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Integrity and Security of Digital Assessment: Experiences in Online Learning

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Abstract
Purpose: This paper discusses measures relevant to ensuring academic integrity and assessment security with an example of a university's final evaluation using online assessment. Academic integrity issues include the student's awareness of honesty and trustworthiness in their study and the severe consequences of malpractices. Whereas, assessment security involves evaluating features to prevent any attempts to deceive and practices to deal with any misconduct.
Design/methodology/approach: Evaluation attempt data of 271 students in online assessment is analyzed to investigate any pattern of malpractice and security issues of current online assessment implementation. It is necessary to discover these security issues in the current context of most sought assessment implementation.
Findings: The measures revealed that the problems and challenges continue to persist, such as difficulties in identifying cheat contracts, difficulties to avoid help and contacts with peers and outsiders, lack of awareness and responsibility in online learning and assessment, and availability of access to online content and assessment.
Research limitations/implications: Three main stakeholders of higher learning institutions play a crucial role in ensuring academic integrity and assessment security in digital assessment. With the help of technology, institutions have certain instrument and tools to ensure the integrity and security of digital assessment using proctoring tools to authenticate students' identities and validate their responses. Students are trained with high moral and ethical conduct to stimulate students' right attitudes and awareness of permissiveness standards in society. Consistently, instructors are required to encounter academic dishonesty to paraphrase the digital assessment, provide plenty questions and do not depend wholly on available resources
Practical implications: Online learning is very much relevant in the era of digital education, especially in a hard time, such as during a pandemic outbreak where face to face learning is not possible. The digital assessment requires educators to verify that students have completed their work in the evaluation, and these reported examples raise concerns related to academic integrity and assessment security issues.
Originality/value: This research is among the limited studies that address the assessment security featuring real experiences to prevent any attempts to deceive in digital assessment and practices to deal with any misconduct.

Keywords: Online learning, Digital Assessment, Cheating, Academic Integrity, Assessment Security

Introduction

Online learning is very much relevant in the era of digital education, especially in a hard time, such as during a pandemic outbreak where face to face is not possible. The digital assessment takes place, and educators face a new challenge: how can they verify that students have completed their work in the evaluation? These concerns raise issues related to academic

integrity and assessment security. Both are necessary to ensure that students who obtain university degrees have met the required outcomes.

There are two related approaches to digital assessment (Bearman et al. 2020). Academic integrity emphasises educating students with high moral and ethical conduct in their learning. Another concept, assessment security, emphasises stiffening student assessment to prevent any attempts to deceive and deal with any misconduct.

Among challenges for educational organisations and instructors in conducting online education include considering technical, organisational, and requirements for pedagogical changes to support the modified interaction style and learning strategy, whilst maintaining high-quality education (Bojović et al. 2020). The digital assessment itself in online education contain challenges in the new educational paradigm.

In higher learning institution, assessment place an important role in the learning process, to offer noticeable indication of learning, regulate student evolution and determine understanding of the syllabus. How an institution conceptualize learning and depicts the ultimate forthcoming nations determine the way it creates and uses assessment (Oldfield and Timmis 2013).

Assessment is part of a good quality instructional design and should be strongly connected to the intended learning outcomes (Bane 2019). The remaining, instructional design is indicated by clear learning outcomes, cautiously organized content, balanced student workloads, utilisation of unified media, appropriate student activities, and assessment. Instructional design itself characterises a process for instructors utilise to organise, employ, and assess their instruction especially in dealing with the normal learning activities (Donmez and Cagiltay 2016).

Despite the challenging time out of the pandemic outbreak, assessment remain its core purpose to support learning (Oldfield and Timmis 2013). Digital assessment involves a system that conduct student evaluation via the web or included as a component within the learning management system (LMS) for example Moodle or Sakai (K. Y. Shraim 2019). Instructional design seems to be significant in digital assessment than in the traditional assessment. While for face-to-face assessment, the underlying model of instructional design appears to be implicit in the decision-making processes, digital assessment requires an explicit use of some type of design process is necessary to integrate and coordinate various learning components (Rapanta et al. 2020).

