JISRP

Jour of Inf Syst Res and Prac (JISRP)
Vol. 2, No. 2, June 2024, pp. 01–16

A Review on Factors Affecting the Success of Online Proctoring System

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Received: 14 March 2024, Revised: 14 April 2024, Accepted: 26 June 2024
Published online: day month 202x
DOI: *TBD*
Publisher: Dept of Information Systems | FCSIT | Uni Malaya

Abstract: The COVID-19 pandemic in 2020 prompted an overnight transition from in-class learning to online classes, significantly impacting educational institutions worldwide. To maintain academic integrity and effective learning outcomes, institutions rapidly adopted online learning and proctoring systems. This paper presents a comprehensive literature review with the primary objective of identifying the factors that affect the success or failure of online proctoring systems. Additionally, it aims to uncover the limitations in the existing literature regarding the assessment of these systems' success. The review highlights the evolution, benefits, and challenges of online proctoring, focusing on privacy concerns, technological requirements, and the impact on academic dishonesty. The anticipated findings are expected to provide actionable insights for improving the deployment and efficacy of online proctoring systems, thereby enhancing academic integrity, and learning outcomes. This study contributes to the field of educational technology by offering a robust evaluation and addressing existing research gaps related to online proctoring systems. Moreover, it provides recommendations for educational institutions to optimize their online assessment strategies in the post-pandemic era.

Keywords: Online proctoring; Academic integrity; Technology impact; Digital literacy; Personal background.

1. Introduction

In recent years, particularly since the emergence of the COVID-19 pandemic, there has been an increase in the use of online assessments, leading to a corresponding rise in research into the area of online proctoring in relation to Technology Impact (TI). Evidence has demonstrated that cheating is more prevalent during online learning [1], although there has been a need for such a type of assessment. Online proctoring technology provides a solution to this. The sudden shift to fully virtual field education introduced new challenges and complexities for student learning. Although a formal evaluation of the learning outcomes associated with online practice teaching is yet to follow, the teaching community, despite notable challenges and strains emerging over time, found energy, strength, and confidence by embracing technology and innovation in delivering social work education, including field education [2]. During the COVID-19 pandemic lockdown, universities had to quickly modify their methods of student assessment. Many countries, particularly those with limited resources, encountered substantial difficulties in executing effective online assessments during the pandemic. However, there is a significant lack of research focusing on the experiences of students in Southern Africa regarding online assessments [3]. According to [4], educators are essential in improving student learning outcomes by overseeing student assessments and the curriculum. Their responsibilities encompass interpreting online written texts by students, recognizing the context, and catering to individual needs during group activities. The shift from traditional face-to-face assessments to online formats is increasingly documented in the literature as a common practice in higher education environments [5]. Adopting online proctoring tools for assessments is one approach to addressing these challenges. By using virtual tools to monitor student activities during exams, online proctoring allows students to take exams remotely. As these tools continue to evolve and overcome their limitations, they have the potential to ensure the integrity, security, and reliability of online assessments [6].

However, concerns about privacy, discrimination, and computer literacy must be considered [7]. This study aims to evaluate the use of online proctoring in an Omani educational institute to determine its impact on academic integrity and student performance, including assessing the need for human invigilators to supplement online proctoring to ensure fairness and ethics. Unfortunately, these aspects were rarely tackled in previous studies like [8] [9] [10] [11] [12] [13] [14] [15] [16] [17] [18] [19]. Therefore, this research will provide a concrete evaluation of TI that can be derived from OP with the help of IS success model and provide recommendations on how OP can be supplemented with human invigilators to achieve the core values of academic integrity, liberty and trust.

This study is focused on undergraduate students and in summary, this work embarks the following objectives:

a. To identify the factors that affect the success of online proctoring,
b. To identify what kind of barriers faced by students when conducting online examinations along with online proctoring, and
c. To provide suggestions for teachers to improve the process of online proctoring and, in return improving academic integrity.

The rest of this paper is organized as follow. Section 2 presents our proposed method. Section 3 our obtained results and following by discussion in Section 4. Finally, section 5 presents the conclusion and highlight future research recommendation.

2. Proposed Method

The methodology follows comprehensive and enhanced procedure by addressing detailed steps and clarifications to improve the clarity and rigor of the research process. In this study, a narrative approach was used to analyse relevant literature. The primary focus was on literature discussing the impact of online proctoring systems.

a. First were the databases searched. The literature search was conducted across multiple databases, including Google Scholar, IEEE Xplore, and ScienceDirect, to ensure a comprehensive review of relevant studies.
b. Second was keywords used. The search utilized a variety of keywords such as “is success” “Delone and McLean framework” “digital proctoring” "Online Proctoring Implications," "Impact of Online Proctoring," "Online Learning," and "Proctoring Systems.".
c. Third was inclusion and exclusion Criteria. The first half of this phase involved identifying papers with titles containing any of the specified keywords. This initial search yielded a large number of papers. The second half was that titles were screened for relevance, and papers that included any of the keywords were shortlisted.
d. Fourth abstract and full-text screening. Abstracts and full texts of the shortlisted papers were reviewed to assess their relevance to the research objective. Papers were selected based on their discussion of online proctoring systems and their impact on online learning and assessment.
e. Followed the fifth step, exclusion Criteria. This step divided into 3 phases. First, papers published before 2019 were excluded, except for foundational theory papers. Then, only peer-reviewed papers published in English between 2019 and 2024 were considered. Finally, studies that did not explicitly discuss online proctoring systems were excluded.
f. After fifth step, sixth step was about data extraction and synthesis. Relevant data from the selected studies were extracted, including study objectives, methodologies, findings, and their relation to online proctoring systems.
g. The seventh step was quality assessment. The quality of the selected studies was assessed based on criteria such as methodological rigor, sample size, and the relevance of findings to the research objective.
h. Eighth was data synthesis. The extracted data were synthesized narratively to identify common themes, patterns, and gaps in the literature. The synthesis aimed to provide a comprehensive understanding of the factors affecting the success of online proctoring systems.
i. Ninth step was searching strategy refinement. Which was to improve search results, advanced search strategies were employed, such as combining keywords using Boolean operators (AND, OR) to narrow down the search to the most relevant studies.
j. Tenth step was the iterative search process. The search process was iterative, with continuous refinement of keywords and search strategies to ensure the retrieval of the best possible results. Despite extensive searching, it was challenging to find studies explicitly focused on the impact of online proctoring systems. The scarcity of such studies was a significant limitation. Unfortunately,

in the absence of direct studies, the best possible results were selected based on their relevance and contribution to understanding the research problem.

