Using Screen-Capture Technology to Authenticate IT Online Learning and Assessment

Sameh S. Ismail and Shubair A. Abdullah

Abstract—Assessment has always been fundamental to teaching as it aims to gauge the impact of the teaching on students learning. The current assessment in teaching computer literacy is objective assessment that focuses on making it intentional, informative, and formalized. Although this assessment is the best way when assessing large groups of students at one limited time, it has a drawback of being limited to check the knowledge of understanding terminology and recalling steps of a particular process. This study introduces a screen-capture technology based approach to performative and authentic assessment. It involved design and implementation of screen-capture assignments to assess computer maintenance skills. The sample consisted of 28 students enrolled in computer hardware and software maintenance classes. Data from students was collected through a multi-modal student survey and a semi-structured interview. The results analysis has indicated that screen-capture performative assessment promotes students' engagement and learning level of solving real-world problems.

Index Terms—Assessment, performative and authentic assessments, screen-capture technology.

I. INTRODUCTION

Many recent research suggests an increasing attention in the use of screen-capture technology in the classroom [1], [2]. However, a little effort has been devoted to the use of screencast software to response or solve students' assignments, particularly in teaching information literacy skills. A screencast is a screen capture of the user's actions on digital screen, including the actions, movements, and audio [3]. Creation of screencasts to demonstrate how to use specific programs is a typical use of screencast software by educators in the field of teaching information literacy [4]. An example of employing screencast software to teach information literacy is Khan Academy that houses thousands of screencasts to demonstrate how to use designing software packages, how to create websites, and how to develop computer applications.

Assessment has been one of the main focuses in education. The assessment process is done either traditionally or authentically. A traditional assessments refer to written testing, such as multiple choice, matching, true/false, essays, etc., and must typically be completed by students within a specific amount of time. Although this assessment is the best way when assessing large groups of students at one limited time, it has a drawback of being limited to check some kinds of knowledge such as the understanding terminology and recalling steps of a particular process [5]. Moreover, some research recommended finding an alternative to ensure that students are actually engaged in and they are learning the skills and knowledge associated with their assignments [6]. The performative and authentic assessments are among the alternatives suggested to mainly focus on students' application of knowledge and skills in real-life settings, such as having students take part in completion of a real-world task.

Gulikers *et al*. likely set one definition for these two types of assessment when they mentioned that the performative assessment is "an assessment requiring students to use the same competencies, or combinations of knowledge, skills, and attitudes, that they need to apply in the criterion situation in professional life" [7]. Similarly, Mueller described the authentic assessment as "assessment in which students are asked to perform real-world tasks that demonstrate meaningful application of essential knowledge and skills" [8]. We believe that the authentic and performative assessments could be used interchangeably to describe any performance-based assessment where students' skills are assessed with a special evidence [9].

With regards to the traditional assessments, both teachers and students express their frustration with the assessment process of practical assignments for different reasons. As the assessment is supposed to help improve practical skills in using computers, there is a concern that these assignments are not achieving their goals [10]. Teachers are concerned with managing the time spent reading students' reports that contain their responses. In addition, teachers are unsure how well their students draw their knowledge and skills to solve real-world problems. The students often complain that the evaluation of students' thinking skills, problem solving, attitudes, and other abilities cannot be quantified easily [11].

This research investigates the issue of using screencast software as an authentic assessment tool at College of Education in Sultan Qaboos University (SQU), Sultanate of Oman. It is a try to provide instructors of information literacy with a mode of assessment that allows them to reduce their frustration with the assessment process. At the same time, by creating performative and authentic assessment approach, a new way may be found to help students identify their learning level and to see how real-life situations affect their theoretical knowledge. The purpose of this study is to examine the efficacy of using screen-capture technology as authentic assessment in teaching computer hardware and software maintenance. It assesses the efficacy from the perspective of

students in terms of their engagement with their assignments. Additionally, it tries to find out from the perspective of the students whether or not they believe using this technology is a positive factor in increasing the level of solving real-world problems, communication skill, as well as their English language level. Specifically, this study addresses the following research questions:

1) Do students find that using screen capture to assess their work is effective and authentically reflects their level?
2) Do students believe that their level in accomplishing tasks associated with the assignments improved due to the use of screen capturing technology?

