Use of take-home exam for remote assessment: A case study from Turkey

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Article Info	Abstract
Keywords: Remote assessment Take-home exam COVID-19 Formative assessment E-assessment Online assessment Research Article	COVID-19 has changed the way we teach. Today, we have become far more experienced in the delivery of distance education and use of online tools. However, the quality of distance education and learning outcomes have become a matter of ongoing debate. Just as higher education aims to develop high-level skills in its students, researchers are seeking ways to perform valid and reliable assessment in distance education. Institutions and educators are also in search of assessment tools that can help prevent instances of cheating and plagiarism. However, performance-based assessment tools may also offer options to measure both high-level skills and in limiting cheating behaviors. In this study, we used the take-home exam as a formative remote assessment tool as a local case in Turkey. We surveyed the views of 43 undergraduate students about the quality of take-home exams as a remote assessment tool. The results showed that participants had a high quality perception about the use of take-home exam, especially with regards to being kept informed about evaluation and scoring, rapid assessment, the provision of feedback, and consistency of scope between assessment and course content. Whereas students highly perceived the use of take-home exams, they reported more moderate views regarding take-home exams increasing the level of interaction with their peers. The results of this study suggest that the use of take-home exams is significantly preferred by higher education students, that it is a reliable and distinctive way to measure students' academic performance, and may increase student-teacher interaction through its formative use.

1. Introduction

Measurement results produce "indicators" that can be used for different purposes in education. These indicators form the basis for crucial individual decisions such as gaining entrance to a certain school or program of academic study, measuring successful completion of a program, achieving the course objectives or obtaining a certificate, and for social decisions such as the determination of educational policies. Most of these decisions are based on summative assessment (Knight, 2002). In addition, results obtained from intermittent and continuous measurements taken throughout the education period are used formatively in order to make the education process more efficient. Determining the disruptions, deficiencies, or errors in education, and then compensating for them through both instructors and/or students can be carried out based on the indicators of formative assessment. Therefore, the importance of measurement results within education is indisputable in terms of determining the quality of education, enhancing academic output, and in making appropriate and necessary decisions.

Higher education is considered the most powerful means available for countries to develop and grow a knowledge society. Higher education presents both the opportunity to facilitate and encourage research to be undertaken, to increase knowledge, and to boost technological innovation (Bouhajeb et al., 2018). Making valid and reliable assessments in higher education is therefore critical, since graduates of higher education must be capable of meeting the wide-reaching requirements of a productive life in the 21st century. With the onset of the COVID-19 pandemic, higher education institutions worldwide are required to utilize distance education and distance tools (Crawford et al., 2020; Salim et al., 2021). On the other hand, institutions were not prepared such an urgent shift (Agormedah et al., 2020, Durak et al., 2020). Overnight, students from applied science disciplines such as medicine, psychology, and education had to be completely educated through remote means (Al-Balas et al., 2020). It is highly arguable as to what extent institutions that had little or no distance education experience or technical competence have been able to provide the required level of qualification through distance education (Mbiydzenyuy & Silungwe, 2020; Sankar et al., 2020). At this point, it is important not only to ensure that students reach their academic goals, but also to determine to what level they have reached, and the validity and reliability of their assigned grades. More than ever, during the Covid-19 pandemic it has become critical for academic institutions to produce valid and reliable assessment results (Schweig et al., 2020; University of Guelph-Office of Teaching and Learning, 2020).

There are numerous advantages that distance education tools provide in terms of educational assessment. Submitting work, responding to students, content and artefact storage, materials reuse, ease of editing based on feedback, and the provision of statistical data are just some of the advantages that distance education tools provide in terms of assessment (Şenel, 2020). Along with these, there are also certain limitations to the use of distance tools in assessment. As with all instructional events in distance education, assessment practices are limited by the information and communication technology competencies of both faculty members and their students. In addition, the difficulty of ensuring test security is considered as the primary limitation (Boud et al.,1999; Butler-Henderson & Crawford, 2020; Dawson, 2020; Peterson, 2019; Rovai, 2000; Sullivan, 2016; Vazquez et al., 2021). Test security means taking certain measures in order to be able to accurately rely upon assessment results (Frey, 2018). The high probability of cheating and plagiarism in remote tests has made test security a more frequently discussed topic in recent literature (Butler-Henderson & Crawford, 2020; Dawson, 2020; Conference on Test Security, 2021; Senel & Senel, 2021; Vazquez et al., 2021).

The virtual classroom may limit certain critical learning components such as collaborative working, communication, and both student-student and student-teacher interaction that are more naturally afforded in the traditional classroom environment (Jung et al., 2002). Deficiency of these critical components therefore must be compensated instructionally in distance education, or through the use of additional educational technological measures that can limit the potential negative effect on learning outcomes (Abrami et al., 2011). Formative assessment emerges as a solution to enhance the social components of learning (Stödberg, 2012), especially student-teacher interaction (Black & Wiliam, 2009). Formative assessment in distance education offers powerful interaction, both amongst students and with their teachers, based on feedback options which provide an opportunity to monitor the learning process and to enhance it via formative feedback. Formative feedback on learning outcomes may also create opportunities for students to organize their learning at the same time. Along with formative assessment and feedback, students can encounter more effective interaction with their instructors as they strive to achieve their educational goals. There is, therefore, a significant need for formative assessment and feedback (Higgins et al., 2002) for both effective learning (Hricko & Howell, 2005) and to increase learner motivation.

Measurement techniques can be divided into two areas; tests and performance-based techniques. In distance education, tests are usually referred to as online synchronous tests, in which a class of students all logon to a learning management system at the same time and enter their answers within a limited time period (e.g., 45 minutes). These tests may consist of true-false, matching, or multiple-choice items that are answered

selectively, as well as open-ended items. As a group, performance-based techniques include performance tasks, assignments, and e-portfolios. Participation and reflection reports can also be added to live lectures or discussion forums in order to be considered as indicators of participation in distance education. Rubrics, rating scales, and also checklists can be used for scoring in performance-based techniques. The choice and application of appropriate measurement techniques, along with software measures, can be effective in overcoming the limitations of remote assessment in distance education. The strengths, limitations, and measures that may be taken against the limitations of online tests in distance education are summarized in Table 1.