Figure 1 illustrates the process of including and excluding papers for this study.

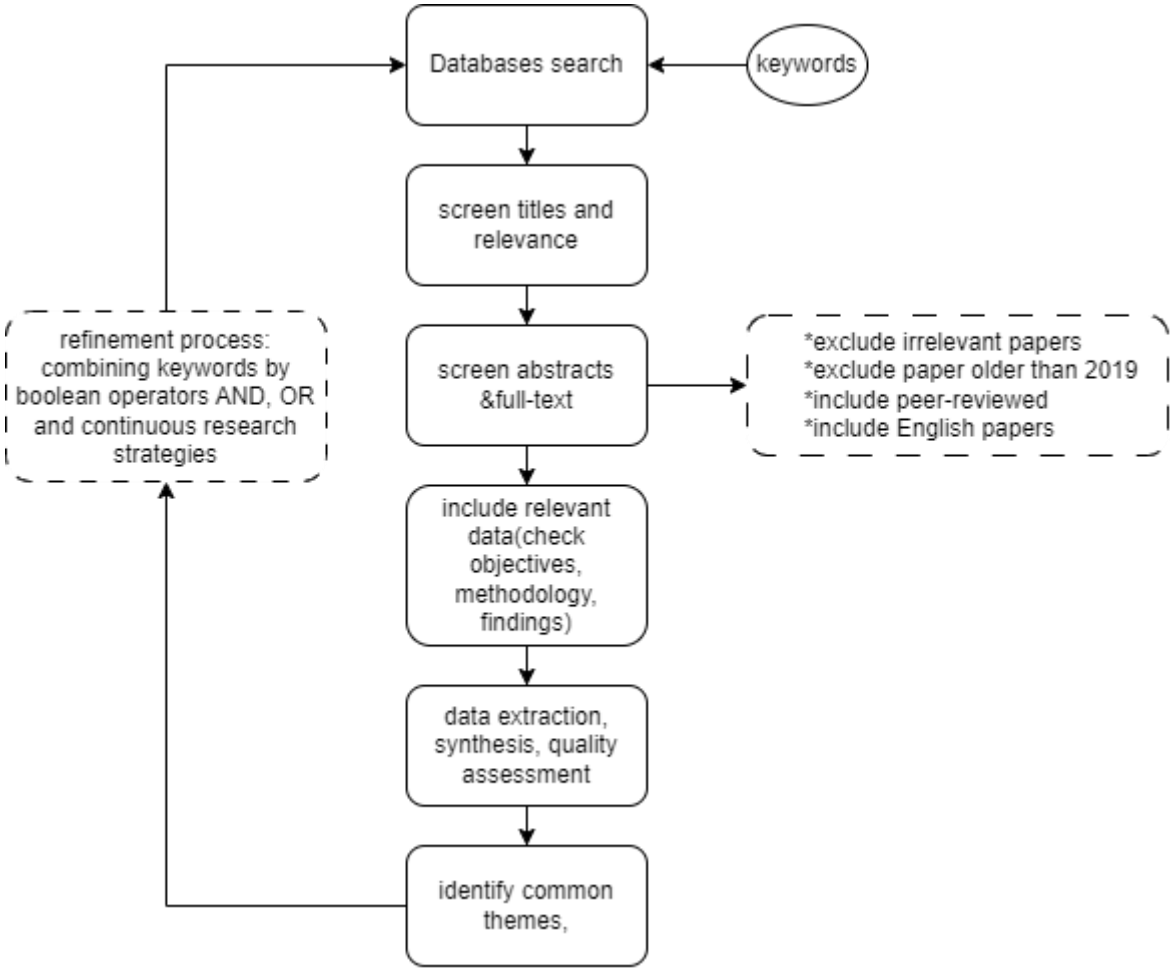

Figure 1. The process of inclusion and exclusion of literatures

3. Results

Table 1 as follow illustrates the result of combined key papers found and evaluated studies that hold a potential to be included in this research.

Table 1. Review of literature analysis

1	**González-González, *et al.*, [8]**
Problem: complete remote teaching, in evaluation process. Most online teaching require the physical presence of students for exams and assessments. Ddifficulties for fully remote education, MOOCs in particular. **Factors**: Quality management, available information, external conditions, trust, attitude, intention, perceived usefulness, perceived compatibility **Method**: Mixed approach **Findings**: Identifying critical aspects influence decision to adopt and deploy online assessment. Such as, trustworthiness, quality management, information availability, external conditioning, confidence, feelings of suitability and usefulness, perspective, and purpose. **Limitations**: Narrow Focus on motivational factors, excluding other influences. Limited Sample. Generalizing. Rapid technological evolution may quickly outdate findings.	
2	**Lee [9]**
Problem: The impact of different exam proctoring environments on student performance. The study investigates whether there is a significant difference in student performance between online proctored exams and offline proctored exams. Concerns about academic integrity. **Factors**: Stress, self-efficacy, familiarity with proctoring environment.	

