Journal of Computer Assisted Learning **WILEY**

In the nexus of integrity and surveillance: Proctoring (re)considered

Mohammad Khalil[1] | Paul Prinsloo[2] | Sharon Slade[3]

[1]Centre for the Science of Learning & Technology (SLATE), University of Bergen, Bergen, Norway

[2]Department of Business Management, University of South Africa, Pretoria, South Africa

[3]EarthTrust, Abingdon, UK

Correspondence
Mohammad Khalil, University of Bergen, Christiesgate 13, 5015 Bergen, Norway.
Email: mohammad.khalil@uib.no

Abstract

Background: The Covid-19 pandemic disrupted higher education in many ways, such as the move to Emergency Remote Online Teaching and Learning (EROTL), often including a move to online assessments and examinations. With evidence of increased academic dishonesty in unproctored online assessment, institutions sought ways to ensure academic and institutional integrity and reputation. In doing this, many institutions selected and implemented online proctoring solutions.

Objectives: This article maps considerations of online proctoring solutions in the nexus between ensuring academic and institutional integrity and reputation, and addressing stakeholder concerns regarding invasive surveillance and the impacts on student privacy.

Methods: The study involved a PRISMA-informed systematic review of three digital libraries, namely Clarivate's Web of Science, Elsevier's Scopus, and Springer's SpringerLink, for peer-reviewed journal articles and conference proceedings. After screening, a final corpus of 27 articles was analysed.

Results and Conclusions: The findings include evidence that, in the midst of the Covid-19 pandemic, higher education institutions were largely influenced by cost, usability and efficiency in choosing online proctoring solutions to ensure academic and institutional integrity. Student privacy was either considered in terms of data protection and transparency, or not at all. This article aims to provide valuable insight into the criteria used to select online proctoring solutions to ensure academic and institutional integrity in online examination environments. Student privacy appears not to have the consideration it warrants.

KEYWORDS
academic and institutional integrity, Covid-19, higher education, online proctoring, student privacy, surveillance

1 | INTRODUCTION

The genie is well and truly out of the bottle and there is no way to put the stopper back in. The entire academic integrity community, including but not limited to staff, students, academic institutions, quality bodies and commercial providers alike, needs to be ready and prepared to act (Lancaster & Cotarlan, 2021) (pp. 15–16).

It is no overstatement to say that the Covid-19 pandemic disrupted higher education in unforeseen ways, and the rapid move to remote/online examinations destabilized existing assumptions and practices

relating to assessment. Many assumptions about ensuring academic integrity in digital and hyperconnected contexts have either been questioned or become inefficient.

The move to adopt online proctoring services has been described (Clark et al., 2020) as a 'technology arms race' as institutions attempted to guard against the vulnerabilities associated with online, off-site assessment (p. 3413). Amid concerns (Chin, 2021) and outrage (Doffman, 2020), online proctoring also provides evidence of increasing, often unrestrained, surveillance of students, and of the increasing influence of ed-tech and the privatization of teaching and learning (Watters & Prinsloo, 2020).

Gamage et al. (2020) discuss ways in which assessment security and academic integrity were addressed in a range of higher education contexts *pre-Covid*, and various challenges resulting from the move to remote teaching. Some institutions turned to take-home examinations, or time constrained assessments, while others adopted no-detriment policies to ensure that students would not be negatively affected whatever the approach. It is clear from Gamage et al. (2020) and others (e.g. Bens, 2020; Dawson, 2020; Holden et al., 2020; Stadler et al., 2021) that ensuring assessment security and academic integrity emerges from consideration of issues such as the quality regimes of accreditation bodies, institutional reputation, and students' investment in graduating from institutions whose integrity and quality were seen to be intact. However, the extent to which tensions between student privacy and using proctoring software were considered when selecting a way forward is less evident. That is, the integrity of the institution appears more important than the personal integrity of students (Kolski, 2020).

The need to ensure quality (of training, competencies and programs) is integral to informal and formal education environments (Baijnath & Singh, 2019; Gamage et al., 2020) and institutional reputation, graduate competencies and the market value of qualifications—all of which form a central part of ranking regimes (Ball, 2000; Blackmore, 2016; O'Loughlin et al., 2015). With many regarding students as customers rather than recipients of learning, both the institution and its students cannot afford to have the integrity and quality of their qualifications and assessment questioned. 'Reputation is everything' (Silverman, 2017).

This article maps considerations of online proctoring solutions in higher education in the nexus between ensuring academic and institutional integrity and reputation, and addressing stakeholder concerns regarding invasive surveillance and the impacts on student privacy. Given the need for institutions to rapidly implement a solution for assessment balanced against a variety of concerns, the question therefore arises: is proctoring a 'necessary evil' (Selwyn et al., 2021)?

The review will be informed by the following research questions:

1. How has proctoring in education been evidenced during the pandemic?
2. How has academic/institutional/reputational integrity played a role in adopting proctoring solutions?
3. (How) have the tensions between ensuring academic/institutional/reputational integrity and student privacy been resolved?

2 | MAPPING THE NEXUS

2.1 | Surveillance and monitoring in higher education

The collection, analysis and use of student data have always been part of education in service of strategic and operational planning, pedagogical and student support strategies. However, the increasing digitalisation and datafication of higher education have resulted in institutions having access not only to more data, but to a greater variety and granularity of data than before. The move to Emergency Remote Online Remote Teaching and Learning (EROTL) in response to Covid-19, provided institutions with unique challenges and allowed educational technology providers opportunities to provide solutions for (real or perceived) pedagogical issues, such as ensuring the integrity of assessments (Gavrielatos, 2020; Williamson et al., 2020). Narratives suggesting that education is broken (Hendrick, 2018) and that technology is the (only) answer gained prominence, heralding a 'seller's market' (Teräs et al., 2020, p. 865). The move to EROTL and the 'permanence' of technological solutions in higher education (Pelletier et al., 2021) results in such narratives 'becoming more and more entrenched, more and more pervasive', to the extent that we forget that they are 'beholden to the ideologies of machines, efficiencies, and capitalism' (Watters, 2020).

For example, the increasing entanglement of teaching and learning with platforms provided by edu-businesses (Williamson, 2021), can result in higher education institutions losing control over their digital infrastructure (and digital learning data). The platformitisation of higher education through agreements with online platform providers contributes not only to the ability of institutions and private providers to ensure that educational delivery and especially examinations could continue, but also to surveil and monitor student behaviour at unprecedented levels (Decuypere et al., 2021; Komljenovic, 2022).

Online proctoring has been a feature in online distance education for the past 20 years (Selwyn et al., 2021). However, the provision and spread of online invigilation systems such as Proctorio (which allows test takers to complete formal assessments from remote locations), saw an exponential increase in uptake and revenue of ed-tech (Calpan-Bricker, 2021), despite concerns which include the institutional ability to collect data from previously 'private' spaces, such as students' homes (Mezzapelle, 2021). As evidence emerges of the impact of these new levels of surveillance, it seems reasonable to explore the extent to which higher education institutions considered the privacy implications when adopting online proctoring services (Chin, 2021; Feathers, 2021).

2.2 | Institutional integrity and reputation

In the light of increasing global competition, higher education institutions cannot afford to have their reputations tainted or questioned (Downes, 2017). Integral to reputation management is governing and ensuring academic standards. While the greatest impact of cheating may be on the *students'* reputations and learning trajectories, it also impacts the institution, raising questions around the academic

integrity of assessment (Medway et al., 2018). Academic integrity 'underpins every aspect of education, and is critical to institutional and sector reputation' (Bretag, 2019). Increased competition for students and scarce resources have highlighted the need for a positive image, as well as credibility and reputation, measured by proxy with 'abstract rankings becom[ing] images of educational institutions and the exchange values of these spectacular images replac[ing] the use values of the institutions themselves' (Chang & Osborn, 2005, p. 340).

