



Original Article

Proposed Modeling of Online Exam-Proctoring: The Case of University of Education (VNU-UED)

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Abstract: Digital transformation in education proposed many changes in term of the formation and paradigm of teaching, assessment and evaluation in all aspects. The ability to integrate online platforms, tools, and technology solutions to increase interactivity and personalization etc. considers new opportunities and challenges for the application of online (remote) assessment and supervision platforms. As a phenomenon of online learning mode the online proctored examinations (OPE) have been considered one of the foremost online proctoring options that share the features of a real examination (paperless) in higher education institutions (HEIs) with a proctor observing examinations remotely. In teaching practice today, with online learning tendency the online proctoring (OP) interest rises for some time and accelerated by COVID-19 pandemic. Many of these online learning programs also include online assessment (online exams) that raise some of the issues and challenges associated with plagiarism and academic integrity in general. One of the ways to deal with some of these challenges is the adoption of online proctoring tools for online assessment.

Keywords: Online assessment; online (e-)proctoring; exam in eLearning; HE students' competence.

1. Introduction

Today in the classroom many students feel more comfortable learning with the smart wearable devices such as computers, tablets... and know well how to use them to cheat in online testing environment. Just like when taking traditional face-to-face exams, students taking online exams prefer to cheat for several

reasons: easy access to cheating materials, less control and stress, improved scores on their average, wanting a higher score for various reasons, etc. However, regardless of online or face-to-face courses/exams, students responded that proctors and monitoring tools and technology are important factors in preventing fraud [1].

When studying as well as taking exams or assessment in online mode students feel the proctors or monitoring tools as subject to change their behavior during the exam [2]. The presence of various proctoring tools (software,

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interface, devices or features etc.) considers serious alert of cheating to them that make necessary psychological effects in online testing environment. Owens [3] states that cheating was more likely to occur in teacher-less exams than in supervised tests, and there were no significant differences between online and in-person courses when the exams were monitored. Cheating is more common in undocumented online exams (and less so in supervised online exams) and students will be more likely to engage in dishonest behavior during learning in online contexts [4].

2. Literature Review

Online proctoring (OP) vs live (real) proctor integrated into exam platform that involves the use of virtual tools for monitoring student activities during assessment activity. These tools (as they continue to overcome their limitations) have the potential for students to take an online exam at a remote location while ensuring the integrity (security and trustworthiness) and reliability of the online exam. This includes the authentication of the student and their identity to secure and maintain the integrity of an exam and its administration [5].

There are two primary components to online proctoring [5]. First, a webcam on the student's computer device must be enabled in order to video record the actual learning area and whatever the student performs throughout the test session. This video recording can be remotely monitored by the examiner or proctor. The examiner or proctor can detect possible cheating, suspicious motions, and posture, such as chatting to someone in the room or glancing at a book, mobile device, or other printed media for answers. The second step is lockdown, which prevents students from accessing any other computer software, including the Internet browser, and user-computing procedures (such as copying, pasting, or printing), which might lead to exam cheating.

Hence, online proctoring - or remote surveillance, supervision of exams provides a

form of digital assessment that allows an exam to be taken from any location. Online proctoring software promises to allow students and course participants to sit their exams anywhere (e.g. at home) in a secure and reliable way. Monitoring software, video images and the ability to monitor the student's screen should prevent them from engaging in fraud. Furthermore, the virtual surveillance system serves four primary functions: i) Authentication: this is the process of confirming that a registered student is a valid student for an online supervised exam; ii) Surfing ability: this is the process of limiting students' capacity to use their computers for other purposes; iii) Remote control and authorization: allow the proctor to start, pause, and end an online supervised exam, as well as flag any suspect student activity; and iv) Report generation: the creation of a report on a supervised examination's student actions.

The exact form of the virtual surveillance system varies between providers according to [6]. It is possible to identify three main types: direct supervision, in which monitoring takes place during periods; the tests will be completed a few days later based on pictures and exam logs, and automated monitoring in which the system of tools will assist in detecting frauds.