II. LITERATURE REVIEW

Assessment has always been fundamental to teaching as it aims to gauge the impact of the teaching on students learning, helps teachers in finding ways to improve instruction, and proves mainly the worth of teacher's work to the students. Regardless of what the teachers teach, the assessment process should try to answer the question: Are the students able to do what the teachers teach them to do?

The current assessment in teaching computer literacy is objective assessment that focuses on making it intentional, informative, and formalized. In their research, K. R. Diller and S. F. Phelps [6] stated that there is a need to authentic assessment in order to ensure that students are actually learning the skills and knowledge needed for success. This form of assessment equips learners with the skills to meet present and future professional demands [12] and allows them to be successful in the real world based on their abilities [13]. The big change that could serve using performative and authentic assessment in teaching computer literacy is the emergence and spread of screen-capture technology.

Several research studies have recently examined the benefits of using screen capturing software in education [14, 15]. Y. Ghilay and R. Ghilay [16] measured in their research the influence of high-quality clips produced by screencast technology on the learning process of math courses. The results indicated worthiness to add screencast technology to math courses. In the same context, H. P. Ginsburg [17] indicated that the formative assessment, which could be considered as authentic, is more than just evaluating students' performance, it has an impact on their motivation and learning potential. The research done by R. Richards [18] concluded that when students generated screencasts as a group after they solved tasks assigned to them, they liked to work together because "it gave them control of their learning and allowed them to document their understanding in ways that made sense to them".

Many research studies have been published to investigate the impact of screencast software on students understanding and motivation during the last decade when the screencast video producing and editing has emerged as one of the effective learning media because it provides an interactive communication between the teacher and his students. The research done by P. Kefalas and I. Stamatopoulou [19] investigated the impact of screencast videos on students' understanding of the logic programming. Another example was the research published by B. Brereton and K. Dunne [20] who studied the impact of screencast tutor feedback on veterinary nursing students' learning. The engineering teaching field has also witnessed some research, for example, the research published by P. R Hampson [21] assessed the effectiveness of the screencast tutorials which have been produced by the author for engineering students to teach the process of modelling laminated materials within the commercial finite element software. These research attempts were accompanied by major developments in video playback devices that encouraged the emergence of studies dedicated to integrating these devices in teaching and learning. The authors A. Burkea and J. Hughes [22] have overviewed some "recent literature related to the benefits and challenges associated with the use of tablets with students in middle schools". Another example is the research of J. P. Rossing *et al*. [23] that investigated the student impressions of learning with mobile tablets in the classroom.

Most teaching units in courses of computer maintenance aim to teach skills beside the knowledge. The assessment of skills acquirement is difficult by using objective assessment and needs for new ways that allow students to apply skills and knowledge in real-life situations. There are some techniques currently used in such kinds of courses e.g. work, project, product techniques based on the basic competencies and indicators [24]. All these techniques require hardware and software to allow the students to practice. Wright indicated in his research [25] that the performative assessment measures both the skill and knowledge acquired by students.

This study creates a new assessment approach that could be considered as a new way to help students identify their learning level and to see how real-life situations affect their theoretical knowledge. The approach introduced is based on screen-capture technology (screencast) that has been notably emerging technology in education. The technology of screencast provides verbal interpretations where students can express their pictures with written texts, a feature that traditional written assessments do not provide. Usually, there is no time for the instructors to meet each student and make individual practical tests. For example, the Covid-19 pandemic, which spread at the beginning of 2020, made it more difficult as everyone now avoids meetings for fear of the spread of the epidemic. To overcome these difficulties, a number of technologies has been employed such audio and video recordings. Recently, the screencast technology has proven its effectiveness in overcoming the mentioned problems and emerged as a strategic option for conducting performative and authentic assessment [26].

III. METHODOLOGY

This research uses descriptive research design to answer the research questions.

A. Instruments

The researchers designed the following two research instruments:
- **Survey:** A survey was designed using Google Forms. The survey was validated by three experts and modified according to their recommendations. The experts were

from the College of Education at Sultan Qaboos University (SQU), two from Instructional and Learning Technology department and one from the Psychology department. Moreover, the Cronbach's alpha test will be calculated to assess reliability of the survey. The instrument consists of three sections (engagement; perceptions of the computer skills learned by this type of assignments; and preferences for using this type of assignments) in addition to the demographic information of the participants.