With 'reputation as brand' (Hearn, 2015, p. 115), the move to online proctoring also signals institutions as innovative and responsive to a new generation of digitally-wise students via the automation of bureaucratic teaching and learning processes (Selwyn et al., 2021). Online proctoring might also potentially be 'framed as a procedural element of universities' capacities to fulfil institutional obligations' (Selwyn et al., 2021, p. 8).

2.3 | Academic integrity in higher education

Ensuring academic integrity has always been part and parcel of higher education. Reports suggest though that 'a substantial majority of post-secondary students have reported... that they have committed some kind of academic misconduct' (Ives, 2020, p. 46) and academic dishonesty has become 'so common that some students consider cheating just one of many tools in their academic arsenal' (Krienert et al., 2021, p. 1). Violations of academic integrity include, inter alia, chatting, plagiarism, fabrication and facilitation (Blau et al., 2021).

There is therefore broad consensus that greater access to technology has 'ushered in new opportunities in both scope and scale for cheating in higher education' with digital cheating emerging as the 'most prominent form of cheating behavior' (Krienert et al., 2021, p. 1). The affordances of online technologies and resources 'often lead to blurred ethical boundaries in students' perceptions of acceptable academic behavior' with many considering 'copying information from the internet as an acceptable behavior, rather than a punishable offense' (Blau et al., 2021, p. 161).

As technology plays an increasingly dominant role in facilitating academic dishonesty (Butler-Henderson & Crawford, 2020; Chotikakamthorn & Tassanaprasert, 2020), institutions look towards technology to curb or prevent academic dishonesty. While online proctoring is germane to distributed forms of learning (Selwyn et al., 2021), the move to EROTL necessitated *technological* solutions to ensure the academic integrity of assessments (Bilen & Matros, 2021). It is not clear to what extent higher education institutions considered student privacy alongside the need to ensure academic integrity and protect the institutional reputation.

To establish to what extent institutions considered student data privacy, this article provides the findings of a systematic review as explained in the next section.

3 | METHODOLOGY

The research focus in this systematic review will be mapping the considerations and trade-offs between institutional integrity and the personal integrity of students.

Systematic reviews are founded upon well-defined research questions that are 'unanswered but answerable' (Alexander, 2020, p. 7). Compared to other research methodologies, the value contribution of systematic reviews is found in, inter alia, provision of new perspectives on topics in educational research (Alexander, 2020, p.58). The systematic review of this study adopts the guidelines and checklist of Preferred Reporting Items for Systematic Reviews and meta-analyses (PRISMA) by (Liberati et al., 2009) to warrant transparency, see Figure 1.

The PRISMA approach taken here involved the following stages; (1) searching three digital libraries: Clarivate's Web of Science, Elsevier's Scopus, and Springer's SpringerLink (selected as among the largest relevant academic databases); (2) removal of duplicates of exact matches by author and article title; (3) careful scanning of returned articles and exclusion of papers not fulfilling selection criteria; and (4) deeper review of each article to review, identify and distil the content and contribution. Throughout the PRISMA process, two authors met as needed to ensure consistency of approach and achieve a higher interrelated reliability.

3.1 | Data search strategy

In this systematic review, we focused on established database providers (Web of Science, Scopus, and SpringerLink) rather than crawler-based search engines (e.g., Google Scholar), following the recommendation of Gusenbauer and Haddaway (2020). The three database libraries were searched using the following keywords and the 'All fields' function enabled:

ALL (education) AND (ALL (covid) OR ALL (covid-19) OR ALL (pandemic) OR ALL (corona)) AND ALL (proctor) AND (ALL (online) OR ALL (virtual)).

Given the pandemic timeline, selected databases were searched from 2020 to present (July 2021).

3.2 | Inclusion/exclusion criteria

A preliminary search of the three digital libraries yielded more than 700 possible articles. Subsequently, the search was limited to peer-reviewed journal articles and conference proceedings. Dissertations, books, book chapters, workshop papers, posters, editorials and reports were excluded. Non-accessible articles were excluded too.[1] Table 1 shows the detailed inclusion/exclusion criteria followed in this work.

3.3 | Reliability

To ensure trustworthiness, we use the Inter-rater reliability (IRR) measure to reduce bias among the selected papers for either inclusion or exclusion. Fleiss kappa method (Fleiss et al., 2013) was used to evaluate the inter-rater agreement. In this study, two authors first

---

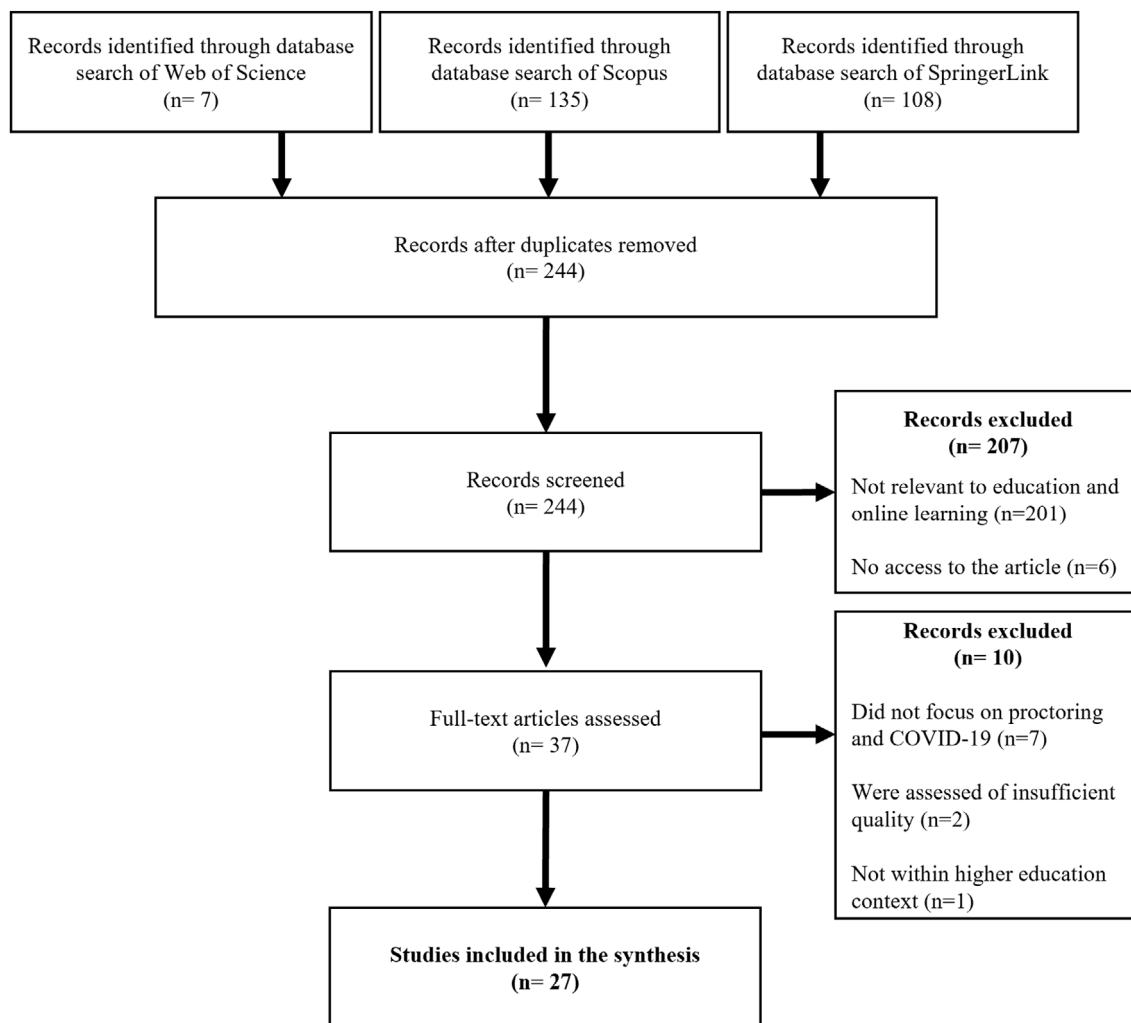[1]Authors contacted via ResearchGate (http://researchgate.net)

FIGURE 1 PRISMA flow chart of events (Liberati et al., 2009)

evaluated all filtered papers separately. The IRR value at the first stage was ($\kappa = 0.179$, $p > 0.5$) revealing insignificant Fleiss kappa value. The two authors next discussed areas of disagreement, resolving contradictions and clarifying inclusion criteria. The IRR kappa value at the next stage was significantly high revealing an excellent level of agreement ($\kappa = 0.738$, $p < 0.005$).