Han, Shengnan; Nikou, Shahrokh; Ayele, Workneh Yilma; Balasuriya, Balasuriya Lekamalage Prasanna; and Svee, Eric-Oluf [7] defined and conceptualized digital (e-proctoring, online, virtual, remote) proctoring in aspects of system development, emergency response to Covid-19 pandemic, new challenges for educators, students' authentication and authorship, comparison between un-proctored and proctored exam in students' performance, MOOC integration, and other issues such as privacy, legal, ethics, safety, security etc. Hence, the research findings proposed technical features of online proctoring systems have improved with both the innovations of education technology of "AI technologies for detecting misconduct and malpractice in online examinations". From this

discussion there is the challenge of how digitalize assessment of learners' academic performance in higher education institutions (HEIs) context. [8]

The most common features of OP systems have four key characteristics: i) Authentication: the process of confirming that the registered student is the correct student taking an online proctored exam; ii) Browsing tolerance: the procedure of limiting a student's capacity to use their computer for other purposes; iii) Remote authorization and control: allows the proctor to start, halt, and finish an online proctored test while also reporting any suspect student behavior; and iv) Report generation: the development of reports detailing a student's activity during a proctored exam. The online proctoring can be classified into two categories: *standalone* and *integrated* proctors.

When the supervision occurs throughout students proctored examination directly directing/supervising the online, virtual examination it may be functionalized as the followings:

Live: Live proctoring through expert human proctors in high-stakes exams may be functionalized by *One-to-many* or *One-on-one* Proctoring that invigilates multiple students simultaneously or one student at a time, respectively.

Automated: Auto proctoring is an AI-based automated proctoring technology that uses students' webcams, and microphone feeds for auto invigilation.

Video-Proctoring: It checks students' video feeds to raises flags in case of any suspicious activity visible in the video

Audio-Proctoring: It checks students' audio feeds and raises flags in case of additional human voices in the vicinity

Image-Proctoring: It assesses checks students' pictures taken at regular intervals

Recorded (Subsequent storage and verification): Record and review proctoring is best suited for low-stakes exams. Proctors review the recorded video feed of students,

ascertaining the flags generated by the artificial intelligence (AI) bot.

Furthermore, the online proctoring system may work with complex of designed and integrated elements in HEIs context for online assessment or exams. Today, most online proctoring tools or software has supported by integration into various MOOC (Massive Open Online Course), LMS or LCMS platforms for school and university online testing practice (built in with learner database, analytic learning system, AI, web-conferencing and other technologies-tools).

Proctoring within an LMS means that educators can initiate cheat-proof exams without leaving their LMS environments (with or without various API/Application Programming Interface Learning , LTI/Tool Interoperability) which allow faculty members to monitor students and course participants from within. A prerequisite to LMS proctoring is that students must enable proctoring on their devices by accepting screen, video and audio sharing.

Thus, universities in the process of selecting and implementing an online test proctoring system must first examine numerous issues. These include (but are not limited to): the ease and flexibility of integration with the existing institutional learning management system, the technical performance and robustness of the proctoring system (sometimes due to insufficient internet bandwidth, poor hardware capabilities, or electrical power failures), the level of efficient task automation, and reporting capabilities. Other critical factors to consider when adopting an online proctoring system are privacy protection and administration, security and anti-fraud measures, and their related costs [6].

Holding an online course test for any subject necessitates extra preparation, whether by the teacher or with the assistance of university students-examinees. University on the responsibilities allocated to it in order to offer the essential environment entrusted to them. All of teacher-proctors, admin and teachers are encouraged during the online exam to support

the students mentally to prepare them for a computerized exam. It is worth noting that many institutions across the world have difficult computerized assessments on their campuses.

The online proctoring system may work with complex of designed elements of both technical and functional requirements (See Table 1).

Table 1. The components of typical online proctoring system
(Adapted from Vladimir L. Uskov et al., 2018)

