Improving E-Assessment Based on University Students' Experiences

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ABSTRACT
The application of electronic assessments (e-assessment) has become inevitable with the expansion of distance education, and learners' perceptions should be considered when designers improve the system to meet their needs and facilitate their acceptance of the system. This mixed descriptive study investigated university students' perceptions about e-assessment system. Data were collected from 308 students at King Saud University during the second semester of 2021, by using a questionnaire that consisted of 34 Likert scale items and two open-ended questions on students' opinions. The results showed the suitability of e-assessment to the university courses, and the importance of rendering guidance to students before the e-exam by providing a user manual, mock exam, and furnishing clear instructions; ensuring flexibility of use; supplying quick academic and technical support during the e-test; and providing immediate feedback to increase students' motivation and learning retention. The findings highlighted students' concerns regarding the type of exam questions, cheating, and techniques of monitoring and verifying their identities. These findings expected to guide administrators, decision makers, researchers, and system developers to design or customize some features of assessment systems for the achieving best practice of evaluation and measurement of higher education students.
Keywords: Distance Learning, E-Testing, Online Assessment, Online Feedback, Online Learning

RESEARCH BACKGROUND
The concept of Assessment
There is a growing interest in the field of education systems to identify indicators and information that help teachers in developing curricula and designing activities and tools to improve students' learning. Assessment is an essential component (Crisp et al., 2016) and a core element in educational systems (Alsadoon, 2017) that provides a performance indicator for both students and teachers (Marriott, 2009). The assessment of learning outcomes is a major concern of educational institutions (Soeiro et al., 2015) for various reasons. First, assessments help us to understand the learners' performance as related to stated objectives (Dabbagh et al., 2018), thus students will know when they are approaching their identified learning goals and teachers will know whether their teaching methods and approaches are appropriate for students (Alsadoon, 2017). Assessment data can be used to reflect the quality of the learning materials, especially when the majority of students do not attain the stated objectives (Dabbagh et al., 2018). Indeed, teachers and learning institutions may modify learning materials and methods based on information gained from assessment. Assessment helps institutions to provide evidence that prove students' competencies for educational policy makers, parents, benefactors, and employers who offer jobs to graduates from their institutions (Alsadoon, 2017). In addition, assessments can motivate learners when their teachers encourage them to attain a particular level (Booth, 2019) that is, they know their learning is monitored through assessments. Therefore, it is imperative to conduct studies to determine the reality of using assessments in education and to understand the students' perspective to develop recommendations that contribute to achieving the assessment objectives.

Assessment is defined as "the process of collecting data to determine the extent to which a person's performance or product or program has met its intended objectives" (Dabbagh et al., 2018, p.173). Gaytan and McEwen (2007) confirmed that it is important for educators to predetermine the purpose of assessment, measured criteria, and desired outcomes to achieve meaningful assessment.

E-assessment: Opportunities and Challenges
The use of technology has led to significant changes and improvement in higher education environments (Alruwais et al, 2018; Crisp et al., 2016) and one of the changes influenced by technology in education is assessment (Rostaminezhad, 2019). The increasing number of students aligning with limited seats in higher education, improvement of educational technology, and accreditation of many programs in universities have resulted in widespread online learning. This new trend in electronic learning (e-learning) necessitates the usage of more efficient exam tools, such as electronic assessment (e-assessment) tools instead of traditional paper-based exams (Kuikka et al., 2014). E-assessment can help in creating innovative assessment practices that augment students' learning motivation and engagement (Marriott, 2009; Pham, 2022). According to Soeiro et al. (2015), the learning components are very complex, and they include defining adequate assessment practices that address the expected outcomes from the students. However, using online learning assessment brings an additional level of complexity to the process.

Al-Azawei et al. (2019) argue that e-assessment is much more effective than traditional assessment methods, and this argument is only applied when it is well-designed and well-applied.

Distant online courses use e-assessment to gauge students' skills or knowledge from a distance through computers and this makes the results available electronically quickly, and stored in electronic personal records (Alruwais et al., 2018; James, 2016; Kassem et al., 2015). Alruwais et al. (2018) argue that in most studies e-assessment has been identified as an electronic assessment or computer-based assessment where all its procedures from the beginning to end must be carried out electronically, which implies that the test design, execution, response recording, and delivery of feedback should be completed electronically.

E-assessment has many advantages: flexibility of conducting exams with regard to location and timing, lower cost over traditional paper assessment, and reduced efforts and lesser pressure on instructors as it is easier to review questions and create exams from question bank, and automatically grade students' responses of the objective questions type. The embedded multimedia (e.g., images, voices, animations) in test questions can provide interactive and engaging assessments and it is possible to give immediate feedback (Gaytan and McEwen, 2007; Gogno, 2014; James, 2016). In addition, Kassem et al. (2015) found that providing formative online assessment is an efficient means that improves students' self-learning skills, learning outcomes, and information retention. Furthermore, e-assessment can be used as a substitute in emergency situations that prevent physical presence, such as the COVID-19 pandemic. Gogno (2014) argues that online tests are more accessible and convenient for students with disabilities as they can use computers with assistive technologies. While it is difficult to prevent cheating in e-exams, teachers may use randomize questions settings, impose time limits to take exams, and restrict attempts (Gogno,2014) that are executable in all e-assessment systems.

James (2016) reported that there are a wide range of e-assessment-related activities in education including the submission of online essays to the fully automated online self-assessment with instant feedback. Jordan (2013, p. 100) confirmed that "we should use computers to do what they do best, relieving human markers of some of the drudgery of marking and freeing up time for them to assess what they and only they can assess with authenticity." Gaytan and McEwen (2007) reported that faculty and students found the use of projects/portfolios, self-assessment, threaded discussions, and the use of rubrics in online courses to be very effective.