4 | OVERVIEW OF INITIAL RESULTS IN THE FINAL CORPUS

The 27 papers selected as relevant for the study are summarized below in Table 2. The table provides a brief description of the context within which the study took place, the type of study and/or methodology (e.g., desk-based studies based on published material available from articles and reports from libraries, websites, and from surveys already carried out, etc.) and the details of the online proctoring services discussed, where applicable. Table 2 is helpful in providing insight into RQ1 (How has proctoring in education been evidenced during the pandemic?). Of the 27 papers reviewed, 13 included desk-based studies or

TABLE 1 Inclusion/exclusion criteria

Criteria	Inclusion	Exclusion
Topic and focus	Proctoring in online/ virtual higher education within the COVID-19 timespan	Research papers that are not: COVID-19, specifically proctored assessment and online higher education themed
Publication status	Peer-reviewed journals and conference and published papers	Non peer-reviewed and Articles In Press (AIP)
Publication type	Journal articles and conference proceedings	Dissertations, books, book chapters, workshop papers, posters, editorials and reports
Publication date	COVID-19 timespan (2020–present)	Assuming that COVID-19 has appeared late 2019, we assume there is no relevant study before 2020
Language	Articles and papers published in English	Other languages

TABLE 2 An overview of articles included in the final review

Paper title	Authors (year)	Context	Methodology	Proctoring systems (if applicable)
An evaluation of online proctoring tools.	Hussein et al. (2020)	Fiji; multi-site university; undergraduate and postgraduate	Desk-based study; pilot study (staff, $n = 34$ and students, $n = 128$); survey	ProctorU; Kryterion; Respondus; BVirtual; AllProctor; Examinity and Proctorio
Online assessment in undergraduate medical education: Challenges and solutions from a LMIC university	Fatima et al. (2021)	Pakistan; private undergraduate medical school	Pilot study; survey (students, $n = 200$)	Respondus; video proctoring via Zoom; video proctoring via Microsoft (MS) Teams
Medical student assessment in the time of COVID-19	Prigoff et al. (2021)	USA; medical school	Case study (students, $n = 50$)	Video proctoring via Zoom; MS Teams and Cisco WebEx
Online Student Authentication and Proctoring System Based on Multimodal Biometrics Technology	Labayen et al. (2021)	5 e-learning institutions (3 universities, 2 training centres) in 3 countries (Latin America, Europe and Asia)	Case study (teachers, $n = 50$, students, $n = 350$); survey	ProctorU; Examinity; PSA; Proctorexam; Kryterion; Remote Proctor; Proctorcam; B Virtual; Proctorio; Proctortrack; Respondus; Comprobo; Sumadi; Proctorfree; HonorLock; ExamSoft and SMOWL
State-of-the-Art of Commercial Proctoring Systems and Their Use in Academic Online Exams.	Arnò et al. (2021)	Italy; 2 studies on 2 courses, psychology and nursing	Desk-based study; 2 case studies (students, $n = 54$ and students, $n = 92$)	ProctorU; Proctortrack; ProctorExam; Respondus; RPNow; Proctorio; 110 Cum Laude; Examity; MettL; AIProctor; SMOWL; ProctorCam; Honorlock; Safe Exam Browser (SEB); Tegrity; Proview; ExamSoft; Exam.net; Top Hat; SmarterProctoring; ProProctor; Kryterion; Loyalist; QuestionMark; Take a Test; Oxagile; Comprobo; Kanpur
A systematic review of online examinations: A pedagogical innovation for scalable authentication and integrity	Butler-Henderson and Crawford (2020)	Higher education; global	Literature review; desk-based study	NA (not applicable)
The right amount of pressure: Implementing time pressure in online exams.	Stadler et al. (2021)	Germany; 1st year undergraduate	Case study (students, $n = 111$); survey	NA
Affordable Proctoring Method for Ad-hoc Off-campus Exams	Chotikakamthorn and Tassanaprasert (2020)	Thailand; undergraduate; IT	Desk-based study; case study (students, $n = 229$); survey	Camera-based software: ReXamHome
Implementing online-testing – cases in higher education in Israel	Kedem-Yemini and Katz (2021)	Israel; 3 institutions (one university, two public colleges); technology-based subjects	Comparative case study; semi-structured interviews (teachers, $n = 16$; students, $n = 12$); exam observation (student, $n = 5$)	Video proctoring via Zoom; SEB; TomaGrade

TABLE 2 (Continued)

Paper title	Authors (year)	Context	Methodology	Proctoring systems (if applicable)
Violation of digital and analog academic integrity through the eyes of faculty members and students: Do institutional role and technology change ethical perspectives?	Blau et al. (2021)	Israel; multi-disciplinary; 2 main ethnic groups	Desk-based study; survey (students, $n = 1482$; faculty, $n = 42$)	NA
A Systematic Review on AI-based Proctoring Systems: Past, Present and Future	Nigam et al. (2021)	Higher education	Desk-based study	ProctorU; Kryterion; Xproctor; TeSLA; PSI Bridge; ProctorExam; SEB; Respondus; Examus
Testing in the time of COVID-19: A sudden transition to unproctored online exams	Clark et al. (2020)	USA; Undergraduate; Chemistry	Case study (students, $n = 500$)	Examplify
Promoting Academic Integrity and Student Learning in Online Biology Courses	Hsu (2021)	University; biology	Literature review	NA
Optimized collusion prevention for online exams during social distancing	Li et al. (2021)	US	Case study (students, $n = 78$); survey	In-house distanced online testing platform
A Visual Analytics Approach to Facilitate the Proctoring of Online Exams	Li, Xu, et al. (2021)	Hong Kong SAR China and Singapore, postgraduate	Desk-based study; case studies (students, $n = 24$ and $n = 16$); interviews (academics, $n = 4$)	Camera-based software: in-house head and mouse movement
Adoption of online proctored examinations by university students during COVID-19: Innovation diffusion study	Raman et al. (2021)	India; undergraduate and postgraduate	Desk-based study; case study; survey (students, $n = 430$)	SEB; video proctoring
Assessing User Experience of a Secure Mobile Exam Application using UEQ+	Setiaji et al. (2020)	Indonesia	Case study (students, $n = 67$); survey	In-house mobile software: video, gyro, voice
Assessment à la Mode: Implementing an Adaptable Large-Scale Multivariant Online Deferred-Grade Exam for Virtual Learning	Balasubramanian et al. (2020)	US; 1st year undergraduate; Chemistry	Case study (students, $n = 700$); survey	Respondus
Intelligent Invigilation Using Video Surveillance	Sakya et al. (2021)	-	Technical overview	In-house software: face recognition, eye and head movement
Moving Assessment Online: Experiences within a School of Pharmacy	Morgan et al. (2021)	US; pharmacy	Case study; survey (students, $n = 251$)	ExamSoft
Dr. Proctor: A Multi-modal AI-Based Platform for Remote Proctoring in Education	Elshafey et al. (2021)	Egypt	Interviews/surveys (students/faculty, $n = 100$); prototype system	Dr.Proctor

TABLE 2 (Continued)