Table 1.
Strengths, limitations and measures taken against online tests limitations

	Strengths	**Limitations**	**Measures to be taken against limitations**
Multiple-choice / Short or single-response items	• Higher content validity • Instant scoring and feedback • Motivating in-class use	• Lower test security • Inefficient for assessing higher-level skills	Varied measures can be taken with software and measurement techniques to ensure test safety. • Time limit for whole exam • Time limit for individual items • Presenting test-takers with items in a different order • Presenting test-takers with response options in a different order • Using item pool/presenting different (equal) items • Disabling option to change an answer once entered • Limiting/blocking new web page or tab opening • Requiring the test-taker's camera to be open • Other technologies (e.g., voice, retinal, face scans)
Long-response or open-ended items	• Aimed at higher-level skills	• Time consuming and heavier workload • Lower scorer reliability	• Well-prepared tests measuring higher-level skills may decrease cheating • Rubrics and control lists for scoring • Use of antiplagiarism software (e.g., Turnitin, iThenticate)

In online testing, test security emerges as an issue that requires significant emphasis. Online tests, which consist of matching, true-false and/or multiple choice items, are more suited to the measurement of low-level skills such as recall, comprehension, and application, are particularly susceptible to acts of cheating and/or plagiarism when applied in the distance education context. As can be seen in Table 1, there are many software measures that focus on test security (Dawson, 2020; Dendir & Maxwell, 2020; Harmon et al., 2010; Howell et al., 2009; Jain et al., 2006; Sullivan, 2016). Asking students an excessive number of items within a given time limit can also be added to the measures (Mohanna & Patel, 2016). The ability of online tests to provide instant feedback is also critical, especially in distance education. This is effective in fostering student motivation and engagement to the lesson (Chaiyo & Nokham, 2017). When open-ended items aimed at higher-level skills such as critical thinking and problem solving are included within online tests, the probability of interference from alternative sources is likely to decrease. In addition, originality reports for open-ended responses can be readily obtained with software support.

Table 2.
Strengths, limitations and measures to be taken against the limitations of performance-based tools

	Strengths	**Limitations**	**Measures to be taken against limitations**
Assignments, performance tasks, e-portfolios	• Aimed at higher-level skills • Fosters student engagement	• Time consuming and heavier workload • Lower scorer reliability • Difficult to measure group member contribution	• Cheating may decrease with a focus on higher-level skills • Demanding assignment-based online/ oral presentation • Demanding schedules and interim reports • Use of self/peer/group assessment • Rubrics and control lists used for scoring

			• Use of antiplagiarism software (e.g., Turnitin, iThenticate)
Participation indicators (attendance rates, post/message numbers, post/message length, other logs)	• Supports student participation and collaboration • Supports self-regulation	• Demands motivation-enhancing activities and feedback	• Initiating discussions by using in-class activities • Routing and guiding discussions (lecturer/assistants) • Clearly explaining about start/end of discussions • Instructor participation in discussions/ evaluations • Providing instant feedback to student posts

The strengths of performance-based techniques are summarized in Table 2. These techniques, which are considered suitable for the measuring of high-level skills, invite students to research, reveal new ideas, and to develop products. Faculty members should choose the technique deemed most appropriate for the intended educational goals, considering the limitations and strengths of the available tools. In terms of remote assessment, it is recommended to apply these methods in a blended way considering their strengths within the context of application (Erkuş, 2006).

Gaining high-level skills and applying these skills are considered some of the required features or competences that higher education students should possess in the 21st century (Kyllonen, 2012). Considering that skills such as critical thinking, problem-solving, collaboration, creativity, and productivity should be at the fore, it is clear that tests consisting of open-ended items and performance-based techniques should be used predominantly in the measurement of high-level skills. Considering what has been reported so far, it is recommended to focus on assessment techniques for high-level skills in remote assessment, which create detailed feedback opportunities, maintain a focus on the students' development, formulation, and support purposes, and provide opportunities for students to organize their learning. However, in addition, test security must also be taken into consideration.

The use of take-home exams in distance education, and during the COVID-19 pandemic in particular, is generally recommended, together with detailed explanations on how to appropriately use take-home exams (Institute of Education Sciences, 2020). Take-home exam is a nomenclature that relates to the conditions of measurement and evaluation, rather than to any specific assessment method (London School of Economics and Political Science, 2020). In take-home exams, with an approach similar to open-book or open-web exams, students may take the exam using a variety of different resources available to them. Due to their obvious similarities, findings related to open-book (Atılgan et al., 2009) and open-web exams were also used in reviewing the current literature. Take-home exams can be defined as a test consisting of open-ended items that provides the student with an opportunity to apply their knowledge to a specific problem or question within a limited time and by using all available resources, regardless of location (Zoller & Ben-Chaim, 1989). Since students are predominantly located "at home" to receive distance education during the pandemic, this approach can be expected to be widely preferred by higher education institutions. Based on the literature, the potential benefits of take-home exams in remote assessment are discussed as follows.

Higher test security: In online tests, test security cannot be fully ensured, even if software-based precautionary measures are taken for test security (Dawson, 2020). Test security can be increased when open-ended items or tasks that aim to measure high-level skills are created through take-home exams (Zoller & Ben-Chaim, 1989). Exams should include items that do not have a concrete answer, and are therefore less liable to instances of cheating and plagiarism affecting the score (Butler, 1988; Mohanna & Patel, 2016). Notably, open-book exams or exams where each student is expected to provide their own unique answers are also referred to as cheating reduction methods (Dawson, 2020; Sullivan, 2016).

