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Measuring Satisfaction with Distance Education: A Scale Development Study for Secondary and High School Students

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Abstract: The efficiency of the distance education process can be evaluated from various aspects. One of the most important indicators in revealing the effectiveness of the distance education process is the satisfaction level of the learners. This study aimed to develop a valid and reliable satisfaction with distance education scale for secondary and high school students. In this context, first of all, the studies on distance education and student satisfaction with distance education were examined, and the appropriate items for secondary and high school students used in these studies were determined. Afterwards, a 26-item initial scale was prepared by the researchers to evaluate the satisfaction levels of the students in the distance education process. This initial scale was applied to a total of 1142 students, 691 females and 451 males, at different grade levels in secondary and high schools. 8 items were removed from the scale as a result of the exploratory and confirmatory factor analyses. The Cronbach alpha reliability coefficient of the final version of the scale was determined as 0.76. The final version of the scale consisted of 18 items and 5 dimensions: "personal compliance", "teacher-student and student-student interaction", "materials and communication tools", "teaching process", "attitude towards e-lessons". It was concluded that the scale developed in this study can be considered reliable in determining the level of the satisfaction with distance education of secondary and high school students, and it is recommended to be used in future research and applications.

Keywords: Distance education, student satisfaction, secondary school students, high school students.

Highlights

What is already known about this topic:
- Evaluation of the distance education is crucial for its improvement. In such studies, the distance education process is tried to be evaluated by considering factors such as students, trainers, organization, and system.
- Students' satisfaction with distance education is an important indicator of the effectiveness of these activities.

What this paper contributes:
- It is seen that student satisfaction scales for distance education are generally prepared for students at higher education level. A valid and reliable scale for and secondary school students is required.
- The satisfaction scale can be used for providing information about the quality of the online learning for young students.

Implications for theory, practice and/or policy:
- It was concluded that the satisfaction scale developed in this study is valid and reliable in measuring the satisfaction levels of high school and secondary school students towards the distance education process in general.
- The distance education satisfaction scale developed in this study can be used by secondary and high school teachers so that they can identify the deficiencies of their teaching practices and improve them.

Introduction

The distance education can be defined as a set of systems that allow learning to be carried out independently of both time and place (İşman, Barkan & Demiray, 2005). Among the studies on the evaluation of distance education, the studies that emphasize the evaluations of the learners are gaining importance among the studies that steer the distance education policies (Yükseltürk &Yıldırım, 2008). In this context, studies that deal with students' own learning processes, their experiences during distance education, and evaluations of instructors, system and organization are guiding for the field of distance education. There are many studies in the literature focusing on student evaluations for distance education within the framework of variables such as learning, attitude, motivation, sense of presence, community perception, and satisfaction (Fidan, 2016). Especially in studies aiming to evaluate distance education in terms of the learner satisfaction, it is constantly emphasized that the design and planning of distance education environments should be done within the framework of the characteristics and needs of the learners (Kuruçay & İnan, 2017).

The satisfaction of learners with distance education activities is an important piece of evident in demonstrating the effectiveness of these activities. Within this framework, determining the satisfaction levels of the students contributes to the teachers and organizations in providing feedback on the problems and eliminating the deficiencies (Baykal, Sökmen, Korkmaz & Akgün, 2002). The satisfaction of the learners towards distance education is basically a multidimensional phenomenon. Namely, many researchers consider learners' satisfaction with distance education as closely related to factors such as the content of the education provided, the features of the software used, the interaction in the learning environment, the structure and frequency of feedback, the teacher's perception of distance education, the student's attitude towards distance education, and the student's attitude towards the computer (Chaney, Eddy, Dorman, Glessner, Lee Green & Lara-Alecio, 2007; Sun, Tsai, Finger, Chen & Yeh, 2008).

Considering the studies on determining student satisfaction with distance education, it is a prominent issue that the students' access to course materials without time and place restrictions positively affects the students' willingness to participate in the course and their satisfaction (Birinci, 2010). Similarly, it is stated that presenting the course contents in different formats and in the form of various teaching materials is crucial for learners with different learning styles to benefit from the course materials. In addition, the type and quality of feedback provided to students in distance education is another important issue that should be considered in meeting the expectations of students with individual differences (Ilgaz, 2008). Besides, it is particularly important to provide the learners with the necessary support for the problems encountered during the distance education process so that they do not feel lonely and develop negative thoughts about the process (Aksaraylı & Pala, 2017).

Literature

Studies on learner satisfaction with distance education in the literature highlight and explore different situations that may affect the satisfaction of students in distance education programs. Some of these studies claim that it is important to enable learners to interact with various components such as chatbox, discussion board, private messaging or face-to-face interaction so that they feel belonging to the learning community during the distance education process and socialize (Deshwal, Trivedi & Himanshi, 2017; Göksel Canbek, 2015). Within this context, it is emphasized that students who interact with other learners, instructors and content in the distance education will be more willing to participate in the distance education process and the lessons, which will contribute positively to both the academic success and satisfaction of the student (Ilgaz & Aşkar, 2009). In the online context, satisfaction is considered one of the most significant factors influencing the continuity of online learning (Moore and Kearsley, 2011; Parahoo et al., 2016).