Paper title	Authors (year)	Context	Methodology	Proctoring systems (if applicable)
Challenges of remote assessment in higher education in the context of COVID-19: a case study of Middle East College	Guangul et al. (2020)	Oman, cross-faculty	Desk-based study, survey (faculty, $n = 50$)	NA
Contract cheating by STEM students through a file sharing website: a Covid-19 pandemic perspective	Lancaster and Cotarlan (2021)	Global study; STEM subjects	Desk-based study	NA
Implementing remotely proctored testing in nursing education	Castaño et al. (2021)	US; nursing	Desk-based study; case study (students, $n = 114$)	Respondus Monitor; ProctorU; RPNow; Examity; Proctorio
Education's Response to the COVID-19 Pandemic Reveals Online Education's Three Enduring Challenges	Openo (2020)	North American perspective	Desk-based study	NA
E-proctored exams during the COVID-19 pandemic: A close understanding	Kharbat and Daabes (2021)	UAE	Case study; survey (students, $n = 350$)	Camera based software
Responding to the COVID-19 emergency: student and academic staff perceptions of academic integrity in the transition to online exams at three Australian universities	Reedy et al. (2021)	Australia; 3 universities (online and campus-based)	Survey (students, $n = 1921$; staff, $n = 49$)	unspecified

literature reviews; 3 detailed pilot studies; 13 described case studies and 16 included surveys or interviews with stakeholders (interestingly, of the latter, 20 papers described student surveys and only 8 mentioned surveys or interviews aimed at faculty). There was no single geographic context, that is, papers were relevant to case studies in single or multiple countries or regions with a further two taking a global perspective. Further details of the papers are included in the discussion section in relation to the three research questions.

5 | DISCUSSION

As stated, our focus here was to investigate institutional considerations and trade-offs between institutional integrity and the personal privacy of students using the three research questions to structure the discussion. Within the final corpus of articles ($n = 27$), most reported on online proctoring solutions whether in systematic reviews, comparative evaluations, reports on student, faculty and administrative/IT staff experiences and/or perceptions or discussions on alternatives to online proctoring (Table 2).

5.1 | Research question 1

How has proctoring in education been evidenced during the pandemic?

Many articles mentioned particular challenges in selecting and implementing online proctoring solutions and in the process, discussed potential alternatives. Stadler et al. (2021) note that online proctoring 'resources are often challenging to implement … or may conflict with existing data protection laws' (p. 219).

Practical concerns were flagged by Chotikakamthorn and Tassanaprasert (2020) who suggest that online proctoring solutions are often precluded by a 'lack of time, budget, privacy concern and instructors' expertise' (p. 266). As an alternative to commercial online proctoring solutions, these authors propose: use of an exam-safe browser (to prevent use of other browsers during an exam); video conferencing software to monitor students; randomized questions; multiple exam versions; limited exam time, etc. In their case, the institution opted for video recording via the student's smartphone and laptop/desktop camera hoping that the psychological effect of being recorded would deter cheating. Similarly, the study from the

University of the South Pacific by Hussein et al. (2020) reflects a broader reality for many by referencing the 'luxuries' required for successful implementation of online proctoring, such as 'access to a personal computer or laptop, a neat and tidy room with sufficient lighting, internet connectivity, food, water or even basic necessities', remarking that not all students may have access to these. This study reviews a number of online proctoring systems (live, recorded, automated), and suggests that relevant factors for consideration of online exam proctoring systems include

> ease and flexibility of integration with the existing institutional learning management system, technical performance and robustness of the proctoring system (sometimes over low internet bandwidth, poor hardware capabilities or electrical power failures), level of efficient task automation, and reporting capabilities. Privacy protection and management, security and anti-fraud measures, and their associated cost are also other key issues that need to be examined when considering an online proctoring system (p. 510).

Prigoff et al. (2021) also consider practical aspects of managing assessment in medical education during the pandemic. They discuss 'the effects of the pandemic on different assessment tools: on free-response and multiple-choice exams, as well as on open-book without proctoring and closed-book with virtual proctoring', and their choice to opt for video-conferencing proctoring to 'avoid adjustments [as a result of the open-book examination] and student dissatisfaction' (p. 374). The resolution to use virtual proctoring appears entirely pragmatic with no apparent consideration of institutional and/or assessment integrity, cost, reputation or student privacy.

Emphasis on the *usability* of online proctoring systems is also paramount for Fatima et al. (2021) in the context of a medical college in Pakistan. While reference is made to the differential impact of online proctoring on students in rural and urban areas, they also highlight the positives of using online proctoring. Faculty commented on a reduction in marking loads and the immediacy of results for review; students also appreciated faster access to their scores; and administrative and IT staff welcomed the ability to scan a large class, and presumed security against cheating. Any negative remarks focused on technical issues only.

Several papers focused on proctoring *features and their effectiveness* (see Table 2). For example, Li, Xu, et al. (2021) discuss an approach which analyses video records of head and mouse movement data of each student. The approach was trialled with a mock exam in which students were asked to cheat in particular ways. Data collected yielded 'key features indicating suspected exam cheating behaviors, including both abnormal head movements (e.g., abnormal head rotation, face disappearance from the screen) and mouse movements (e.g., copy and paste, moving the mouse out of the exam web page)' (p. 2).

Another study by Arnò et al. (2021) reviewed various commercial online proctoring solutions against criteria including LMS integration, scalability, Android/iOS Secondary Device Support, authentication, lockdown and monitoring functions, 'force completion of the exam', live chat support, GDPR compliance, free, user-friendly, platforms (desktop/mobile), plugin/browser extension, need client installation, internet connection, and open source.

User experiences of a secure mobile examination application in Indonesia is the focus of the article by Setiaji et al. (2020). The application was built with gyro, voice, and image recording facilities. Respondents in the research indicated usefulness, intuitive use and clarity as the most successful features and although the score for the trustworthiness of the application was positive, it rated low in comparison to other elements surveyed. Given an assumption that non-proctored online examinations are not reliable, Raman et al. (2021) also report on university students' attitudes to online proctored examinations in India. The authors refer to the work of Kitto and Saltmarsh (2007) who suggest that student cheating can be understood as 'subterranean ethics', referring to how students navigate university examination requirements through interactive and collaborative engagement with other students. Despite this, Raman et al. (2021) pronounce online proctored examinations as 'a clear winner' (p. 15).

Several papers adopted a *case study* approach. Balasubramanian et al. (2020) from the US report on a number of institutional initiatives in response to the pandemic such as 'deferred grading, a lockdown browser, multiple question variants, time controls, and controlled access to the completed exam to combat potential cheating' (p. 4297). The institution decided against one system (ProctorU) on the grounds that 'it was not clear how comfortable students would be with an unknown person watching them during the exam', concerns about technical issues, and the additional pressures on students at a time of increased challenges (p. 4298). Their institution used the Respondus lockdown browser, 'a software program which uses a webcam and artificial intelligence (AI) to proctor and prevents students from using their computers for purposes other than taking the exam' (p. 4298). During implementation, about 25% of students had technical difficulties, and were offered another opportunity with a variation of questions and deferred grading.

Sakya et al. (2021) report on 'an intelligent invigilation using video surveillance that can autonomously detect and track examinee's eye gaze, head orientation, and mouth movement to robustly detect their cheating activities' (p. 401). The online proctoring system verifies student identity and checks for 'any cheating activity by capturing the next movement at the desk' (p. 404). There is no discussion of broader issues of institutional integrity and/or reputation, nor of the trade-offs between ensuring assessment integrity with infringements on student privacy.

The process of integrating remote online proctoring into a nursing program is described by Castaño et al. (2021) and the authors discuss types of remote proctored testing, the process of integrating remotely proctored testing, and benefits and challenges. The selection of Respondus was based on an existing contract with the supplier, compatibility with their learning management system and costs being already covered by the institution. Mention is also made of the system's ability to handle large cohorts synchronously. Institutional use

of proctoring systems extended also to ProctorU for the final course assessment, so that two online proctoring systems were used concurrently by the same institution. Of further interest is the instructions issued to students that included that they should 'not chew gum or flip your hair', that iPads should be used as 'last resort' and 'If you have a slow internet connection, please request your other household users to stop using their devices when you are taking the quiz' (p. 158).

