Scale of Attitudes Towards Online Formative Assessment: Teacher' Attitudes during COVID-19 Pandemic

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Abstract: Due to the pandemic in many countries, schools were closed in 2020. Therefore, education was suspended, and distance education was started. During the Coronavirus disease (COVID-19) pandemic, teachers gave lessons online in virtual classrooms. In this study, Scale of Attitudes Towards Online Formative Assessment (S-AOFA) for teachers conducting online and distance courses was developed, and the teachers' attitudes were examined with respect to demographic variables. In the study conducted in the mixed-design method, qualitative and quantitative data were collected for the scale development and survey. Data were obtained from 369 teachers (science teacher, mathematics teacher, classroom teacher, and teachers in other fields) working in school in Turkey. S-AOFA was made up of 20 items and two factors as a five-point Likert-type. When the teachers' attitudes towards online formative assessment (AOFA) was examined, it was found that the mean for the factor of "Assessment Systems" was lower than that of the "Assessment Approaches". In addition, the findings revealed that there was no significant difference in the teachers' AOFA in terms of gender and that no significant difference existed in AOFA with respect to the school levels of the teachers (elementary, secondary and high school). Moreover, the results demonstrated that there was a low negative significant relationship between the teachers' AOFA and the number of students in which virtual lessons were given online. Lastly, there was a low level positive significant relationship between the teachers' AOFA and the in-class participation percentages of the students who were taught online in virtual classrooms. S-AOFA could be used by researchers in different studies in future.

Keywords: *COVID-19 pandemic, formative assessment, online assessment, scale development, teacher attitude.*

Introduction

Pandemic means a large epidemic that is highly contagious in many countries at the same time (Turkish Language Association [TLA], 2020). In 2019, it was noticed that there were many pneumonia patients in Wuhan, the capital of the Hubei region of China. Due to the rapid increase in the number of patients with the same complaints in the region, the World Health Organization (WHO) announced in January 2020 that the cause of these complaints was a new type of coronavirus [Co(corona) vi(virus) d(disease) -19] and declared an international emergency due to its spread to other countries as well as in China. COVID-19 infects the lung alveoli, causing a visible change in oxygen saturation (Zhou et al., 2020). WHO declared the COVID-19 epidemic as a global pandemic, when it had devastating effects on the economy, education, psychology and social life, especially in the health sector, in the countries where it spread.

All the activities that aim to help people not only have a profession but also become a useful individual, from an early age, for their family, environment, society and country refer to the education system. It is seen that societies with high education levels develop rapidly and have a competitive advantage in many areas. Due to pandemic caused by COVID-19, the education system is faced with many problems (Karaca & Kelam, 2020). The pandemic has caused disruptions in a large number of sectors in many countries. In particular, the suspension of face-to-face teaching at all levels of education has fundamentally shaken the students, who are the founders of the future. After the COVID-19 pandemic, distance education became a basic learning tool as the epidemic prevented face-to-face education (Can, 2020). Due to the epidemic, most countries temporarily closed schools. However, in order for students not to stay away from education and for the purpose of maintaining the continuity of learning, most of the countries with epidemics have thought of new alternatives and found the solution in distance education (Gilani, 2020). However, in the study conducted by Taşkın and

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Aksoy (2021) in which the opinions of the teachers were obtained, the teachers stated that distance education does not provide benefits as in formal education.

Due to the rapidly increasing number of cases because of the pandemic in Turkey, schools were closed on March 23, 2020; education was suspended; and distance education was started. While distance education was given with the support of the Internet at universities in Turkey, education was continued at primary and secondary education levels through EBA TV broadcast and Education Information Network (EBA) due to the pandemic (Ministry of National Education [MNE], 2020a). Distance education center working with the EBA infrastructure was established by MNE). During the pandemic, the EBA content was further developed, and virtual live lessons were given in order to be able to interact and communicate with students one-on-one. Television is mostly used in Turkey to provide access to distance education, which was initiated due to the COVID-19 outbreak (Sönmez et al., 2020). After the COVID-19 outbreak, the Zoom, Google Meet, Skype and similar application started to be used widely in many countries to make video calls and chat in the virtual environment and to give online lessons. It was pointed out that virtual classrooms could be applied in education platforms like ZOOM as well as EBA program during live lessons held within the scope of distance education in both private and public schools in Turkey (MNE, 2020b).

Theoretical Framework

Distance education refers to the form of education in which the learner and the teacher are in different physical environments (Akdemir, 2011). In other words, distance education refers to the learning strategies that aim to save learners from time and place constraints while offering flexible learning opportunities. Distance education has gained a new identity with the Internet technology as distance learning (e-learning) or as Web-based learning. Web-based learning is an education model in which access is achieved both in the same time zone (synchronous) and in different time zones (asynchronous) over an Internet network. It allows users to choose the time, the place and the learning method (Hannum, 2001).

One of the important topics in distance education is measurement and evaluation. Assessment is reported to have a direct effect on learning and is thus at the center of all kinds of learning (Angus & Watson, 2009; Bransford et al., 2000). According to the purpose of assessment in education, there are three types of assessment: diagnostic, summative and formative. Formative assessment, is often used as the basis of feedback, which helps maintain the continuity of teaching and learning processes conducted for the purpose of improving students' progress in the classroom (Hargreaves, 2008; Phoophuangpairoj & Pipattarasakul, 2022). In addition, formative assessment is also known as assessment improving the teaching process in order to support learning that takes place during education (Kişin & İlhan, 2022). Formative assessment provides the practitioner with practicality, builds expertise and helps schedule the teaching process more easily. It also encourages students to do self-assessment (Smith, 2007; Stiggins & DuFour, 2009). With the increase in the use of technology, formative assessment can also be used in online education. As a matter of fact, it offers many opportunities such as giving immediate feedback to students, managing the teaching process and overcoming deficiencies, and detecting and correcting the wrong learning (Stacey & Wiliam, 2013).