Studies assert that student satisfaction with distance education should be handled and determined in terms of different factors affecting it. Mayadas, Bourne, and Moore (2002) stated that student satisfaction in distance education can be evaluated by considering the level of interaction of the student with the teacher and other students, comparing the students' understanding with learning outcomes of the lesson, and analyzing the adequacy and appropriateness of the support and feedback provided to the student. Ilgaz (2008) investigated the contribution of technology acceptance and community feeling to the student satisfaction of distance education and determined a positive and high level of relationship between both technology acceptance and community feeling with student satisfaction. Strong, Irby, Wynn, and McClure (2012) conducted a study to measure students' perceptions of learning environment, social presence, and satisfaction in online courses with 164 graduates who received online agriculture education at a university in Texas through Distance Education Learning Environment Questionnaire, Social Presence Scale and Distance Education Satisfaction Scale. In a recent study evaluating the distance education system from a student perspective, Gürler, Uslu, and Daştan (2020) developed a questionnaire including both questions about the demographic characteristics of the students and open-ended questions and applied to 2371 students studying at different faculties and vocational schools at a state university. The study concluded that vocational school students found the distance education system more successful than faculty students. Deveci Topal (2016), on the other hand, applied the e-course Satisfaction Scale of five-point Likert-type 35 items and the 18-item Likert-type Online Learning Readiness Scale to 352 university students to determine the relationship between e-lesson satisfaction and readiness for online learning and the effect of the materials used in e-learning on student satisfaction. It was concluded in the study that as the number of materials used in the lessons increased, the level of satisfaction increased as well.

Considering the studies on student satisfaction regarding distance education, the research aiming to develop a measurement tool to determine student satisfaction is becoming more widespread. Satisfaction has been the focus of online learning in numerous previous research and reported to be a critical sign of learning success and the success of online learning system implementation (Ke and Kwak, 2013). The scales developed in these studies investigated the relationship between student satisfaction and the variables such as student-student interaction, student-teacher interaction, content of online courses, technical support, teaching materials, and evaluation processes (Arbaugh, 2000; Chou, Peng & Chang, 2010; Çalışır, Altın Gümüşsoy, Bayraktaroğlu & Karaali, 2014). In one of the scale development studies, Yıldırım, Yıldırım, Çelik & Karaman (2014) prepared a 42-item 5-point Likert-type scale revealing the views of students about distance education and applied this scale online to 1040 students enrolled in a nursing undergraduate program at a state university. Eygü & Karaman (2013), on the other hand, aimed to develop a questionnaire specifically designed for determining the satisfaction perceptions of distance education students towards their education. The study sample consisted of undergraduate theology and computer programming associate degree students (335 students in total). Their scale with a Cronbach alpha reliability of 0.930 determined students' satisfaction in 8 factors (personal compliance, effectiveness, learning, program evaluation, technology, material, evaluation) and concluded that the ideas of the students changed according to their demographic characteristics. Similarly, Kolburan Geçer & Deveci Topal (2015) developed a measurement tool in order to determine the satisfaction levels of university students towards e-courses in their study. At the end of the study, they developed a five-point Likert-type scale with Cronbach alpha reliability coefficient of 0.966 consisting of 35 items and five factors: the content of the course and the teaching process, the materials and communication tools used, the attitude towards e-learning, the media design, and the teacher-student interaction. Likewise, Deshwal, Trivedi & Himanshi (2017) conducted a study to determine the satisfaction of university students in India with their online learning experiences in terms of different factors. In the study carried out with 150 students, the data were collected through the Coursera platform, which offers extended content for different universities. In the study, a scale with four factors (useful-satisfying experiences, usage-oriented experiences, hedonistic and fascinating experiences, and socialization experiences) was developed and used. It was concluded that the reliability of the dimensions of the scale was between 0.745 and 0.852 and the scale was reliable. Recently, Bayrak, Tibi & Altun (2020) conducted a study to develop a reliable, valid and practical tool to measure student

satisfaction with online courses. The research was carried out by e-mail with over 1000 students who took online courses at a state university in Turkey. In this study, a factorless (single factor) scale consisting of five-point likert-type 8 items was put forward with the Cronbach Alpha reliability coefficient of 0.94. Sharma, Deo, Timalsina, Joshi, Shrestha & Neupane (2020) conducted a study to determine online learning satisfaction of students at a Medical School in Nepal who took online courses during the pandemic period. It was conducted with 434 undergraduate and graduate students at different departments through a 29-item 5-point Likert-type scale of four domains (student characteristics, technological features, teacher characteristics, and course management and coordination) with the Cronbach alpha reliability coefficient as 0.89. At the end of the study, it was concluded that although the transition to online education was very fast, students' satisfaction with online courses was still good. In one of the survey development studies carried out during the pandemic period, Elshami, Taha, Abuzaid, Saravanan, Al Kawas & Abdalla (2021) conducted a study aiming to determine the factors affecting student and faculty satisfaction regarding online learning during the pandemic period. The researchers developed a questionnaire of open and closed-ended questions as a data collection tool and applied it to 370 students and 81 faculty members at the medical faculty and health sciences school. The study concluded that such issues as workload, class participation, technical problems, etc. affect student and faculty satisfaction.