Digital assessment systems carry significant benefits and concerns, as widely debated in a body of research highlighting online learning (K. Y. Shraim 2019). Among the major advantages of digital assessment over face-to-face assessment include simplification of the traditional evaluation process from the designing the assessment to evaluating, analysing and reporting. The ability of digital assessment to provide immediate feedback also benefits students to rectify misconceptions.

Among the main challenges in digital assessment concerns with the time and skills required to construct high-quality and fair assessment instrument (Moneo et al. 2015). Next, challenges form readiness of infrastructure and skills in both instructors and students sideways to support digital assessment (Avci, Dwyer, and Lawson 2020; Wu and Wang 2021). Network and system failure during digital assessment can discourage both instructors and students from utilising the intended systems (Rapanta et al. 2020). Challenges from integrity and security aspects in digital assessment continue to raise, especially the issue of students make various attempts in cheating by communicating with other students or by browsing the internet (Okada et al. 2019).

Academic dishonesty in online assessment is pervasive, and the common belief that cheating in online assessment is more accessible than in traditional examination might provoke an increased temptation for students (Lee-Post and Hapke 2017). On the one hand, the assumption could be considered insulting to students, although, on the other hand, cheating should be an

avoidable issue in a well-designed course. Such a situation requires that professors provide a large pool of questions to avoid the pitfalls of using test banks (Golden and Kohlbeck 2020).
This paper discusses measures relevant to ensuring academic integrity and assessment security with an example of a university's final evaluation using online assessment. This paper reviews the emphasis on student awareness of honesty and trustworthiness in their study and the severe consequences of malpractices. This paper also discusses the assessment security involves evaluating features to prevent any attempts to deceive and practices to deal with any misconduct.

Literature Review Integrity and Security in Digital Assessment for Online Learning

Due to the current pandemic outbreak, online learning and digital assessment will continue to persist as the regular education system. Digital assessment appears to be considered as the most challenging part in online learning (Motala and Menon 2020). Previously the institution takes full control in physical assessment or written exam, but the control shifts towards the students in digital assessment create difficulties in ensuring that students are not cheating (Rapanta et al. 2020).
With the drastic changes to online learning, there are concerns about the integrity and security of the assessment and strategies to deal with misconduct. Despite the new routine digital evaluation, learning institutions continue to provide quality education without compromising integrity and security issues. While academic integrity emphasises providing necessary preparation for students following necessary ethical learning, academic security deals with strategies to combat any misconduct (Dawson, Sutherland-Smith, and Dullaghan 2020).
To encounter integrity and security issues regarding digital assessment, best practices in teaching and tools can be deployed to help higher learning institutions (Rowe 2004). Three important stakeholders in digital assessment (higher learning institutions, students, and instructors) play essential roles. The responsibility of the institution continues to be critical in this challenging time. Educators play an essential role to portray the right model in academic integrity (Alias et al. 2019, 2020; Alias, Ishak, and Zakaria 2019), As a standard practice worldwide, academic integrity is a law enforced mandate that requires institutions to authenticate each student's identification using valid login and password, proctored assessments, and various technologies to verify student participation (Abdel Karim and Shukur 2016a, 2016b; Bane 2019). A diverse discussion has been made on how institutions can embrace cost-effective academic integrity solutions while maintaining the accessibility and flexibility of digital assessment (Brown 2018; Lee-Post and Hapke 2017; Saiboon 2020).

Strategies to Address the Problems

With the help of technology, the institution has been able to ensure academic integrity using mainly two types of technologies with certain features (Bane 2019): 1) a certified test proctor application be connected to student's device during assessment 2) computer-algorithm based tool to observe any misconduct such as asking for help using the second screen. During the assessment, the proctor uses the student's webcam and microphone to remotely monitor the environment and body gestures in a real-time manner. The proctoring technologies serve to authenticate students' identification and legitimacy of student's response in digital assessment to avoid academic misconduct and quality assurance purposes (Okada et al. 2019).
Likewise, emerging technologies such as surveillance systems, biometrics, and predictive analytics provide further authentication for high integrity in digital assessment (Lee-Post and Hapke 2017). The impact of proctoring technologies across various student's profile end-users are yet to be examined and understood (Okada et al. 2019). Despite the effectiveness of these proctoring technologies, they are prone to errors and invite certain risks related to violation of