As well as practical issues and system features, some papers touched on *student privacy* and other aspects of online proctoring. Kedem-Yemini and Katz (2021) explored the adoption of online exams on a large scale in Israel. Interestingly, they note how online surveillance of students affected faculty.

> During the exam, I had to watch the students very closely. I felt uncomfortable with it ... I saw one student that tended to grab his hair and tear it out ... I felt bad for him! [...] I saw a student whose family kept entering the frame since they ate lunch behind her and it disturbed her. I felt sorry for her! ... I did not know that XXX has Attention Deficit Disorder ... I'm not sure I was supposed to know that... (Lecturer, case study interview) (p. 96).

The same study reported that students admitted that 'they did something that was forbidden by the institute' (p. 102) following the move to online exams, apparently confirming the need for online proctoring solutions. The authors offer recommendations for improved online closed-book exams including camera installation and allowance for students with special problems (e.g. internet connectivity, or disabilities) to write up on-campus.

Elshafey et al. (2021) acknowledge that remote or online proctoring has limitations. Their research found that while 'faculty is mainly concerned with cheating, students are concerned about their privacy and face a lot of stress when using available software' (p. 146). The authors moot concerns about 'unfettered access to students' data' (p. 145). There are also questions around how biases in the machine learning (ML) models may impact on system fairness. 'To the best of our knowledge, none of the available platforms [...] clarify the intricacies of their models or demonstrate what biases they exhibit' (pp. 145–146). All the systems discussed had face recognition and anomaly detection, and some also tracked eye movement. Most also provided behavioural analysis and motion detection. The research reports on the development of an AI-based proctoring tool, Dr Proctor, 'infused with psychological means and economic considerations to present a multi-modal approach with novel offerings' (p. 146). The tool's student hub is 'equipped with monitoring facilities such as screen and video monitoring, system monitoring, keystroke and activity watchers and other functionality to collect data and detect cheating attempts' (p. 147). While the authors state that 'Dr. Proctor addresses network and privacy issues, affordability, student stress, and availability to underprivileged communities', they do not present evidence as to how their AI-based proctoring tool achieves this.

Hsu (2021) situates discussions around online proctoring in the context of how it impacts *student learning*. He highlights concerns including a lack of access to quiet and private spaces, the issue of bandwidth and limited technological access, the impact of increased anxiety on student performance, and concerns about student privacy and security. The article warns that steps undertaken to prevent academic dishonesty may be counterproductive and damage student learning.

Morgan et al. (2021) report on the approach taken by a US-based school of pharmacy. Their research found that the vast majority of students preferred unproctored, or open-book exams. For proctored exams, students reported increased stress levels and concerns about internet connectivity. Despite this, 47% of respondents agreed that 'A proctored exam is necessary to maintain academic integrity' (p. 249). Students reported difficulty and stress in managing both Zoom and ExamSoft during the exam, and both students and staff commented on internet instability. Students also reported feelings of invasion of privacy.

Kharbat and Daabes (2021) present a case study of UAE students' attitudes and concerns around the use of an e-proctoring tool in their final exams during the pandemic. They found that a large majority of students had 'predominant concerns over privacy and various environmental and psychological factors' (p. 1). The study reports that students felt anxious and nervous while using online proctoring, feeling as if they had allowed a stranger into their house. Students accepted the importance of academic integrity but felt it should be balanced against their privacy concerns. Around a quarter of students stated that online proctoring was not acceptable in their culture and family: 'I think an open webcam during the online exam is insensitive to Islamic traditions and culture' (p. 10).

Cheating appeared as a focus in a few papers. While Lancaster and Cotarlan (2021) focus mainly on contract cheating, they report that 'when students are not monitored during examinations, they may be able to turn to file sharing websites to request contract cheating solutions' (p. 3). They suggest that this illustrates a 'trade-off between the need to protect the value of academic awards, but to still ensure that students feel supported and do not need to use suspect providers of services from outside their own academic institution' (p. 3).

From the context of Oman, Guangul et al. (2020) report on a questionnaire exploring the challenges of remote assessment in general, and academic dishonesty in particular. Regarding online proctored examinations, the authors identify increased student stress, the need for well-established infrastructure, the potential failure of software and its impact, hardware and/or internet connectivity, personal and/or cultural reasons for avoiding camera surveillance and other technical difficulties faced by students. They report that the majority (62.5%) of faculty would prefer *not* to proctor students, although this relates to the unavailability of appropriate infrastructure rather than any perceived invasions of student privacy.

Reedy et al. (2021) explore perceptions of academic staff and students to student cheating behaviours in online assessment in the context of three Australian universities. The study aimed to inform decision-making for the future of online exams. The authors refer to a

generational rift in perceptions of academic integrity, with the younger generation seeing 'knowledge ownership, acquisition, and distribution in radically different terms than in previous generations' (Evering and Moorman 2012, in Reedy et al., 2021, p. 4). The research also found that 'Younger students, in the age range 18–24 years ($n = 676$), perceived cheating to be easier in online exams and alternative assessments than any other age group' (Reedy et al., 2021, p. 11). In their article, digital cheating refers to access to resources, collusion, impersonation, and contract cheating. A lack of supervision was one factor identified as making it easier to cheat in online examinations. Interestingly, the authors suggest that online proctoring software should be avoided. 'While these technical solutions are applied for the purpose of reducing the opportunity for students to engage in academic misconduct, their use needs to be considered in light of digital and other equity issues they raise as well as concerns around privacy' (p. 22).

5.2 | Research question 2

How has academic/institutional/reputational integrity played a role in adopting proctoring solutions?

As previously noted, academic and institutional integrity of an institution is closely linked to its reputation - the reputation of its qualifications, rankings and student expectations of the reputational value of their qualifications. Overlaying this, the pandemic led to an exponential increase in the selection and use of online proctoring solutions. So what role did academic and institutional integrity play in considering online proctoring during the pandemic?

The review of the analysed corpus provides little evidence that academic and institutional integrity featured in considerations of a shift to online proctoring for most institutions. It may be that reports on the topic during this period have simply taken academic and institutional integrity as a given.

In contrast, the study by Labayen et al. (2021) places institutional integrity central to the consideration of online proctoring. Quality is assured by identity verification and the reduction of cheating. The authors review three different types of commercial solutions (fully live online proctoring, recorded and reviewed proctoring, and fully automated systems) against their service characteristics, technical features and legal aspects. Institutional integrity is also specifically referenced by Chotikakamthorn and Tassanaprasert (2020) in their study in Thailand in opting for non-commercially available technical solutions (webcams) to discourage student cheating.

Three additional considerations emerged in the review: the need to authenticate student identity, the role of government regulations, and the need for students to meet professional standards. Kharbat and Daabes (2021) report that a Ministerial Decree asked universities in UAE to switch to distance learning during the pandemic, with appropriate remote assessment tools in place to preserve academic integrity and maintain educational standards. Butler-Henderson and Crawford (2020) also posit that the dominant rationale for online proctoring systems is 'to authenticate learning' (p. 2) and refer to

governmental requirements that 'appropriate procedures or technology are implemented to authenticate distance students' (p. 8). Morgan et al. (2021) feel that online proctoring was necessary in 'maintaining the standards necessary to prepare practice-ready student pharmacists' and allowed 'internet access-enabled exams that ensured academic integrity and rigor' (p. 245). Openo (2020) discusses the need for 'authentic assessment' in high-stakes exams where students' credentialing by professional bodies depend on the validity and authenticity of their final assessments. Online proctoring offers *one* way of improving assessment authenticity.