The studies on student satisfaction with distance education or online learning widely focused on determining the satisfaction levels of students (Gürler, Uslu & Daştan, 2020; Kolburan Geçer & Deveci Topal, 2015; Sharma, Deo, Timalsina, Joshi, Shrestha & Neupane, 2020; Strong, Irby, Wynn & McClure, 2012), identifying which factors and how satisfaction levels are related to(Deshwal, Trivedi & Himanshi, 2017; Deveci Topal, 2016; Elshami, Taha, Abuzaid, Saravanan, Al Kawas & Abdalla, 2021; Gürler, Uslu & Daştan, 2020; Ilgaz, 2008; Strong, Irby, Wynn & McClure, 2012), and developing a valid and reliable measurement tool to determine student satisfaction with online education (Bayrak, Tibi & Altun, 2020; Deshwal, Trivedi & Himanshi, 2017; Elshami, Taha, Abuzaid, Saravanan, Al Kawas & Abdalla, 2021; Eygü & Karaman, 2013; Kolburan Geçer & Deveci Topal, 2015; Yıldırım, Yıldırım, Çelik & Karaman, 2014). When these studies are analyzed in terms of their samples, it is seen that university students from different faculties or vocational schools (Bayrak, Tibi & Altun, 2020; Deshwal, Trivedi & Himanshi, 2017; Deveci Topal, 2016; Elshami, Taha, Abuzaid, Saravanan, Al Kawas & Abdalla, 2021; Gürler, Uslu & Daştan, 2020; Karakuş, Cheapsatar, Karacaoğlu, Esendemir & Bayraktar, 2020; Kolburan Geçer & Deveci Topal, 2015; Sharma, Deo, Timalsina, Joshi, Shrestha & Neupane, 2020), undergraduate completion students (Eygü & Karaman, 2013; Ilgaz, 2008; Yıldırım, Yıldırım, Çelik & Karaman, 2014), academicians or instructors (Gürer, Tekinarslan & Yavuzalp, 2016; Elshami, Taha, Abuzaid, Saravanan, Al Kawas & Abdalla, 2021), and graduates (Deshwal, Trivedi & Himanshi, 2017; Strong, Irby, Wynn & McClure, 2012) were taken as samples to determine their satisfaction levels for online education. In another study, Yan et al. (2021) obtained 1,170,769 student data of this large-scale online education and investigated the learning conditions, benefits, and obstacles and their expectations for online education. Based on the analysis of different grades of K-12, they put forward some suggestions for various situations.

One of the most important limitations of online learning satisfaction scales in the literature is that these tools are generally developed for participants at the higher education level, which may be due to encouraging and implementing distance education mostly in higher education. Various situations that may affect the satisfaction of the participants at the higher education level are taken into account and the scale items are prepared accordingly. In addition, the items in the scales are expressed in a language with appropriate statements that can be understood by the participants at the higher education level. Since these scale items are mostly written with expressions that can be understood by undergraduate students, they are generally not suitable to be used to measure the satisfaction of secondary and high school students. For instance, the scale developed by Eygü and Karaman (2013) to determine the satisfaction perceptions of associate degree students receiving distance education includes specifically the concepts or terms of higher education expressions such as "postgraduate education", "communication with student affairs" and "interaction with faculty members" in the items and are not

suitable for younger students. This situation is similar for other scales, questionnaires, data collection tools, etc. suitable for higher education students.

Prior studies categorized the factors effecting student satisfaction into various categories: faculty, interactivity, and technology (Kuruçay, İnan, 2017; Bolliger, 2004) and students, instructor, and institution (Bolliger, Wasilik, 2009) respectively focusing on university students. However, the behaviors of undergraduate students and the faculty during online courses generally different from the younger students in secondary and high schools and their teachers. Many factors can affect to this difference such as psycho-social developments, infrastructures of the universities, professional developments of faculty and teachers, experiences about delivering and receiving courses online. One other difference can be considered related with the expectations of university students and secondary and high school students. While undergraduate students study for their professions or carriers, younger students generally focus on success in exams or preparing for next schools. Lack of supervision and appropriate interaction between the teacher and student, could also result in transactional distance (Moore, 1993). Considering students' self-regulation of within the ages of the students, it can be thought that learning process management which can be a prominent factor about satisfaction may differ among undergraduate students and the younger students.

The abandonment of face-to-face learning environments due to the global pandemic and the transition to distance education in all education levels including secondary and high schools since the first half of 2020 makes it necessary to determine the satisfaction of secondary and high school students with online education applications (Ilgaz & Aşkar, 2009). Considering that the satisfaction perceptions of individuals will change according to their age levels, it is necessary to take into account the characteristics of the relevant age group while writing the factors in the preparation process of the scales and the items for these factors (Tüzün & YörükToraman, 2021).

Therefore, the limitation in the existence of a distance education satisfaction scale that appeals to secondary and high school students and is suitable for their levels and satisfaction perceptions is considered as one of the starting points of this study. In this regard, this study aims to contribute to the literature by developing a satisfaction scale for distance education for secondary and high school students. Thus, it will be possible to contribute to the secondary and high school teachers and instructional designers in terms of making student-based assessments during distance education.

Theoretical Background

Distance education, as the fastest developing online and offline technology accepted by the society, affects and changes all the cultural values of humanity. In general, distance education can be defined as an interactive data exchange between the instructors and students who are far from each other based on the web and advanced technological tools (Çalışkan et al., 2017). Saykılı (2018) defined distance education as a form of education that brings together physically distant learners and their mentors around planned and structured learning experiences, using various bi- or multi-directional media channels that allow interaction between both learners and mentors, and learners and educational resources.