Method: Quantitative **Findings**: There was no significant difference in student performance between the two settings. Legitimacy of online assessments due to potential differences in proctoring environments may be unfounded. **Limitations**: Significant duplication of students might influence the results. Results are based on data from a single program. Graduate Student Sample (Findings may not be generalizable to undergraduates).	
3	**Conijn, *et al*., [10]**
Problem: negative side-effects of using online proctoring software. Investigates the effects of proctoring on students' temptation to cheat, perceived exam difficulty, performance, and test anxiety. **Factors:** Students' characteristics, contextual factors (dedicated study space, reliable technology, financial issues), experience, demographic factors(gender) **Method:** Quantitative **Findings:** The purpose of this research is to determine whether or whether proctored exams reduce students' feelings of test anxiety, perceived exam difficulty, and students' likelihood of cheating. We also investigate the factors, both environmental and individual, that contribute to students experiencing anxiety during online assessments. **Limitations:** Limited scope that does not cover all negative side-effects. Self-Selection bias. Students unaware of cheating. anxiety influenced by course. exam format familiarity unmeasured.	
4	**Moro, *et al*. [11]**
Problem: Challenges and factors influencing the implementation of e-proctoring systems in Spanish universities. Widespread adoption faced significant hurdles. **Factors**: Student concerns, perceived reliability of technology, security, complexity, compatibility, cost, management support, government pressure (to use e-proctoring), competitors force, IS providers support, leader or manager characteristics, size of the company, technological organizational readiness, relative advantage **Method**: Qualitative **Findings**: The study is focused to describe the effect of Covid-19 pandemic on the Spanish educational system and the potential benefits of implementing e-proctoring in Spanish universities to improve academic integrity. This research analysed different 15 factors that affect the adoption of technological tools. **Limitations**: Focused only on Spanish universities. Additional research needed on student expectations and incentives for e-proctoring acceptance. Limited resources due to lack of external funding. Ethical and Legal Concerns (data protection and privacy). Judgmental bias. Technological Readiness (equipment, connectivity, and training not fully explored). Generalizability.	
5	**De La Roca, *et al*. [12]**
Problem: Ensuring academic integrity in online education, MOOCs (Massive Open Online Courses). Investigating students' perceptions and experiences with online proctored exams to address issues related to cheating and to validate the effectiveness and fairness of the evaluation process. **Factors:** Technical resource, students' emotions, satisfaction level, perception of proctoring, information and support. **Method:** Quantitative **Findings:** The main aim of this study is to determine students' perception and their performance towards proctoring through online exams in a MOOC **Limitations:** Sample size (only 109 out of 299 enrolled) and demographics (age and education level might affect the generalization of the results). Technical requirements absence among 17% of students. Some students had first-time experience with online proctoring. Stress	
6	**Archer [13]**
Problem: the rapid shift to online assessments and proctoring due to the COVID-19 pandemic, focusing on the associated challenges related to social justice, ethics, and validity. **Factors:** Emotional factors (anxiety, behavioural changes due to surveillance, self-sustaining), race(Difficulty in tracking and identifying students with darker complexions), digital literacy, technology, disability factors **Method:** Qualitative **Findings:** Racial biases in facial recognition. Disadvantaging students with limited access to technological resources. Privacy intrusions, increased stress and anxiety, and data security risks. Assessments validities is questioned due to varying home environments and digital literacy levels among students, failure to accommodate students with disabilities. Advocates for less intrusive, more equitable assessment methods that promote higher-order learning and critical thinking, moving beyond a sole focus on preventing cheating. **Limitations:** Privacy and data security concerns, technological barriers, standard image of students.	
7	**Hartnett, *et al*. [14]**
Problem: The study addresses the issue of digital inequalities in the context of online proctored exams. It focuses on understanding students' digital confidence and competence, which are critical for equitable access to online assessments.	

Factors: Digital access, digital confidence, digital competence, ethnicity, and online learning experience. These elements are critical in understanding the disparities in students' ability to effectively engage with online proctoring systems. **Method:** Quantitative **Findings:** Significant digital inequalities based on ethnicity, with Pacific learners reporting lower digital competence despite similar online learning experiences compared to other groups. Most students felt confident and had the necessary digital access. **Limitations:** The study's focus on a single university in New Zealand may limit the generalizability of the findings. Additionally, reliance on self-reported data could introduce bias.	
8	**Jiang, *et al*. [15]**
Problem: The study addresses the problem of understanding university students' acceptance of online proctoring systems. The importance to investigate factors influencing students' willingness to adopt and use online proctoring, which had not been sufficiently explored. **Factors**: Social influence, social presence, and perceived usefulness, social influence and social presence. **Method**: Quantitative **Findings**: Social influence and social presence significantly impact perceived usefulness and acceptance of online proctoring systems. Perceived ease of use did not positively affect acceptance, suggesting that technological familiarity reduces its importance. Building a positive social presence enhances user acceptance, and social influence from peers, teachers, and institutions is crucial. **Limitations**: The study's focus on university students during the COVID-19 pandemic may limit the generalizability of the findings to other contexts or periods.	
9	**Ford, *et al*. [16]**
Problem: address the challenge of conducting secure and effective online examinations for pre-registration nursing students during the COVID-19 pandemic, focusing on the use of remote proctoring services to meet Professional Statutory Regulatory Body (PSRB) requirements. **Factors: F**amiliarity with software, practice with hardware, confidence in handling IT issues, ongoing pastoral support, and awareness of academic misconduct. These factors are crucial for understanding and improving students' experiences with online proctoring. **Method:** Quantitative **Findings: S**tudents generally appreciated the practice test function, which helped them become familiar with the exam platform and reduce stress. However, digital inequalities were apparent, with some students feeling less confident in their IT skills. The realist evaluation revealed five interconnecting themes: software familiarity, hardware practice, IT confidence, pastoral support, and academic misconduct awareness. These findings highlight the necessity of robust support mechanisms and effective communication to address students' diverse needs and enhance digital literacy. **Limitations:** The study's primary limitation is its focus on a specific group of students (pre-registration nursing students) at a single university, which may limit the generalizability of the findings. Additionally, the sample size of 87 students is relatively small, and the study relies on self-reported data, which can introduce bias.	
10	**Green [17]**
Problem: the primary issue addressed is the challenge of mitigating impersonation attacks during e-assessments through continuous authentication methods while understanding how these methods impact student attitudes and intentions **Factors**: The key factors examined include performance expectancy, effort expectancy, privacy concerns, trust, and perceived risks. These factors are analyzed to understand their impact on students' acceptance and use of continuous authentication systems **Method**: Quantitative **Findings**: The study found that performance expectancy and effort expectancy positively influence students' attitudes and intentions to use continuous authentication technologies. However, privacy concerns significantly heighten perceived risks, negatively impacting students' willingness to engage with these technologies, especially webcam monitoring and lock-down browsers. Trust is identified as a crucial moderating factor, mitigating the adverse effects of privacy concerns and enhancing acceptance of proctoring systems. The findings underscore the necessity for educational institutions to address privacy issues comprehensively and build trust through transparent communication and robust privacy protections to improve student acceptance and ensure a positive user experience with online proctoring systems. **Limitations**: The study faced limitations such as a small sample size for biometric technologies, potential biases in user perceptions influenced by personal experiences or cultural backgrounds, a homogenous participant pool from one university, and a predominately female population. These factors may limit the generalizability and practical reliability of the findings	
11	**Oeding, *et al*., [18]**