Interestingly, ensuring the academic integrity of assessment is also linked to the *ethical* responsibilities of higher education. Castaño et al. (2021) discuss the ethics of using remote proctoring services, suggesting that educators should consider both their ethical responsibility to ensure examination integrity and to ensure that 'students' rights are not violated' (p. 160). In safeguarding academic integrity, educators ensure the production of 'competent graduates' and 'safeguard the profession' (p. 160). As such, the authors regard remote proctoring as 'a major mechanism by which to accomplish this task' (p. 160).

5.3 | Research question 3

(How) have the tensions between ensuring academic/institutional/reputational integrity and student privacy been resolved?

In setting this question, there was an assumption that higher education institutions would have considered institutional and academic integrity as key in the move to online proctoring solutions. Given general concerns around the increasing surveillance of students in higher education, this question aimed to establish the extent to which student privacy was also considered.

The approach taken to this particular aspect might be broadly divided into an exploration of compliance with relevant legislation and consideration of student concerns.

Regarding the former, the study by Labayen et al. (2021) provides an overview of a number of online proctoring services according to service, technical and legal requirements, and while these do not refer specifically to, for example, facial, voice or iris recognition, the requirements include 'authentication during the whole exam or session' and 'multi biometric authentication'. With regard to the legal aspects, only two offered GDPR compliance. They state that the validation of student identity in online proctoring should 'be non-invasive and non-disruptive, and … not distract the learning process' (p. 72399). In their evaluation of online proctoring services, Arnò et al. (2021) identified other tools that they considered GDPR compliant. This points to the possibility that researchers and institutions interpret GDPR regulations differently.

In regard to student concerns, Hussein et al. (2020) refer to several aspects linked to student privacy in their evaluation of online proctoring systems, such as the secure/encrypted transferring of data, the need for a web camera, face and voice recognition, fingerprint and iris scanning and 'room panning'. Of the systems evaluated, only

Proctorio had the capability for facial and voice recognition, and none allowed for facial and iris scanning. Student perceptions regarding how Proctorio impacted on privacy were not considered, with students asked only whether they felt 'uncomfortable' completing the assessment whilst using Proctorio. Students were generally positive but some reported feeling 'uncomfortable that the camera was recording every movement' and others were 'concerned about the privacy of the videos and its use' (p. 521). In their conclusion, the authors propose that online proctoring may result in 'a divide between those with, and without access to this technological infrastructure', flagging concerns around how the recorded data may be interpreted and noting that students with disabilities may be more adversely affected when using online proctoring systems.

The privacy policy of the adopted system, SMOWL, states that the system does not work with 'identities, so it lacks connection with the student personal data' (p. 72402) and states that 'The user's identity remains protected' (p. 72403). While students are reported as thinking 'that biometric authentication and proctoring is appropriate', teachers expressed concerns that the 'student will feel a) observed (83%), b) not comfortable (58%), c) worried with the fact that a computer application is recording/ managing their personal data (72%)' (p. 72409). 'Despite these concerns, 78% of them [teachers] explicitly recognise the need for this kind of application to authenticate and monitor online students in their e-learning activities in the near future' (p. 72409).

Other articles also acknowledged the discomfort students may experience and possible privacy harms, although this did not seem to deter proceeding with an online proctoring system, nor result in steps to ameliorate any effects of intrusion, discomfort or privacy harms. For example, while the proctoring solution reported on by Chotika-kamthorn and Tassanaprasert (2020) involved non-commercial technologies in the form of webcams, there is no consideration of student privacy and the intrusiveness of the recordings. Although the study by Kedem-Yemini and Katz (2021) reported that all faculty interviewees felt that students' privacy rights were abused (p. 95), no recommendations addressed these concerns. The authors did, however, acknowledge that 'many issues regarding students' privacy and rights have yet to be accounted for' (p. 110).

Li, Luo, et al. (2021) claim that online proctoring is 'costly, compromises privacy, and can lead to prevailing collusion' (p. 1). They recognize that, while there are benefits to online proctoring, there is also 'valid concern that using such draconian measures bluntly signals to our students the lack of our trust in their honesty' (p. 1). While these authors refer to privacy concerns in the context of online proctoring, they aim to redirect the discourse by asking 'Is Faculty's role to merely catch and punish cheating students or is it to support students through their studies so that ultimately, they can be confident that by working hard they will be successful without having to resort to deception?' (p. 1).

Clark et al. (2020) propose that 'students should be positioned as partners, not customers or intervention recipients or, we may add, as adversaries to foil when administering online exams.' and 'our responsibility is to craft an environment sensitive to student concerns of

access and continuity that is also secure' (p. 3416). However, they also discuss their uses of Examplify, which records keystrokes during assessment 'though students were unaware of this capability' (p. 3415). Hsu (2021) raises the impact of online proctoring on student anxiety and student performance, and points to concerns about student privacy and security. Although he proposes steps to alleviate student stress, the continued use of online proctoring is not questioned, nor are the concerns about student privacy addressed.

In their proposal for a visual analytics approach to facilitating the proctoring of online examinations, Li, Xu, et al. (2021) address privacy concerns in a dedicated section. The authors acknowledge that ensuring a 'fair evaluation of students' performance, keeping the integrity of exams is crucial and is actually the responsibility of teachers' (p. 14). They acknowledge that this necessitates the balancing of academic integrity and privacy concerns, and feel that their method strikes a reasonable balance. This 'balance' appears to entail secure infrastructure and 'comprehensive regulations to store, use and delete the collected data appropriately'. Students are informed about 'methods of data collection, processing, analysis and destruction' before the online examination and their consent obtained. The proposal also includes the use of a virtual background to alleviate concerns about showing family members or the home environment and states that 'once all the cheating reviews are done, the data should be destroyed permanently' (p. 14). The authors conclude that their proposal meets their three criteria, namely convenience, efficiency and reliability, with no further mention of privacy.

In considering students' ethical or legal rights, Castaño et al. (2021) acknowledge that remote proctoring systems may make students feel uncomfortable, or may impact negatively on students with disabilities. Somewhat awkwardly, they propose to resolve this by providing students with 'details of how the recordings are used and stored along with the possible infringement of their privacy rights' (p. 160). Students would also be reassured that their information will not be shared or sold. It is not clear how such reassurances address the original infringement.

In their discussion of AI-based proctoring systems, Nigam et al., (2021) moot several privacy issues and the potential for misuse of personal data. They mention that systems ideally 'rely on self-authentication and are non-invasive. These do not record and store data anywhere, and are hybrid which means that a proctor can interrupt the test at any time in case they suspect malicious activity' (p. 19). They cite 'further diminution of student privacy and autonomy, and increased distrust towards institutions that are bastions of social values. Another "fear, ... is that these platforms could contribute to the issues of growing surveillance, liberty and privacy loss, mining of massed personal data, and dubious instances of AI decision-making" (p. 22). Despite such acknowledgements and the evidence of inherent biases in AI decision-making systems (e.g. Crawford, 2021; Eubanks, 2017), the authors do not suggest how such privacy harms might be addressed in online proctoring solutions.

Finally, Openo (2020), referring to Watters and Prinsloo (2020), situates concerns about privacy in the context of broader concerns

around increasing surveillance of students and increased policing of teaching and learning spaces by private ed-tech companies.