Distance education is considered a student-centered teaching method because the student chooses what, how, and when to start and finish. The student can work at his own pace and receive education according to his own wishes. While the strengths of distance learning are that it is flexible and comfortable, its weaknesses can be expressed as the difficulty of giving feedback, motivating the student and technical problems (Fedynich et al., 2015). Moreover, distance education practices are criticized for not being as efficient as face-to-face education. Although the studies do not indicate a significant difference in the efficiency of distance and face-to-face education, these criticisms continue today (Saykılı, 2018).

Determination of the effectiveness of the distance education is crucial for its improvement. In studies investigating the effectiveness of the distance education, evaluations are made by considering factors

such as the students, trainers, organization, and system. Among them, studies focusing on student perspective and satisfaction levels are the studies that direct distance education policies. Student satisfaction with distance education is an important indicator of the effectiveness of these activities. Ansari (2002) thinks that one of the most important indicators in evaluating the effectiveness of teaching-learning activities is student satisfaction. In this context, organizing the learning-teaching activity in a planned, goal-oriented, interactive way and meeting the needs of the students will both make education effective and increase student satisfaction.

Methodology

In this study, a satisfaction scale for distance education was developed for secondary and high school students. In order to develop this scale, first of all, the studies on distance education and the literature describing the scientific method steps followed in this subject were examined (Büyüköztürk, Kılıç Çakmak, Akgün, Karadeniz & Demirel, 2016; Ekici, 2002; Kan & Akbaş, 2005; Karasar, 2013; Tavşancıl, 2002). The concept of satisfaction with the distance education process was defined in the context of basic components such as learning environment and teaching process in distance education and their relationships, which was created as a result of examining the sources including the theoretical frameworks and practices in this field and analyzing the studies that focus directly or indirectly on satisfaction in distance education in different categories. Within this framework, the stages of literature review, determination of factors and writing of preliminary items, expert opinion, pilot application, the scale application, analysis of the data, and finalization of the scale according to the results of the analysis were followed, respectively.

Participants

A total of 1142 students, 691 females and 451 males, from all grade levels studying in 15 different secondary and high schools located in the Black Sea region of Türkiye participated in this study. The distribution of the sample by gender and class is shown in Table 1.

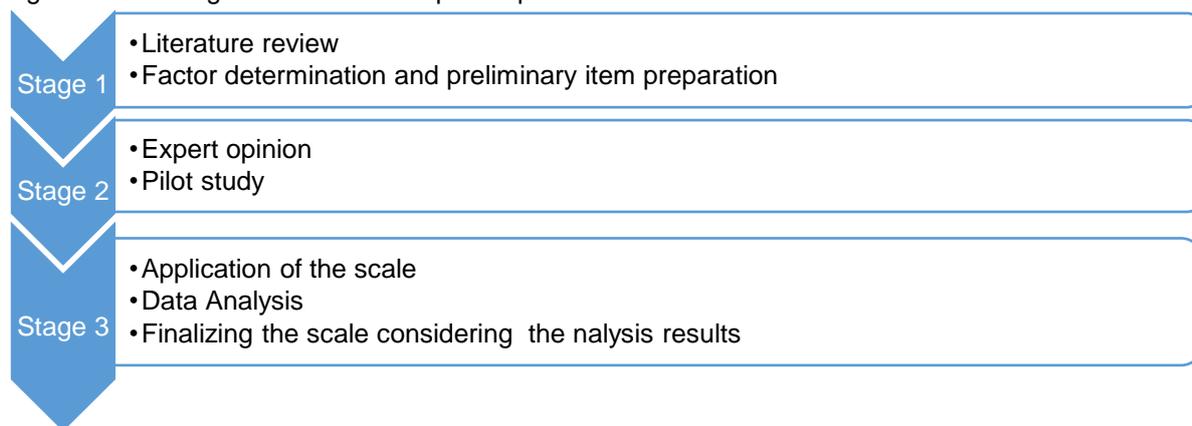Table 1. The distribution of the sample by gender and grade

Variables	Category	f	%
Gender	Female	451	39
	Male	691	61
	Total	1142	100
Grade	Grade 5th	122	11
	Grade 6th	96	8
	Grade 7th	51	5
	Grade 8th	95	8
	Grade 9th	453	40
	Grade 10th	118	10
	Grade 11th	173	15
	Grade 12th	34	3
	Total	1142	100

The Process of Scale Development

The scale development process consisted of three stages in total. In the first stage, the literature was examined, the factors that would reveal the opinions of secondary and high school students on distance education were determined by taking expert opinions, and 32 preliminary items were written. A 5-point Likert-type scale as 1 (Strongly Disagree), 2 (Disagree), 3 (Neutral), 4 (Agree), 5 (Strongly Agree) was used to evaluate the prepared items. In the second stage, the developed items were submitted to the opinion of a language expert, 2 assessment and evaluation experts, 2 computer and instructional

technology experts, and a pilot study was carried out with 20 students studying in a secondary school in Trabzon. At the final stage of the scale development process, data from a total of 1142 students, including 691 female and 451 male students used. The students have received distance education during Covid-19 pandemic. Both students and their teachers have used synchronous online tools like Zoom, Teams, Google meet or other popular systems. Some other popular LMSs have also be used as asynchronous interaction. The scale was finalized by examining the data with the Principal Component Analysis method. The internal consistency of the scale was measured with the Cronbach's alpha reliability test. The final version of the scale developed to measure the satisfaction level of secondary and high school students about distance education is given in Appendix 1. The scale development process is shown in Figure 1 below.