Applicaton	Assessment context awareness and learning adaptability, assessment activities, and assessment content in accordance with a) the present (accessible) online testing environment, and so on.
Monitoring dashboard	Monitoring numerous scenarios and providing metrics in general; specifically, monitoring learning quality, learner achievement, student academic performance, and so forth.
Face recognition and identification	Detect the faces of different learners in a variety of settings, including testing (in the classroom, in the real world), etc.
Recognition and detection of motion	In a testing setting, sense or detect the movements of various persons and things.
Recognition of gestures	To recognize and proctor the learner's motions in a testing setting
Intelligent surveillance	Using various forms of smart devices, monitor and proctor activities or behavioral patterns, as well as any changes in the testing environment.
Recording	Various activities (situations) in the testing environment are automatically recorded in high-quality audio and video.
Analytical forecasting	Data analyzed from numerous sensors is processed to produce predictions about the next steps/actions in the testing process; learner report.
Quick video processing and analytics	Processing of huge data from recorded videos (for example, surveillance video cameras) in a quick and relatively simple manner (getting analytics).
Quick and simple remote access	Easy access to the real-time or recorded video/audio/information by the instructor (or, most likely, the safety officer) from practically anyplace, but at the very least via a central context awareness unit (system).
Notifications	Send an email, text message, or phone call notifications on a regular basis.
Alerts	Send learners real-time safety and security alerts, as well as notifications in the event of illegal action or cheating.
Intelligent navigation	Provide the learner with highly accurate information concerning unexpected actions or cheating as well as completed report.

Currently, most online proctoring tools or software has supported by integration into various MOOC, LMS or LCMS platforms for school and university online testing practice (built in with learner database, analytic learning system, AI, web-conferencing and other technologies-tools). On the other hand, the consideration of compatibility of existing online testing software, supported platforms, computer system requirements, the need for internet connection during the exam, and the testing structure for online testing environment play significant role.

3. Study Design

The MZ (Moodle LMS and Zoom meeting) online exam system of VNU-UEd mobilizes two actors in the online exam process: the proctors (admin, teacher-proctor, and technician) and the examinees (students), with integrated digital platforms as Moodle (LMS) and Zoom (web-conferencing). In other words, to take the online test (in both synchronous and asynchronous modes) candidates need to access Moodle and Zoom tools simultaneously.

This system is used in the final exam for all students, with various exam forms, including essay, multiple-choice test, short answer, constructive questions or combined format. From the features available on the Moodle system, design essay tests with complete test-taking tools such as adding images, text, linking,... The Multiple-choice tests with the questions inside have been designed and mixed to avoid students cheating by copy the question with unauthorized interference. The students who enter from the different IP's cannot use the allocated domain and thus the system is secure.

Before participating in the exam, candidates must log in to the LMS Moodle to update personal information for identification, complete exam records as required and participate in mock exams. Students, after fully logging in/registering before the exam, will be given a technical supervisor to handle problems with the exam system and control the

candidate's activities on this system, including testing. Students control the number of exams and the number of candidates who participate and submit successfully.

In taking the exam, students enter the correct exam subject, their exam room and start taking the test. Students are allowed to submit work before it ends, but the system will immediately lock it when the time expires. With multiple-choice tests, students receive their results immediately after taking the exam, while with essays, they are sent to the teacher and get their results back a few days later.

By entry into Zoom (with function supported of using web-conferencing, extended exam monitoring, surveillance students' behaviors, prohibited action alert, recording etc.). Before participating in the exam, candidates must log in to the virtual exam room on Zoom software, then follow the regulations of the exam room, such as checking the candidate's identity, turning on the camera, the microphone during the exam, the test location must meet the conditions of light, sound,... During the test, candidates can interact with the proctor through the software to respond to questions and get technical help from the proctor.

To prevent cheating in exams, all tests in different formats are given in an open format; which means that students are entitled to use hardcopy materials such as textbooks. However, examinees absolutely must not use web browsers to look up results or use intelligent devices during the test or receive help from others while taking the test. The proctor is divided into two roles to supervise closely and timely support the candidates: the main proctor (monitoring through audio and images acquired on Zoom application) and the technology supervisor (supervising) assist in monitoring test takers' performance on the Moodle system), such division is also intended to reduce cheating on each platform. In case of detecting a candidate's cheating behavior, the main proctor will take a screenshot of the candidate's cheating behavior and ask the candidate to stop taking the test; at the same

time, the technology supervisor will cancel the ability to take the test - contestant's exam on the Moodle platform. The exam process is similar to when a candidate participates in a live exam, all cheating will be recorded, and the exam will be suspended.

Thus, it can be said that the MZ online exam system has helped ensure the regulations and regulations of a traditional exam room, organize the exam to ensure quality, and prevent cheating during the online exam (See Figure 1).