5.4 | Themes arising

In considering the tensions that arise in the nexus of ensuring academic and institutional integrity and acknowledging, ameliorating and/or preventing student privacy harms, the following themes arise:

- The review points to the implementation of online proctoring solutions from a wide-range of geopolitical, institutional and disciplinary contexts in response to a global crisis.
- Higher education institutions were under huge pressure to find rapid solutions to effectively enabling (formal) assessment whilst also minimizing academic dishonesty. The need to ensure academic and institutional integrity emerged from a range of stakeholders such as faculty, governments, accrediting and professional bodies. However, there was little evidence that academic integrity played a key part in the adoption of online proctoring solutions. Those instances where academic integrity was explicitly referenced most often referred to a need to ensure maintenance of professional or vocational standards.
- There is sufficient evidence that unproctored, online assessment results in more instances of academic dishonesty than proctored online assessment. Interestingly, student knowledge of proctoring did not necessarily eliminate cheating and may result in a 'subterranean ethics' (Kitto & Saltmarsh, 2007).
- Given the rapid move to online assessment, selecting an online proctoring solution was often easier and faster than consideration and implementation of alternative approaches assumed to be labour/time intensive and not scalable. Although the adopted solutions were perhaps not always ideal, their use was driven by pragmatism.
- Automated proctoring is generally acknowledged as more efficient, but potentially less precise. The use of automated systems may be specifically linked to the time available for implementation and the context, although this is difficult to infer without a longer (post-pandemic) study.
- Usability, cost and support of the online proctoring system, together with technical issues such as connectivity, software and hardware, and the specific needs of students with disabilities, were of greater concern than student privacy.
- Consideration of student privacy and potential privacy harms were often addressed through assurances that data would not be sold or shared. There was little to no attempt to address the introduction and effect of surveillance and intrusion.
- Faculty and staff expressed concerns about student privacy. Faculty voiced disquiet in the voyeurism of their observational role of students in a personal setting. Although it might be argued that students are closely monitored by invigilators in a traditional assessment setting, the context here is different. We have an expectation of privacy in our personal spaces, and the sense of

being monitored in an examination hall in real time, for example, is arguably not the same as the sense of being studied as an individual, potentially on replay. This sense of discomfort was broadly echoed by students in the studies reviewed. What was lacking here though was evidence that students were aware of further potential privacy implications, such as who might access their data, and any downstream uses of the collected data.

6 | LIMITATIONS OF THIS STUDY

Although we sought to limit prejudice in the selection of papers, there is potential bias, which is common in such studies. We acknowledge that the selection of three databases, excluding documents other than journal articles and conference proceedings and restricting the language to English are limitations here. Another limitation of this work as Table 1 indicates, was the exclusion of articles that were inaccessible and/or in press. A filtered search was performed using eight search terms 'education', 'covid', 'covid-19', 'pandemic', 'corona', 'proctor', 'online' and 'virtual' combined with Boolean operators. The authors acknowledge the fact that the omission of some of these terms, or the use of alternative terms, would potentially result in other papers being considered. Additional insight might also have been achieved had we been able to consider a broader set of sources outside of the three digital libraries, for example, non-academic or commercial publications.

7 | CONCLUSIONS

In this article we attempt to explore the nexus between academic and institutional integrity and student privacy in the context of uses of online proctoring. While online proctoring has been part of distance education provision for over two decades, ensuring the integrity of assessment was central in the move to EROTL during the pandemic. It seems clear that while some institutions considered alternatives, the easier and more scalable immediate solution was to move to online proctored examinations resulting in a 'technology arms race' (Clark et al., 2020). Given that unproctored online exams may not have withstood scrutiny from faculty, governments and accrediting and professional bodies, the move to online proctoring during the pandemic was, in many respects a 'necessary evil' (Selwyn et al., 2021).

While there are some signs at the time of writing of a return to face-to-face teaching and in situ examinations, in many respects, the pandemic and the subsequent institutionalization of online proctoring suggests that the 'genie is well and truly out of the bottle'. (Lancaster & Cotarlan, 2021, pp. 15). There is a danger that we simply accept the use of online proctoring systems as is as inevitable, without serious consideration of alternatives that are less invasive and with greater respect for the (data) privacy of our students. It is suggested that institutions take time to review stakeholder perspectives of online proctoring systems. If online proctoring is to remain, it should do so on the understanding that adopted systems are appropriate to

the context, offer sufficient data protection and do not intrude on student privacy.

PEER REVIEW

The peer review history for this article is available at https://publons.com/publon/10.1111/jcal.12713.

DATA AVAILABILITY STATEMENT

Data sharing is not applicable to this article as no new data were created or analyzed in this study.

ORCID

Mohammad Khalil ⓘ https://orcid.org/0000-0002-6860-4404
Paul Prinsloo ⓘ https://orcid.org/0000-0002-1838-540X

REFERENCES

Alexander, P. A. (2020). Methodological guidance paper: The art and science of quality systematic reviews. *Review of Educational Research*, *90*(1), 6–23.

Arnò, S., Galassi, A., Tommasi, M., Saggino, A., & Vittorini, P. (2021). State-of-the-art of commercial proctoring systems and their use in academic online exams. *International Journal of Distance Education Technologies (IJDET)*, *19*(2), 41–60.

Baijnath, N., & Singh, D. (2019). Examination cheating: Risks to the quality and integrity of higher education. *South African Journal of Science*, *115*(11–12), 1–6.

Balasubramanian, B., DeSantis, C., & Gulotta, M. (2020). Assessment à la mode: Implementing an adaptable large-scale multivariant online deferred-grade exam for virtual learning. *Journal of Chemical Education*, *97*(12), 4297–4302.

Ball, S. J. (2000). Performativities and fabrications in the education economy: Towards the performative society? Frank Tate memorial lecture and keynote address to the AARE annual conference (Melbourne 1999). *Australian Educational Researcher*, *27*(2), 1–23.

Bens, S. (2020). A reflection on change and academic integrity during COVID-19. *Canadian Perspectives on Academic Integrity*, *3*(2), 11–13.

Bilen, E., & Matros, A. (2021). Online cheating amid COVID-19. *Journal of Economic Behavior & Organization*, *182*, 196–211.

Blackmore, P. (2016). *Prestige in academic life: Excellence and exclusion*. Routledge.

Blau, I., Goldberg, S., Friedman, A., & Eshet-Alkalai, Y. (2021). Violation of digital and analog academic integrity through the eyes of faculty members and students: Do institutional role and technology change ethical perspectives? *Journal of Computing in Higher Education*, *33*(1), 157–187.

Bretag, T. (2019). Contract cheating research: Implications for Canadian universities. Canadian symposium on academic integrity, held at the University of Calgary, April 17–18. Retrieved from https://prism.ucalgary.ca/handle/1880/110279

Butler-Henderson, K., & Crawford, J. (2020). A systematic review of online examinations: A pedagogical innovation for scalable authentication and integrity. *Computers & Education*, *104024*, 104024.

Calpan-Bricker, N. (2021). Is Online Test-Monitoring Here to Stay? The New Yorker. Retrieved from https://www.newyorker.com/tech/annals-of-technology/is-online-test-monitoring-here-to-stay

Castaño, M., Noeller, C., & Sharma, R. (2021). Implementing remotely proctored testing in nursing education. *Teaching and Learning in Nursing*, *16*(2), 156–161.

Chang, G., & Osborn, J. R. (2005). Spectacular colleges and spectacular rankings. *Journal of Consumer Culture*, *5*(1), 338–364.

Chin, M. (2021). *University will stop using controversial remote-testing software following student outcry*. Retrieved from. https://www.theverge.com/2021/1/28/22254631/university-of-illinois-urbana-champaign-proctorio-online-test-proctoring-privacy

Chotikakamthorn, N., & Tassanaprasert, S. (2020). Affordable proctoring method for ad-hoc off-campus exams. In *Proceedings of the 21st annual conference on information technology education* (pp. 266–272). New York, NY, USA: Association for Computing Machinery. https://doi.org/10.1145/3368308.3415421

Clark, T. M., Callam, C. S., Paul, N. M., Stoltzfus, M. W., & Turner, D. (2020). Testing in the time of COVID-19: A sudden transition to unproctored online exams. *Journal of Chemical Education*, *97*(9), 3413–3417.

Crawford, K. (2021). *Atlas of AI. Power, politics and the planetary costs of artificial intelligence*. Yale University Pres.

Dawson, P. (2020). *Defending assessment security in a digital world: Preventing e-cheating and supporting academic integrity in higher education*. Routledge.

Decuypere, M., Grimaldi, E., & Landri, P. (2021). Introduction: Critical studies of digital education platforms. *Critical Studies in Education*, *62*(1), 17–33.