Figure 1. The stages of scale development process

Stage 1	• Literature review • Factor determination and preliminary item preparation
Stage 2	• Expert opinion • Pilot study
Stage 3	• Application of the scale • Data Analysis • Finalizing the scale considering the nalysis results

Data Collection Process and Analysis of Data

The scale, which was prepared on Google form application and finalized as a result of the pilot study, was conveyed online to 5-6-7-8th grade secondary school students and 9-10-11-12th grade high school students through teachers and school principals. In the beginning part of the scale, the purpose of the study was stated, and a tab was included that the data obtained would be kept confidential, that the participation in the study was voluntary, and that the participants had to mark that they participated in the study voluntarily. The data collection process took approximately three months. Before depicting the values of the principal components analysis, the KMO (Kaiser-Meyer-Olkin) value, which gives information about the adequacy of the sample size, which is the assumption of this analysis, and the Barlett Test of Sphericity, which tests whether there is a correlation between the variables, were examined. Cronbach's alpha internal consistency coefficients were calculated for the scale whose factor analysis was determined. The criteria that the items to be included in the factor should be consistent in terms of meaning and content, the factor eigenvalues should be 1 or above 1, an item should have a factor load of ".45" or more in the factor it is included in, etc. (Büyüköztürk, 2009) were taken into consideration. SPSS 20.0 program was used in the analysis of the data for exploratory factor analysis.

Findings

This study aimed to develop a satisfaction scale for distance education for secondary and high school students. With the literature review, the main factors related to the satisfaction of secondary and high school students towards distance education were evaluated within the framework of basic elements such as tools, teaching system, teaching methods, teachers, content, etc. These factors consist of personal compliance, teacher-student-friend interaction, materials and communication tools used, teaching process, and attitude towards e-courses.

The factor analysis was conducted for the reliability and consistency of the items during the scale development process. The first part of the analysis was exploratory factor analysis (EFA) with the SPSS 26 package program. Before factor analysis, KMO and Bartlett's tests were applied first to ensure that the data set was suitable for factor analysis. KMO value was 0.87 and Bartlett's test result (x^2 =6071.99; p=0.000) was also significant. (Missingvalue calculation was not done because there were no missing data.)

Exploratory factor analysis was carried out with 26 items following the Kaiser-Meyer-Olkin (KMO) test, which tests the adequacy of the sample. The KMO test results greater than 0.5 indicate the suitability of the data set for Principal Components Analysis (Kalaycı 2006). As a result of the analysis, the KMO value was found to be 0.87, suitable for factor analysis since this value was greater than 0.70. Whether the data set met the normality assumption was checked with the Barlett Test of Sphericity. Bartlett's test result (x^2 =6071.99; p=0.000) was also significant. KMO and Bartlett test results are shown in Table 2.

Table 2. KMO and Bartlett test results

KMO		,873
Bartlett's Test	Chi-Square	6071,990
	Df	253
	Sig.	,000

According to the EFA result, the scale eigenvalue was found to be greater than 1 and the items were grouped under 5 factors with the explained variance value of 49.86%. Factor load value of 26 items subjected to the analysis were examined above 0.30, and since the factor loads of questions 5, 13 and 26 were spread over many dimensions, the questions were excluded from the analysis. In Table 3, factor load values of 23 items obtained as a result of EFA are given.

Table 3. Results of Exploratory Factor Analysis

Item	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5
q7	,821				
q6	,784				
q8	,746				
q12	,715				
q16	,582				
q1	,496				
q15	,404				
q18		,738			
q17		,720			
q19		,664			
q20		,476			
q24			,742		
q23			,740		
q3			,534		
q21				,685	
q25				,595	
q9				,581	
q11				-,494	
q2					-,636
q14					,626

q4	,617
q22	,581
q10	-,408

Table 3 reveals that there are 7 items with factor loads ranging from 0.404 to 0.821 under the first dimension. Under the second dimension, there are 4 items with factor loads ranging from 0.476 to 0.738. Under the third dimension, there are 3 items with factor loads ranging from 0.534 to 0.742. Under the fourth dimension, there are 4 items with factor loads ranging from 0.494 to 0.685. Under the fifth dimension, there are 5 items with factor loads ranging from 0.408 to 0.636.

Confirmatory Factor Analysis (CFA) analysis was used to verify the structure in the AMOS 22 package program. The findings obtained as a result of the analysis are presented in Table 4.

Table 4. CFA Analysis Results

Model	CMIN DF	CFI	NFI	GFI	RMSEA
5-Factor Structure	3,826	0,928	0,905	0,957	0,49
Criteria	<5	>0,90	>0,90	>0,90	<0,80

Table 4 reveals that the fit indices were at acceptable values. The fit indices were lower than EFA, so the questions were eliminated until the values were acceptable. Standardized regression coefficients were taken into account before the eliminations were made. Since the NFI value, which is one of the fit indices, was below the criterion, it was improved by creating new covariances according to the modification indices rather than the elimination method. The analysis was not repeated upon reaching the desired values. The eliminated questions were the 19th question from the second dimension, the 25th and 11th questions from the fourth dimension, and the 14th and 22nd questions from the fifth dimension.