Measuring/enhancing higher level skills: Take-home exams emerge as the recommended method for measuring students' high-level skills. In addition, when used for formative assessment, preparation with items for high-level skills is also important for the development of high-level skills and professional development (López et al., 2011; Mohanna & Patel, 2016).

Supporting learning: Take-home exams support learning by helping students to acquire, research, and apply course-related skills within a real-time environment (Sullivan, 2016). As in the current research, take-home exams are considered to be supportive of learning outcomes by allowing students to concentrate on specific topics, and to research and access resources for a limited 12-48 hour examination period.

Collaboration: Given the relatively limited application time limit (e.g., 1-2 days), the fact that all students taking a course are working on the same task on the same day can enhance collaboration. Students are able to communicate with each other about items. Similarly, take-home exams are also open to group working practices, and may thereby create increased peer interaction and collaboration through group exams (Johnson et al., 2015).

Decreasing exam anxiety: One byproduct of take-home exams can be said to be reduced test anxiety for students. The literature has shown that open-book exams cause less exam-based anxiety than closed-book exams (Atılgan et al., 2009; Gharib et al., 2012). Considering the negative academic connotations of the pandemic on student learning, it is seen as important that take-home exams may also lower levels of exam anxiety for students (Özdin & Bayrak Özdin, 2020). Decreasing exam anxiety may be also be considered as being even more supportive for students with lower achievement levels (Zoller & Ben-Chaim, 1989).

Higher content validity: In take-home exams, students are offered longer response times than for other types of online exam, due to the generally higher content validity of take-home exams (López et al., 2011). In this way, most educational objectives within the scope of a course can be measured.

Detailed feedback: Take-home exams provide the opportunity and support for students to organize their learning through detailed feedback. It is understood that feedback also increases student motivation towards lessons (Higgins et al., 2002), and encourages them to take responsibility for their learning; both of which can help to support students' success in distance education.

Considering its potential benefits, a well-structured take-home exam can be a very effective method when applied within the distance education context. However, at this point, it is important to consider which subjects or educational targets may be appropriately assessed. Subjects such as research methods and statistics are very much suited to the take-home format of exams, since they may provide the opportunity for students to use their knowledge in well-defined problem situations and to create a research environment themselves from various sources. From a test security perspective, take-home exams offer certain advantages. As previously stated, test security has become a subject of significant discussion in the realms of distance education. Controlling and monitoring students using the latest technology such as 360° video capturing around online test-takers and the use of biometrics (e.g., fingerprint scans, optic-retinal tests, facial recognition), or analyzing keystroke patterns are some of the available high-tech solutions that can be applied in order to prevent instances of cheating or plagiarism (Harmon et al., 2010; Howell et al., 2009; Sullivan, 2016). However, the application of these types of high-tech solution are not that common, yet have the potential to be much more common in the near future. However, the use of such control mechanisms, which aim to control and monitor students technologically during online exams, may lead to additional stress on those considered as "dishonest" or a "cheater." The effect of this view on student motivation and learning may be the subject of future studies in this area. Similarly, Butler-Henderson and Crawford (2020) reported in their systematic review of online examinations that the literature focuses more on the technical aspects rather than the pedagogy of online exams. As technology evolves, new assessment tools can be developed, but it is always possible to create appropriate measurement conditions by taking

advantage of the strengths of certain measurement methods, regardless of their technological application. The use of take-home exams, which have the benefit of high test security and are considered to result in reduced anxiety, in measuring students' high-level skills, may reduce some of the aforementioned limitations. In this respect, the current research is considered significant as it emphasizes the importance of high-security assessment in distance education through well-designed assessment tools.

The purpose of the current study is to present an example of the take-home method used in higher education assessment during the COVID-19 pandemic using case study methodology, and to provide empirical evidence about how this method is perceived by students (as test-takers). Within the framework of this purpose, answers to the following research questions were sought:

- What are students' perceptions about the quality of assessment using take-home exams?

- What are the views and preferences of students regarding the effect of take-home exams on their learning?

2. Methodology

A case is actually a complex phenomenon which has a specific definition as well as combined and well-described procedures and limits that serve a specific purpose or aim (Stake, 1995). Case studies, which are mostly qualitative in nature, aim to fully describe and offer detailed analyses of a limited process or period such as a program, a classroom event, a group of people, or a unique subject or happening (Merriam, 1998). Case studies generally focus on unique cases in order to answer and explain the "how" and/or "why" academic questions (Yin, 2002).

Similarly, the current study aims to explore how a specific assessment tool, "take-home exams," can be employed as a formative assessment tool in a specific learning context (remote assessment in distance education), and how participants react to this unique case. As the pandemic continues to limit the use of conservative assessment tools, and instructors also look for reliable and valid means and methods of measurement, the researchers of the current study sought to design a specific case study in order to offer a viable solution. The current research employed case study methodology in order to explain how a local and unique practice of take-home exams in distance education is used, and how the participants perceived its effectiveness.

2.1. Study Group

The current study was conducted with students enrolled to a Basic Statistics course at Faculty of Education in Turkey. In total, there were 64 students registered to the course and all received a take-home exam for their mid-term evaluation. Of the 64 students, 43 volunteered to complete the data collection tool and to state their opinion about the evaluation method applied in the course. The 43 university students (31 female, 12 male) were attending a mid-sized state university in Turkey, and were studying in their second or third grade (37 were 2nd graders, six were 3rd graders). All of the students were aged between 20 and 23 years old. The data were collected via an electronic form, with answers given anonymously in order to ensure sincere participant views were collected, with only their gender and grade level recorded.

