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STRATEGIES FOR PROCTORING ONLINE EXAMS IN UNIVERSITIES: THEIR PROS AND CONS

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Abstract. In the wake of technological revolutions in the field of education, presently, higher institutions of learning not only teach but also administer online exams. The essence of conducting online exams was heightened even further after the COVID-19 pandemic outbreak, due to the imposition of lockdowns. Due to the limited studies that evaluate the effectiveness of methods used in proctoring online exams using technology, this study explored the best strategies that can be employed to ensure academic integrity while upholding accessibility and student privacy. The study employed a qualitative research approach involving a review of related literature. The results discussed the use of various modes of proctoring, such as an automatic multimedia analytics system, hybrid proctoring, live proctoring, and recorded proctoring, citing their pros and cons. The novelty of this study lies in its offering of a wide array of viable proctoring options that educational institutions can adopt as online exam administration continues to gain traction. This study recommends further investigation into the ethical implications of Artificial Intelligence (AI)-driven behaviour analysis tools in the administration of online exams.

Keywords: Online Exams, Proctoring, Artificial Intelligence, Academic dishonesty, Internationalisation

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СТРАТЕГИИ ПРОКТОРИНГА ОНЛАЙН-ЭКЗАМЕНОВ В УНИВЕРСИТЕТАХ: ИХ ПРЕИМУЩЕСТВА И НЕДОСТАТКИ

Норман Аниньо*

Абстракт. Вслед за технологическими революциями в сфере образования в настоящее время высшие учебные заведения не только преподают, но и проводят онлайн-экзамены. Важность проведения онлайн-экзаменов ещё больше возросла после вспышки пандемии COVID-19 из-за введения локдаунов. В связи с ограниченным количеством исследований, оценивающих эффективность методов, используемых для прокторинга онлайн-экзаменов с помощью технологий, настоящее исследование изучило лучшие стратегии, которые можно применять для обеспечения академической честности при сохранении доступности и конфиденциальности студентов. Исследование применяло качественный подход, включающий обзор соответствующей литературы. В результатах обсуждалось использование различных режимов прокторинга, таких как автоматическая система анализа мультимедиа, гибридный прокторинг, живой прокторинг и записанный прокторинг, с указанием их преимуществ и недостатков. Новизна данного исследования заключается в предложении широкого спектра жизнеспособных вариантов прокторинга, которые образовательные учреждения могут принять по мере того, как проведение онлайн-экзаменов продолжает набирать популярность. Исследование рекомендует дальнейшее изучение этических последствий инструментов анализа поведения на основе искусственного интеллекта (ИИ) при проведении онлайн-экзаменов.

Ключевые слова: Онлайн-экзамены, Прокторинг, Искусственный интеллект, Академическая недобросовестность, Интернационализация

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UNİVERSİTETLƏRDƏ ONLAYN İMTAHANLARIN NƏZARƏTİ ÜÇÜN STRATEGİYALAR: ÜSTÜNLÜKLƏRİ VƏ MƏNFİ CƏHƏTLƏRİ

Norman Anyinyo*

Abstrakt. Təhsil sahəsində texnoloji inqilabların ardınca, hazırda ali təhsil müəssisələri təkcə tədris aparmır, həm də onlayn imtahanlar keçirir. Onlayn imtahanların keçirilməsinin əhəmiyyəti COVID-19 pandemiyasının baş verməsindən sonra, karantin tədbirlərinin tətbiqi səbəbindən daha da artmışdır. Onlayn imtahanların proktorinqi üçün istifadə olunan üsulların effektivliyini qiymətləndirən məhdud araşdırmalar səbəbindən bu tədqiqat akademik dürüstlüyü təmin edərkən əlçatanlığı və tələbə məxfiliyini qoruyan ən yaxşı strategiyaları araşdırmışdır. Tədqiqat əlaqəli ədəbiyyatın icmalını əhatə edən keyfiyyət tədqiqat yanaşmasından istifadə etmişdir. Nəticələr proktorinqin müxtəlif rejimlərinin – avtomatik multimedia analitik sistemi, hibrid proktorinq, canlı proktorinq və qeydə alınmış proktorinq kimi – üstünlükləri və mənfi cəhətləri ilə birlikdə müzakirə edilmişdir. Bu tədqiqatın yeniliyi onlayn imtahanların idarə edilməsi populyarlıq qazandıqca təhsil müəssisələrinin qəbul edə biləcəyi geniş çeşidli real proktorinq variantlarını təklif etməsindədir. Bu tədqiqat onlayn imtahanların idarə edilməsində Süni İntellekt (Sİ)-ə əsaslanan davranış analizi alətlərinin etik nəticələrinin daha dərindən araşdırılmasını tövsiyə edir.