In web-based education, assessment is required to control students' learning and to organize the given feedback and the learning gained in the process. Formative assessment integrated into web-based learning environments provide participants with more efficient learning (Buchanan, 2000; Gardner et al., 2002; Henly, 2003). By placing formative assessment at the center of assessment activities to be carried out in online education, the learning deficiencies likely to arise can be identified and eliminated. It is thought that practices of monitoring aiming to detect such learning deficiencies will be useful in terms of improvement, participation in the lesson, paying attention, and thus reminding students of their responsibility for learning (Hotaman, 2020). Providing students with immediate feedback is the basis of formative assessment. Considering the class sizes in schools, it is seen that there is a need for a period of time other than the recommended course hour. However, formative assessment materials in web-based education already exist within the system. Students can themselves access these materials at any time they want. In this respect, the attitudes of students and teachers towards formative assessment methods and the use of these methods are important. Predicting the behavior to be demonstrated by individuals in any situation helps determine the strategies to be applied in such situations. The concept of attitude is referred to as the tendency to react positively or negatively, which is acquired through experience (Tezbaşaran, 1997). Not only the knowledge of the narrator but also his/her approach to the situation helps the individual achieve the desired outcome. In this respect, the student's achievement of the desired goal in the school environment depends on the teacher's both cognitive and affective approach. Formative assessment, which is an efficient form of assessment, must be applied in order for web-based education to function smoothly as well as to achieve success. For this reason, it is important that teachers, who are the implementers of the system, have a positive attitude towards this evaluation approach.

Studies on Formative Assessment

Feedback, correction, active participation of the student and reinforces, are important for formative assessment and in the arrangement of the learning environment. By using these variables, teachers keep the process under control by detecting, in a timely manner, the situations that prevent the realization of learning. Studies show that there is a positive

increase in success in learning environments where formative assessment is integrated (Ateh & Wyngowski, 2015; Bransford et al., 2000; Ibabe & Jauregizar, 2010). Black and William (1998), in their study, found that in science lessons where the mastery learning approach is applied and where formative assessment is integrated have a positive effect on students' success. Similarly, Timmers et al. (2013) applied the computer-based formative test (CBFA) in their study to examine the effects of various variables on students' feedback behaviors through formative assessments and found that the majority of the students spent much more effort to complete the CBFA. Buldur and Hasbek (2020) tried to determine the perceptions of preservice teachers regarding the concept of formative assessment with various metaphors. The results revealed that the highest number of metaphors were developed in the theme of "increasing the level of learning" among the themes put forward regarding formative assessment.

In the study by Critchley et al., (2009), the researchers developed an e-learning and e-assessment system in which web-based formative assessment was applied. As a result of their research, the learning styles and the assessment approach towards formative assessment were reported to be important variables that affected student success in the web-based learning environment. In the study investigating the effects of the web-based assessment and feedback system for formative assessment which they developed on the self-regulated learning of the students, Zou and Zhang (2013) reported that there was a positive and significant relationship between the post-test results of the students and the scores they got from the cognitive regulation dimension. In the study by Alır (2015), students' acceptance of the web-based formative assessment system and their interaction levels with the feedback were investigated. In a study by Mudau (2021) were investigated the lecturers' views of using e-portfolio for formative assessment in Open Distance e-Learning.

Rationale of the Study

Web-based education eliminates the space and time constraints and provides individuals with opportunities to interact with each other at any time. In this respect, students have the privilege of sharing information with their peers and teachers, collaborating, brainstorming and constructing their own knowledge. However, it is necessary to do appropriate assessments in order to prevent and eliminate incorrect and incomplete learning in the process. Studies show that there is a positive development in student learning in teaching environments where the formative assessment method is applied (Ateh & Wyngowski, 2015; Furtak, 2012). Although the features mentioned about formative assessment are more suitable for face-to-face education given in the classroom, they should also be applied in web-based education. Practitioners must adhere to certain principles when integrating formative assessment into web-based education.

Although both the teacher and the student take part in the planning in the distance education process, the manager of the process is generally the teacher. The attitudes of the teachers who will carry out the formative assessment in practice have an important place in the distance education process. It is thought that teachers' positive and negative feelings towards formative assessment in web-based education will also affect their use of this assessment method in practice. In the literature, there are many studies revealing the attitudes of teachers in many fields. Studies conducted to determine teachers' attitudes towards educational research (İlhan et al., 2013), attitudes towards formative assessment (Ozan & Köse, 2013; Yan & Cheng, 2015) and attitudes towards distance education (Agir et al., 2008; Kışla, 2016; Metin et al., 2021). In the literature, there was no measurement tool used to reveal attitudes towards formative assessment in web-based education. In this respect, research on determining and improving teachers' attitudes towards formative assessment will contribute to the field. As in other countries in the world, distance education, which was put into practice due to the epidemic, has started to be implemented in Turkey as well. On the other hand, even when there is no epidemic, courses are conducted in many countries via distance education. Therefore, it is important to develop a scale that measures the attitudes of teachers who practice online teaching towards formative assessment in distance education.

Purpose

The purpose of this study was to develop the Attitudes towards Online Formative Assessment-Scale (S-AOFA) and to determine teachers' attitudes towards online formative assessment (AOFA) in distance education practices implemented in Turkey due to the COVID-19 pandemic. In line with the purpose of the study, answers to the following research questions were sought.

- What is the validity and reliability of the Scale Of Attitudes Towards Online Formative Assessment?
- What are the AOFA levels of the teachers who teach online during the epidemic?
- Is there a significant difference in terms of gender among the teachers who teach online during the epidemic?
- Is there a significant difference between the teachers' levels of AOFA with respect to the school levels (Elementary, secondary and high school) who give online lessons during the epidemic?
- Is there a significant relationship between the number and participation of the students in online classes and AOFA levels of the teachers who teach online during the epidemic?

Methodology

Research Design

Mixed method research design, both quantitative and qualitative research designs, was used (Creswell, 2014). In the qualitative part of the study, the teachers' views about distance education process and formative assessment related to online education were determined and analyzed through interviews in the process of creating the scale items. The quantitative part of the study covered the development of the scale and the findings obtained according to the survey method. According to the survey study, AOFA was evaluated according to certain demographic variables of the teachers.