students' rights to privacy and reasons for disturbing their attempt to respond to the assessment (Lee-Post and Hapke 2017). Among exciting areas the research would embark on whether using these technologies may enhance trust in digital evaluations. The pattern of students' acceptance on these technologies varies across various demographical factors like gender, age, and previous experiences (Okada et al. 2019). One of the findings from mixed-method analysis suggests a broadly positive acceptance of these proctoring technologies in an online learning environment. Nevertheless, student's background plays a significant role in students' responses: male students show minor concern to share personal data than female students; middle-aged students display higher awareness of cheating and plagiarism implication; juniors indicate a tendency to reject the technology, substantially owing to data privacy and confidentiality.

Despite focusing on the traditional way of assessing students using a summative format, various suggestions emerge on how technology-enhanced digital assessment by shifting the paradigms and improving assessment practices to benefit student learning ultimately. For example, digital review for online collaborative learning groups is proposed to implement collaborative learning contexts (Moneo et al. 2015). There are five focus areas where digital technologies support digital assessment particularly related to (Oldfield and Timmis 2013):

1. The use of multiple forms of representation enables students to represent their learning in ways of their choice.
2. Develop different ways of summative assessment in other subjects
3. Develop different methods to gain learning skills, competencies and dispositions as opposed to traditional assessment methods
4. Develop methods to assess peer interaction, group performance and collaboration
5. Application of learning analytics and data mining

Consistently, a sole digital assessment may create some inherent problems where students express negative feelings related to fear of, or unfamiliarity with, the technology of the evaluation and a lack of knowledge about digital assessment methods (Fluck, Adebayo, and Abdulhamid 2017). Therefore, Background Electronic assessment serves as another option for assessing student learning that offers independence of choice regarding the locality of the test to give a direct response. Students' acceptance and familiarity with digital assessment are of great concern by an education provider. The digital evaluation appears to be beneficial in a problematic surrounding such as in higher education institutions in Palestine. A Survey of 342 undergraduate students shows that digital assessment seems to have significant benefits over face to face assessment featuring these elements: reliable and efficient grading, effective in energy and cost (K. Shraim and Crompton 2015).

Rules and Roles

As part of academic security action, institutions explore ways to handle students who had been found to violate ethical conducts, such as using the Academic Integrity E-Learning tutorial tool at MacEwan University, Canada (Benson, Rodier, and Enström 2019). The institution only emphasises the increased understanding and strengthening of students' commitment to high moral conduct to a proactive focus on education.

To enhance students' awareness of academic integrity and secure digital assessment tasks, institutions can create an ethical learning experience among students by communicating essential information (Bane 2019). Since the digital assessment provides a tremendous opportunity to attempt cheating, there are additional challenges for an institution to stimulate the right attitudes of the student population and the acceptable permissiveness in the society (Kitahara and Westfall 2007). The culture requires some time and commitment among educators to keep educating and reminding students with high moral and ethical conduct in their good learning habits (Dawson, Sutherland-Smith, and Dullaghan 2020). Students can

avoid academic dishonesty in digital assessment given the high ethical conduct develops as a strong culture, and the environment does not provoke an increased temptation for students. Students appreciate the learning experience about the technical content and soft skills embedded from the discipline raised in a well-designed course (Dutchak et al. 2021; Northcote 2019).

As part of instructors roles, various attempts have been reported to encounter academic dishonesty in digital assessment and instructors have been strategised many ways to minimise its effects (Golden and Kohlbeck 2020). One of the validated approaches to lessen the trial of cheating on digital assessment applies to paraphrase. Students score better on the verbatim questions instead of the translated questions (80.4% vs. 69.1%), which suggest that instructors escape the pitfalls of using test banks. The findings confirm that students cannot easily find the online answer for a paraphrased test bank question due to the absence of such question in a verbatim form. Therefore, cheating should be avoidable in a well-designed course where instructors plan for various methods of assessing students using recent technologies (Oldfield and Timmis 2013). The situation also requires instructors to provide many questions and do not depend wholly on available resources (Golden and Kohlbeck 2020).