Although using e-assessment is considered to be crucial in distance learning, there are some challenges in its design and implementation. Tarricone and Newhouse (2016) argue that the teachers' expertise in the design and application of the instrument and their judgment and evidence of students' performance are considered to be the main factors that influence assessment reliability. In addition, Crisp et al. (2016) found that there is significant interest in authentic assessment tasks and such new approaches of e-assessment are necessary to assess higher-level cognitive skills that cannot be assessed using selected-response formats. This means that some skills need to be assessed using constructed-response, where the students write their answers (e.g., essays) and teachers read the answers before scoring them. Jordan (2013, p. 100) clarifies that "there are some assessed tasks (e.g., experimental reports, essays, proofs) that present considerable challenges for machine marking." Hillier (2014) confirmed this and reported that students are cautiously optimistic about being able to type their answers in e-exams.

Dabbagh et al. (2018, p. 176) argue that complex learning outcomes (e.g., assessing projects that require data collection, followed by conducting experiments, and then creating reports about the work) are more difficult to assess than simples ones (e.g., recall and recognition tasks). In general, complex learning outcomes need to be assessed by multiple tools of assessment such as tests and quiz tools, digital portfolio systems, student response systems (e.g., clickers), or immersive technologies (p. 177). A study conducted at the Centre for Schooling and Learning Technologies (CSaLT), Edith Cowan University, Perth, Western Australia found that technologies were insufficiently used for high-stakes assessment in tertiary entrance, although it is available in educational institutions (Tarricone and Newhouse, 2016).

Rostaminezhad (2019) raises some questions that need to be investigated through research: when is instant feedback in e-assessment good for students and when does it have negative effects, such as increased exam anxiety? Furthermore, proctoring students during the test and ensuring their identities are important issues that influence teachers' and institutions' perceptions about e-assessment systems. Adebayo and Abdulhamid (2014) found that cheating can happen in e-exams and there is a possibility for technical problems owing to network failure or computer malfunctions.

E-assessment plays a significant role in higher education. It has been widely used at King Saud University (KSU) in recent years, especially with the launch of distance learning courses in 2018/2019 at the College of Education, Arts, Sports, Business Administration, Tourism, and Archaeology, Medicine, and Nursing. During the COVID-19 pandemic, the number of final electronic exams conducted remotely in the second semester (April/May) of 2021 using only the Blackboard learning management system was 5559, and the number of students who submitted the e-test at that time was 113,475 (Deanship of e-Transaction and Communication, 2021).

E-assessment in King Saud University

Professors at KSU may use different e-assessment systems, not only LMS tools, including free and commercial systems. Nearly all of these e-test systems have a common set of features that include true/false questions, multiple choice questions, essay questions that need key words to match the students' answers, options to attach answer files, and others. In addition, most systems allow professors to create a question bank according to the difficulty of each question, having the option to reorder the questions for each student randomly, and/or randomly assigning multiple-choice questions for each student. Al-Smadi et al. (2009) argue that when defining the services of the electronic system, it is important to know that there is no "best practice" for performing it; instead, one should be concerned about how to implement the services, focusing more on the functionality of the service and how it functions in conjunction with other services.

This implies that when using an external e-assessment system, it is important to consider how to integrate the e-assessment system with other university systems, especially the academic system that saves students' records and their grades as well as the LMS. Some colleges under KSU prefer to integrate commercial features into the Blackboard LMS, in order to proctor students. However, proctoring students seems to be challenging as many students are confused about opening the camera during the exam and about using artificial intelligence technology as an alternative to human monitoring. Adegbija (2012) recommended the importance of training students and faculties to achieve the best results. Alasfor (2021) concluded that researchers and practitioners need to pay attention to conservative cultures when they employ distance education in segregated campuses (such as in Saudi Arabia). Some female students may be dissatisfied and not agree to showing their faces during the exam, especially when an instructor of a different gender may need to check their identity or return to the recording video to ensure that there has been no cheating.

Despite the keenness of KSU to provide support and assistance through the Deanship of e-Transaction and Communication, which continues to publish guidance and advice to ensure the smooth running of e-exams, the dean received many complaints regarding technical problems. For example, the number of requests that the Deanship received during the final electronic exams of the second semester of 2021 (April/May) included 237 calls regarding LMS technical problems and 207 chats from 45 teachers and 41 students (Deanship of e-Transaction and Communication).

In this regard, the current study aimed to investigate students' perceptions about the effectiveness of providing different forms of guidance before the e-exam, their opinions regarding the features of e-assessment system, their attitudes of e-assessment in comparison with the traditional ones, and their attitudes toward verifying the students' identity and monitoring them during the e-assessment. Based on the technology acceptance model, students' attitudes and their confidence have a significant impact on their acceptance of each technology (Rostaminezhad, 2019), and this could also affect their performance. Moreover, many previous studies (Gaytan and McEwen, 2007; Kuikka et al, 2014; Alkharusi, and Alwahaibi, 2021) recommended the importance of using e-assessment in educational institutions, the need for further research to explore their efficiency, and the best techniques for assessment in an online environment by examining students' attitudes. This is an important issue considering the expansion of distance learning courses, whether for graduate studies or diplomas at KSU. Khare and Lam (2008 cited in James, 2016) noted that the academic literature in e-learning gives more focus to teaching pedagogies while there is little attention on e-assessment. To the best of my knowledge, this is the first study investigating students' perceptions on e-assessment conducted on a sample from a whole university using both quantitative and qualitative methods, that help in improving the e-assessment systems and customizing services to satisfy students' needs. Indeed, the results of this study can guide administrators, decision makers, researchers, and system developers to design or customize some features of assessment systems for the achieving best practice of evaluation and measurement of higher education students.