2.2. Procedure

The research context for the study was an introductory course in statistics. The course was offered to undergraduate students of a mid-sized state university in Turkey. All of the course content was delivered through the distance education medium, with synchronous weekly lessons and asynchronous activities used as additional studies. Microsoft Teams was the platform used for all of the instructional activities, including live lessons, assignments, the sharing of course material, announcements, and both student-student and student-instructor communication.

The exam date and start time was announced in advance to the students (participants), and the take-home exams were uploaded to Microsoft Teams prior to the set exam hour. The participants were then able to access the exam document at the predetermined exam hour, and were given 14 hours to respond. The course instructor was available online throughout the exam hours, and replied to student queries regarding the exam through instant messaging. Details about the procedure are as follows.

2.2.1. Developing take-home exam

Exams such as take-home, open-book, or open-web, where students have the opportunity to access different resources, are key to measuring the high-level skills of students (Atılgan et al., 2009). However, the probability of test-taker cheating may increase as students can easily find answers from different sources. For this reason, such exams should include items that cannot be answered simply, but require a unique and often long answer (Butler-Henderson & Crawford, 2020; Mohanna & Patel, 2016). This basic principle has also been taken into consideration in the development of take-home exams. The literature reports that the use of take-home exams is considered more appropriate for fields/subjects such as mathematics, science, and statistics (Atılgan et al., 2009). In the current study's Basic Statistics course, the students were asked to create their own dataset and then to perform their analysis on the created dataset. In this case, 64 separate datasets were used by 64 students, enabling them to produce original and unique results through each revealing their own dataset. English language translations of some of the take-home exam items are presented in Annex 1.

2.2.2. Use of take-home exam

Since the higher education institution to which the participants were affiliated in the current study used Microsoft Teams as the main distance education platform, the MS Team's assignment tool was employed for the take-home exam. The various technical features of each learning management system can result in e-assessments being easier or more difficult (Butler-Henderson & Crawford, 2020; Seow et al., 2014). The basic features of MS Team's assignment tool in terms of take-home exams are:

1. Uploading the exam title and instructions (uploading files as necessary)

2. Setting the date and time for the exam start and finish

3. Creating a rubric for scoring

When take-home exam is sent out to the students enrolled to a course, notifications are sent direct to the user (student) accounts. When students receive the exam, they can look at the exam instructions and the developed rubric for scoring. Therefore, students can understand the assessment criteria and submit their answers within the framework of the predetermined assessment criteria. In the current study, the participant students were asked to submit their responses within a set 14-hour (08:00-22:00) window considering the active study time.

2.2.3. Scoring and Feedback

Different holistic rubrics were used for each item in scoring the take-home exam. In an analytical rubric, various dimensions of performance are scored separately (Kutlu et al., 2008). However, as separate criteria were created for each item, the use of an item-based rubric was considered to be more appropriate. A 5-point rating rubric was created for each item of take-home exam. Table 3 presents a sample rubric created in MS Teams.

Table 3.

Holistic rubric in MS teams (Sample Item-Interpretation of distribution of test scores)

Item	Achievement level / Criterion				
	1	**2**	**3**	**4**	**5**
Explain normality of distribution of test scores (10 pts)	Correct interpretation with a single statement and with no source detailed (mean-mode-median; histogram)	Distribution interpreted via histogram plot or mean-mode-median agreement	Distribution interpreted via histogram plot and mean-mode-median agreement	Distribution interpreted via histogram plot, mean-mode-median agreement, and skewness-kurtosis coefficients	Distribution interpreted via histogram plot, mean-mode-median closeness, and skewness-kurtosis coefficients. Group success evaluated according to the distribution.

As shown in the example in Table 3, each item was scored using a 5-point rating. The graded score was decided separately by the two researchers. Thus, it was possible to determine the interrater reliability for the total scores by using the Krippendorff alpha technique (Bıkmaz Bilgen & Doğan, 2017). The interrater reliability was found to be .89, which Krippendorff (1995) defined as high reliability (.80 or above). The researchers met, discussed, and rescored answers where there was no initial agreement until a consensus was reached. Histogram and descriptive statistics of the participants regarding take-home exam results are presented in Figure 1.
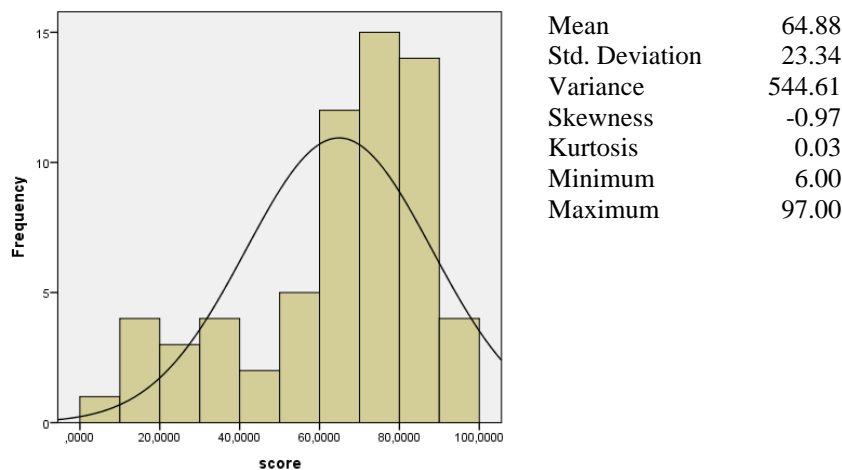

Mean	64.88
Std. Deviation	23.34
Variance	544.61
Skewness	-0.97
Kurtosis	0.03
Minimum	6.00
Maximum	97.00

Fig 1. Histogram and Descriptive Statistics of Take-Home Exam Results

When Figure 2 and descriptive statistics were examined, mean score shows participants' average of the achievement is above the middle score. As a supporting result, distribution of the scores is skewed to left, without distorting normality. Besides, the group is heterogeneous in terms of achievement scores regarding standard deviation (S = 23.34).