Açar sözlər: Onlayn imtahanlar, Proktorinq, Süni intellekt, Akademik qeyri-dürüstlük, Beynəlxalqlaşma

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1.Introduction

Online university learning has recently revolutionised education worldwide. Based on the fact that students do not have to attend a physical classroom facility, online learning has made access, equity and inclusion in education more realistic. Fundamentally, the pivotal challenge for higher education in the twenty-first century is globalisation, which has shaped the definition of political, economic and socio-cultural events. Higher education authoritative bodies are attempting to address issues ranging from students adjusting to a diverse world, enhancing their ability to coexist with people from other backgrounds, responsiveness to market demands, consideration of environmental and social consequences, and making responsible political and life decisions [Myhovich, 2019]. Particularly after the COVID-19 pandemic, the rapid shift to online learning impacted students at various levels of learning differently; for instance, the degree of seriousness of undergraduate and postgraduate-level students differs in the manner of their learning, internalisation, and retention [Rajendra et al., 2022]. During the outbreak, universities at first endeavoured to sustain their usual business until the reality of embracing an online assessment strategy struck [Lee et al., 2021].

Lee et al. (2021) opine that even though the social constructivist learning paradigm, which by its characteristic is experiential, involves collaborative knowledge construction as well as authenticity in evaluation of learning, the pandemic paved the way for the physical isolation of learners who only met to learn, watch lesson recordings and take exams online rather than promote a sense of collegiality and community. In this way, gaps emerged on how online exams could be effectively proctored, owing to the fact that the human capacity to detect malpractices that arose proved limited. Some of the contributors to the varying achievement of learners in online exams are matters of social inequality [Karakose, 2021]. They include the suitability of the study area at home, unequal technological access, family social and technological support, among other reasons.

In the sphere of education, globalisation has engendered internationalisation, which is a transformational process that integrates international, intercultural and global dimensions in the goals [Myhovich, 2019]. He maintains that the internationalisation of education has spurred the growth of cross-border education globally in terms of policies, participants, providers, programs, projects and mobility. This view is in agreement with Raman et al. (2021), who stated that global citizens don't need physical presence to study abroad, as they can virtually travel to other countries and engage with their classmates and instructors whom they only happen to meet online. By reason of providing intellectual, social and psychological training of students, UNESCO emphasises the need for online learning and examinations in conformity to

global technological advancements [Raman et al., 2021]. To protect the integrity of these online exams, proctoring comes in handy as an effective method. Nurpeisova et al. (2023) view proctoring as an effective means of curbing dishonesty in examinations and further underscore the role of maintaining academic honesty as a key pillar in achieving the objectives of learning outcomes.

In the early 2000s, the introduction of computer-based proctoring systems aimed at permitting students in their uninterrupted environments to take exams while still upholding exam integrity [Heinrich, 2025]. World over, prestigious institutions like Harvard University, Massachusetts Institute of Technology, University College London, University of California do not just promote excellent online learning, they also administer exams to students while they are at home [Siemens, 2015]. However, a study by Alesio et al. (2017) revealed that online examinations must be proctored since unproctored online exams do not meet the criteria for reliability. This was a consequence of a comparative analysis of online test results of the proctored versus the unproctored exams. From the results of that study, students scored 17 points less on average (a grade disparity) and utilised significantly minimal time (time usage lapse) writing software-proctored versus unproctored exams. OECD (2020) recommended that, in light of the growth in online learning, there is a critical need for the reconstruction of examinations to factor in the type of knowledge and skills they are intended to measure, warning that some higher education exams have encouraged memorisation at the expense of critical thinking and analysis. This gap can be addressed by designing implementable online exams to measure higher-order thinking skills like analysis, evaluation and synthesis.