Table 5 shows that the load values in the first factor vary between .404 and .821. Since the items in the first factor were related to the lifestyles of the students in the distance education process, the first factor was named "Personal Compliance".

Table 5. Factors and load values

Factor	Items	Load Value
Personal Compliance	q7	,821
	q6	,784
	q8	,746
	q12	,715
	q16	,582
	q1	,496
	q15	,404
Interaction with Teacher-Student-Friends	q18	,738
	q17	,720
	q20	,476
Materials and Communication Tools	q24	,742
	q23	,740
	q3	,534
Teaching process	q21	,685
	q9	,581
Attitude Towards e-lessons	q2	-,636

q4	,617
q10	-,408

The load values in the second factor vary between .476 and .738. Since the items in the second factor were about the students' interactions with their teachers and friends during the distance education process, the second factor is called "Interaction with Teacher-Student-Friends".

The load values in the third factor vary between .534 and .742. Since the items in the third factor were related to the communication tools used by the students in the distance education process and the hardware competencies, they had to use these tools, the third factor was named "Materials and Communication Tools".

The load values in the fourth factor vary between .581 and .685. Since the items in the fourth factor were related to the learning process of the students through distance education, the fourth factor was named "Teaching Process".

The load values in the fifth factor vary between -.408 and -.636. Since the items in the fifth factor aimed to reveal the attitudes of the students towards the distance education process, the fifth factor was named "Attitude towards E-lessons". With the emergence of the questions, the final confirmatory factor analysis model is shown in Figure 2.

T-values were examined to determine whether the standardized analysis values of each item related to the Confirmatory Factor Analysis (CFA) in the scale were significant. The calculated t values were found to be significant at the $p < .01$ level for all items. As a result, when the fit index values obtained after CFA were examined, it was seen that the 18-item measurement tool showed a good fit and was applicable. Figure 4 presents the model for the five-factor structure.

Figure 2. Confirmatory Factor Analysis Model

The fit indices for perfect and acceptable fit indices i and fit indices from first and second level CFA is presented in Table 6.

Table 6. Fit indices from first and second level of CFA

Fit indices	Perfect Fit criteria	Acceptable Fit criteria	Fit indices from 1st level CFA	Fit indices from 2nd level CFA
χ^2/sd	$0 \leq \chi^2/sd \leq 2$	$2 \leq \chi^2/sd \leq 5$	3,82	4.96
CFI	.95 ≤CFI ≤ 1.00	.90 ≤CFI ≤ .95	.92	.89
NFI	.95 ≤NFI ≤ 1.00	.90 ≤NFI ≤ .95	.90	.86
NNFI (TLI)	.97 ≤NNFI≤ 1.00	.95 ≤NNFI≤ .97	.90	.87
RFI	.95 ≤RFI≤ 1.00	.90 ≤RFI≤ .95	.88	.84
IFI	.95 ≤IFI ≤ 1.00	.90 ≤IFI ≤ .95	.92	.89
RMSEA	.00 ≤RMSEA≤ .05	.05 ≤RMSEA≤ .10	.04	.05
SRMR	.00 ≤ SRMR ≤ .05	.05 ≤ SRMR ≤ .10	.04	.06
PNFI	.95≤ PNFI ≤ 1.00	.50≤ PNFI ≤ 95	.71	.73
PGFI	.95≤ PGFI ≤ 1.00	.50≤ PGFI ≤ .95	.67	.71

χ^2/sd value is accepted by different researchers which they recommended using ratios as low as 2 or as high as 5 to indicate a reasonable fit (Byrne, 1989, p. 55; Marsh & Hocevar, 1985)

Table6 indicates that first and second level CFA fit indices are close to each other. The second level CFA is shown in Figure 3.

Figure 3. CFA Second-Level

In this study, an 18-item scale consisting of 5 sub-dimensions- personal compliance, interaction with teacher-student-friends, materials and communication tools used, teaching process and attitude towards e-courses- was developed for secondary and high school students to determine their satisfaction with distance education.

The developed scale includes questions about the level of compatibility of the distance education process with the lifestyles of the students in the dimension of personal convenience, students' ability to interact with their teachers and friends in the distance education process in the dimension of interaction with teachers, students and friends, the students' level of having the appropriate equipment for the communication tools they used in the distance education process and using these tools effectively in terms of the materials and communication tools used, the level of being able to reach their teachers and understanding the lessons when they needed them in the dimension of the teaching process, and their general thoughts about the distance education process in the dimension of attitude towards e-courses.

As a result, the 5th, 11th, 13th, 14th, 19th, 22nd, 25th and 26th questions were removed from the scale consisting of 26 items initially, in line with the findings obtained from the factor analysis, and the final scale consisting of 18 questions was obtained. The correlation analysis is shown in Table 7.

