so on) to reduce your students' exam anxiety?
IT21. How well can you meet your students' social and emotional needs?
IT22. How well can you identify your students' basic needs (nutrition, shelter, security, health, access to technology, etc.)?
IT23. How well can you motivate your students by meeting with them one-on-one or in groups using video conferencing tools and mobile devices?
IT24. To what extent can you hold online assessment meetings to determine whether you are meeting the expectations of students or their parents?
IT25. To what extent can you divide the learning content into smaller chunks to facilitate learning?
IT26. How well can you identify the most critical ones among the curriculum objectives?
IT28. How well can you teach by prioritizing critical curriculum objectives?
IT29. How well can you teach your special-needs students by using appropriate techniques (subtitles, large fonts, contrast colours, and so on) for their disability status?
IT30. How well can you teach online lessons taking into account the characteristics of your special-needs students?
IT31. How well can you provide your special-needs students with open access measurement and assessment tools (multiple choice test, performance task, and so on) based on their disability status?
IT33. How well can you take the necessary precautions (additional time, describing graphics, etc.) for your special-needs students in exams?

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