In this study, a Likert-type scale was developed and used as a data collection tool to determine the teachers' attitudes towards online formative assessment in education. There are certain steps to be followed while developing a scale. It is important for the validity and reliability of the scale to fulfill these steps in order (Sönmez & Alacapınar, 2016). In the introduction of the present study and in the parts summarizing the related studies, existing scales related to the variable to be measured were searched, and it was revealed that a new scale was needed in this area; for this reason, information about the theoretical framework of the scale was given. In this study, the plans and practices regarding the development process of the scale were based on the related literature (Büyüköztürk, 2005; DeVellis, 2016; Lane et al., 2016).

The stages and content of the scale development process determined in line with the review of the literature can be seen in Table 1.

Table 1. Scale Development Stages and Contents (Büyüköztürk, 2005; DeVellis, 2016; Lane et al., 2016; Sönmez & Alacapınar, 2016)

Scale development stages	Procedure
Establishing the theoretical framework	Examining the sources and research on the behavior to be measured (Examining similar scales, theses and articles in the literature)
Determining the behaviors to be measured and creating an item pool	Determining the behaviors to be measured, interviewing the teachers, writing an item about the behaviors determined.
Asking for expert opinion	Sending experts (teachers and academicians with a good command of the scale subject) the items written about the behaviors to be measured and examining the items
Application of the measuring tool	Application of the scale and collection of the data after receiving feedback and corrections from the experts
Statistical analyses for validity and reliability	Statistical evaluation of the data obtained after the application (For validity, item analysis and factor analysis; and for reliability, Cronbach alpha)
Finalizing the scale	Finalizing the scale according to the results of the validity and reliability analyses (the final version of the scale by removing items and naming the scale dimensions)

Scale Development Process

Establishing the Theoretical Framework of the Scale

In the development process of the scale, first of all, resources and scientific studies related to online education were examined. Following this, the concepts regarding formative assessment developed in the study and other scales related to the subject of the scale were examined. Finally, behaviors were determined for the items to be found in the scale. Formative assessment is often used as the basis for feedback, which maintains continuous learning and which aims to improve students' classroom learning (Hargreaves, 2008). With the increase in the use of technology in the online education process, formative assessment has begun to be used in web-based education. In order to reveal the theoretical dimension of the scale developed in the study, key concepts and topics for web-based teaching and formative assessment were determined. These were self-assessment (Smith, 2007; Stiggins & DuFour, 2009), giving feedback (Stacey & Wiliam, 2013), improving learning positively (Gardner et al., 2002; Henly, 2003), identification and correction of mislearning (Stacey & Wiliam, 2013).

Identifying the Behaviors to be Measured and Establishing an Item Pool

In the process of creating the S-AOFA items in the study, first, the teachers' views about formative assessment in online education and about the distance education were determined via interviews and analyzed. In the interview held with 10 teachers, first, the teachers were given the definition of formative assessment, and following this, the question of "What are your thoughts about formative assessment in online education?" was directed to the teachers. In line with the answers given by the teachers, the data regarding the items to be added to the scale were obtained. Sample quotes from the interviews held with the teachers are presented in Table 2.

Table 2. Sample Quotes from the Interviews with the Teachers

Teacher	Teachers' views about the question of "What are your thoughts about formative assessment in online education?"
T1	I mostly use the question-and-answer technique during online education.
T2	I try to keep the attention of the students constantly live with educational games during online education.
T3	In online education, I enable students to participate in the process by making peer assessments.
T4	In online education, I assign homework through EBA.
T5	I review the method and technique I use by watching the online lesson video again.

Secondly, as a result of the literature review, the scales measuring attitudes towards formative assessment (Ozan & Köse, 2013; Yan & Cheng, 2015) and the scales measuring attitudes towards distance education (Agir et al., 2008; Kışla, 2016; Metin et al., 2021) were examined, and it was checked whether there were any items to be added to the S-AOFA. However, the items in these resources regarding formative assessment in online education were indirectly used. S-AOFA was drafted with 37 items. The items written for S-AOFA were designed to be answered in a 5-point Likert-type (strongly disagree, disagree, neutral, agree, and strongly agree).

Asking for Expert Opinion

After the draft items were created, the scale prepared was sent to nine experts, and their opinions were taken. The experts were selected among people who had developed scales before. The experts were one professor, one associate professor, three academicians who had completed their doctorate education and two teachers who had taken a course of scale development and continued their doctoral education at the university. For the language validity of the S-AOFA, it was sent to two teachers of Turkish Language, and their expert opinions were obtained. After providing the experts with theoretical information about formative assessment in online education, they were asked to rate the items in the scale from 1 to 10. A section was added to the bottom of the scores for them to write their opinions about their suggestions any change. As a result of the feedback received from the experts, changes and corrections were made on the items.

Table 3. Expert Opinion Form

Sample Items	1-Strongly Disagree	2-Disagree	3-Neutral	4-Agree	5-Strongly Agree	Evaluate the items in the scale in terms of "attitudes towards online formative assessment" and express your opinions and suggestions
I consider it important to ask short questions to determine the students' level of understanding the concepts in the course during the online education process.						Degree of Eligibility (1)(2)(3)(4)(5)(6)(7)(8)(9)(10) Your suggestion for any change: ....
In virtual classrooms (zoom, skype, adobe connect, perculus, etc.), I like using the question-answer technique to observe the results the students reach by the end of the lesson.						Degree of Eligibility (1)(2)(3)(4)(5)(6)(7)(8)(9)(10) Your suggestion for any change: ....
In online education, it makes me curious to learn the students' readiness levels by applying multiple choice tests.						Degree of Eligibility (1)(2)(3)(4)(5)(6)(7)(8)(9)(10) Your suggestion for any change: ....