According to Atoum et al. (2017), despite the adoption of an online evaluation system to complement in-person writing of exams, when it comes to proctoring, human proctoring is still largely prevalent, requiring the test taker to visit the examination centre or use a webcam to monitor them visually and acoustically. The key drawbacks resulting from the use of human proctoring systems are the labour intensity and cost implications. Furthermore, in-person proctoring has been sharply criticised for aiding dishonesty among exam-takers by allowing cheating incidents, hence raising ethical concerns. However, these ethical concerns are not exclusive to human proctoring, but they still manifest even with the use of automated systems. [Tweissi et al., 2022]. Among these ethical concerns are unfairness resulting from erroneous artificial intelligence judgment, intrusion into the privacy of students, psychological factors and limitation of autonomy [Kharbat & Daabes, 2021]. Additionally, the overreliance of online proctoring systems on data sets heightens the mistrust between the instructors and their students because it

opens a gap where privacy can be compromised through data mining [Tweissi et al., 2022].

Slusky (2020) opines that to mitigate the vulnerability of exposing students' data, the software used must guarantee the safety of stored data and records, as students reluctantly provide data that they presume will not be securely stored and protected. The forms of data commonly susceptible to abuse include Internet Protocol (IP) addresses, facial identity, identity card scans and recorded videos. It is therefore imperative for automated proctoring software developers to asynchronously analyse a test whenever a suspicious activity is detected [Slusky, 2020]. During the administration of online examinations, irregular behaviour that amounts to malpractice has always arisen. Examples of these behaviours include referring to mobile devices for communication, receiving and distributing exam questions, impersonation, violating timings, referring to textbooks or online sources, soliciting help from parties within the vicinity, and copying from others [Oncul, 2021; Peled et al., 2019]. It is the increased frequency of these malpractices that triggered universities to adopt online proctoring systems that have now flooded the field of educational technology.

Given the malpractices mentioned above that compromise the integrity of online examinations, this research discusses the various strategies that institutions and exam administrators can safely apply during the conduct of online examinations. The need to embrace online examination proctoring, therefore, remains a necessity backed by research. For instance, a study by Raman et al. (2021) to test student adoption experience of online exams revealed that of the university students interviewed, 55% had a positive attitude in favour of online proctored exams. Of the rest, 24% showed a negative attitude, citing difficulties with the internet, and 21% were indifferent. Unproctored online exams, unlike proctored ones, encourage academic dishonesty. This was proved through a study conducted by Seife and Stockton (2020) as students realised higher GPAs than in the proctored exams. Elsewhere, the emergence of websites like Quizlet.com encouraged intellectual property theft, and this provoked practising scholars to devise tamper-proof best practices [Williamson, 2018].

While sufficient evidence links online examination to academic dishonesty, conclusions are yet to be drawn on how this phenomenon can be mitigated [Peled et al., 2019]. It is against this background that this study sought to explore the online exam proctoring strategies with their advantages and disadvantages to inform end users as they opt for any. Having been widely used to test learning achievement of learners in recent years, online examinations are more prone to fraudulent activities, which could compromise their credibility [Nurpeisova et al., 2023]. This agrees with a study by OECD

(2020), which specified the challenges that were witnessed during the shift to online examinations at the onset of COVID-19 as follows: intense cheating, inability to assess practical skills and knowledge, fairness towards examinees and the danger of technical hitches during implementation.