Problem: academic dishonesty in online courses and the impact of online proctoring software on mitigating this issue. **Factors**: Gender, full-time part-time student status, cumulative GPA, course type, pre and post- proctoring comparison, demographic (age, race and ethnicity, in-state out-of-state status, on off-campus, first-generation college student status, major, college classification, high school GPA.) **Method**: Quantitative **Findings**: The implementation of online proctoring software had no significant impact on students' course grades when analyzed across six undergraduate courses. However, individual course analyses revealed significant findings, when considering variables like gender and full-time/part-time status. Different groups with different responding to proctoring were noticed. The results varied among different courses, with some showing no significant changes due to proctoring software. **Limitations**: COVID-19 pandemic impacted performance of student and their interaction with proctoring software. Limited the sample size. Findings might not be fully representative of the broader student population. Generalization to different course types. Technical factors. No long-term effects examined.	
12	**Han, *et al*., [19]**
Problem: The primary focus is on how digital proctoring systems have been adopted by higher education institutions (HEIs) to ensure academic integrity during online examinations. The paper identifies key topics and challenges through a systematic literature review, revealing issues such as the technological advancements needed for proctoring, stakeholders' concerns, and the ethical implications of continuous surveillance. **Factors**: Technological Advancements (cheat detecting, authentication system), student and educator perception. **Method**: systematic literature review **Findings**: The review identified seven main topics in the literature, including technological solutions for academic integrity, challenges in implementation by institutions, impacts of different proctoring approaches on students, features of proctoring systems, task characteristics influencing use, student perceptions, and institutional policies. Insights on the current state of digital proctoring in higher education and calls for further research to enhance academic integrity through these evolving technologies **Limitations**: Limited scope of publication, geographic and language bias, reliance on topic modelling, lack of quality assessment, limited synthesis, generalization	

As shown in Table 1, papers were collected and arranged in chronological order. Starting from 2020, there were two papers published, three articles in 2022, four articles in 2023, and three in 2024. This sums them to twelve papers in total. These were the best papers selected to serve this study, however there were other papers used for having factors used for the discussion. They all interconnect with each other in terms of the factors affecting the online proctoring process during the online exams in universities. Factors influencing online proctoring was the main criticize technique to evaluate each paper's components in research.

3.1. Key Paper 1 Overview

According to [8], the current assessment methods in online education are a significant weakness, especially as fully remote instruction becomes more common. The report indicates that, in response to the UNESCO Educational Disruption and Response to COVID-19 crisis, most countries are closing educational facilities and shifting their activities to online and remote formats. However, e-proctoring technologies (electronic proctoring) already exist, so this may be done remotely, without the need for a physical presence on either the student's or the proctor's part. Therefore, the purpose of this research is to determine what factors influence institutions to accept and implement this evaluation system as a method of remote supervision, and to bring this information to the attention of those institutions that are still skeptical. Experts in the field of online education use a combination of a bibliographic research and a causal investigation to accomplish this goal. With fuzzy cognitive mapping (FCMs), you can easily see how various ideas and system components are connected via semantically meaningful causal relationships. So, this model is being used to validate or refute the effect of motivating elements gathered from a literature analysis of prior research on the factors that determine whether the educational system adopts this instrument as a form of remote online supervision. Therefore, the purpose of this research was to identify the driving forces behind the adoption of this evaluation system, to lay out a list of motivational influencing factors at play whenever new technological tools are accepted by the educational system and to identify the most significant of these factors. Quality management (QM), Available information (AI), external conditioning (EC), perceived utility (PU), trust (T), intention (I), perceived compatibility (PC), and attitude (A) are some of the motivating variables on the list. The level of confidence (T) that institutions have in the safety and confidentiality of this method is crucial.

Research by [8] explore the implementation of e-proctoring in online teaching by identifying the motivational factors that influence its acceptance and use. Through a combination of bibliographic and causal studies involving experts in online education, the research aims to promote e-proctoring as a viable method for remote supervision. The study outlines key motivational factors, including quality management, available information, external conditioning, trust, perceived compatibility, perceived usefulness, attitude, and intention, with trust being the most decisive factor. Data were collected via interviews with eight experts, and the Fuzzy Cognitive Maps (FCM) methodology was used to analyze the relationships between these factors. The findings highlight the importance of trust and security in e-proctoring tools, suggesting that comprehensive communication and advertising campaigns are essential to enhance their adoption. The study concludes that while e-proctoring holds significant potential, further efforts are needed to address its challenges and improve its implementation in online education settings.

3.2. Key Paper 2 Overview

Research by [9] Online and hybrid course options are becoming more common in institutions. There is a lack of data on how test proctoring settings affect student performance on online assessments, despite the fact that enrolment in online degree programs and online courses has risen over the previous decade. As the landscape of online education continues to change, institutions of higher education must work harder than ever to ensure that their online degree programs, online courses, and online examinations continue to meet or exceed students' high expectations. This research compares two types of proctored exams—online and offline—to determine whether one has a greater effect on student performance. In all, 1,762 students were surveyed over the course of eight years (2009-2016) at a single institution for this research. This research uses a t-test for comparing means between two groups and a regression analysis to evaluate the hypothesis. The results indicate that it is very improbable that students' test performance is affected by the proctoring setting, whether the exam is proctored online or offline. test proctoring does not seem to affect student performance, as shown by the findings of this research, which found no statistically significant difference in test scores due to the proctoring setting. Students' academic performance does not seem to be affected by the proctoring settings, according to the results.

3.3. Key Paper 3 Overview

The study conducted by [10] aimed to explore the potential side-effects of online proctoring on students, particularly focusing on test anxiety. With the shift to online education due to the COVID-19 pandemic, understanding how online proctoring affects students' performance, cheating behavior, and psychological state became crucial. Several factors influencing test anxiety were discussed such as student characteristics including persistence in learning, environmental structuring, and internet literacy. Another factor was contextual factors like the lack of study space, unreliable technology, and financial issues. In addition, demographic factors such as gender differences, with women showing higher levels of test anxiety. The study employed a large-scale survey conducted among students at a Dutch university over the span of one year. The survey included data from 1760 students across three waves, focusing on their experiences with online and proctored exams. Exam data and grades were also collected to analyze the effects of proctoring on performance and anxiety levels. The main findings of their study were that there were no significant differences were found in perceived cheating between online and offline exams or between proctored and non-proctored exams. Furthermore, proctoring did not significantly affect students' perception of exam difficulty or their performance. Both online and proctored exams were associated with higher levels of test anxiety. Proctoring specifically increased test anxiety, partly due to the nature of online exams.