METHODOLOGY

This study aimed to understand the students' perceptions about the e-assessment, make recommendations that could improve it, and maximize its efficiency among students in the university. It is important to study students' perceptions to determine the services that suit learners and generally higher education students, as one of the advantages of e-assessment systems is customizing services based on beneficiary needs. Therefore, this research sought to answer the following questions:

1. What are the students' perceptions regarding the importance of providing different forms of guidance before the e-exam?
2. What are the students' opinions regarding the features that they need in the e-assessment system?
3. What are the students' attitudes toward the feedback of the e-test?
4. What are the students' attitudes toward their experience of e-assessment in comparison with traditional ones?

5. What are the students' attitudes toward the techniques that can be used for verifying their identity and monitoring them during the e-assessment?

To answer the research questions, a mixed descriptive research method was used. According to Lodico et al. (2010) descriptive research studies participants' perceptions, attitudes, behaviors, and beliefs regarding particular issues or trends. Data were collected from students by using an online questionnaire, and according to Wellington (2015), the questionnaire is the most commonly used format for giving an overview or a "wide picture."

The study was conducted during the final exam of the second semester (April/May) of 2021 among undergraduate and postgraduate students at KSU in Saudi Arabia. All students were subjected to e-assessment owing to the CO-VID-19 lockdown. The sample included female and male students in KSU, and their ages were eighteen and above. The population of the study included 63,891 students (SPA, 2021); and 308 responses have received. The online questionnaire was constructed based on existing literature; it consisted of 34 closed-ended questions related to students' perceptions about their experience of e-assessment and two open-ended questions. The first 34 closed-ended questionnaire items were based on a 5-point Likert scale ranging from totally disagree (1) to totally agree (5). These items were related to students' perceptions regarding the importance of providing different forms of guidance, features that they need in e-assessment system, feedback, techniques of monitoring and verifying their identity, and their experience of e-assessment in comparison with the traditional ones. The participating students were supposed to tick the level they believe was appropriate (see appendix A).

To measure the reliability and validity of the questionnaire, a pilot test was conducted with 73 undergraduate students in KSU after their e-exam, prior to the full distribution of the survey to all students. The results revealed that the alpha coefficient values for all parts of the questionnaire parts were between (0.882) to (0.966), and it was (0.977) for the overall questionnaire, which is considered to be very high. The internal consistency of the questionnaire was calculated by using the Pearson correlation, and the results revealed that all items in the questionnaire were statistically significant and valid to be used for this study. In addition, this study provides sufficient information about the e-assessment in KSU, research design, data findings, and analysis to enable any individual to decide the possibility of transferring the findings and conclusion to other settings or contexts, or even transfer them to the same context at any other time (Korstjens and Moser, 2018; Lincoln and Guba, 1985)

The data were collected through the distribution of the online questionnaire link to the university email addresses of students once my research was approved by the Standing Committee for Scientific Research Ethics at KSU (Ref No: KSU-HE-21-346). Descriptive statistics, including percentages, and means, were used to present the numerical data of each item (see appendix A) in conjunction with the application of statistical techniques as a "sense making" to the non-compulsory open-ended questions, to measure the students' perceptions and gain insight into the effectiveness of e-assessment and provide recommendations that could improve the e- assessment systems.

RESULTS

The average percentages of each question areas, and means are presented in the table below.

Table 1: Students' Perceptions of E-assessment

Areas	Strongly agree (%)	Agree (%)	Neutral (%)	Disagree (%)	Strongly disagree (%)	Mean
The Importance of Providing Different Forms of Guidance before the E-exam	46	25	12	10	7	4.02
The Needed Features in E-assessment System	64	21	8	4	3	4.36
The Feedback of the E-test	64	19	11	4	2	4.42
E-assessment in Comparison with the Traditional Tests	40	24	14	11	11	3.95
Monitoring and Verifying Identity Techniques	28	18	15	15	24	3.66

The majority of students admitted that providing different forms of guidance before the e-exam is important. 46% of responses strongly agreed, and 25% agreed (Figure 1). The highest important guidance that respondents "strongly agree" on was providing a user manual showing how to solve the test questions.
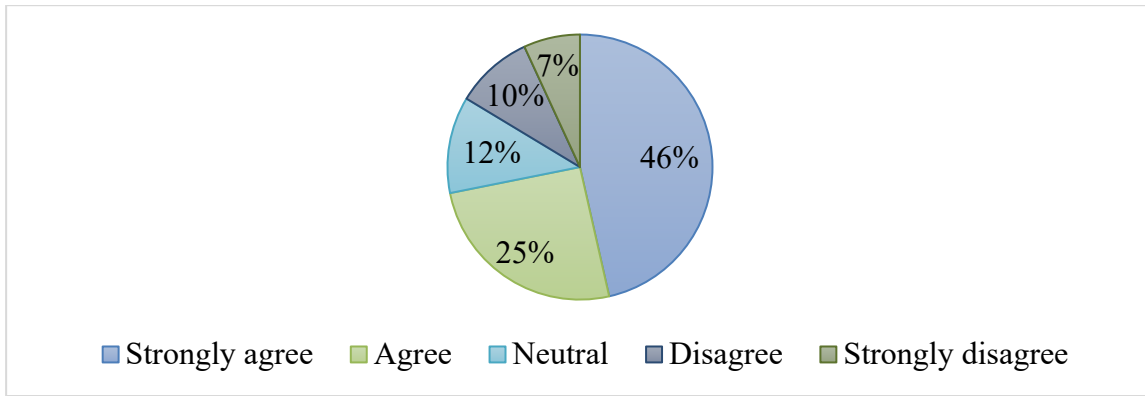
Figure 1: The percentage level of agreement with the importance of providing different forms of guidance

It seems that students prefer to receive instructions through infographics; the open comments from students confirm their need for a user manual describing the test format and how to move onto the next question. One of students commented, "I was afraid when I press the Enter button to move to the next row, that my exam is submitted!". Other students believe that mock exams are highly important as it makes them familiar with e-exam and reduce stress. Interestingly, some students commented in the open questions that the professors need to take training sessions to efficiently use the exam built-in tool in the Blackboard.