The distinct characteristics found in online examination proctoring systems undergo modifications time and again, which ensures reliability and validity in the online exam proctoring systems used. As summarised in Table 1 below, the authentication feature that verifies the examinee and the proctor uses a one-time password, two-factor authentication and face recognition aspects. Secondly, the browsing lenience features, which restrict users from accessing other system features that can aid cheating, have adopted long tracking analysis and object and face detection. Besides, remote control and authorising features, which permit the proctor to have control of the examination process remotely, have been upgraded such that select persons have exclusive rights and security measures are hierarchically implemented. Finally, report generation features that display the examinee's report and activity log during the examination process have paved the way for technologies like Python and assorted open-source programming languages [Rajendra et al., 2022]

Table 1. Characteristics of Online Proctoring Systems

Characteristics	Description	Modified Version of Technology
Authentication	This involves the authentication and verification of the examinee and the proctor as fundamental entities of the proctoring software.	One-time password, two-factor authentication, face recognition are used to verify entities in the proctoring system.
Browsing lenience	Refers to the restraint provided by the proctoring system software about the usage of other resources, for example, browser tabs, face detection in the event of live proctoring.	Applying log-tracking analysis, object detection, face detection and other means.
Remote control and authorising.	This authorises the proctor to be able to control the proctoring system during the conduct of the examination. They can remotely start, pause or stop the process.	It is done by assigning administrative rights to select individuals and using multi-level security measures.
Report generation	It involves the generation of the examinee's report and activity log during the examination process	Modern technologies such as Python, ASP.NET and other open-source programming languages are used.

Source: (Rajendra et al., 2022, modified by Author).

2.Materials and Methods

A qualitative research approach was used for this paper. This involved a qualitative content analysis (QCA) of scientific works that address the issues of using Artificial Intelligence (AI) and emerging technologies in learning, online learning and evaluation modes and internationalisation of higher education. By mingling the results and perspectives of numerous studies, a qualitative literature review can potentially elaborate on phenomena more intensely than a single study. This technique enables scholars to see social reality in a subjective yet scientific style, hence placing prominence on both the content and text [Roller, 2019]. Both full papers and abstracts of published articles were reviewed, and the findings about the distinctions of the various online exam proctoring types were discussed in the results section.

Additionally, for each proctoring type, the review has also included the pros and cons associated with their use. The abstracts were scanned to establish the classifications of the proctoring types as advanced by various scholars from the results section. The full articles published were reviewed to establish the various features of the online proctoring types, their merits and demerits. To ensure relevance of the findings, this review favoured an exclusion criterion of considering only literature that was published not more than 10 years ago. The main search engine used for the retrieval of the resources was Google Scholar.

3.Results and Discussion.

Based on a review of published scientific works, the findings indicate an ever-evolving array of technological tools used in examination proctoring. These tools continue to advance in tandem with technological innovation trends. Considering the harsh reality that unproctored online exams have a high likelihood of encouraging dishonesty, Rajendra et al. (2022) propose two deterrent features that a good proctoring software should possess. Firstly, the possibility of activating the computer camera to record the student taking the exam for the faculty to monitor any suspicious behaviour. Secondly, limiting computer usage for copy-pasting, browsing, printing or recording all the students' activities in the computer for future review. Slusky (2020) identifies three categorisations of Online Proctoring Systems (OPS), namely fully automated AI-enabled systems, discretionary live proctor systems and hybrid systems, which are automated AI-enabled systems with a proficient live proctor as controller. Similarly, Rajendra et al. (2022) classified the online proctoring systems into three categories, namely: live, recorded and automated proctoring.

3.1.Automatic Multimedia Analytics System (Automated Proctoring)

Atoum et al. (2017) describe a system known as a multimedia analytics system that automatically proctors online exams. For the purpose of monitoring the acoustic and visual environment of the examination room, the system hardware comprises a single wearable camera, a single webcam, and a microphone. The webcam component in this system is significant in that it aids in the authentication and monitoring of the physical space found within the user's proximity [Slusky, 2020]. Rajendra et al. (2022) reiterate that an effective proctoring system needs to curb impersonation by revealing the identity of the examinee in order to uphold the sanctity of online examination.