The study had several limitations. It did not cover all potential negative side-effects of proctoring or all factors influencing test anxiety. The voluntary nature of the surveys might have introduced self-selection bias, and the self-reported data could have been influenced by social desirability. The study was conducted at a single Dutch university, which might limit the generalizability of the findings. Some variables were approximated (e.g., familiarity with online exams), which might not fully capture their impact on test anxiety. The study highlights the significant impact of online proctoring on test anxiety among students, pointing out the need for educational institutions to consider these psychological effects when implementing proctoring methods. Future research should aim to explore additional factors and potential side-effects to provide a more comprehensive understanding of the implications of online proctoring.

3.4. Key Paper 4 Overview

From the study of [11] it is analyzed that this research aims to examine the primary elements that contribute to the effective adoption of e-proctoring in Spanish universities. It examines various crucial factors involved in the implementation of e-proctoring such as the significance of technological infrastructure, the influence of institutional support and regulations, the acceptability of students and faculty, and the need for efficient training and communication techniques. The authors underscore the need of ensuring that the implementation of e-proctoring is in compliance with the distinct requirements and objectives of individual universities and programs. In addition, the article emphasizes the importance of upholding academic integrity during the implementation of e-proctoring, as well as the potential difficulties related to privacy issues and ethical considerations. The results of this study enhance comprehension of the intricacies associated with the implementation of e-proctoring in higher education. Additionally, they provide essential perspectives for educational institutions in Spain and other regions as they navigate the dynamic environment of online assessment and remote learning. In this research, the causal study was conducted using the methodology of fuzzy cognitive maps. The data collected from the study were subsequently analysed using the FCMappers tool. This provided insight into the significant involvement of students in the non-implementation of e-proctoring, as they raised concerns regarding the insufficiency of resources required for its usage and the potential violation on privacy associated with this tool. Additionally, it underscored the influence of external factors such as governmental pressure or incentives in addressing these concerns and facilitating the adoption of e-proctoring in Spanish universities.

3.5. Key Paper 5 Overview

The study of [12] employed a mixed-methods methodology including both surveys and interviews as data collection techniques. The participants of the research include of those who have encountered online proctoring during their participation in MOOCs, as well as those who have not. The results indicate that the usage of online proctoring can improve the security of examinations; nonetheless, it may concurrently engender elevated levels of tension and anxiety among students. Certain students have raised concerns over the infringement upon their privacy and the persistent sense of being under constant surveillance during evaluation processes. Moreover, the research emphasizes that the satisfaction levels of students about MOOCs might be impacted by the availability or lack of online proctoring. Certain individuals value the use of security measures, whereas others perceive them as intrusive and disruptive to their educational endeavors. The research highlights the significance of thoroughly evaluating the integration of online proctoring in MOOCs, taking into account its advantages in upholding academic honesty while also considering the potential adverse effects on students' contentment and perspectives. This study aims to examine the potential impact of online proctoring technologies on students' experiences and overall happiness with MOOCs. Specifically, the study seeks to determine whether the use of these technologies which serve to monitor students during online tests as a means of preventing cheating, has any detectable effect on students' perceptions and levels of satisfaction within the MOOC context.

3.6. Key Paper 6 Overview

Research by [13] explores the validity, social justice, and ethical concerns associated with the shift to technology-driven proctoring in higher education due to the COVID-19 pandemic. Utilizing a qualitative approach, the study applies 5D conceptualization framework, which includes disparity, deprivation, disadvantage, dysfunction, and difference, to examine the complexities of digital proctoring. Data collection involved a comprehensive literature review, analysis of scholarly publications, grey literature, and social media memes to capture diverse perspectives on digital proctoring. The study identifies significant social justice issues, such as racial biases in facial recognition technology and the digital divide exacerbating inequalities among students with varying access to technological resources. Ethical concerns are raised regarding privacy intrusions, increased student stress and anxiety due to constant monitoring, and risks related to data security and breaches. The validity of assessments is questioned as differing home environments and digital literacy levels introduce uncontrolled variables affecting fairness. Additionally, the lack of adequate accommodations for students with disabilities further underscores the need for more inclusive practices. The findings highlight the intrusive nature of digital proctoring and its potential to reinforce structural inequalities.

The study advocates for less intrusive, more equitable assessment methods that emphasize higher-order learning and critical thinking. These alternatives would move beyond merely preventing cheating to promoting a holistic approach to student evaluation. The research concludes that while digital proctoring is likely to remain part of the educational landscape, it must be implemented with caution, considering the diverse needs and realities of all students to ensure fair and valid assessments. Future research should involve a broader range of participants and consider additional external variables to further understand the impact of digital proctoring on higher education.

3.7. Key Paper 7 Overview

Research by [14] investigate digital literacy factors affecting the use of online proctored exams (OPE) in New Zealand during the COVID-19 pandemic. The study, which surveyed 761 university students, found that while most students felt confident and had the necessary digital access to complete online exams, significant digital inequalities were observed based on ethnicity. Notably, Pacific learners reported lower digital competence despite similar online learning experience compared to other groups, highlighting persistent barriers and systemic inequities in digital literacy. The authors suggest that enhancing digital literacy skills and providing differentiated technical support are crucial for addressing these inequalities and improving the effectiveness and fairness of online proctoring systems. Research by [14] directly address the impact of personal background, particularly focusing on ethnic disparities, on digital competence and confidence in online proctoring. The study revealed significant digital inequalities among students from different ethnic backgrounds, with Pacific learners reporting lower digital competence compared to other groups despite having similar online learning experiences. This disparity underscores how personal background factors, such as ethnicity, can affect students' ability to effectively engage with and benefit from online proctoring systems. The findings emphasize the need for tailored support and resources to bridge these digital gaps and ensure equitable access to online assessments, highlighting that personal background plays a critical role in shaping students' experiences and success with online proctoring.