The experts, who were sent an expert opinion form, stated that the scale items should generally contain only one verb or proposition and that since it was an attitude scale, they should have verb structures to reveal positive and negative judgments of people. It was agreed that the scale items should be formed in a way to cover the key concepts determined. It was also noted that all the items in the scale should be time-matched and that the items should not lead. It was pointed out that if there were to be items with negative verb stems in the scale, the number of items for these should be low. Some examples of the feedback from the experts can be seen in Table 4.

Table 4. Examples of Feedback from the Experts

Sample Items	Average degree of Suitability	Examples of expert feedback
M4	9	"The assessment tool to be used for checking homework could be specified" (Expert 3)
M10	7	"If there will be an item with a negative verb stem, their number should generally be less than the total number of questions (it could be one-third, one-quarter, 2-3 in total out of 10-15 questions.)" (Expert 4)
M11	3	"It doesn't look like a very formative question because as long as formative assessment is not done by the teacher, it will not be much meaningful." (Expert 2)
M20	9	The tense used is important for all items" (Expert 1)

Application of the Measurement Tool

After the corrections made as a result of the feedback from the expert, the scale was sent to the teachers for application. Attention was paid to the fact that the teachers in the research sample were the teachers who taught lessons in the distance education process conducted after the pandemic. The scale was arranged in an online environment, and it was sent to the teachers working in all the provinces in Turkey to collect data to represent the universe (https://forms.gle/mXgKrrVUGq74h3vX9). The scale was shared in various social media sites where teachers were mostly present. The scale, which was sent to teachers working in elementary, secondary and high schools, whether private or public, in Turkey, was filled by 369 teachers. Volunteering was taken into account in filling out the scale. Ethics committee approval was obtained from the university for the application of the scale.

Statistical Analysis for Validity and Reliability

The data obtained after the application were first transferred to Excel and then to the software of SPSS and prepared for the validity and reliability analyses. First of all, the data were analyzed descriptively, and it was checked whether the data demonstrated a normal distribution or not. Following this, in order to determine the items to be found in the scale, item analyses were performed "based on the difference between the lower and upper group means" and "based on correlation". After these two analyses, the items to be removed were determined. Afterwards, exploratory factor analysis was conducted to determine the number of dimensions of the scale. The numbers of the factors were determined after the exploratory factor analysis. Following the validity analysis, the item-total correlation values of each item were calculated, and the items to be removed from the scale were checked again. Next, the Cronbach alpha value of each factor of the scale and the Cronbach's alpha value of the whole scale were calculated, and the reliability coefficients were examined. The data obtained have been presented in the findings section. Statistical analyses for validity and reliability conducted during the development of the scale have been presented in the section of findings.

Finalizing the Scale

After the statistical analyses were completed for validity and reliability, some of the items in the scale were removed, and the items to be found in the scale were determined. After the exploratory factor analysis, the factors in the scale were named. S-AOFA was finalized as a 5-point Likert-type attitude scale consisting of 20 items with 2 factors.

Participants of the Study and Data Collection

The sample for the quantitative part of this study included elementary, secondary and high school teachers, who actively took part in distance education activities in Turkey, who conducted online lessons and who carried out virtual live lesson activities. The data regarding the qualitative part of the study were collected from 10 teachers from elementary, secondary and high schools who were interviewed before the scale items were created. Participation of the teachers interviewed was on voluntary basis. Since the data in the present study would be collected online, teachers working in both public and private sectors in our country participated in the study. The plan before the research process was to collect data from approximately 400 teachers for the scale development, but the scale was filled by 369 teachers. The sample of the survey study consists of science teacher, mathematics teacher, classroom teacher, and teachers in other fields. In relation to the scale development and survey, the demographic backgrounds of the 369 teachers were examined, and it was seen that there were teachers from 29 different fields of teaching and in 42 different cities. While collecting data with S-AOFA, some demographic information was obtained as well. In the online form created for data collection, the teachers were asked about the number and percentage of the students' participation in the lessons they taught online, about the socio-economic status of the students, about the school level they worked at (elementary-secondary-high school), and about the formative teaching tools they used (mobile phone, computer and tablet).

The research sample consisted of elementary, secondary and high school teachers who continued to give education remotely and carried out course activities in various virtual environments (EBA, LMS, Zoom, Google Meet, etc.) starting from March 2020, when the COVID-19 epidemic started in Turkey (Table 5). In the study, the data were collected online

(https://forms.gle/mXgKrrVUGq74h3vX9). Since the scale was published online in the study, the teachers who gave distance education in all schools in Turkey had the chance to participate in the study.

Table 5. Characteristics of the Teachers Participating in the Application

Gender	Female	Male		
	201 (% 54.5)	168 (% 44.5)		
Type of school	Elementary	Middle	High	
	65 (% 17.6)	211 (% 57.2)	93 (% 25.2)	
Online Teaching Tool	Computer	Mobile phone	Tablet	Mixed
	221 (% 59.9)	60 (% 16.3)	16 (% 4.3)	72 (% 19.5)
Socio-economic status of the students attending the online courses according to teachers	Poor	Medium	Good	
	161 (% 43.6)	177 (% 48)	31 (% 8.4)	

Demographic characteristics of the participants showed that the majority of the teachers preferred the computer as a communication tool in online lessons and that the socio-economic status of the students participating in the lessons was good, medium or poor.

Findings / Results

Descriptive Statistics for 37-item S-AOFA

In the development of the scale, the data collected with the draft scale created after item writing were analyzed descriptively, and item analysis was conducted for the selection of the items to be included in the final version of the scale. First of all, the scores of the negative items (5, 13, 22 and 23) in the scale were reversed. In addition, the total scale score obtained from the items was calculated, and the data showed a normal distribution or not was examined. For the 37 items found in the scale at the beginning, item analysis was performed "based on the difference between the lower and upper group means" and "based on correlation." When the descriptive statistics of the scores obtained with the draft scale was examined (Table 6), the minimum score to be obtained for the 37-item five-point Likert-type S-AOFA was 37, and the maximum score to be obtained was 185. The minimum score obtained with the S-AOFA was 101, and the maximum score was 182. Mode, median and arithmetic mean values of the sum of the items were close to each other (Mean=146.1816, Median=146.0000, Mod=143.00). Since the skewness and kurtosis coefficients were in the range of (-1, +1), it could be stated that the data again showed a normal distribution (Büyüköztürk, 2020).