MS Teams offers a functional environment for take-home exams with the aforementioned capabilities. Students can readily access and read the instructor's feedback entered on an exam paper or feedback tool. It is also possible for students to make revisions according to the feedback they received. Where permitted by the instructor, students can revise and resubmit their answers. In Figure 2, student paper (1), instructor feedback on student paper (2), overall feedback (3) and rubric for scoring (4) were presented.
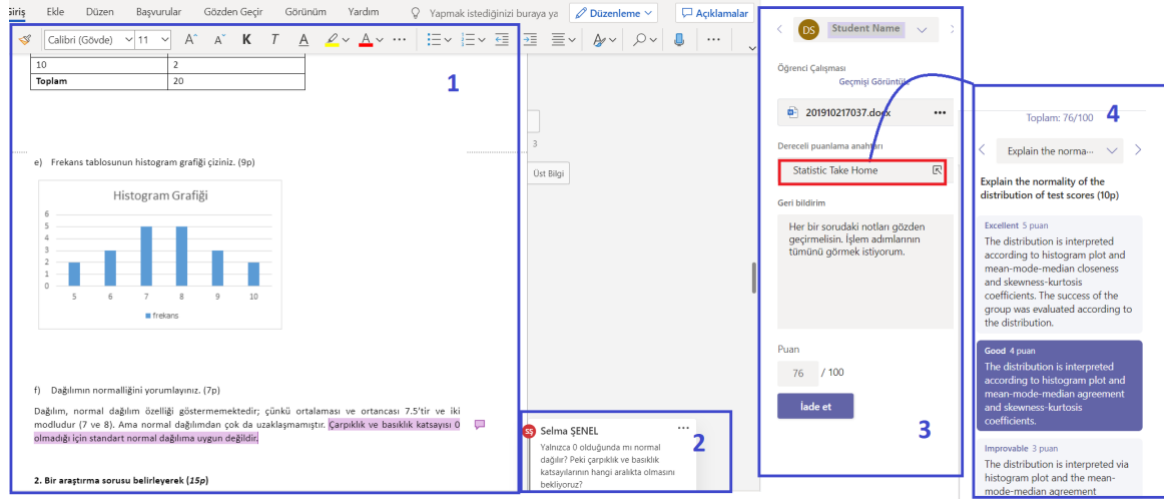
Fig 2. Scoring and feedback on MS Teams

The steps followed in scoring and feedback on MS Teams are as follows.

> 1.Scoring with 5-point rating without downloading the document (Fig 2-1)
>
> 2.Writing explanations (feedback) on students' paper (Fig 2-2)
>
> 3.Entering additional textual feedback for each item via MS Teams feedback tool
>
> 4.Providing overall feedback about the total of the take-home exam via MS Teams feedback tool (Fig 2-3)
>
> 5.Rubric for each item and automatic total scoring (Fig 2-4)
>
> 6.Returning results to students to review the scoring and feedback given

As can be seen in Figure 2, students can see scores they received for each item as well as their total score. In addition, students can review feedback entered for any of their responses and also read the additional or overall feedback on the exam paper. These features also afford an important level of convenience for faculty members in terms of exam scoring, feedback, and storage.

2.3. Data Collection Tools

There are two data collection tools used in this study. These tools are presented to participants in one form. This form was sent to participants electronically. Details of the data collection tools employed in the current study are as follows:

2.3.1. Students' perception about the quality of assessment with take-home exams

In order to determine the perceptions of university students regarding the quality of measurement and evaluation applied in their courses, the 11-item, single-dimension, 5-point, Likert-type instrument developed by Senel and Senel (2021) was used. While the maximum score obtainable from the scale is 55, the minimum score is 11. Senel and Senel (2021) presented validity evidence by undertaking a trial application with 486 students from various different faculties and departments. The variance explained by the instrument amounted to 55.43%. The Cronbach Alpha internal consistency coefficient of the instrument was originally calculated as .93, and .91 for the current study.

2.3.2. Views and preferences of students about take-home exams

Seven questions were prepared in order to elicit the views of the participant students regarding their use of take-home exam method. Through these questions, the aim was to collect information about how much the specific objectives targeted in the current study were achieved. For example, the limitation of only being able to answer take-home exams during daytime hours (0800-2200) was expected to increase the

cooperation of the test-takers (students). During the exam hours, it was considered that the students would be awake and focused on the exam. In addition, assessment methods aimed at evaluating high-level skills are expected to route students towards study methods appropriate for these skills. The current study's participants were asked whether or not they found the take-home exam to be an effective assessment method in distance education, and about their preferences for take-home exams. The available question responses were arranged as a 5-point, Likert-type scale, with 1 = totally disagree, 2 = disagree, 3 = partially agree, 4 = agree, and 5 = strongly agree. Additionally, an open-ended question proposed to participants for enabling them to express further views about the unique experiences.

2.4. Collecting Data

All 64 students of the course were subject to a take-home exam. They were asked to share their opinions about the quality of the assessment through take-home exam, and for their views about take-home exams. It is important for students to voluntarily participate in academic studies in order that they respond openly and honestly. In the current study, although no personal information was recorded, a total of 43 students participated using the applied data collection tool, and analyses of the students' perceptions and opinions were then conducted according to their data.

3. Results

In this section, the participants' responses were analyzed according to the research questions of the study, and were therefore presented under two headings: the students' perceptions about the quality of the assessment with take-home exams, and the students' views and preferences about take-home exams.