3.8. Key Paper 8 Overview

Research by [15] explore university students' acceptance of online proctoring systems during the COVID-19 pandemic using an extended Technology Acceptance Model (TAM). The study highlights that social influence, social presence, and perceived usefulness are critical predictors of online proctoring acceptance. Through structural equation modeling of data from 760 university students, the research reveals that social influence and social presence significantly impact perceived usefulness and the acceptance of online proctoring systems. Interestingly, perceived ease of use did not positively affect acceptance, likely due to students' familiarity with the necessary technical requirements. The study underscores the importance of building a positive social presence and group atmosphere to enhance user acceptance and reduce psychological barriers, such as increased test anxiety. These findings suggest that educational institutions should focus on fostering a supportive and engaging online environment to improve the effectiveness and acceptance of online proctoring tools.

3.9. Key Paper 9 Overview

Research by [16] evaluate the use of remote proctoring for online examinations among pre-registration nursing students during the COVID-19 pandemic at Northumbria University. The study, using a realist evaluation methodology, identified key factors affecting the success of online proctoring: familiarity with software, practice with hardware, confidence with IT issues, ongoing pastoral support, and awareness of academic misconduct. Findings revealed that while most students valued the practice test function and support provided, there were concerns about privacy and stress due to technical issues. The study highlights the importance of comprehensive support and clear communication to enhance digital literacy and reduce anxiety, thus improving the overall experience with online proctoring.

3.10. Key Paper 10 Overview

Research by [17] investigates student attitudes and intentions towards continuous authentication methods designed to mitigate impersonation attacks during e-assessments. Utilizing the Unified Theory of Acceptance and Use of Technology (UTAUT) model, the study identifies performance expectancy, effort expectancy, and privacy concerns as significant factors influencing students' behavioral intentions and attitudes towards technologies such as proctoring, webcam monitoring, and lock-down browsers. The findings indicate that while performance and effort expectancy foster positive attitudes and

intentions to use these systems, privacy concerns significantly heighten perceived risks and negatively impact students' willingness to engage with the technologies.
Furthermore, the study highlights the role of trust as a moderating factor, particularly for proctoring systems. Increased trust can mitigate the adverse effects of privacy concerns, thereby enhancing student acceptance of continuous authentication methods. The research also notes that privacy concerns have both direct and indirect negative effects on behavioral intentions, especially with webcam monitoring and lock-down browsers. This underscores the necessity for educational institutions to address privacy issues comprehensively and foster trust through transparent communication and robust privacy protections. Authors' findings stress the importance of considering student perspectives to improve the implementation and effectiveness of continuous authentication technologies. Addressing privacy concerns and building trust are crucial for reducing perceived risks and enhancing students' acceptance and use of these systems. These insights are essential for educational institutions aiming to maintain academic integrity while ensuring a positive user experience with online proctoring systems. Future research should further explore the application of the IS Success Model to provide a comprehensive evaluation framework, integrating dimensions such as system quality, information quality, service quality, use, user satisfaction, and net benefits.

3.11. Key Paper 11 Overview

Research by [18] examine the complex impact of online proctoring software on undergraduate course performance, focusing on the interplay between demographic factors and academic integrity. Utilizing a quantitative approach, the study employs regression analysis to explore the relationship between course grades and variables such as the implementation of proctoring software, gender, full-time/part-time status, and cumulative GPA. Data was collected from various undergraduate courses, both pre- and post-implementation of the software, providing a comprehensive dataset for analysis.
The results revealed mixed outcomes: while the overall impact of proctoring software on course grades was not statistically significant, individual course analyses showed significant variations. For example, a 200-level business law course experienced lower grades with proctoring software, particularly when factoring in gender and full-time/part-time status. Female students in a 100-level math course and full-time students in a 300-level engineering course exhibited lower grades when proctoring software was used, suggesting these groups may be more affected by the implementation of such technologies.
Cumulative GPA consistently emerged as a significant predictor of course grades, indicating that students with higher GPAs tended to perform better regardless of the use of proctoring software. The study also noted that the Covid-19 pandemic likely influenced the data, as the shift to online learning and the stressors associated with the pandemic could have impacted student performance and interactions with proctoring software.
The study's findings suggest that while online proctoring software can help maintain academic integrity, its impact varies across different courses and demographic groups. The authors recommend further research to explore the long-term effects of proctoring software, the inclusion of additional demographic variables, and the consideration of technical and environmental factors that might influence the effectiveness of online proctoring. Limitations of the study include the potential influence of the Covid-19 pandemic, the voluntary nature of data collection, and the need for a more diverse and larger sample size to enhance the generalizability of the findings.

3.12. Key Paper 12 Overview

[19] presents a systematic literature review on digital proctoring in higher education. The main objectives are to understand how digital proctoring has been implemented in higher education institutions (HEIs) and to propose future research directions. The authors conducted a systematic literature review following the PRISMA procedure and used topic modeling techniques to identify the key themes discussed in 154 relevant publications. The review identified seven key topics from the literature, including solutions for detecting cheating and student authentication in digital proctoring, challenges and issues with the uptake of digital proctoring systems by HEIs, impacts of different proctoring environments on student performance, technological attributes and features of digital proctoring systems, task characteristics that influence the use of digital proctoring, student perceptions and experiences with digital proctoring, and institutional policies and regulations around the use of digital proctoring. The paper offers valuable insights into the implementation, adoption, and impacts of digital proctoring in higher education digitalization, benefiting academics, policymakers, practitioners, and students. It highlights the need for further research on enhancing academic integrity in online

examinations through digital proctoring solutions. Overall, the review comprehensively captures the current state of research on digital proctoring in higher education and outlines important directions for future studies in this evolving field.