According to Slusky (2020), features contained in the automated option include multifactor authentication, an end-to-end video recorder and an AI-enabled feature for behaviour flagging. This option is most appropriately used in safeguarding examinations ranging from lower to middle-security. Automated proctoring is a self-paced type of proctoring in which exams are written depending on the examinee's chosen time. However, that does not

impede the monitoring of the examination writing process. As seen from the test results of a study conducted by Alesio et al.(2017), it is safe to conclude that the video component of the automated AI-enabled proctoring is highly significant based on how proctoring with video deterred academic dishonesty.

Automatic proctoring is becoming more popular because it is highly scalable, time-saving, assists individual supervision and generates reports of possible exam malpractices [Kubiatko, 2020]; views shared by Rajendra et al. (2022) who stated that this system uses algorithmic and technological mechanisms to detect the lightest of fraudulent cases. Atoum et al. (2017) maintain that automated online exam proctoring overcomes geographical restrictions by facilitating the availability of learning resources required for writing online exams. Like any other proctoring system with merits, this system is not devoid of demerits.

As noted from a study among university students in Turkey, while it is proven to be accurate, efficient and effective for proctoring online examinations, it also faces technical challenges that hinder its effective use [Ilgaz & Adanir, 2020]. The automatic proctoring system is designed in a manner that its level of control adheres to an established system. Therefore, in spite of a decrease in labour cost that comes with its use, for it to be installed, professional support is required to use it, owing to the complexity of the system design [Oncul, 2021; Rajendra et al., 2022]. Furthermore, a study conducted among Kazakh universities showed that automated proctoring has several limitations, such as the inability to proctor certain types of tests, heavy financial implications that accompany the use of commercial softwares which are rarely free, putting information security into jeopardy, and backlash from students who feel artificial intelligence is invading their privacy [Nurpeisova et al., 2023].

3.2.Live Proctoring System

According to Nie et al. (2020), of the forms of online proctored exams (OPE), live proctoring is better since it allows the possibility of viewership of the examinee through the screen and not merely remotely, as in the case of automatic proctoring. What distinguishes live proctored exams from automated ones is that it is mandatory for the examinees of live proctored exams to adhere to a specific schedule before they can take exams; hence, numerous students take the exam simultaneously [Raman et al., 2021]. Furthermore, in live online proctored examinations, tutors or proctors are assigned to monitor examinees as they write the exam. They play an active role in checking the register, accounting for every single examinee and authorising those who are admissible for the exam to curb incidents of impersonation. Raman et al. (2021) add that since students may be unfamiliar to the proctor,

the device camera captures and records a photograph of the student to ascertain that they are not impostors.

In agreement with Kaiiali et al. (2016), one of the recommendations for ensuring best practice in live online exam administration by Williamson (2018) is the use of a customised lockdown browser as an enhancer of exam security. This browser disables activities such as copying and pasting, printing, exploring websites and applications that can give students an undue advantage in the course of the examination. Additionally, she proposes the adoption of the D2L learning management system, which deactivates the right-clicking option. By so doing, the students are incapable of highlighting any text within the quiz that they cannot copy and paste [Williamson, 2018]. Proctor U is another online testing service used for live proctoring of exams scheduled to be done on a particular date and time, provided the candidates have been registered. In this case, administrators proctor the exams by getting access to the webcams that monitor exam progress and student behaviour. Before the start of the password-protected exams, the administrator verifies the examinees' identities from their cards and then issues the password for accessing the exam [Williamson, 2018].

Research reveals that the realisation of live exam proctoring is highly dependent on the availability of a strong internet connection, students' digital devices and the ease of access to the exam. In certain instances, the securitisation of examination setups bars access to the internet and local files and only allows common applications such as spreadsheets [Kaiiali et al., 2016]. Additionally, competence in technology is required for whoever is in charge of monitoring the system [Oncul, 2021; Rajendra et al., 2022]. A live proctoring strategy can be used to uncover academic malpractices such as cheating, in conjunction with input procedures like facial recognition and movement of the eyes. This is in tandem with a study by Rajendra et al. (2022), who outlined the following as merits of live proctoring: it happens in real time, it has proved to be very effective for administering theoretical exams, and because of the ease of identification of the examinee by the human proctor, cases of malpractice are significantly flagged or diminished. Whenever instances of cheating are detected, the immediate intervention of the proctor eliminates the subsequent review of the recorded examination process by the university staff, a mechanism that saves time [Dadashdaze, 2021].