● **Interviews:** The individual Interviews consisted of a number of open-ended questions in addition to the demographic information of the participants. Two experts validated this instrument and their suggestions were included in it. The experts were from the College of Education at SQU, one from Instructional and Learning Technology department and one from the Psychology department.

B. Participants and Settings

The Instructional and Learning Technology department in which this study was conducted serves approximately 200 students. Students are almost homogeneous in background and are frequently outstanding in high school. This study included 28 undergraduate students taking one of the first-stage course required by the department in the fall of 2018 and fall of 2019. The course is entitled "Utilization & Maintenance of Instructional Devices". Of the 28, 10 were male and 18 were female. One instructor involved in using the screen capturing software as a mean of assessment. The reason of choosing this course is twofold. First, this course is very crucial exposing the undergraduate students to architecture of computers and other instructional devices such as tablets, printers, and interactive multimedia projectors. Second, the main objective of this course is to increase the skills of presentation, problem solving, and instructional hardware devices fixing. All these skills could be improved by practicing on a specific device failure scenario, and trying to explain the fault and the fixing way. All students were invited to participate in the survey either via an e-mail or personally. Of the potential 51 students, 28 students completed the survey.

C. Screen Casting Approach

The instructor announced four assignments throughout the semester. The time giving for solving each assignment was 7 days. Within this period, the students have to record and edit their videos, and once they finish, they have to upload these videos into the Moodle website of the course. The uploaded videos are not publicly accessible online because they are stored behind password-protected accounts of the instructor and the students. To better assess the objectives of each assignment, a rubric was devised and tailored to each assignment to explain the criteria for the assignments and what needs to be included in order to receive a score. According to the rubric, the students were demanded to explain the objectives and the content of the video, to identify the terms related to the content, and to describe in details the practical steps needed to perform the task. The Screencast-O-Matic screen recorder software used to record the assignments by the students because of its free of cost and ease to use. The free version of Screencast-O-Matic software limits recording time to fifteen minutes, which is enough for the students to record their videos in responding to their assignments. The videos are produced according to the steps previously identified and published to the students online. Fig. 1 depicts the steps followed in the method of videos production.
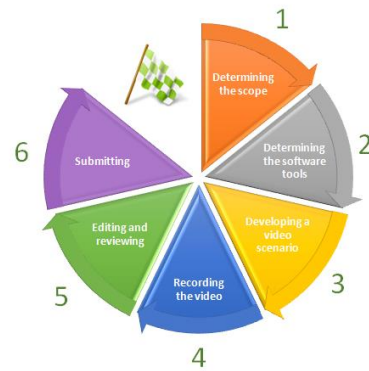

Fig. 1. Video production method.

The steps are explained in the following:
1) Determining the scope of the problem to be solved in assignment, i.e., OS, Application, hardware, viruses, etc.
2) Determining the software tools needed to solve the problem in the assignment, i.e., the cmd Windows tool, Windows Control Panel, antivirus application, etc.
3) Developing a video design scenario that aims to determine:
● The way followed to attract the attention of the listeners to the video's theme
● The objectives of the video
● The video designing elements such as images, sounds, footages, etc.
● The practical steps to follow to solve the problem
● The software used for recording the video (the recommended software is Screencast-O-Matic)
● The video conclusion that summarizes the topic of the video
4) Recording the video according to what is planned in the scenario.
5) Editing and reviewing the video to produce the final version.
6) Submitting the video into the Moodle website of the course.

IV. DATA COLLECTION

Data from students was collected through a "multi-modal student survey" placed on Google Forms. The survey has been devised as a tool to answer the first question research. It consisted of 15 questions made up three constructs of interest: attentiveness and engagement; perceptions of the computer skills learned by this type of assignments; and preferences for using this type of assignments. In order to ensure the validity of the coverage of questions, three experts were involved in evaluating the content validity and evaluating the relation between questions and the research topics. The constructs

were measured on a typical four-point Likert scale item with responses: strongly disagree, disagree, agree, and strongly agree. Additionally, during the two semesters of the research and after the submission due dates of all assignments, the authors conducted normal individual interviews with 8 students. Conducting of interviews was for the purpose of answering the second question of the research questions. Each interview lasted approximately 10 to 15 minutes. Open-ended questions were used to estimate the students' level in accomplishing tasks associated with assignments. Interviews were conducted based on an interview protocol of three questions.