Regarding the needed features in e-assessment system, respondents' answers were generally "strongly agree" with general mean 4.36 to the survey items. About 85% strongly agreed or agreed (Figure 2).
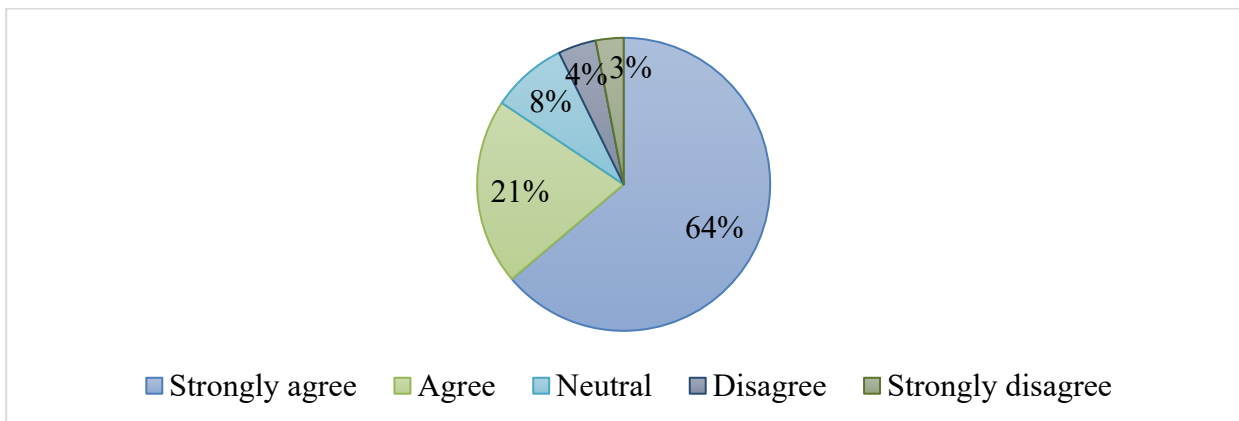

Figure 2: The percentage level of agreement with the needed features in e-assessment system

The most important three features that the e-assessment system should include based on students' perceptions were: providing clear instructions including: the number of questions, how to answer them, and the test duration; the system saves the answers automatically, in the event of an Internet failure; the high flexibility and ease of use. Some students explained the flexibility they need, that is, to attend the exam at their time of preference during the day and in the event of a technical glitch, to complete the exam in the same duration after the problem is fixed, to use the system in any electronic device (mobile phones, laptops, iPad, etc.), to move between questions, and having the option to write comments. They suggested that the system shows the professors the reason for students' disconnection (disconnected by the user or by the system), and this would increase the fairness of the system. Some students found difficulties with regard to the Arabic language in the e-assessment system—when the professors wrote questions that combined both Arabic and English texts, the words of the sentence appeared in incorrect order.

Other suggestions from students included the following: option to mark the questions that students need to return to; give alarms when the students pass half the exam duration; provide calculator and other supplementary tools; ease of communicating with teachers during the exam and having a voice chat with them to clarify some questions when needed; and the option to write notes deliver them to teachers.

Regarding the feedback of E-test, students' responses were generally "strongly agree" (with general mean 4.42), and the majority confirmed that that getting immediate feedback helps them to retain the information and motivates them. Only about 4% disagreed and 2% strongly disagreed (**Figure 3**). The top two feedback styles they preferred

were: the appearance of the total score immediately after completing the test; and providing detailed explanation about the wrong answers. Students commented that the essay questions are corrected by professors in most situations, and this is an area that needs improvement because automatic corrections do not provide detailed explanations regarding the students' mistake.
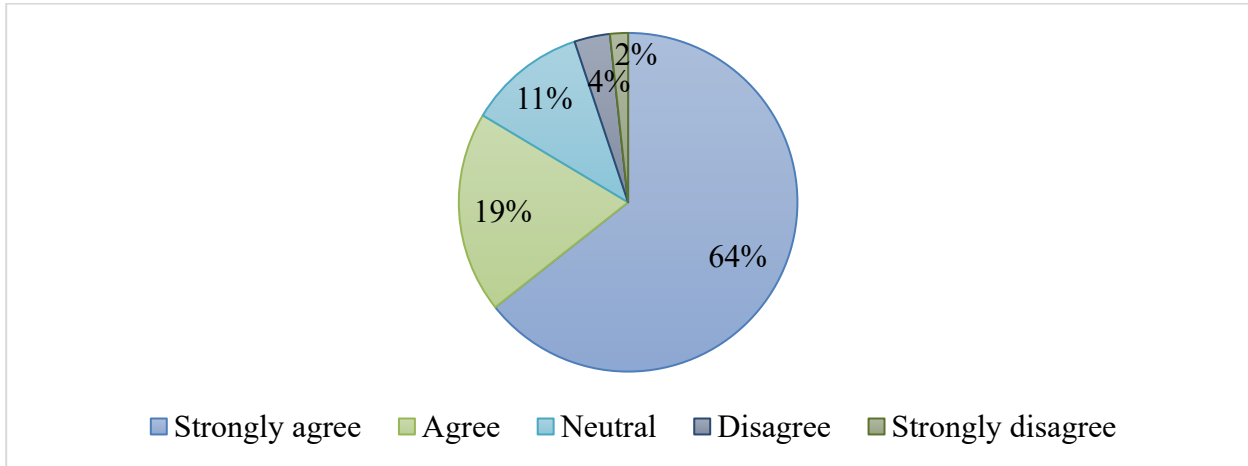