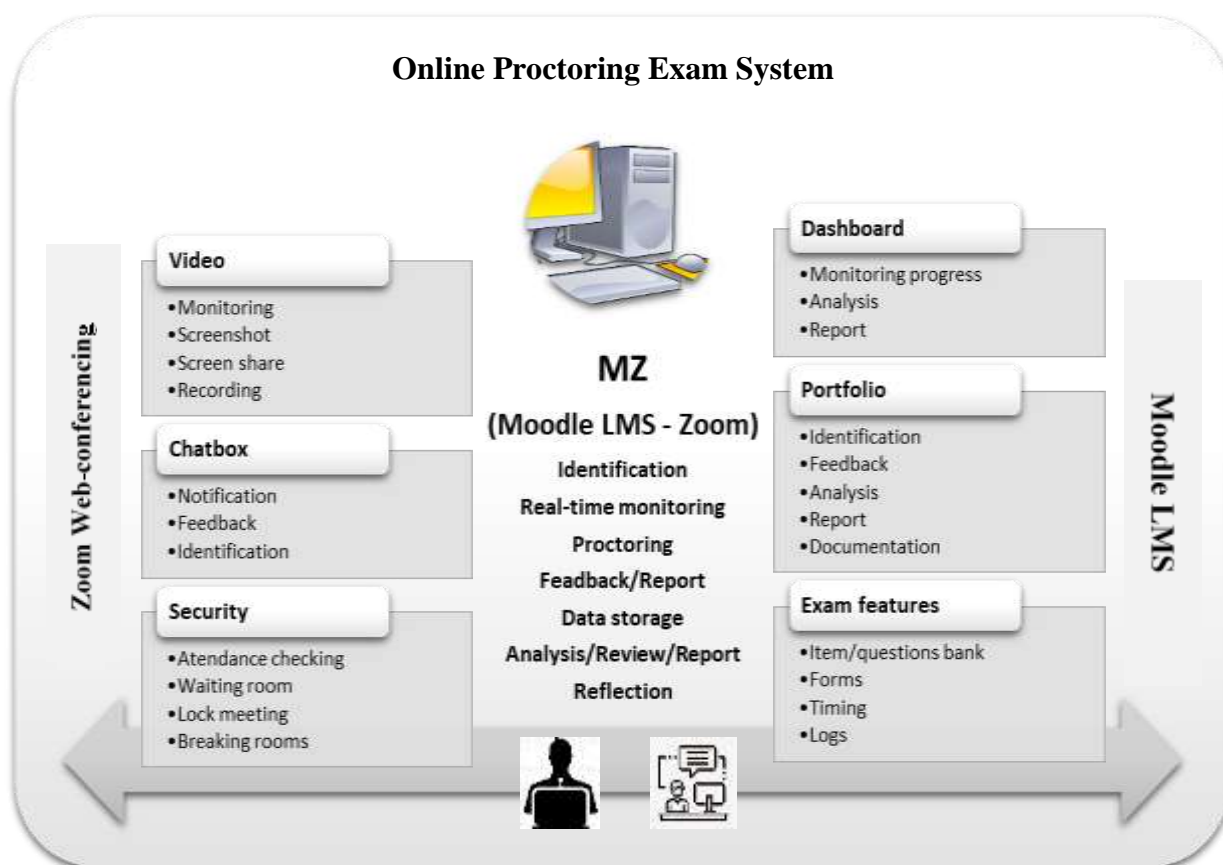


Figure 1. Online Exam Proctoring System MZ used by VNU-UEd (academic year 2020-2021).

The study has been designed with six proposed hypotheses of using MZ within VNU-UEd students while taking online exams (perceived ease of use, perceived usefulness, utility, intention, attitude towards use, and actual usage). Then, an assessment of the adoption of new technology can be made by looking at the likes and dislikes of people with attitudes about the usefulness of the system. The analysis results also prove that only one is rejected out of the above six hypotheses. The relationships between variables that are positively significant include: i) Ease of use

versus perceived usefulness; ii) Perceived ease of use; iii) Perceived utility; iv) attitude toward usage; and v) Behavioral intention to use throughout the system.

The Likert scale had been used in the survey to investigate and get feedback from students at the University of Education, Hanoi National University, about the use of MZ online exam technology. The questionnaire has been divided into two parts. The first part is about questions related to demographics such as age, the field of study, and frequency of using the MZ model. The second focus on testing and

technology used aspects such as assessment of assistive technology: usefulness, the ease of use, and the intentions, possibility towards using MZ system in the testing process.