These three stakeholders contribute to the achievement of integrity and security of digital assessment. Figure 1 presents the model of integrity and security in the digital assessment model. This model guides higher education institutions to integrate their roles and strengthening their rule to address the integrity challenges.

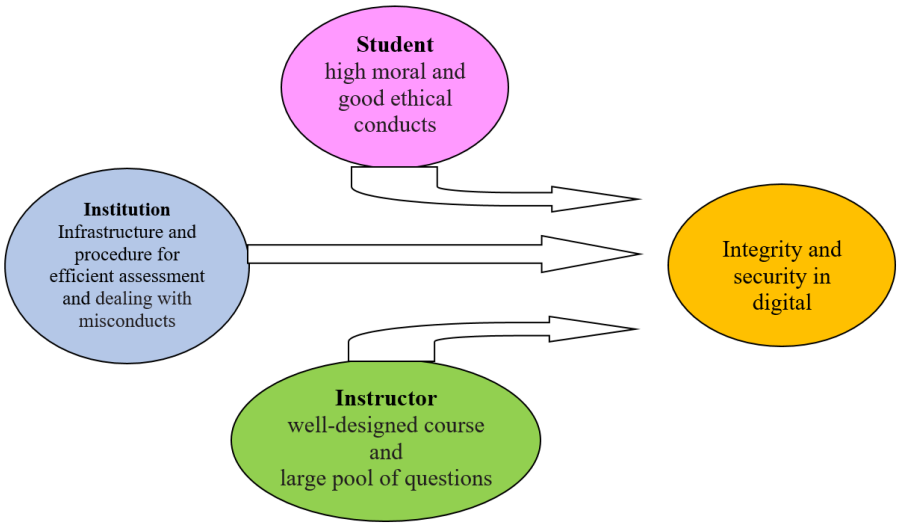

Figure 1: Integrity and Security in Digital Assessment Model

Method

The quantitative part of the research is described according to the undertaken steps.

Location

This study is implemented among undergraduate students at the Faculty of Information Science & Technology (Fakulti Teknologi dan Sains Maklumat, FTSM), Universiti Kebangsaan Malaysia (UKM). These students register for analytic data courses and experience examinations using digital assessment. Almost all courses in this faculty conduct digital checks due to the inability to implement face to face examination in the time of a pandemic outbreak.

Sampling

This study's generated data is considered primary data with the respondents involved consisting of first, second-and third-year students. Altogether sample from 271 students who participate in the digital assessment provides the data for further analysis.

Sampling Instrument for digital assessment

The instrument comprises 40 multiple-choice questions to be answered in a one-hour maximum attempt. The instrument development follows the course proforma to fulfil the designed learning objectives at the beginning of the semester. The development of the instrument applies a variety of question types from Bloom Taxonomy level: knowledge to analysis to assess students' overall understanding and ability in the course. The assessment is implemented using the institution learning management system (LMS), UKMfolio, a sister system to Moodle. The LMS provides the grading system and offers various data reports, including the score, log in and log out time, and the length of responding time. The assessment component in UKMfolio allows instructors to design and establish evaluation to consist of a diversity of question types including multiple choice, true-false and short answer questions (K. Y. Shraim 2019).

The assessment applies standardised limited time of a maximum of one hour to answer and limits one attempt for an individual student. Before the final evaluation, students are exposed to the mock assessment to familiarise students with the assessment setting. The digital evaluation allows students to answer in a time window of two hours (students are freely set their one hour slot). Once the time expires, open attempts are submitted automatically.

The instrument layout considers presenting the item on a page for one question. The setting limit only one question per page. The assessment applies sequential navigation where students must progress through the quiz and may not return to previous pages or skip ahead. The question behaviour uses a multiple-choice question format with four answers, and only one answer is correct. The item's presentation considers shuffle question order to ensure each question randomly scuffle each time a student attempts the quiz. The question does not follow the topic order. Students need to identify the particular topic for each question before they proceed to answer.