Table 6. Descriptive Statistics for the S-AOFA

N= 369	Value
Mean	146.1816
Median	146.0000
Mod	143.00
Skewness	-0.210
Kurtosis	-0.498
Minimum	101
Maximum	182

Correlation-Based Item Analysis

For this analysis, the correlation values between each item and the draft scale total scores were determined (Table 7). It is known that when selecting items for a scale developed, items with a correlation value ranging from .20 to .30 between the scale item and the total score obtained from the scale can be included in the scale when deemed necessary and that items with a correlation value higher than .30 are well discriminating (Büyüköztürk, 2020). When the item-total correlation coefficient values for the 37 items created initially in the scale were examined, it was seen that it was r=.146 (p>.01) for Item 10, which was the lowest; that it was r=.144 (p>.01) for Item 21; and that it was r=-.196 (p>.01) for Item 28. The item-total correlation coefficient values of the other items ranged from .328 to .689 (Table 2). In addition, Items 10, 21 and 28 did not show a significant correlation with the scale score at the level of .01. This result demonstrates that items 10, 21 and 28 should be removed from the scale or revised.

Item Analysis Based on the Difference between the Lower and Upper Group Means

For the item analysis based on the difference between the lower and upper group means used in selecting the items for the scale, the data were put in order from the lowest to the highest according to the total scores. Following this, the scores belonging to the upper part of 27% (100) and to the lowest part of 27% (100) were grouped. Next, the difference between the means of the item scores in the upper and lower groups was analyzed with t-test for the independent groups. Except for the Item 28 in the scale, the difference between the lower and upper group means for the other items was found significant (Table 7).

According to the results of the item analysis conducted based on the difference between the lower and upper group means and based on correlation, the Items 10, 21 and 28 could be removed from the scale.

Table 7. T-test Results between the Lower-upper Group Means and Item-total Correlations of the S-AOFA

Item	Item-total correlations (r)	The t-value for lower/ upper group	Item	Item-total correlations (r)	The t-value for lower/ upper group
1	.371	7.104	20	.560	11.127
2	.365	7.534	*21*	*.144*	*3.686*
3	.376	7.484	22	.393	7.867
4	.363	8.229	23	.405	8.950
5	.357	8.480	24	.572	16.979
6	.459	10.077	25	.519	10.910
7	.421	9.137	26	.655	16.206
8	.387	8.338	27	.411	11.274
9	.328	7.165	*28*	*.196*	*2.316*
10	*.146*	*4.476*	29	.578	12.847
11	.438	9.884	30	.492	10.680
12	.473	9.899	31	.363	7.834
13	.372	8.438	32	.518	12.062
14	.441	8.703	33	.622	13.909
15	.636	14.405	34	.677	16.167
16	.616	13.461	35	.689	16.896
17	.562	13.373	36	.639	16.652
18	.585	12.299	37	.438	9.793
19	.404	8.262			

Exploratory Factor Analysis

While performing the exploratory factor analysis, firstly, the suitability of the data for factor analysis was examined. The Kaiser-Meyer-Olkin (KMO) value of the data obtained from S-AOFA was found to be .906, while the Bartlett's test was calculated as 5087.046 (561, p< .001). In order to perform factor analysis, the KMO coefficient should be higher than .60. Data were considered to be suitable for factor analysis as the sample size was good and the Bartlett's test was significant (Büyüköztürk, 2020). The following methods were used to determine the number of the factors in the scale: the method of percentage of total variances, eigenvalue statistics and scree plot. In the first analysis conducted with 34 items, it was revealed that the scale was explained by 8 factors with an eigenvalue higher than 1.

Table 8. Eigenvalues and Variances

Factor	Eigenvalues	Variance (%)	Cumulative (%)
1	10.083	29.657	29.657
2	2.085	6.131	35.788
3	1.770	5.206	40.994
4	1.697	4.992	45.986
5	1.297	3.814	49.800
6	1.224	3.601	53.401
7	1.129	3.322	56.723
8	1.010	2.970	5 9.692

When the scree plot was examined (Figure 1), it was seen that the scale could consist of two factors. The number indicated by the point in the scree plot where the slope started to slide showed the number of factors. As a result, the decision was that the scale would consist of two factors, considering the factors with an eigenvalue above 1 and the scree plot of the number of factors in S-AOFA.
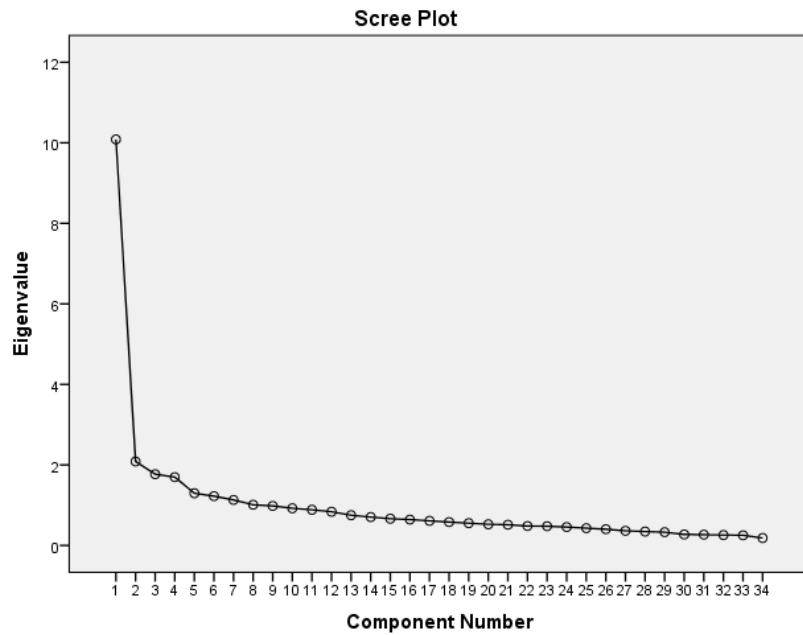
Figure 1. Factor Analysis Scree Plot