Figure 3: The percentage level of agreement with the feedback of the E-test

More than half (64%) of the students admitted that they were more comfortable using e-tests than traditional ones (**Figure 4**), and some of them commented that taking an exam from home is more psychologically comfortable.
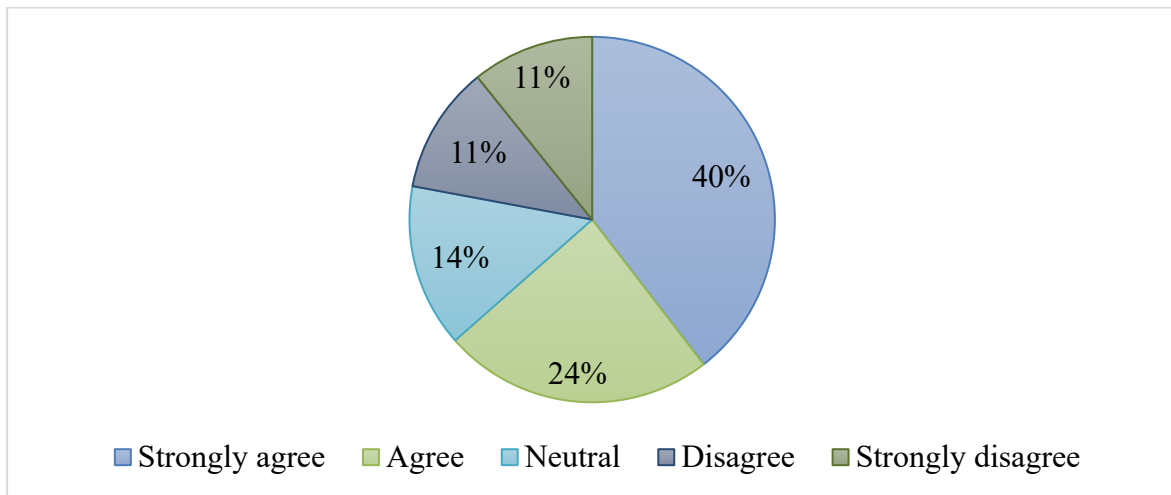

Figure 4: The percentage level of agreement with E-assessment in comparison with the traditional tests

Interestingly, the majority of students (over 79%) found that the types of questions in e-exam were in line with the learning objectives of the course, and over 56% believed that their achievement level in the e-test is not different from that in the traditional test. However, further examination of students' comments revealed complaints regarding the inappropriate nature of questions with respect to subjects. They commented that some professors used only multiple-choice questions while their subjects necessitate including questions regarding their perceptions and writing explanations; professors also decreased the exam duration to prevent cheating. Others commented that some professors reduce the duration, not allowing students to return to the previous questions to prevent cheating, and this negatively affects the "fairness" concept of e-tests.

Furthermore, the results of monitoring and verifying identity techniques showed a 46% total percentage of agreement among students with the survey statements of this area, and 15% of students did not either disagree or agree, while 39% disagreed (Figure 5). Students' responses revealed that they strongly agreed to verifying their identity by logging into the system using their university email address and password, and they also agreed to taking the audio attendance by using a microphone or by being present in a simultaneous session with the course professor during the exam, with the possibility of calling them by their names.
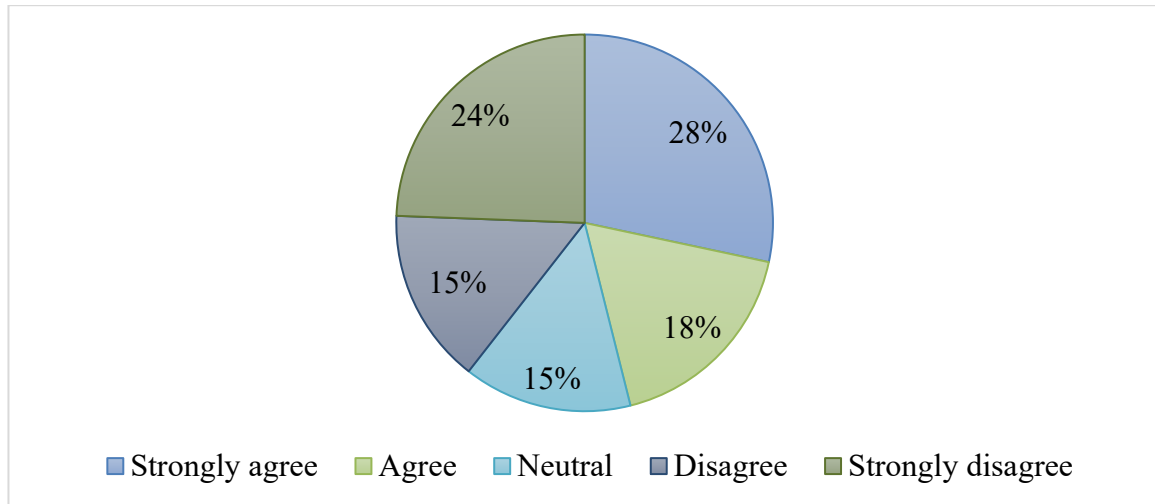
Figure 5: The percentage level of agreement with monitoring and verifying identity techniques

On the contrary, students' responses uncovered their disagreement regarding three techniques of verifying their identity as follows: opening the camera and placing their university card in front of it at the beginning of the test; opening the camera at the beginning of the test and matching their current photo with their photo in the academic system; and opening their camera during the entire test period.