3.3.Hybrid Proctoring System

The other option advanced by Slusky (2020), which is hybrid in nature, has live proctors, an AI-enabled mechanism for behaviour analysis and also incorporates professionally qualified human proctors. This system is suitable for professional tests and certifications [Slusky, 2020]. The AI factor is used in this option to uphold exam integrity by detecting peculiar behavioural

signals, such as variations in light, movements, and hushed tones. The unique behaviour signals prompt live proctor actions on the screen or initiate a communication with the exam taker through either the webcam or the monitor. This hybrid option ensures balance and removes proctoring biases. Oncul (2021) posits that due to the lack of supervision of situations that may emerge in distance education tests, a form of remote supervision, which is hybrid in nature, has been adopted. The exam access procedure for this hybrid option, in his view, entails monitoring password typing speed, involves a 360-degree examination room recording, mobile telephone frisking, conducting face and voice recognition, inserting a password, and an internet protocol record. Furthermore, the procedure of remote administration of examinations demands making the application in full screen, limiting the transition to tabs, conducting an IP check, controlling the web camera, random presentation of test questions, and finally administering individualised questions [Oncul, 2021].

3.4.Recorded Proctoring System

Recorded proctoring, as espoused by Oncul (2021), involves the use of specified tools to record the exam environment at the conclusion of the examination period and then safely keeping the records in a tamper-proof manner. After the termination of the examination period, various activities such as eye tracking, face movement, object and face detection and the log details are analysed to verify if the test process was observed [Rajendra et al., 2022]. Dadashdaze (2021) refers to this proctoring technique as record and review proctoring because audio, video and screen recording of the candidate are recorded and stored to be played later by a qualified proctor who can flag suspicious behaviour of the candidate. A comprehensive sessional review is done by certified proctors for the test sponsor to uphold the results, suspend it or implement corrections. It allows a demand-driven exam administration that respects the schedule and convenience of the examinee. Record and review proctoring systems that have gained prominence include Proctor U, Honorlock, RPNow and other non-Learning Management System software [Dadashdaze, 2021].

It is disadvantageous as it requires human intervention, which is expensive and time-consuming [Oncul, 2021]. These sentiments are shared by Rajendra et al. (2022), who posited that recorded proctoring is both time-consuming and expensive due to the involvement of humans in the proctoring process. When software like ProctorU's Review+ is used, Dadashdaze (2021) argues that sufficient investigation by trained proctors needs to be done and integrity lapses reported to the instuctor which is quite a complex process.

4.Conclusion

The onset of online examination administration and the subsequent online exam proctoring (OEP), having been used to achieve efficiency in learning and

boost progression rates, thus reducing wastage at educational levels, should also be seen for its negative ramifications. These ramifications include erosion of pedagogical subjects and practices, production of docile students lacking collaborative skills, critical thinking, controversies in the relationship between the students and faculty, and unfairness in the educational structures and practices. Therefore, immediately after taking the online exam through any of the above strategies, conducting integrity checks, for example, running answers to check for plagiarism or conducting follow-up interviews, would help to affirm the outcomes and reinforce the learners' abilities. In future, standardised examination bodies offering tests like TOEFL, NLAT should consider the benefits of online proctoring of exam techniques, such as timeliness, cost-effectiveness, accessibility and inclusiveness against the constraints before making a decision on which one to use. Furthermore, since there is no singular foolproof method of the four, a layered method can be used to achieve balance. Finally, further investigation needs to be conducted regarding the ethical implications of Artificial Intelligence (AI) -driven behaviour analysis tools in the administration of online exams, so that, apart from accuracy and exam integrity being upheld, the fairness towards examinees and their privacy is also factored in.

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