The review option for this digital assessment applies deferred feedback with certainty-based marking. Students have a limited way to interact with the questions in the quiz by entering an answer to each question and then submit the entire quiz before anything is graded or they get any feedback. Certainty-based marking (CBM) requires students to provide the answer to each question and report their confidence in giving the response. Students are given three choices: not very sure (66% or less confidence), reasonably confident (67% or more trust) or very sure (80% or more confidence). The grading is adjusted based on the certainty level. Students get three marks for absolute confidence for the correct response and get an adjustment of one to 0.33 for guessing. Students gain an adjusted mark from zero to negative two for the wrong response they were sure to answer.

Mock Evaluation

This is a trial environment to familiarise the student with the evaluation setting and to evaluate system efficiency. Students are given clear instructions that mimic the final evaluation. Students are required to answer all five questions in ten minutes. Each question has no mark. They have only one attempt to answer. It contains similar evaluation features that involve shuffle question order, sequential navigation of the question. This session is optional. 207 out of 276 registered students take part in the session.

Reminder Calls and Non-Responsive

To avoid any risks of not participating in the final evaluation, the instructors team up to contact students with non-active indications. In the attempt, the instructors briefly introduce themselves and straight away remind them about the final evaluation. The LMS provide non-active students of at least two hours from accessing the system. Of more than 20 phone calls made, nearly half are categorised non responded. Those who respond, know about the session and show a willingness to participate in the evaluation.

Out of the total of 276 registered students, five do not participate in the evaluation. Four of the non-participant has been recognised earlier as missing students and do not belong to any registered set. One of the students informs the instructor that he intends to withdraw from the course.

The digital assessment requires students to provide valid reasons for absence and evidence for uncompetitive evaluation. Like the face-to-face final exam procedure, any problems and issues for the inability to participate in the session follow a strict policy of the second attempt. Students must explain the difficulty in accessing the link or provide evidence of sickness and any health issues.

Clear instructions are given to highlight essential requirements in the assessment on the front page of the instrument. Students are expected to read the instruction before they start answering. These are the instruction points.

1. Answer all 40 questions in one hour.
2. Each question carries one mark.
3. You have only one attempt to answer.
4. We shuffle the question order, identify the topic of each question to answer them.
5. We set sequential navigation of the question. You must progress through the quiz in order and may not return to previous pages nor skip ahead.

Validity

The instrument's validity is tested using Peer Appraisal of instructors who know the course but do not teach the subject for the current semester. The Quality Assurance committee conducted the appraisal to ensure that the instrument contains items that tap students' ability as planned in the proforma document. As a result of these assessments, a few changes in sentence structure, language, and presentations are corrected.

Data Analysis

Non-parametric procedure equivalent to the t-test method is used to analyse the data due to the small sample size for the emerging groups. This method is chosen to identify a significant difference in the score of digital assessment for the two groups. The data are analysed using PSPP, an open-source tool to serve as statistical software similar to SPSS.

Results

The non-parametric procedure is conducted to examine if there is a significant difference in the score for two different groups: 1) submit the response earlier of the time window (the first 75 minutes). 2) submit the response later in the last 45 minutes of the time window. Note that students are given 120 minutes time window, although they are allowed to answer within the one-hour maximum. The analysis involves two variables as the dependent variable in the comparison study: time to respond and assessment score. Table 1 provides the descriptive statistics for the variable.

For Group 1, i.e. students who submit the response earlier (the first 90 minutes), there are 254 observations, take an average of 55.661 minutes to answer, the most frequent time is 60, the

median is 59, the smallest time taken is eight and the highest time taken is 60 (the time limit). For Group 2, i.e. students who submit the response later in the last 45 minutes of the time window, there are 17 observations, take an average of 30.176 minutes to answer, the most frequent time is 44, the median is 31, the smallest time taken is six and the highest time taken is 44.

Table 1: Time to Answer and Assessment Score.