4. Discussion

The rapid advancement of technology, particularly during the COVID-19 pandemic, has significantly transformed educational and business environments by necessitating a shift to remote learning and online assessments. This shift has underscored the importance of maintaining academic integrity and quality in online education, with Online Proctored Examinations (OPEs) becoming crucial tools for replicating traditional exam conditions virtually to prevent cheating [20] [19]. However, this swift transition also revealed substantial challenges related to technology reliability, student perceptions, privacy concerns, and social justice [13] [21]. These issues play a significant role in the success of online proctoring systems, highlighting the need for a nuanced understanding of factors influencing their effectiveness and acceptance in higher education. Technological infrastructure and reliability are crucial for the success of online proctoring systems, but human factors such as student anxiety, perceptions, and broader social justice issues are equally important [10] [13]. Ensuring data security and privacy, developing inclusive policies, and maintaining academic integrity are essential considerations [17] [22]. By integrating insights from multiple studies, a comprehensive understanding of online proctoring systems can be achieved, offering practical recommendations for educational institutions to promote a more inclusive, equitable, and effective approach to online assessments [21] [23]. The reliability and robustness of technological infrastructure are paramount for the seamless operation of online proctoring systems. Technological reliability is essential for maintaining the integrity of online assessments, with issues such as unstable internet connections and software glitches significantly disrupting the examination process and negatively impacting student performance and confidence [8] [19]. Trust in the technological infrastructure is critical for the adoption and effectiveness of e-proctoring systems [8]. Advanced technological solutions, such as AI and machine learning, enhance security and functionality but also raise significant privacy concerns [23]. The need for user-friendly and accessible technology is emphasized, as technological issues can significantly influence student satisfaction with online teaching [21]. Human factors, including student perceptions, psychological impacts, and the need for support and training, are critical to the success of online proctoring systems. Online proctoring significantly increases test anxiety among students, with privacy concerns exacerbating this anxiety [10] [17]. Providing comprehensive support and training for both students and educators is essential to reduce anxiety and enhance confidence in using proctoring technology [16]. Collaboration between teachers, students, and administrative staff is necessary to improve the quality of online education and address the human factors that impact the success of online proctoring systems [21].

Security and privacy concerns significantly affect the acceptance and effectiveness of online proctoring systems. Continuous monitoring and data security are major issues, with the intrusive nature of digital proctoring raising significant privacy concerns [13] [17]. Trust plays a critical role in the acceptance of online proctoring systems, requiring transparent communication about data collection, usage, and protection [17]. Institutions must prioritize robust privacy protections and transparent policies to build trust and acceptance among students [23] [22]. Social justice and equity are crucial considerations in the implementation of online proctoring systems. Digital inequality and racial biases in facial recognition technology can disproportionately disadvantage certain groups, emphasizing the need for inclusive policies to ensure equitable access to online assessments [13] [14]. Collaboration and comprehensive approaches are necessary to create a fair and equitable online assessment environment [21] [22].

Ensuring academic integrity and effectiveness in online proctoring requires a balanced approach that combines robust technological solutions with comprehensive educational strategies. While online proctoring can maintain academic standards and integrity, institutions must address associated stress, demographic variations, and foster a culture of honesty through education and collaboration [9] [18] [24] [22] [23]. Considering this, however, the main factors that were put in focus are students' personal background and their level of digital literacy.

4.1. Personal Background

Personal background factor plays a significant role in the effectiveness and fairness of online proctoring systems. These factors encompass students' existing education and learning backgrounds, digital literacy, socio-economic status, and professional identity. The impact of these personal background elements on students' experiences with online proctoring has been highlighted in several studies.

Research by [25] surveyed students' views on the implementation of IT tools by institutions during the COVID-19 pandemic, focusing on video-based monitoring (VbM) software. Their findings revealed that students found VbM problematic, especially during the lockdowns when they had to manage significant changes in their personal lives. The abrupt transition to remote learning environments exacerbated existing challenges related to students' educational backgrounds and their ability to adapt to new technologies. This study underscores the importance of considering students' prior experiences and readiness for digital learning when implementing online proctoring systems. Research by [26] provides further insights into how digital inequities and vulnerabilities affect both students and instructors in the context of online proctoring. The study on English-language teachers (ELT) in Canada highlights the disparities in digital literacy among students and the professional vulnerabilities of instructors. These disparities can create significant obstacles in navigating remote assessments effectively. Detwyler's findings suggest that socio-economic background and access to digital resources are critical factors that influence the fairness and effectiveness of online proctoring. Addressing these digital inequities through targeted support and resources is essential to ensure that all students, regardless of their personal backgrounds, can participate equitably in online assessments.

Research by [27] explores novice nurses' perceptions of academic dishonesty during their education, shedding light on the influence of ethical beliefs and professional identity on attitudes towards online proctoring. The study found that dishonest behaviors in academic settings could potentially extend into professional practice, affecting patient outcomes. This highlights the need for robust integrity education and support systems that consider students' ethical and professional development. Gough's research emphasizes that personal background factors, such as ethical beliefs and professional identity, must be addressed to maintain high standards of academic and professional integrity in online proctoring systems.

In summary, personal background factors significantly affect the implementation and effectiveness of online proctoring systems. Students' educational backgrounds, digital literacy levels, socio-economic status, and professional identities all influence their experiences and perceptions of online assessments. To ensure equitable access and maintain high standards of academic integrity, educational institutions must address these personal background factors by providing comprehensive support systems and resources tailored to the diverse needs of their student populations [25] [26] [27]. This holistic approach will help create a more inclusive and fair online assessment environment that accommodates the varied backgrounds and experiences of all learners.

4.2. Digital Literacy

Digital literacy is a critical factor influencing the success of online proctoring systems. It encompasses a range of competencies, including the ability to effectively use digital tools, understand and interpret information, and navigate online environments. As highlighted by [28], digital literacy is integral to the successful utilization of e-services and has been incorporated into models predicting user satisfaction and net benefits. Research by [29] emphasizes that students' preparedness for e-learning, which includes personal motivation, self-confidence, and proficiency in technology, is vital for their successful engagement with online proctoring systems. Teachers also play a crucial role in fostering these competencies, highlighting the need for comprehensive support systems that enhance students' digital literacy. Research by [30] further underscore the importance of digital literacy by pointing out that students' proficiency in computer skills and mastery of the English language are fundamental to the success of e-learning. These skills enable students to navigate online proctoring platforms effectively and perform well in remote assessments.