3.1. Students' perception about the quality of assessment with take-home exams

A histogram graph of the students' perceptions about the quality of assessment with take-home exams is presented in Figure 3, together with the descriptive statistics.
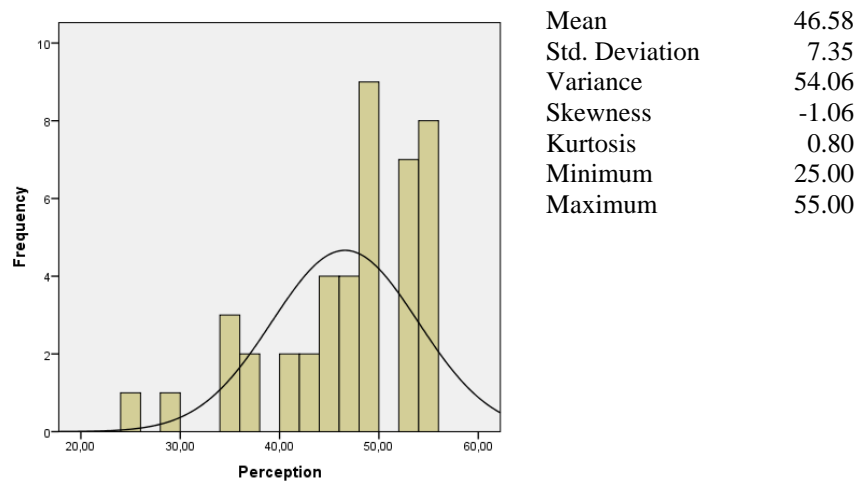

Mean	46.58
Std. Deviation	7.35
Variance	54.06
Skewness	-1.06
Kurtosis	0.80
Minimum	25.00
Maximum	55.00

Fig 3. Histogram of students' perceptions of quality of assessment of take-home exams

When the histogram graph with the normal distribution curve and descriptive statistics presented in Figure 3 are examined, it can be interpreted that the students' perception about the quality of the assessment is high ($\bar{X} = 46.58$, S = 7.35). Considering that the maximum score that can be obtained from the scale is 55, this value can be interpreted as an indicator of the students' positive perception regarding the take-home exam method. Senel and Senel (2021) found a 35.29 mean score (S = 11,00) of students' perceptions about the quality of measurement when applying the same scale in Turkish universities during the 2019-2020 spring semester (initial COVID-19 pandemic conditions). As can be seen, the perceived quality of the take-home

exam method measured in the current study was one-unit standard deviation higher. The mean ($\bar{X}$) and standard deviation (SD) values regarding the responses given to the scale items are presented in Table 4.

Table 4.

Item statistics about the participants' perceptions about the quality of assessment using take-home exams

No	Item	$\bar{X}$	SD
i1	Instructions and explanations in assessment / assignments were understandable and clear.	4.07	0.86
i2	I was informed about the evaluation and scoring (rubric and evaluation criteria etc.).	4.44	0.77
i3	Techniques used in the assessment were appropriate to the skills aimed at being acquired in the course.	4.40	0.85
i4	Assessment was aimed at measuring high-level skills (creative thinking, critical thinking, problem-solving, etc.).	4.35	0.87
i5	Learning effectiveness was increased through rapid assessment and feedback.	4.44	0.93
i6	Assessment results and feedback were instant.	3.81	1.03
i7	Feedback was detailed and instructive.	4.00	0.98
i8	Assessment practices did not allow cheating or plagiarism.	4.23	1.00
i9	Assessment results were reliable.	4.33	0.89
i10	Distinctiveness of test results was high.	4.02	0.99
i11	Assessment scope did not exceed beyond the provided content.	4.49	0.70

According to Table 4, the mean value of the items varied between 3.81 and 4.49, and the overall mean value was found to be 4.23. This result shows that the students' views were between agree and strongly agree. In their study, Senel and Senel (2021) found the mean value of the students' perceptions about the quality of assessment to be 3.17.

It can also be observed from Table 4 that the lowest scored item was "instant feedback" (i6). The take-home exam method is somewhat time-consuming compared to online tests, which predominantly consist of multiple-choice, short-answer, true-false, and matching item types. Within the scope of the current research, since each exam paper was scored by two separate raters, the process took 14 days for all the feedback to be given in full. This may have contributed to the lower quality perception about instant feedback. The highest mean scores were that the assessment scope did not exceed the scope of the course content ($\bar{X}_{i11} = 4.49$, SD=0.70), regarding the detailed information about how assessments would be made and the scoring ($\bar{X}_{i2} = 4.44$, SD=0.77), about how learning effectiveness was increased through rapid assessment and feedback provision ($\bar{X}_{i5} = 4.44$, SD=0.93), how the take-home exam was an appropriate method to assess the skills aimed to be acquired on the course ($\bar{X}_{i3} = 4.40$, SD=0.85), that assessment was aimed at measuring high-level skills ($\bar{X}_{i4} = 4.35$, SD=0.87), that the assessment results were deemed to be reliable ($\bar{X}_{i9} = 4.33$), and how the assessment practices did not allow for cheating or plagiarism ($\bar{X}_{i8} = 4.23$, SD=1.00).

3.2. Views and preferences of students regarding the effects of take-home exams on their learning

The mean and standard deviation values of the students' responses regarding the take-home exam method after the application, and the percentages for each answer category, are presented in Table 5.

Table 5.
Views and preferences of students about take-home exams

	Question	definitely disagree	disagree	partly agree	agree	definitely agree	$\bar{X}$	S
				% per response category				
Q1	Take-home exam assessment method supported my learning.	0.00	2.33	13.95	25.58	58.14	4.37	0.90
Q2	Take-home exam assessment method increased my motivation to the course.	0.00	11.63	4.65	46.51	37.21	4.09	0.95
Q3	I shaped my learning strategies according to the take-home exam and feedback received.	0.00	6.98	13.95	37.21	41.86	4.14	0.91
Q4	Limiting exam hours to working hours (08:00-22:00) helped me to maintain focus.	0.00	6.98	9.30	18.60	65.12	4.42	0.93
Q5	The take-home exam increased my course interaction with my peers	0.00	13.95	27.91	27.91	30.23	3.74	1.05
Q6	I think the take-home exam is an effective assessment method in distance education.	0.00	4.65	11.63	20.93	62.79	4.42	0.88
Q7	I would prefer take-home exams for other courses.	2.33	4.65	16.28	20.93	55.81	4.23	1.04