In terms of absolute value, the correlation coefficient reveals a high level of relationship between .70-1.00, a moderate level of relationship between .69-.30, and a low level relationship between .29-.00 (Büyüköztürk, 2009). Table 6 shows that the relationship between the first factor and the second factor (r=.,331) is moderate. The relationship between the first factor and the third factor (r=.119) is low. The relationship between the first factor and the fourth factor (r=.233) is low. The relationship between the first factor and the fifth factor (r=.280) is also low. The relationship between the second factor and the third factor (r=.211) is low. The relationship between the second factor and the fourth factor (r=.064) is low. The relationship between the second factor and the fifth factor (r=.008) is low. The relationship between the third factor and the fourth factor (r=.118) and the relationship between the fifth factor (r=173) is low. The relationship between the fourth factor and the fifth factor (r=,112) is low.

Table 7. Correlation Analysis Results between Scale Scores and Criteria

	1	2	3	4	5
1	1,000	,331	,119	,233	,280
2	,331	1,000	,211	,064	,008
3	,119	,211	1,000	,118	,173
4	,233	,064	,118	1,000	,112
5	,280	,008	,173	,112	1,000

It is highlighted in the literature that the alpha coefficient should be above 0.7 in order for the scale to be reliable. In this study, the alpha coefficient was 0.73. As a result of the analysis, item 10 was reversed and the analysis was repeated by reverse coding in SPSS. The final alpha coefficient was 0.76.

Discussion

Several factors in this study such as personal compliance, interaction with teacher-student-friends, materials and communication tools, teaching process, and attitudes towards e-learning have been found to be associated with student satisfaction with online learning. The factors in this survey are in line with some other measurement tools. For instance, Wang (2003) suggested the use of asynchronous learning with the elements of content, user interface, learning community, and learning performance for assessing learner satisfaction. Baber (2020) showed the variables for perceived learning satisfaction in his study as classroom interaction, student engagement, course structure, teacher awareness, and facilitation. The interaction and the course structure are similar to the factors of interaction with teacher-student-friends, teaching process with teacher awareness and materials and communication tools found in this study; however, students engagement and facilitation are somewhat different from the factors of the validated scale in this study.

The reason for including the "*personal compliance*" factor in the scale is the belief that the suitability of the distance education process with the personal characteristics of the student is effective on the motivation of the student. Lack of motivation can often cause students to avoid studying and to incline to non-educational activities, perceiving studying as boring (Akbaba, 2006). In terms of taking individual differences into account, individualized distance education or preparing a distance education plan suitable for interests and abilities and courses designed in accordance with the characteristics, curiosity and interest of the student will be more effective (Başaran et al. 2020).

Hiltz (1993) highlighted that instructor performance is highly associated with student satisfaction. If the instructor has no experience teaching online or designing online courses, he will not be able to take an online class effectively. Also, the scale should include some items about the presentation of the content and also the teachers' way of teaching. The reason why the factor of " *teacher-student-student interaction*" is included in the scale is that teachers should be active in making the distance education

process easier. A quality interaction process depends on teachers' ability to use course materials, to involve students in the teaching process, to increase motivation by using different learning methods and techniques, to provide cooperation between students, to manage time well, and to plan learning stages. Rizwan and Iftikhar (2019) pointed one of the important factors as instructor-related factors, and also student related factors and technology related factors. Students better satisfaction in online classes when institutions provide sufficient online resources and technical support to enhance student-instructor interaction.

The evaluations in the literature regarding the ability of students to be able to use the communication tools that are in constant interaction with content, teacher and other students in a learning environment where teachers and students are not face-to-face are the source of the "*materials and communication tools used*" factor in the scale. Chou, Peng, and Chang (2010) pointed out that interaction refers to functions or processes that enable users to receive content and other studies and feedbacks via computer, and that it is a very important factor in the quality and success of learning through distance education. In addition, online discussions are crucial for online learning success in communication framework, as they provide active learning environment through discussions by supporting students to engage in conversational content (Elshami et al, 2021). Another important factor of the scale is the "*teaching process"*, which is based on suggestions such as designing the teaching process to support students' participation in the course and using teaching strategies and techniques that will enable students to participate in the teaching process. Namely, the quality of the interaction that students experience throughout the teaching process, the perceived usefulness and ease of use as well as the quality of the teaching process have a positive effect on learner satisfaction. As the quality of the teaching process increases, learners will perceive the process as more beneficial and, thus, adopt it easily (Çalışır, Altın Gümüşsoy, Bayraktaroğlu, & Karaali, 2014). On the other hand, the reason why "*attitude towards e-lessons*" factor is included in the Scale is the belief that students' positive attitudes towards distance learning and computers will increase their learning levels, indicating a direct link between the student's attitude and satisfaction. That is to say, students who think that distance education is an effective learning tool display a positive attitude towards distance learning (Liaw, Huang & Chen, 2007; Özkan & Köseler, 2009).

Overall, the validity and reliability results of the scale developed in the research justify that the scale is reliable at an acceptable level both in general and in terms of factors. Expert opinions were taken to determine the content validity of the scale, and exploratory and confirmatory factor analyses were used to test the construct validity. It was determined that the standardized factor loads of the model were sufficient and the t values were significant. The fit indices considered in the evaluation of the model indicate that there is an acceptable level of fit between the data and the model structure.