After the number of the factors was determined, the rotation of the factors was started in order to obtain factors that could be named and interpreted; the varimax technique was used, the Rotated Component Matrix was created, and the factor loadings of the items in the factors were examined. It was accepted as a criterion that the factor loadings of the items and each factor in the scale should be at least .40. While determining the items suitable for the factors determined for the scale, attention was paid to ensure that the load values of the same item in different factors were not close to each other (Büyüköztürk, 2020). Considering these criteria, as a result of the analyses conducted with 34 items, firstly, Items 5, 13, 22 and 23 were removed from the scale. After repeating the analyses and the process continued for a few steps, Items 1, 4, 6, 11, 12, 15, 24, 26, 30 and 34 were removed from the scale. As a result of these processes, the number of the items in the final version of the S-AOFA was reduced to 20. The KMO value for the 20-item S-AOFA was .884, and the Bartlett's test value was 2616.081 (190, p< .001).

The total variance explained for the scale consisting of 2 factors was 40.630% (Table 9). The first factor (Items 2, 3, 7, 8, 9, 14, 16, 17, 18, 19, 20 and 29) constituted 33.047% of the total variance, while the second factor (Items 25, 27, 31, 32, 34, 35, 36 and 37) constituted 7.583% of the total variance. The variances explained by the two factors whose eigenvalues were greater than 1 after rotation were 21.478% for the first factor and 19.152% for the second factor. These explained 40.630% of the total variance. The factor load values of the items in the scale were between .414 and .803 (Table 9).

Table 9. Eigenvalues, Variances and Factor Loads of the Scale Items

	1. Factor	**2. Factor**	**Principal Component Analysis**		
			Eigenvalues	**Variance (%)**	**Cumulative (%)**
M16	.710				
M20	.664				
M17	.607				
M14	.583				
M19	.582				
M18	.564		4.296	21.478	21.478
M29	.539				
M8	.524				
M3	.515				
M2	.461				
M7	.443				
M9	.417				

Table 9. Continued

	1. Factor	2. Factor	Principal Component Analysis		
			Eigenvalues	Variance (%)	Cumulative (%)
M34		.803			
M35		.776			
M36		.663			
M32		.644	3.830	19.152	40.630
M31		.643			
M37		.542			
M25		.505			
M27		.414			

Item Analysis and Internal Consistency Coefficient for the 20-Item S-AOFA

As a result of the factor analysis, the item-total correlations of the scores obtained with the S-AOFA, which included 20 items, were calculated. The item-total correlation coefficient values for each item ranged from .390 to .713 (Table 10). The reliability coefficients of Cronbach's Alpha were calculated as .812 for the items in the first factor of S-AOFA, as .828 for the items in the second factor, and as .882 for all the dimensions (20 items). These values showed that the internal consistency of the scale was high.

Table 10. Reliability Coefficients and Item-total Correlations for 20 Items in the Scale

Factors	Item	Items	Item-Total Correlations	Cronbach's Alpha
Assessment Approaches	2	At the end of the live lessons (EBA, zoom, Google meet, etc.) in virtual classes, I give importance to determining the students' levels of understanding with the question-and-answer technique.	.403	.828
	3	During online education, I like to direct the flow of the lesson by learning the students' preliminary knowledge about the subject.	.432	
	7	I consider it important for students to make self- and peer-assessment in online education.	.415	
	8	I find it useful to use online applications (simulation, animation, etc.) to identify and correct misconceptions in students.	.422	
	9	The homework I assign via the EBA learning management system in online education is valuable for me not in terms of giving grades to the student, but in terms of helping the student give meaning to the information.	.390	
	14	I consider it important to do assessment (project-based, network research-webquest, etc.) that take learning out of the classroom in online education.	.462	
	16	I give importance to revising my teaching method according to the feedback from the online assessments.	.633	
	17	Interactions in virtual laboratories (question-answer-feedback) develop students' sense of curiosity.	.562	
	18	It gives me confidence to determine students' learning through online assessments in order to organize the learning environment.	.570	
	19	I find it useful to have students solve problems/questions via the smart board in live lessons (EBA, Zoom, Google Meet etc.) in the virtual classroom.	.459	
	20	I give importance to motivating students with educational games (via EBA, Okulistik, Morpa campus, etc.) for assessment purposes in online education.	.594	
	29	I value providing feedback in the virtual classroom to help students make progress.	.530	

Table 10. Continued

Factors	Item	Items	Item-Total Correlations	Cronbach's Alpha
Assessment Systems	25	I like to ensure the continuity of learning by submitting assignments through online assessment systems (EBA, Okulistik, morpa campus, etc.).	.532	
	27	I like to watch my online lecture videos/audio recordings again and review the lesson.	.403	
	31	I believe that I can reveal the misunderstandings of the students in the lessons with the help of solving questions and tests in the virtual classroom.	.405	
	32	I like to have students deal with online assessments/tests to identify their needs and to restructure the lessons.	.528	.812
	34	I believe that I can increase the quality of teaching with the evaluations I make during virtual lessons.	.699	
	35	The midterm assessments of students' learning in the virtual classroom allow me to discover the best ways to facilitate learning.	.713	
	36	I like to give feedback by submitting assignments through online assessment systems (EBA, Okulistik, Morpa campus, etc.).	.661	
	37	It is easy to give feedback by checking the assignments I give in the virtual classroom.	.434	
		Cronbach's Alpha for 20 items		.882

Naming the Factors

S-AOFA included two factors. First factor of the scale consisted of 12 items (2, 3, 7, 8, 9, 14, 16, 17, 18, 19, 20 and 29), and the second factor consisted of 8 items (25, 27, 31, 32, 34, 35, 36 and 37). The factors were named by taking the content of the items into account. It was understood that the items in the first factor were related to the assessment approach, methods and techniques. For this reason, the first factor was named "Assessment Approaches". Considering that all of the items in the second factor were related to online formative systems, this factor was named "Assessment Systems".