According to the student response statistics presented in Table 5, the mean score of all the items, except for the item ($\bar{X}_{Q5}$ = 3.74, SD=1.05) about take-home exams increasing peer interaction, was above 4.09. Although the take-home exam method leaves students open to using resources and to interact with each other, it is quite understandable that students may want to create their own unique answers considering the limited response timeframe. This may have contributed to the students' views about interaction and take-home exams. The most interesting finding from this part of the study is that none of the respondents choose "strongly disagree" regarding six of the seven items. The students reportedly found the take-home exam method to be an effective method for distance education ($\bar{X}_{Q6}$ = 4.42, SD=0.88), and they also indicated having a preference for take-home exams in other courses ($\bar{X}_{Q7}$ = 4.23, SD=1.04). In addition, the students replied positively that limiting exam hours to working hours enabled them to maintain their focus ($\bar{X}_{Q4}$ = 4.42, SD=0.93). Additionally, the students considered that the take-home exam method supported their learning ($\bar{X}_{Q1}$ = 4.37, SD=0.90), and shaped the learning strategies through feedback ($\bar{X}_{Q3}$ = 4.14, SD=0.91).

The students were asked an open-ended question at the end of the data collection tool regarding their views about the use of take-home exams as an assessment method in distance education. It was not an obligatory question, and seven of the students provided their views; some of which are reported in the following as direct quotations to support the quantitative data.

One of the participants talked about the COVID-19 pandemic and distance education, and having found take-home exams to be the assessment tool most appropriate for distance education. The participant mentioned issues of test security and the measuring of high-level skills when comparing take-home exams with other remote assessment methods that had been used.

> *Due to the pandemic conditions, we receive distance education and have unfortunately witnessed cheating in many online exams. Thanks to take-home exams, I both received a really challenging exam and felt that cheating had been prevented. I believe that take-home exams are the best method in distance education.*

Another participant emphasized the importance of feedback and how take-home exams helped learning through well-defined problems. Similarly, the participant compared take-home exams and online tests, and reported that in online tests they did not even remember the test items but that the take-home exam helped

them to learn through well-defined problem situations. Another issue participant stated is that exam instructions were very clear.

> *After completing a time-limited online test, I even forget the questions, but the fact that the take-home exam method is in the form of an assignment presents real scenarios, and the feedback helped to make it possible to learn in a more practical way. It was really important that the exam instructions were both clear and precise.*

One of the students drew attention to the technical benefits of take-home exams. Comparing take-home exams to other online assessment methods, the participant found take-home exams more convenient and relaxing. Time limitations and potential problems related with internet access may cause to feel high levels of exam anxiety for students. Take-home exams have potential to help students to feel more relaxed during remote assessment.

> *The take-home exam method eliminates the possibility of problems like Internet or power failure. It helps to make students feel very comfortable. Instant disruptions within online tests can pose big problems for students, i.e., when communication via the Internet was problematic. We have limited time and high exam anxiety in online tests.*

4. Discussion

The current study aimed to examine students' views about use of take-home exams in remote assessment. The COVID-19 pandemic forced educators into using distance education and remote assessment, which meant an increased need for both valid and reliable assessment methods. As a solution, the researchers opted for take-home exams as a remote assessment tool in a unique case, with the aim to provide empirical data about how students perceive the quality of assessment through take-home exams.

Results indicated that the students had a high perception about the issue of test security. As stated by Zoller and Ben-Chaim (1989), test security can be increased when well-defined open-ended items or tasks are developed to measure high-level skills. The current study's results showed that the students found the exam instructions to be both clear and helpful. Additionally, the literature suggests avoiding developing test/exam items that have concrete or definitive answers (Butler, 1988; Mohanna & Patel, 2016). In the case of the current study, each student created their own data and then performed analysis based on their unique dataset. This approach provided a significant advantage in the prevention of cheating and plagiarism. The literature reports that open-book exams, in which students have unlimited access to books, also have a higher degree of test security (Butler-Henderson & Crawford, 2020; Dawson, 2020; Sullivan, 2016). Participants of this study, similarly, reported higher perception about the security of the take-home exam as an assessment practices and they highly reported that this method did not allow cheating or plagiarism which is a common problem in online classes (Dendir & Maxwell, 2020). Additionally, participants found take-home exams reliable and distinctive as a remote assessment tool. This result is consistent with another result of this study that students would prefer take-home exams in other courses too.

One of the biggest advantages of take-home exams is its ability to measure high-level skills (Bengtsson, 2019). The results of the current study indicate that the participants perceived the take-home exam as an assessment tool that aims to measure high-level skills such as critical thinking and problem-solving. The literature also offers take-home exams as a formative assessment tool that may help to enhance and/or measure the high-skill levels of learners (López et al., 2011; Mohanna & Patel, 2016). Participants of this study showed high level of perception about the take-home assessment method was aimed at measuring high-level skills. One of the participants compared take-home exams and online tests expressing additional

views and stated that take-home exam presents real scenarios while he/she could not even remember the test items in online tests. Additionally, using problem situations in take-home exams can also help to prevent cheating, since cheating in take-home exams is considered to be a relatively minor problem as the aim is to measure higher taxonomy levels (Bengtsson, 2019).

Take-home exams provide a high level of content validity with a wider exam-hour timeframe (López et al., 2011). With no overriding time limit in take-home exams, most educational objectives can be tested through the use of well-defined items. According to the results of the current study, the participant students showed high levels of perception regarding the relationship between the scope of the assessment and the course content. Additionally, the students considered take-home exams to be an appropriate method of evaluating the skills aimed to be acquired from the Basic Statistics course. Atılgan et al. (2009) reported that subjects such as science, mathematics, and statistics are considered to be more appropriate for take-home exams.