Selwyn, *et al*. in [31] discuss the widespread adoption of online proctoring in Australian universities, stressing the necessity of critical digital literacies among students and staff. The study reveals that while online proctoring can facilitate remote assessment, it also introduces significant concerns related to surveillance, control by commercial providers, and hidden labour. The authors advocate for a more democratic approach to technology procurement and the development of digital literacies to ensure informed and ethical use of proctoring technologies in education. Harnett, *et al*. in [14] explore digital literacy factors affecting online proctoring in New Zealand, particularly during the COVID-19 pandemic. Their study found significant digital inequalities based on ethnicity, with Pacific learners reporting lower digital competence despite similar online learning experiences compared to other groups. These findings highlight the persistent barriers and systemic inequities in digital literacy. The authors suggest that enhancing digital literacy skills and providing differentiated technical support are crucial for addressing these inequalities and improving the effectiveness and fairness of online

proctoring systems. Ford, *et al*. in [16] provide a comprehensive evaluation of remote proctoring for pre-registration nursing students, identifying digital literacy aspects such as familiarity with software and confidence in handling IT issues as key factors. The study emphasizes the importance of practice tests and detailed guidance to alleviate students' anxiety and improve their digital competence. The findings suggest that robust support mechanisms and effective communication are essential for the successful implementation of online proctoring. In summary, digital literacy is a vital component for the success of online proctoring systems. It involves not only the technical skills required to use digital tools but also the ability to critically navigate and engage with online environments. Enhancing digital literacy through targeted support and training can help mitigate the challenges associated with digital inequalities and ensure equitable access to online assessments. Educational institutions must prioritize the development of digital literacy skills among students and staff to foster a more effective and inclusive online proctoring environment [28] [29] [30] [31] [14] [16].

The reviewed literature highlights several gaps and limitations in the research on online proctoring systems. Many studies are context-specific, limiting the generalizability of their findings. For example, [8] and [9] conducted their studies within single institutions, which may not reflect the broader educational landscape. Additionally, methodological limitations such as self-selection bias, reliance on self-reported data, and limited sample sizes are common issues affecting the robustness of the findings [10] [18]. These limitations underscore the need for more diverse and large-scale studies to provide a comprehensive understanding of the factors influencing the success of online proctoring systems.

The practical implications of these findings are significant for educational institutions. To enhance the effectiveness and fairness of online proctoring systems, institutions should invest in reliable technology and infrastructure, provide comprehensive support and training to students and educators, and develop inclusive policies that address digital inequalities and privacy concerns. For instance, [21] and [32] emphasize the importance of robust technological infrastructure and clear communication to build trust and reduce anxiety among students. Additionally, institutions should foster a collaborative environment involving all stakeholders to ensure that the diverse needs of students are met, as suggested by [16] and [21].

Future research should aim to apply the IS Success Model to online proctoring systems, integrating its comprehensive dimensions to assess system quality, information quality, service quality, use, user satisfaction, and net benefits. This approach will help identify critical success factors and address the limitations identified in the current literature, leading to more effective and equitable proctoring solutions. Periodic assessments and updates of these systems are essential to keep pace with technological advancements and evolving educational needs. By incorporating the IS Success Model, future studies can provide a more holistic evaluation of online proctoring systems, identifying areas for improvement and best practices to enhance their implementation and acceptance [28]. Furthermore, there is a need for longitudinal studies to understand the long-term impacts of online proctoring on student performance, well-being, and academic integrity. Such studies would provide valuable insights into how these systems evolve over time and their sustained effects on different student populations. Exploring less intrusive assessment methods that promote higher-order learning and critical thinking, as advocated by [13], is another important direction for future research. This would help develop more holistic assessment strategies that go beyond merely preventing cheating to fostering a deeper understanding and engagement among students.

In summary, addressing the gaps and limitations in the current research on online proctoring systems is crucial for developing more effective and equitable solutions. By applying comprehensive models like the IS Success Model, conducting longitudinal studies, and exploring alternative assessment methods, future research can provide valuable insights to enhance the implementation and acceptance of online proctoring systems. Educational institutions must prioritize these efforts to ensure that online proctoring systems not only uphold academic integrity but also support a fair and inclusive educational environment.

5. Conclusion and Future Work

The comprehensive review of literature on online proctoring systems during the COVID-19 pandemic reveals several key insights into the impact and implementation of these systems in educational settings. This analysis provides a nuanced understanding of whether online proctoring systems should be adopted by educational institutions, acknowledging both their benefits and limitations.

The review suggests that online proctoring systems can be effective in maintaining academic integrity, a critical concern as educational activities shift online. Studies show that online proctoring does not

significantly affect student performance compared to traditional proctoring methods [9], indicating that these systems can be used without compromising the validity of exam results. Moreover, the adoption of e-proctoring systems is influenced by factors such as trust, perceived usefulness, and the compatibility of the technology with existing educational practices [8] [11]. However, the psychological impact on students is significant, with increased levels of test anxiety associated with proctored exams [10]. This highlights a crucial limitation of online proctoring systems, suggesting the need for less intrusive methods that do not exacerbate student stress. Additionally, ethical concerns such as privacy intrusions and potential biases in facial recognition technology raise questions about the fairness and inclusivity of these systems [13]. The review underscores the importance of using theoretical frameworks like the Technology Acceptance Model (TAM) and Fuzzy Cognitive Maps (FCMs) to understand the factors influencing the adoption of online proctoring systems [12] [8]]. However, it also identifies a gap in the literature regarding the application of the IS Success Model (Delone and McLean Model) to evaluate these systems comprehensively.

Despite the extensive research, none of the reviewed studies applied the IS Success Model to online proctoring systems. This model, which includes dimensions such as system quality, information quality, service quality, use, user satisfaction, and net benefits, could provide a more comprehensive evaluation framework. The current literature lacks a holistic approach that integrates these dimensions, leading to an incomplete understanding of the success factors and limitations of online proctoring systems. Based on the review, it is recommended that educational institutions consider adopting online proctoring systems to maintain academic integrity, especially in the context of increasing online education. However, these systems have notable limitations, particularly related to student anxiety and ethical concerns. To address these issues, institutions should explore less intrusive proctoring methods and ensure robust communication strategies to build trust and acceptance among stakeholders.

Future research should aim to apply the IS Success Model to online proctoring systems, integrating its comprehensive dimensions to assess system quality, information quality, service quality, use, user satisfaction, and net benefits. This approach will help identify critical success factors and address the limitations identified in the current literature, leading to more effective and equitable proctoring solutions. Periodic assessments and updates of these systems are essential to keep pace with technological advancements and evolving educational needs.

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