Some students in the current study confessed that the test timing of one of their tests coincided with the time of call for prayer (Athan) and the proctoring program showed an indication of the possibility of cheating owing to the sound of Athan.

DISCUSSION
The findings of this study revealed that students appreciate providing guidance and conducting a mock exam before the e-exam, which support James (2016) study where students found providing guidance prior to the exam was comfortable and caused less anxiety. The high preference for a clear user manual by the participants in this study is evidence that visualization of data (infographics) can convey complex information that people can quickly and easily understand (Smiciklas, 2019).

Participants in the current study confirmed the importance of having an e-assessment that provides clear instructions, automatically saves their answers, is flexible and easy to use, and enables teachers to see and know technical problems faced by the students or inquiries while they are taking their exam and provide support simultaneously. These are important features that should include when using e-assessment as in previous studies (e.g. Alruwais et al., 2018; Faniran and Ajayi, 2018; James, 2016; Rostaminezhad, 2019) reported that poor technical infrastructure in some countries or institutions, high stress owing to unfamiliarity with technology and test conditions, and lack of direct contact to get clarification during the exam are the challenges of using e-assessments.

In addition, the comparison results of e-assessment with traditional tests in this study are consistent with the findings of previous studies (Alruwais et al., 2018; Alsadoon, 2017; Bandele et al., 2015; James, 2016; Rudland, et al., 2011; and Faniran and Ajayi, 2018). E-tests were also preferable owing to the ease of reading questions from a screen, no requirement for advanced technical skills from students, lower anxiety level, unbiased grading, and immediate feedback, and it helped faculty to improve learning and the quality of assessment in higher education. About 40% of students in James's (2016) study expected to have better performance owing to being in a comfortable place with fewer distractions, such as poor lighting or the temperature of the room.

In the study of Flowers et al. (2011) staff and both ordinary students and students with disabilities preferred e-tests to the paper-based exams, and students believed their performance was better when using a computer. However, some studies revealed neutral attitudes regarding e-tests, such as Dembitzer et al. (2017) and Kim (2015) who classified students into four types regarding their attitudes toward e-tests: (I) dissatisfaction type, (II) friendly type, (III) adjustment seeker type, and (IV) apprehensive type. Flowers et al. (2011) recommend additional research to better evaluate the relationship between testing modes and students' performance, where the extraneous factors are controlled, such as teaching time and familiarity with testing environment.

Regarding e-test feedback that participants prefer, the findings in this study are consistent with the results of Alruwais et al. (2018), Alsadoon (2017) and Rudland, et al. (2011) where the students preferred receiving immediate

feedback in e-assessment on their performance. Alruwais et al.(2018) confirmed that using an online assessment gave the students the opportunity to know their level of understanding and make improvements based on their progress and correct their misconceptions on learning; this further encouraged deep learning among the students that improved their performance.

The findings also support those of Rostaminezhad (2019) who investigated students' attitudes toward e-testing and instant feedback, and he found that getting instant feedback reduced students' stress of waiting for paper-based exam results; students believed that seeing the results right after the exam is very productive. However, students in his study also faced challenges that need consideration. One of the challenges is that students are demotivated to take other tests when they receive immediate feedback about their failure in exams. Based on his research findings, he recommends examining quantitative and qualitative variables when studying learners' attitudes toward feedback such as exam anxiety and personality type (Rostaminezhad, 2019).

Although the quantitative data in the current study revealed that students found the type of questions in online exams to be appropriate, the qualitative data showed that some professors were restricting the questions to only the multiple-choice type and that were not agreeable, especially when students expected essay questions to display their understanding of a particular topic or when testing their practical skills. Topuz et al. (2022) found the most commonly used five question types in many educational institutions during the Emergency Remote Teaching period are multiple choice, essay, true/false, short-answer, and option matching.

Wang (2010) argues that professors can take advantage of students' positive attitude toward multiple-choice questions to employ this type of questioning to reflect students' learning of facts in the courses. Hillier (2014) confirmed that students preferred e-exams in the disciplines that utilized computers as a basic in their learning and assignments, concluding that students complained about having to complete a paper exam on software coding. In contrast, he also found that students in business and social sciences disciplines were somewhat enthusiastic about e-exams. However, Babo et al. (2020) reported that although online tests included theoretical topics, practical topics need to be complemented with other methods to achieve practical learning outcomes. Thus, Hillier (2014) highlights the significance of considering the suitability of the exam nature in various discipline areas. This implies that it is necessary to ensure that e-tests are suitable to the nature of subject in each discipline and measure the educational aims to increase the "fairness" concept of e-tests by students. Alsadoon (2017) stressed the importance of designing assessments that reflect the nature of learning where the students become more responsible for their learning. Thus, questions should not only measure their knowledge, but they should also allow students to demonstrate their capability in solving problems, which reflect the constructivism approach of measuring students' ability in critical thinking and problem solving. Topuz et al. (2022) recommended investigation future research that determine to what extent the development of problem-solving questions that use of graphics and animations in e-assessment meet our need.