Conclusion and Suggestions

The results confirm that the current scale is a valid and reliable measurement tool that can be used to measure secondary and high school students' satisfaction with the distance education process. Since the study aims to measure satisfaction with all courses in general, more detailed scales can be developed to measure the satisfaction of students on the basis of each course in future studies. The factors in the scale include items to measure students' perceptions of distance education, their interactions with their friends and teachers, their thoughts on comprehending lessons, and the problems they experience during the distance education process. Therefore, this scale can be used to determine the quality and deficiencies of teaching activities through distance education and to design a more effective distance education process by eliminating the identified deficiencies.

The answers given to the items of the developed satisfaction scale can be scored in a 5-point Likert-type structure, evaluating each factor over the averages of points within the ranges of the averages. The scale items were developed by considering the environments where learning management systems,

virtual classrooms, live lessons, asynchronous homework and project application applications are carried out as distance education tools in secondary education institutions. Thus, these tools, which are believed to be developed in future studies, are expected to facilitate the learning-teaching processes. Based on this idea, distance education tools were not directly mentioned in the scale, but satisfaction was evaluated on the tasks performed with these tools.

The satisfaction scale developed can help improve distance education applications by taking the evaluations of secondary and high school students who encounter distance education applications. Furthermore, local or country-wide policies can be developed to contribute to the regulation of content, systems and organizations. The factors in this study were not developed directly within the framework of a distance education design model. In future studies, the development of similar scales in line with instructional designs that take into account the pedagogical frameworks of distance education for perceptions of satisfaction may contribute to the field.

Educators or practitioners should consider putting learning interactions in the core of planning, designing and delivering online learning to afford a sense of community and an online environment that gives priority to providing students with opportunities to contribute to the learning process. Instructors should realize that interactions in the learning process both assist students to learn, affect their satisfaction, and help them build self-confidence in online academic life. It is recommended that planning and developing a course should be given particular attention to identify how student satisfaction is impacted by specific elements of a course.

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Appendix.1

Satisfaction Scale with Distance Education for Secondary and High School Student

Factor	Items	
Personal Compliance	7	Uzaktan eğitim öğrenmeye karşı daha istekli olmamı sağlar. (Distance education makes me more willing to learn.)
	6	Uzaktan eğitim ile öğrendiklerim daha kalıcı olur. (What I learn with distance education will be more permanent.)
	8	Uzaktan eğitimde dersleri yüz yüze eğitimden daha dikkatli dinlerim. (I listen to the lessons more carefully in distance education than face-to-face education.)
	12	Uzaktan eğitimde yüz yüze eğitimden daha iyi anlarım. (I understand better in distance education than face-to-face education.)
	16	Uzaktan eğitimde yapılan sınavların bilgi düzeyimi doğru ölçtüğüne inanırım. (I believe that the exams conducted in distance education accurately measure my level of knowledge.)
	1	Uzaktan eğitim yaşam tarzıma uygundur.

		(Distance education fits my lifestyle.)
	15	Uzaktan eğitimde ders kaynaklarını kendim araştırıp bulmaktan memnunum. (I am happy to research and find course resources myself in distance education.)
Teacher-student-friend interaction	18	Uzaktan eğitim sürecinde ödevlerimi yaparken gerektiğinde öğretmenlerimden destek alırım. (I get support from my teachers when necessary while doing my homework during the distance education process.)
	17	Uzaktan eğitim sürecinde öğretmenime istediğim zaman soru sorabilirim. (I can ask questions to my teacher at any time during the distance education process.)
	20	Uzaktan eğitim sürecinde kendimi öğretmenlerime ve arkadaşlarıma iyi ifade edebildiğimi düşünürüm. (I think that I can express myself well to my teachers and friends during the distance education process.)
Materials and Communication Tools	24	Uzaktan eğitim sürecinde yararlandığım iletişim araçlarını kullanırken zorlanırım. (I have difficulty in using the communication tools that I use during the distance education process.)
	23	Uzaktan eğitim sürecinde kullanılan iletişim araçlarına (tablet-telefon-bilgisayar-televizyon) kolay ulaşırım. (I have easy access to the communication tools (tablet-phone-computer-television) used in the distance education process.)
	3	Uzaktan eğitim bana yüz yüze eğitimden daha masraflı geliyor. (I think distance education is more expensive than face-to-face education.)
Teaching Process	21	Uzaktan eğitimde konuları anlayamadığımda kendimi yalnız kalmış hissediyorum. (When I do not understand the subjects in distance education, I feel alone.)
	9	Uzaktan eğitim sürecinde öğrenemeyince ümitsizliğe kapılırım. (When I can't learn during the distance education process, I fall into despair.)
Attitude towards e-lessons	2	Eğitim almak için okula gitmek benim için zordur. (It is difficult for me to go to school to get an education.)
	4	Zorunlu olmasam tüm dersleri yüz yüze eğitimle almak isterdim. (If it weren't compulsory, I would like to take all the lessons with face-to-face training.)
	10	Uzaktan eğitim sürecinde derslere istediğim yer ve zamanda katılmak hoşuma gidiyor. (I like to attend classes whenever and wherever I want during the distance education process.)

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Author's Contributions (CRediT)

Melike Zeytinli Ünal: Methodology, Investigation, Writing – original draft, Suat Ünal: Writing-review & editing, Data curation, Visualization; Ünal Çakıroğlu: Conceptualization, Project administration, Resources.

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Ethics Statement

Informed consent was obtained from parents for whom identifying information is included in this article.

Conflict of Interest

The authors do not declare any conflict of interest.

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