Each question has five answer options showing the level of students' perception towards MZ use while taking online exams in the academic years 2020 and 2021 (1: Strongly disagree; 2: Disagree; 3: Neutral; 4: Agree; 5: Strongly agree). The survey aims to assess the understanding and acceptance of the online exam technology that combines Moodle and Zoom technology and evaluate the ease of use and usefulness of these two software and their intention of use. The survey results were obtained from 237 answer sheets from students of VNU-Ued of which 59.7%, 15.6%, 24.7%, 2.1% students from the first-year to the final year, respectively.

Hence, in this study there are hypotheses have been developed to assess the acceptance of MZ online proctoring system according to the

TAM model (Technology Acceptance Model) as following:

H1. Is understanding MZ technology positively related to the intent to use this technology (IU)?

H2. Is perceived ease of use MZ positively related to intent to use this technology (PEU)?

H3. Is the utility of MZ technology positively related to the intent to use this technology (U)?

H4. Is the intention to use MZ positively related to the ease of use and usefulness of this technology (PU)?

4. Findings

Research findings represented the result of statistically significant variation in various evaluation contents between the groups of people with different disciplines in HEIs training programs (Table 2).

Table 2. The correlation of significance of MZ

		Correlations			
		IU	U	PU	PEU
IU (Intentions to use)	Pearson Correlation	1	0.283**	0.661**	0.399**
	Sig. (2-tailed)		0.000	0.000	0.000
	N	237	237	237	237
U (Perception of OP)	Pearson Correlation	0.283**	1	0.338**	0.250**
	Sig. (2-tailed)	0.000		0.000	0.000
	N	237	237	237	237
PU (Usefulness)	Pearson Correlation	0.661**	0.338**	1	0.482**
	Sig. (2-tailed)	0.000	0.000		0.000
	N	237	237	237	237
PEU (Easy to use)	Pearson Correlation	0.399**	0.250**	0.482**	1
	Sig. (2-tailed)	0.000	0.000	0.000	
	N	237	237	237	237

** . Correlation is significant at the 0.01 level (2-tailed).

The Table 2 shows that the more users rate the usefulness, ease of use and support of MZ, the more likely they are to continue using MZ. The level of influence of factors on usability, from high to low, is the usefulness, ease of use and support of MZ, respectively (r is 0.661, 0.399 and 0.283 respectively), all p (2-tailed) =

$0.000 < 0.01$. An r value of -0.20 or 0.20 is the minimum that the correlation is statistically significant and large enough to be of interest. The correlation coefficient $r = 0.10$ is considered a "little" effect; $r = 0.30$ is considered a "medium" effect; and $r = 0.50$ is considered a "large" effect [Cohen, 1988]. The

above results show that the usefulness of MZ has a large influence on the user's ability to continue using the MZ application, and the supportability of the MZ has little influence on their intention to continue using the MZ. The user evaluation results also show that: the ease of use of MZ is highly appreciated, the usefulness is also highly appreciated by users ($r = 0.482$), and the supportability of MZ also has a medium influence. Average ($r = 0.338$) to the usefulness of this application.

5. Conclusion

Using the MZ online exam system is a flexible, emergency, and adaptive solution for the University of Education (VNU-UEd) in the very first period of Covid-19, realizing the motto “disruptive classes but undisruptive learning” at HEIs. Furthermore, the MZ application for online testing supports digital transformation in HEIs while changing thinking, educational approaches and culture associated with online assessment and testing by technologies.

6. Recommendation

Given these issues and considerations of MZ, the following recommendation should be taken towards implementing online proctoring as part of examination processes:

- Having a positive potential for digital transformation in HEIs, the universities proposed the process of thinking changing, educational approaches and culture associated with online assessment and testing by technologies for staff and students; This will also provide clarity around roles and responsibilities of the lecturer and that of the student to facilitate the online tests in a uniform manner;

- Online proctoring can easily be integrated into Moodle (API, LTI) without much additional infrastructure. This process requires systematic implementation of procedures such

as research on new approaches and assessment changes in online testing model, user characteristics of the online testing environment such as renovation of items bank and structure of exam design, connecting infrastructure, software, new technologies AI, Big Data, Blockchain etc. for both staff training and academic data base security.

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