In the current study, the take-home exam was used as a formative assessment tool, with the students able to access the feedback and comments from their instructor for each exam item. The students found the feedback they received to be both detailed and instructive; helping to enhance student-teacher interaction, which is a key indicator of effective distance education (Harper, 2018). Additionally, the students were able to see the evaluation criteria and scoring. As reported earlier, the study's results showed that the students have a high level of perception about their exam results, and found the take-home exam results to be reliable and distinctive. Actually, this result provides additional clues regarding the prevention of cheating since students (e.g., a group of close students) may feel a sense of injustice if they believed there was cheating in any part of the take-home exam.

Another promising result of this study is about the supportive role of take-home exams for learning. Take-home exams may enhance learning by presenting chance students to research, and apply gained skills within a real-time problem (Sullivan, 2016). Similar with findings of Hall (2001) participants of this case study reported highly positive views about this new assessment method supported their learning. Additionally, participants of this study reported that take-home exams increased their motivation towards course.

Online tests may cause text anxiety for test-takers (Woldeab & Brothen 2019). Potential for technical system problems such as lack of internet access or login failures, exam-related stress, use of online proctoring systems may create anxiety among test-takers (Ilgaz & Afacan Adanır, 2020). Besides, take-home exams may help students to feel more relaxed in online exams by reducing anxiety (Rich et al., 2014; Hall, 2001). Similarly, participants of this study reported that they feel more relaxed in take-home exams eliminating potential problems.

However, take-home exams are disadvantageous in terms of developing and scoring. During Covid-19 pandemic, all of the courses moved to distance education. Using take-home exams for all of the distance courses will be time consuming and may create heavy workload. Creating feedback for each item and student takes serious time. In this study, researchers scored each paper independently for inter-rater reliability and this scoring process took approximately 14 days. Students' moderate views about the instantaneity of the assessment results and feedback may be reasoned from this unintended delay.

The current research was designed as a case study, with the take-home exam designed as a remote assessment tool. Due to the COVID-19 pandemic, the participants were studying all of their courses online (Carr, 2020), and experienced various assessment methods from other faculty members on other courses. More research may be conducted on this area in order to compare remote assessment tools, with a broader framework established for the assessment of higher education students receiving instruction via distance education. The current study aimed to employ the take-home exam as a formative assessment tool.

However, the use of assignments, e-portfolios, and performance tasks are also formative assessment tools, which may also increase student-student and student-teacher interaction during the COVID-19 period of distance education. Researching the effectiveness of these various tools may help both practitioners and course/program designers to find new solutions that can offer valid and reliable forms of academic assessment.

5. Limitations

As with all studies, the current study has certain limitations. In total, 67 students were enrolled to the Basic Statistics course upon which the take-home exam was applied. However, since not all of the students volunteered to participate, the study was conducted with only 43 voluntary participants. Second, the feedback given in response to the students' exam answers were provided 14 days after the exam day. With two separate coders evaluating the students' answers and then providing the instructor feedback, there was some debate between the coders with regards to scoring and feedback, and this additional workload led to the unanticipated delay in providing finalized feedback to the students. This may be considered a limitation as the literature clearly emphasizes the importance of feedback being given instantaneously (Nutbrown et al., 2016). Researchers used MS Teams for developing and applying take-home exams. MS Teams is a powerful tool for preparing take-home exams. On the other hand, there are numerous learning management systems used in distance education and technical capabilities of these tools may vary. Researchers and practitioners must reconsider the technical capabilities of online tools developing take-home exams.

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Annex 1.
Basic Statistic Take-Home Exam Example Items

Important Note: Students must provide explanations for each calculation steps. Results must be entered in the spaces provided.

The table (below) is for a double-scored achievement test result, with 10 items applied in a class ($n = 20$); where i1-i10 = item numbers and s1-s20 = student numbers.

Create your own unique dataset by entering test data as 1 = correct and 0 = incorrect (see first cells).

a) Calculate students' total test scores and enter in "Test Score" column. Calculate the "z" and "t" scores and enter in the appropriate columns.

b) Calculate central trend statistics and standard deviation, range, variance, and quarter deviation for the test scores, and enter to the appropriate shaded cells.

	i1	i2	i3	i4	i5	i6	i7	i8	i9	i10	Test score	z-score	t-score
s1	0	1	.	.	.	.	.	.	.	.			
s2	.	.	.	.	.	.	.	.	.	.			
s3	.	.	.	.	.	.	.	.	.	.			
s4	.	.	.	.	.	.	.	.	.	.			
s5	.	.	.	.	.	.	.	.	.	.			
s6	.	.	.	.	.	.	.	.	.	.			
s7	.	.	.	.	.	.	.	.	.	.			
s8	.	.	.	.	.	.	.	.	.	.			
s9	.	.	.	.	.	.	.	.	.	.			
s10	.	.	.	.	.	.	.	.	.	.			
s11	.	.	.	.	.	.	.	.	.	.			
s12	.	.	.	.	.	.	.	.	.	.			
s13	.	.	.	.	.	.	.	.	.	.			
s14	.	.	.	.	.	.	.	.	.	.			
s15	.	.	.	.	.	.	.	.	.	.			
s16	.	.	.	.	.	.	.	.	.	.			
s17	.	.	.	.	.	.	.	.	.	.			
s18	.	.	.	.	.	.	.	.	.	.			
s19	.	.	.	.	.	.	.	.	.	.			
s20	.	.	.	.	.	.	.	.	.	.			
Mean			*S*										
Mod			**Variance**										
Median			**Quarter Deviation**										
Range													

c) Interpret the test results (in terms of distribution and trend) according to the statistics.
d) Create a frequency table of the data.
e) Draw a histogram graph of the frequency table.
f) Interpret the normality of the test score distribution.