Variable	**Time to answer**			**Assessment score**		
Set	Group 1	Group 2	All	Group 1	Group 2	All
N	254	17	271	254	17	271
Mean	55.661	30.176	54.063	21.622	19.942	21.517
Mode	60	44	60	21	11	21
Median	59	31	59	22	19	22
Min	8	6	6	0	4	0
Max	60	44	60	35	33	35
Std dev	7.540	10.346	9.896	7.078	9.093	7.212

Tables 2 and 3 present the output for the non-parametric procedure for each variable, respectively. In Table 2, the test statistic and probability value (Chi-square=46.29, p-value < 0.0001) suggest a significant difference in time to answer these two groups. In Table 3, the test statistic and probability value (Chi-square=0.520, p-value < 0.473) indicate no significant difference in assessment scores for these two groups. The findings show that students who submit the response earlier take significantly longer time (mean 55.661) to answer than students who submit the response later (mean 30.176). However, there is no significant difference in the assessment score for the two groups.

Table 2: Non-Parametric Result: Time to Answer.

Measures	Group1	Group 2
Mean	55.661	30.176
Variance	56.849	107.029
Observations	254	17
Hypothesized Mean Difference	0	
Chi-square Stat	46.29	
P(T<=t) two-tail	0.000	

Table 3: Non-Parametric Result: Assessment Score.

Measures	Group1	Group 2
Mean	21.622	19.941
Variance	50.094	82.684
Observations	254	17
Hypothesized Mean Difference	0	
Chi-square Stat	0.520	
P(T<=t) two-tail	0.473	

Discussion and Conclusion

This paper elaborates on two issues: academic integrity and assessment security, with an example of a university's final evaluation using online assessment. These two related issues concern educating students with high moral and ethical conduct in their learning and stiffening student assessment to prevent any attempts to deceive and deal with any misconducts that had happened, respectively.

The evaluation attempt data of 271 students in online assessment shows that students who submit the response earlier take significantly longer to answer than students who submit the response later. However, there is no significant difference in the assessment score for the two groups. The findings oppose the expectation that students who submit the response earlier take significantly longer to answer than students who submit the response later and score higher. The second group shows some indications of dishonesty to achieve as much as their counterpart, although they take a shorter time.

With the opportunities students have in digital assessment, the score at par could be contributed from leaked information of their peers who complete the evaluation earlier. With no proctoring technologies in hand for the studied institution, not enough prevention is sought for unethical practices in digital assessment. It is necessary to discover these security issues in the current context of most sought assessment implementation. The experience revealed that the problems and challenges of integrity and security in digital assessment continue to persist (Brown 2018; Northcote 2019).

The current study shows related challenges, such as difficulties in identifying cheat contracts, difficulties to avoid help and contacts with peers and outsiders, lack of awareness and responsibility in online learning and assessment, and availability of access to online content and assessment. It certainly requires the help of technology, with attention from institutions to invest in procedure, instrument and tools to ensure the integrity and security of digital assessment such as to authenticate students' identities and validate their responses (Bane 2019; Benson, Rodier, and Enström 2019).

Institutions also play key role to support academic honesty among students in digital assessment. Despite tremendous challenge for creating such environment in online learning with axiomatic utilisation of technology in learning and instruction, concrete effort to find steps and strategies to decrease violations and dishonesty among students serves as determination factor to develop a culture that acknowledge and appreciate everyone with high moral and ethical conduct to be part of their learning process (Dawson, Sutherland-Smith, and Dullaghan 2020). A strong culture of the high ethical conduct evolves some time to be part of student learning environment to train students to avoid academic dishonesty in any chances appear in digital assessment (Ayoub/Al-Salim and Aladwan 2021; Garg and Goel 2022).

As conclusion, three main stakeholders of higher learning institutions play a crucial role in ensuring academic integrity and assessment security in digital assessment. With the help of technology, institutions have certain instrument and tools to ensure the integrity and security of digital assessment using proctoring tools to authenticate students' identities and validate their responses. Students are trained with high moral and ethical conduct to stimulate students' right attitudes and awareness of permissiveness standards in society. Consistently, instructors are required to, which suggest that instructors escape the pitfalls of using test banks.

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