Correlation between the Factors

The results of the relationship between Factor 1 and Factor 2 of S-AOFA can be seen in Table 11. The simple correlation procedure, which was performed to reveal whether there was a relationship between the first factor and the second factor and between the factors and all the dimensions of the scale, showed a positive significant relationship between the first and second factors (r=.633, p<.01), between the first factor and the total scores of the scale (r=.905, p<.01), between the second factor and the total scores of the scale (r=.902, p<.01).

Table 11. Relationship between the Factors

		Factor 1	Factor 2	S-AOFA
Factor 1	Pearson Correlation	1	.633**	.905**
	Sig. (2-tailed)		.000	.000
	N	369	369	369
Factor 2	Pearson Correlation	.633**	1	.902**
	Sig. (2-tailed)	.000		.000
	N	369	369	369
S-AOFA	Pearson Correlation	.905**	.902**	1
	Sig. (2-tailed)	.000	.000	
	N	369	369	369

**Correlation is significant at the .01 level

Findings Regarding the Teachers' AOFA

The teachers' attitudes towards online formative assessment were examined with S-AOFA, which included 20 items. When the mean scores of the factors in the scale, which had a five-point Likert-type two-factor structure, were examined according to the item means, it was seen that the mean of the items in the "Assessment Systems" factor was lower than that of the "Assessment Approaches" (Table 12). Items with the lowest mean were Item 37, Item 27 and Item 31,

respectively, and these were the items under the heading of assessment systems of the scale. Items with the highest mean were Item 2, Item 9 and Item 3, respectively, and these items were in the dimension of the assessment approach of the scale (Table 12).

Table 12. Teachers' AOFA

	Mean	**Std. Deviation**	**Item average of the factor**	**Std. Deviation of the factor**
M16	4.43	.770		
M20	4.45	.783		
M17	4.42	.790		
M14	4.07	.962		
M19	4.49	770		
M18	3.82	1.023	4.3688	5.756
M29	4.38	.788		
M8	4.45	.852		
M3	4.63	.660		
M2	4.66	.587		
M7	4.00	1.009		
M9	4.65	.664		
M34	3.99	.986		
M35	3.94	.972		
M36	4.08	1.018		
M32	4.27	.836	3.8591	5.662
M31	3.80	1.021		
M37	3.19	1.369		
M25	4.12	.964		
M27	3.48	1.333		
	Mean		4.1649	10.31846

The Teachers' AOFA with Respect to Gender

When the means obtained from the S-AOFA were examined with respect to gender (Table 13), it was revealed that the female teachers' attitudes towards formative assessment in online education (M=84.9) were higher than those of the male teachers (M=81.3). When the results of the independent groups t-test performed to reveal whether the difference between the means was significant or not, it was seen that the difference was significant ($t(367)=3.328$, $p<.01$, Cohen's d= .348). Effect sizes can be considered to be moderate.

Table 13. T-test Results of the Scores for the 20 Items in the S-AOFA with Respect to Gender

Gender	N	Mean	S	SD	t	p	Effects size (Cohen's *d*)
Male	168	81.3690	10.78064	367	3.328	.001	.348
Female	201	84.9104	9.64997				

The Teachers' AOFA with Respect to Their School Levels

According to the school level of the teachers, their AOFA was examined in terms of elementary, secondary and high school levels. The lowest score to be obtained from S-AOFA, which was a five-point Likert-type scale, was 10, and the highest score was 100. When the teachers' AOFA was examined in accordance with their school level, it was found that the means for elementary school, secondary school and high school were 83.55, 83.99 and 81.53, respectively (Table 14).

Table 14. AOFA According to the Teachers' School Levels

	N	Mean	Std. Deviation
Elementary school	65	835.538	980.757
Secondary school	211	839.953	982.974
High school	93	815.376	1.158.106
Total	369	832.981	1.031.846

ANOVA (one-way analysis of variance) was performed to reveal whether there was a significant difference between the school level means of the teachers' AOFA (Table 15). According to the findings obtained via ANOVA, there was no significant difference between the teachers' AOFA in terms of school level ($F(2-366)=1.864$, $p>.05$).

Table 15. ANOVA for School Level

	Sum of Squares	Df	Mean of Squares	F	p
Between groups	395.034	2	197.517	1.864	.157
Within groups	38786.175	366	105.973		
Total	39181.209	368			

The Relationship between the Teachers' AOFA and the Number of Students and Their Participation in Online Lessons

The teachers gave online lessons in virtual environment and virtual classrooms through distance education during the COVID-19 epidemic. The relationship between the average number of students in which online virtual live lectures are given and the percentage of the students' participation and the teachers' AOFA was examined using a simple correlation analysis of Pearson product moment correlation coefficient (Table 16). It was seen that there was a low level of negative significant relationship between the teachers' AOFA and the average number of students in which virtual lessons were given online ($r = -.105$, $p<.05$). It was also revealed that there was a low level of positive significant relationship between the teachers' AOFA and the percentage of participation of the students who were taught in the virtual classroom online ($r = .106$, $p<.05$).

Table 16. Pearson Correlation results

		Teachers' AOFA
Average number of students in online courses	Pearson Correlation	-.105*
	Sig. (2-tailed)	.044
	N	369
Class participation percentage of students in online courses	Pearson Correlation	.106*
	Sig. (2-tailed)	.041
	N	369

* Correlation was significant at the level of .05.

Discussion

The development of the S-AOFA was conducted in accordance with the mixed method research approach. In the development of S-AOFA, first, the theoretical framework was determined, and the behaviors to be measured were identified. In the preparation of the S-AOFA items, the literature and teachers' views about online assessment were used.

In order to reveal the theoretical framework of S-AOFA, studies covering the following concepts were used: self-assessment (Smith, 2007; Stiggins & DuFour, 2009), feedback (Stacey & Wiliam, 2013), improving learning positively (Gardner et al., 2002; Henly, 2003), formative assessment (Ozan & Köse, 2013; Yan & Cheng, 2015), detection and correction of mislearning (Stacey & Wiliam, 2013), distance education (Agir et al., 2008; Kışla, 2016; Metin et al., 2021). These studies were used for item writing for S-AOFA, yet no direct item was taken.