V. DATA ANALYSIS

SPSS 19 has been used to analyze the survey data, and the descriptive statistics minimum, maximum, mean, and the standard deviation were calculated on the three constructs. To ensure the reliability of the three constructs, Cronbach alphas were calculated. The Cronbach's alpha overall score was 0.84 indicating high reliability of the items in the instrument. Table I shows the values Cronbach alphas for the three constructs. The interviews conducted in this research are transcribed and analyzed using a coding process based upon grounded theory [27]. The main objective of interviews analysis is to identify students' perspectives and students' thought regarding the use of screen capturing software in creating authentic assignment. The following steps were followed to perform the analysis:

1) Using the IBM Watson Speech-to-Text service to convert the recorded interviews into transcript.
2) Placing the interview transcripts into MS word in two-column format, one column (left) for the transcript and one column for coding (right).
3) Using line-by-line technique to define and categorize the codes of the transcripts.
4) Using the AntConc corpus analysis toolkit to create frequency list of words, which is a two-column table, the word and the number of times each word occurred. The word frequency list identified the most frequently occurring words in the transcripts.
5) The words were grouped into categories based on the data, including a) use of technology, b) improve of English language, and c) perception of screen capturing software for the students.

VI. FINDINGS AND DISCUSSION

In terms of the first research question: "Do students find that using screen capture to assess their work is effective and authentically reflects their level?" the survey reflected that the students in the sample found that using the screen capturing technology as performative and authentic assessment was more effective than traditional objective assessment. The mean scores for the constructs ranged from 2.757 to 2.879 as shown in Table II. These figures indicate that across the three constructs the students chose to "agree" that they were engaged, had a positive perception, and preferred this method of assessment. One female student who

registered the course in fall 2019, a junior student disagreed with all of the preference construct of the survey, which may indicate that some of the students, may prefer a more traditional way of assignments.

TABLE I: CONSTRUCT RELIABILITIES

Construct	Cronbach alpha
Engagement	0.7235
Perceptions	0.7462
Preferences	0.7677

TABLE II: DESCRIPTIVE STATISTICS

	N	Min	Max	Mean	Std. deviation
Engagement	28	1.8	4	2.879	0.6705
Perceptions	28	1.6	4	2.757	0.6333
Preferences	28	1.6	4	2.764	0.6846

Table III Shows the analysis based gender. The mean scores for the three constructs in male students ranged from 2.72 to 3.22 while it ranged from 2.589 to 2.767 in female students. Although these figures indicate that both male and female students chose to "agree", the figures indicate also that the male students had more positive perception than the female students. They were engaged more that the females (mean=3.22), and they preferred using screen capturing as performative and authentic assessment more than the females (mean=3.08). Perhaps this was because female students are interested more in the use of computers that in experiments and solving problems related to video recording, montage, and programming. This result is consistent with the findings of D. Stoilescu and G. Egodawatte research [28] who found that female students were not so involved in computing activities whereas male students were heavily involved.

With regard to the second questions on whether the students believe that their level in accomplishing tasks associated with the assignments improved due to the use of screen capturing technology as performative and authentic assessment, the interviews indicate that the students believed that their level has been improved significantly. The following three themes pertain to the second research question.

A. Theme One: Screen — Capture Changes the Process of Fostering Learning of Computer Skills

When comparing screen-capture assignment to the essay or report assignments, which are written assignments, students believed that the screen-capture assignment contributes very well to fostering learning of computer repainting skills. One students said "the task to be accomplished in the assignment required a practical effort from us to accomplish" and "I repeated the recording two times to get it as perfect as recommended in the rubric". One female student talked about the focus needed to complete the assignment. She said "it is special assignment that needs more focus" and she felt that students would need more time management to prepare themselves to accomplish the task as described in the rubric, fostering greater learning about the skills needed to accomplish the task. In general, students believed that screen-capture can add more practical dimension. Thus, the level of engagement reported by the

students could be seen as an increase in fostering learning of computer skills.