However, it is important to remember the learning process cycle (Figure 6) while designing online learning. Learning objectives and goals should be identified clearly at the beginning, based on learning content and the assessment activities that are designed, then they need to be evaluated to ensure that they are compatible with the learning objectives and goals. If not, the learning content or the assessment activities should be redesigned or adapted to support and enhance the learning objectives and goals (Al-Smadi et al., 2009). Thus, e-assessments should be designed to measure the learning goals and display students' competencies and performance related to the identified learning objectives and goals.
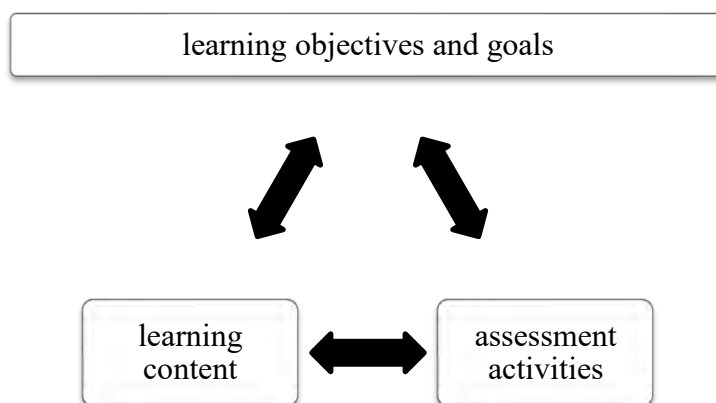

Figure 6: Learning Process Cycle

Soeiro et al. (2015) developed an interactive web-based platform that integrated with another tool to ensure the validity of e-assessment. In this project, the teachers had to describe the learning outcomes for the platform that would analyze them and provide the most consistent e-assessment strategy that aligned with learning outcomes. This process happened based on the link between the learning outcomes with verbs, which were revised based on Bloom's taxonomy and the six general assessment methods (multiple choice questions; essays; problem solving; practical work; short answer questions; and reflective practice assignments). Soeiro et al. (2015) found that this platform not only helped teachers to plan the best e-assessment strategy, but also it supported and guided teachers to formulate the learning outcomes in accordance with Bloom's taxonomy, which increased the accuracy of the learning outcome.

The students in the current study did not worry about cheating in e-tests, as a majority were neutral about this point, which is consistent with Alsadoon's (2017) study where students were positive about the fact that online assessments do not facilitate cheating. Contrarily, Rudland et al. (2011) and Kocdar et al. (2018) found that students considered the possibility of cheating and plagiarism as the main problem in e-assessment. Topuz et al. (2022) found the most commonly used restriction methods in e-assessment for prevent cheating in many educational institutions during the emergency remote teaching period in 2020 are disabling copy/paste, blocking exit from full-screen, turning off print-screen function, deactivating right click, preventing additional software from being run, and enabling unprinting. Kocdar et al. (2018) suggested some dynamics that reduce cheating and plagiarism when using e-assessment including: a) students' and teachers' trust on advanced software that detect cheating and plagiarism; b) students' awareness about the functions of this software and not discrediting themselves or their studies; and c) using both forms of assessment: online and face-to-face. When these dynamics are followed, students would be careful about putting themselves at risk through illegal behaviors in online assessment. More studies are needed to determine the possible strategies that students may use for cheating and how to limit them.

Regarding the techniques for monitoring and verifying identity, the majority of students in the current study "disagree" to using camera during the test. Similarly, James (2016) found that most students did not like being observed by a webcam and they faced inadequate technical support from the proctoring company, especially with regard to the facial recognition software, giving conflicting information when the lecturer allowed students to use some materials while the proctoring system pointed them out as an illegal exam aid. Other concerns of students in James's study were the disruptions from people or distractions from their surroundings, and privacy concerns. Indeed, the study of Castelli and Sarvary (2021) concluded that cameras should be avoided with distance learners due to learners' discomfort, as well as social norms (e.g. intrusion into learners' homes). Topuz et al. (2022) confirm that collecting and analyzing students' biometric data during e-assessment (such as screen record, and images) is considered to be sensitive subject in some countries that requires high attention by law. These findings can guide system developers, researchers and decision-makers to improve the monitoring methods and security to satisfy users' country law.

Topuz et al. (2022) found that students preferred semi-automatic monitoring (machine and human proctoring) over full-automatic monitoring (machine proctoring) because they claimed that artificial intelligence technologies are still insufficient for fraud detection, thus human proctor lead to verification through two steps.

It is necessary to ensure and study the importance of proctoring students during the online assessment, especially when the questions measure their creativity, comprehensive skills, and their critical thinking. Looking at the students' responses in the current study, more than 47% found that cheating in electronic exams is difficult and a majority of students (over 56%) reported that their achievement level in the e-test was not different from that in the traditional test. Thus, it is important to study the need for using cameras during online tests for university students.

CONCLUSION AND IMPLICATIONS

This study has significant findings for higher education institutions, especially with widespread distance learning that necessitates the use of e-assessment. Overall, the findings of this study showed the importance of providing guidance to students before e-assessment, providing instructions during the exam especially the testing duration, not preventing the students from reviewing their previous answers, and having the option to write comments. Our findings suggested that the system should report details in case of disconnection or any technical problems so that students would feel confident.

Finding showed that the majority of students preferred using e-tests over traditional tests and opined that their achievements were not affected when they used e-tests during distance learning. However, teachers need to pay more attention to using suitable questions that match their courses' learning objectives, as well as exam duration, comparing its nature to traditional exams.

The findings strengthen arguments that confirmed the importance of providing immediate effective feedback after the e-assessment. However, findings suggested that essay questions represented challenges with respect to feedback as automated corrections did not provide detailed explanations.

E-assessment systems should customize some features based on the user's needs, especially their language and the procedures of verifying and monitoring students, to increase their comfort and acceptance of the system. The techniques students found appropriate for verifying their identity were logging into the exam system using their university email and password, and taking audio attendance through a microphone or calling students' names by a professor in a simultaneous session. However, the study finding showed that respondents were very conservative to monitoring with the use of a camera, even when privacy was ensured.