Validity and reliability analyses were conducted for the data obtained. As a result of analyses, the S-AOFA was composed of 20 items five-point Likert-type with 2 factors as "Assessment Approaches" and "Assessment Systems". The internal consistency Cronbach Alpha value was found to be .882 for the S-AOFA, for total 20 items. A reliability coefficient is considered sufficient for the reliability of the test scores (Büyüköztürk, 2020).

When similar scale development studies in the literature were examined, it was seen that Agir et al. (2008) developed the attitude scale towards distance education consisting of 21 items with six factors, and Kışla (2016) developed a uni-dimensional 21-item scale with six factors to determine attitudes towards distance education and that Kışla (2016) developed a uni-dimensional 35-item scale to determine attitudes towards distance education. On the other hand, Metin et al., (2021) developed a scale consisting of 15 items with six factors.

The teachers gave online lessons in virtual environment and in virtual classrooms through distance education during the COVID-19 epidemic. In this study, the findings obtained when the teachers' AOFA were examined in terms of the survey study. In this study, when the ranges obtained from the arithmetic means for 5-point Likert-type S-AOFA were taken as 0.8; Teachers' attitude levels can be assessed as 1.00-1.80 very low, 1.8-2.60 low, 2.61 -3.40 medium, 3.41-4.20 high, 4.21-5.00 very high. Mean of the items in the factor of "Assessment Systems", which was a sub-dimension of S-AOFA, was lower than that of "Assessment Approaches". The results show that teachers' AOFA generally have high. However, in teachers' AOFA in the factor of "Assessment Systems" of is moderate. Teachers quickly started to teach lessons with distance/online education due to the COVID-19 process. The fact that teachers receive training on formative assessment in online education may also cause changes in their attitudes towards formative assessment.

Studies on the effect of formative assessment in the literature show that formative assessment practices integrated into web-based learning environments cause positive development in participants (Buchanan, 2000; Gardner et al., 2002; Henly, 2003; Khan et al., 2001).

In the study, whether the teachers' AOFA differed depending on the school level they worked in (elementary school, secondary school and high school) was examined, and the findings obtained with ANOVA revealed no significant difference between the teachers' AOFA with respect to the school level they worked in.

The findings obtained in the study demonstrated that there was a low level of negative significant relationship between the teachers' AOFA and the average number of students in which virtual lessons were given online. In addition, it was seen that there was a low level of positive significant relationship between the teachers' AOFA and the percentage of the students' participation in online lessons in the virtual classroom. In this study, it was seen that with respect to the variable of gender, there was a significant difference in the teachers' AOFA in favor of the female teachers.

In a study conducted with teachers in relation to distance education, Ülkü (2018) concluded that the attitude of female teachers was more positive than that of the male teachers. In one other study with university students, Schifter (2002) reported that the perception of distance education caused a significant difference in terms of gender and that the perception scores of female students were higher than those of male students. These results were parallel to the those obtained in the present study. On the other hand, Fidan (2016) observed that the attitudes of the participants (university students) towards distance education were higher for men than for women with respect to the variable of gender. In addition, study by Kırali and Alcı (2016), there was no significant difference in terms of gender in the participants' perceptions of distance education.

Conclusion

The teachers gave online lessons in virtual environment and in virtual classrooms through distance education during the COVID-19 epidemic. In this study, S-AOFA, which helped reveal the teachers' attitudes towards formative assessment conducted during online and distance education applications, was developed, and the teachers' attitudes were examined with respect to certain demographic variables.

The development of the S-AOFA was conducted in accordance with the mixed method research approach. In the preparation of the S-AOFA items, the literature and teachers' views were used. After the draft items of S-AOFA were written, expert opinion was taken. After expert opinion, the research data were collected from 369 teachers working in schools. Validity and reliability analyses for scale were conducted. As a result of analyses, the S-AOFA was composed of 20 items with 2 factors as "Assessment Approaches" and "Assessment Systems". For the 20-item five-point Likert-type S-AOFA, the minimum score to be received was 20, and the maximum score was 100. As the scores obtained from the scale were closer to 20, the teacher's attitude towards online formative assessment could be said to be low. Based on a score closer to 100, it could be stated that the teacher's attitude was high. As a result, a scale with reliability and validity was obtained from the data obtained, which can be used in research.

The results show that teachers' AOFA generally have high. However, in teachers' AOFA in the factor of "Assessment Systems" of is moderate. In this study, the findings revealed that teachers' AOFA related to "Assessment Systems", was lower than their "Assessment Approaches". Findings revealed no significant difference between the teachers' AOFA with respect to the school level they worked in (elementary school, secondary school and high school). The findings demonstrated that there was a low level of negative significant relationship between the teachers' AOFA and the average number of students in which virtual lessons were given online. In addition, it was seen that there was a low level of positive significant relationship between the teachers' AOFA and the percentage of the students' participation in online lessons in the virtual classroom. In this study, it could be concluded that the female teachers participating in the study had higher attitudes towards formative assessment in online education than the male teachers.

Recommendations

Researchers willing to determine teachers' attitudes towards formative assessment in online and distance education could benefit from S-AOFA. S-AOFA could be used to investigate the influence of methods and techniques within the scope of formative assessment used in live lessons in distance/online education. The fact that teachers receive training on formative assessment in online education may also cause changes in their attitudes towards formative assessment. Teachers' online formative assessment practice can be investigated from different tool.

Limitations

In this study, teachers' attitudes towards online formative assessment are limited to the web tools they use for formative assessment. Teachers quickly started to teach lessons with distance education due to the COVID-19 process, and their experience and experience is quite limited.

Authorship Contribution Statement

İlhan: Conceptualization, design, analysis, writing, editing/reviewing, supervision. Güngör: Analysis and writing. Gülseven: Analysis and writing.

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