B. Theme One: Screen — Capture Proves Beneficial for Improving Student Presentation Skill Compared to the Traditional Assessment

In order to discuss and describe their experience of screen-capture for assignment, students compared the method to other forms of assignment with which they were more familiar, such as essays, reports, and case studies. Some students compared screen-capture assignment to presentations. One students of those who registered the course in fall 2018 said he thought of the screen-capture like

one-sided presentation. Another student said, "It required me to practice on how to present ideas, how to introduce myself to the students, and it's helpful in enhancing the presentation level of teachers." One student of those who registered the course in fall 2019 said screen-capture assignment requires more than searching for the information on the Internet, making a summary of data, and submitting the results to Moodle website. He talked about enjoying the way of presenting him in English language at the beginning of the recording, the recording process, and the video editing skill acquired.

TABLE III: DESCRIPTIVE STATISTICS BASED ON GENDER

	Male					Female				
	N	Min	Max	Mean	Std. dev.	N	Min	Max	Mean	Std. dev.
Engagement	10	2.4	4	3.22	0.603	18	1.8	3.8	2.689	0.629
Perceptions	10	1.6	4	2.74	0.765	18	1.8	3.8	2.767	0.546
Preferences	10	1.8	4	3.08	0.688	18	1.6	3.6	2.589	0.616

C. Theme Three: Screen — Capture Proves Beneficial for Improving Student Technical Skills

The final question in the interview was whether or not the students felt screen–capture added new skills and was a worthwhile endeavor in terms of student growth as qualified technicians. One female student felt that she was more willing to learn about video editing, creating video titles after recording her videos. Another female student from same cohort said "I found myself having new technical skills such as video montage". She said "for some reasons, I needed to record the video first and later, I added the narration to it".

Regarding to the result obtained, this research is similar to several published studies. For the purpose of generalizing the results, we follow comparative literature analysis procedure, which is considered as a notable procedure of research findings generalization [29]. Based on the results of research published by Vidya Kharishma [30], which involved 47 participants, the screen-capture is helpful in understanding the course subject. The findings showed also that it is an attractive and provides motivation to learn more about the subject. Similarly, the study conducted by Steger F. and J. I. Kizilhan [31] on Iraqi university students concluded that the screen-capture approach is easy to use, useful, and recommended for the student's homework and academic requirements. The purpose of study published by F. H. Yahya and *et al*. [32] was to examine the effectiveness of the integration of online screencast video with quick response (QR) code. They stated in their conclusion that the integration of video screen-capture by scanning the QR code can be a potential tool to support the use of blended and mobile learning. Finally, the review study published by P. Mahoney *et al*. [33], which was purposed to establish the current state of research into screen-capture feedback video, stated that the screen-capture video technology has a high level of acceptance amongst both staff and students and may help strengthen student-marker relationships.

VII. CONCLUSION

This study introduced a screen-capture technology based approach to performative and authentic assessment. It is a pilot study using surveys of 28 students enrolled in computer hardware and software maintenance classes. The screen-capture based authentic assessment system has been designed and implemented using four screen-capture assignments to assess different kinds of computer maintenance skills. The results analysis indicated that the system promoted students' engagement and learning level of solving real-world problems. Most of the students find this method of assignment much more preferable to the more traditional types of assignment given. However, a very few junior students disagreed with all of the preference construct of the survey and this may indicate that they prefer a more traditional way of assignments.

While screen-capture technology proved an important tool in creating authentic assessment, there may be certain types of pedagogical assessments which might make screen-capture technology less effective. These types of assessments pedagogical may include assessing the knowledge, assessing intelligent, and assessing critical thinking. Additionally, some students mentioned that they were preoccupied with being precise that they eventually stopped focusing on the quality of his work. In terms of recommendation for future research, it would be beneficial to conduct research on screen-capture technology as authentic assessment with larger sample sizes because having a larger sample size would allow for more generalizability.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

AUTHOR CONTRIBUTIONS

Sameh S. Ismail and Shubair A. Abdullah conceived of the

research idea. Sameh S. Ismail developed the theory and performed the computations. Sameh S. Ismail verified the analytical methods. Shubair A. Abdullah supervised the findings of this work. Both authors discussed the results and contributed to the final manuscript.

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