Research attention should be given to understanding when the students need proctoring in e-assessment and developing innovative technology to detect cheating and verify students' identities considering their preference and culture.

Findings of this research expected to help decision makers, researchers, and system designers and developers in improving e-assessment systems. Recommendations include conducting future studies that address the effects of different kind of e-assessment systems on students' satisfactions, motivations, and on their academic performance. This study has two limitations: first, the population in this study included only students from KSU in Saudi Arabia during the distance learning period in the COVID-19 pandemic. Second, the sample size is small considering the population, as the number of students in KSU in the latest published statistics was 63,891 students (SPA, 2021).

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Appendix A. Survey of Students' Perceptions of E-assessment

No	Items	Strongly agree (%)	Agree (%)	Neutral (%)	Disagree (%)	Strongly disagree (%)	Mean	Std. Deviation
	The Importance of Providing Different Forms of Guidance before the E-exam							
1	Provide a user manual showing how to solve the test questions.	56.5	26.6	7.8	4.5	4.5	4.26	1.081
2	Provide a video explaining how to solve the test questions.	34.4	25.6	17.2	14.3	8.4	3.63	1.310
3	Provide training on how to solve test questions and deal with the system.	41.2	28.2	14.3	9.7	6.5	3.88	1.232
4	Conducting a mock exam where the marks do not count, before the actual exam.	53.6	21.1	7.8	9.4	8.1	4.02	1.313
	The Needed Features in E-assessment System							
1	Ease of providing the physical requirements of the system (hardware, Internet speed, etc.).	52.3	30.2	10.1	5.5	1.9	4.25	0.979
2	The ability to deal with the system easily using a mobile phone or laptop.	61.7	25.0	7.5	3.2	2.6	4.39	0.948
3	Providing clear instructions including: the number of questions, how to answer them, and the test duration.	73.1	21.4	2.9	1.9	73.1	4.64	0.696
4	High flexibility and ease of use.	70.5	19.8	5.5	2.6	1.6	4.55	0.843
5	The system saves the answers automatically, in the event of an Internet failure.	73.7	14.6	6.8	3.6	1.3	4.56	0.869
6	The system allows the student to skip some questions and return to them again to answer.	73.4	10.1	4.2	4.5	7.8	4.37	1.236
7	Easy communication with the technical team when there are technical problems.	62.3	17.5	14.6	2.9	2.6	4.34	1.003
8	The ability of answering students' inquiries during the test through the voice chat.	53.6	21.8	14.0	6.8	3.9	4.14	1.003
9	The ability of answering students' inquiries during the test through the written chat.	53.6	24.7	9.7	6.8	5.2	4.15	1.132
	The Feedback of the E-test							
1	I prefer the appearance of the total score immediately after completing the test.	77.6	14.3	4.2	1.9	1.9	4.64	0.817

2	I prefer the detailed explanation about the wrong answers.	74.0	18.5	4.5	2.3	0.6	4.63	0.734
3	It is necessary to obtain electronic feedback for each question.	58.4	22.4	14.6	2.9	1.6	4.33	0.941
4	I feel motivated when I get instant feedback after the test.	58.8	25.0	11.0	4.2	1.0	4.36	0.908
5	Getting immediate feedback helps me to retain the information.	69.8	18.5	9.1	1.6	1.0	4.54	0.803
6	The automatic correction makes me feel comfortable, especially since it does not require the intervention of the course professor.	47.4	16.6	24.4	7.5	4.2	3.95	1.182
E-assessment in Comparison with the Traditional Tests								
1	I feel more comfortable using electronic tests than traditional ones.	48.7	19.8	14.0	8.8	8.8	3.91	1.328
2	The use of electronic tests commensurate with the nature of our generation which is passionate about technology.	53.2	20.1	14.0	7.5	5.2	4.09	1.198
3	It is difficult to cheat in electronic exams.	28.9	18.8	19.2	13.3	19.8	3.24	1.490
4	The achievement level in the electronic test is not different from that in the traditional test.	30.2	26.0	17.9	14.9	11.0	3.49	1.349
5	The text formats are suitable for reading from the screen.	54.2	28.6	10.4	4.9	1.9	4.28	0.969
6	The types of questions are appropriate to the learning objectives of the course.	47.1	32.5	12.7	3.9	3.9	4.15	1.041
7	The duration of the electronic test is the same as the traditional test.	26.3	19.5	12.0	20.8	21.4	3.08	1.520
8	The duration of the electronic test is sufficient in relation to the number and nature of questions.	27.9	26.3	15.3	16.2	14.3	3.37	1.407
Monitoring and Verifying Identity Techniques								
1	Verify the identity by requiring you to log into the system using the university email and password.	69.5	23.4	3.6	2.3	1.3	4.57	0.781
2	Verify the identity by opening the camera and placing the university card in front of it at the	14.0	12.3	17.5	22.1	34.1	2.50	1.433

	beginning of the test, while preserving the privacy of the photos.						
3	Verify the identity by opening the camera for the student at the beginning of the test and matching the current photo with his photo in the academic system, while maintaining the privacy of the photos.	14.0	12.3	17.5	22.1	34.1	2.47	1.250
4	Verify the identity through taking the audio attendance by using microphone.	14.9	9.7	18.2	21.8	35.4	3.87	1.319
5	It is preferable that the students be present in a simultaneous session with the course professor during the exam, with the possibility of calling the students by their names.	39.9	31.2	14.0	6.2	8.8	3.79	1.414
6	It is preferable that students be monitored by opening their camera during the entire test period, while maintaining the privacy of the videos.	12.0	9.7	13.3	20.1	44.8	2.24	1.240
7	It is enough to check by IP address to make sure that no students are in the same place.	34.1	25.6	17.2	10.7	12.3	3.58	1.373