Doffman, Z. (2020). Exam monitoring webcam tech meets student outrage. *Forbes* Retrieved from. https://www.forbes.com/sites/zakdoffman/2020/04/24/no-lockdown-exams-sorry-kids-this-creepy-webcam-tech-lets-you-sit-them-at-home/?sh=28207ef25cc5

Downes, M. (2017). University scandal, reputation and governance. *International Journal for Educational Integrity*, *13*(1), 1–20.

Elshafey, A. E., Anany, M. R., Mohamed, A. S., Sakr, N., & Aly, S. G. (2021). Dr. proctor: A multi-modal AI-based platform for remote proctoring in education. In *International conference on artificial intelligence in education* (pp. 145–150). Springer.

Eubanks, V. (2017). *Automating inequality*. St Martin's Press.

Fatima, S. S., Idrees, R., Jabeen, K., Sabzwari, S., & Khan, S. (2021). Online assessment in undergraduate medical education: Challenges and solutions from a LMIC university. *Pakistan Journal of Medical Sciences*, *37*(4), 945–951.

Feathers, T. (2021). *Schools are abandoning invasive proctoring software after student backlash*. Retrieved from. https://www.vice.com/en/article/7k9ag4/schools-are-abandoning-invasive-proctoring-software-after-student-backlash

Fleiss, J. L., Levin, B., & Paik, M. C. (2013). *Statistical methods for rates and proportions*. John Wiley & sons.

Gamage, K. A., Silva, E. K. D., & Gunawardhana, N. (2020). Online delivery and assessment during COVID-19: Safeguarding academic integrity. *Education in Science*, *10*(11), 301. https://doi.org/10.3390/educsci10110301

Gavrielatos, A. (2020). Edtech and COVID-19. *Education*, *46*, 1–3.

Guangul, F. M., Suhail, A. H., Khalit, M. I., & Khidhir, B. A. (2020). Challenges of remote assessment in higher education in the context of COVID-19: A case study of Middle East college. *Educational Assessment, Evaluation and Accountability*, *32*(4), 519–535.

Gusenbauer, M., & Haddaway, N. R. (2020). Which academic search systems are suitable for systematic reviews or meta-analyses? Evaluating retrieval qualities of Google scholar, PubMed, and 26 other resources. *Research Synthesis Methods*, *11*(2), 181–217.

Hearn, A. (2015). The politics of branding in the new university of circulation. *International Studies of Management and Organization*, *45*(2), 114–120.

Hendrick, C. (2018). Challenging the 'education is broken' and Silicon Valley narratives. *researchED Magazine 1*(1).

Holden, O., Kuhlmeier, V. A., & Norris, M. (2020). Academic integrity in online testing: a research review. *Preprint from PsyArXiv*, https://doi.org/10.31234/osf.io/rjk7g

Hsu, J. L. (2021). Promoting academic integrity and student learning in online biology courses. *Journal of Microbiology & Biology Education*, *22*(1), ev22i1-2291.

Hussein, M. J., Yusuf, J., Deb, A. S., Fong, L., & Naidu, S. (2020). An evaluation of online proctoring tools. *Open Praxis*, *12*(4), 509–525.

Ives, B. (2020). Your students are cheating more than you think they are Why? *Educational Research: Theory and Practice*, *31*(1), 46–53.

Kedem-Yemini, S., & Katz, A. (2021). Implementing online-testing–cases in higher education in Israel. *Journal of Information Technology Case and Application Research*, *23*(2), 83–114.

Kharbat, F. F., & Daabes, A. S. A. (2021). E-proctored exams during the COVID-19 pandemic: A close understanding. *Education and Information Technologies*, *26*, 1–17.

Kitto, S., & Saltmarsh, S. (2007). The production of 'proper cheating' in online examinations within technological universities. *International Journal of Qualitative Studies in Education*, *20*(2), 151–171.

Kolski, T. (2020). Virtual proctoring and academic integrity. In *Learning in the digital age*. Oklahoma State University Libraries. Retrieved from. https://open.library.okstate.edu/learninginthedigitalage/chapter/virtual-proctoring-and-academic-integrity/

Komljenovic, J. (2022). The future of value in digitalised higher education: Why data privacy should not be our biggest concern. *Higher Education*, *83*, 1–17.

Krienert, J. L., Walsh, J. A., & Cannon, K. D. (2021). Changes in the tradecraft of cheating: Technological advances in academic dishonesty. *College Teaching*, 1–10. https://doi.org/10.1080/87567555.2021.1940813

Labayen, M., Vea, R., Flórez, J., Aginako, N., & Sierra, B. (2021). Online student authentication and proctoring system based on multimodal biometrics technology. *IEEE Access*, *9*, 72398–72411.

Lancaster, T., & Cotarlan, C. (2021). Contract cheating by STEM students through a file sharing website: A Covid-19 pandemic perspective. *International Journal for Educational Integrity*, *17*(1), 1–16.

Li, H., Xu, M., Wang, Y., Wei, H., & Qu, H. (2021). A visual analytics approach to facilitate the proctoring of online exams. In *Proceedings of the 2021 CHI conference on human factors in computing systems* (pp. 1–17). Association for Computing Machinery.

Li, M., Luo, L., Sikdar, S., Nizam, N. I., Gao, S., Shan, H., Kruger, M., Kruger, U., Mohamed, H., Xia, L., & Wang, G. (2021). Optimised collusion prevention for online exams during social distancing. *NPJ Science of Learning*, *6*(1), 1–9.

Liberati, A., Altman, D. G., Tetzlaff, J., Mulrow, C., Gøtzsche, P. C., Ioannidis, J. P., Clarke, M., Devereaux, P. J., Kleijnen, J., & Moher, D. (2009). The PRISMA statement for reporting systematic reviews and meta-analyses of studies that evaluate health care interventions: Explanation and elaboration. *Journal of Clinical Epidemiology*, *62*(10), e1–e34.

Medway, D., Roper, S., & Gillooly, L. (2018). Contract cheating in UKhigher education: A covert investigation of essay mills. *British Educational Research Journal*, *44*(3), 393–418.

Mezzapelle, L. (2021). *Students say Concordia's continued use of Proctorio infringes upon their privacy*. Retrieved from. https://thelinknewspaper.ca/article/students-say-concordias-continued-use-of-proctorio-infringes-upon-their-privacy

Morgan, K., Adams, E., Elsobky, T., Darr, A., & Brackbill, M. (2021). Moving assessment online: Experiences within a School of Pharmacy. *Online Learning*, *25*(1), 245–252.

Nigam, A., Pasricha, R., Singh, T., & Churi, P. (2021). A systematic review on AI-based proctoring systems: Past, present and future. *Education and Information Technologies*, *26*(5), 1–25.

O'Loughlin, D., MacPhail, A., & Msetfi, R. (2015). The rhetoric and reality of research reputation: 'Fur coat and no knickers'. *Studies in Higher Education*, *40*(5), 806–820.

Openo, J. (2020). Education's response to the COVID-19 pandemic reveals online Education's three enduring challenges. *Canadian Journal of Learning and Technology*, *46*(2), 1–13. Retrieved from. https://journals.library.ualberta.ca/cjlt/index.php/cjlt/article/view/27981/20493

Pelletier, K., Brown, M., Brooks, D. C., McCormack, M., Reeves, J., Arbino, N., Bozkurt, A., Crawford, S., Czerniewicz, L., Gibson, R., Linder, K., Mason, J., & Mondelli, V. (2021). 2021 EDUCAUSE horizon report teaching and. In *Learning Edition*. EDU. Retrieved August 8, 2021 from. https://www.learntechlib.org/p/219489/

Prigoff, J., Hunter, M., & Nowygrod, R. (2021). Medical student assessment in the time of COVID-19. *Journal of Surgical Education*, *78*(2), 370–374.

Raman, R., Sairam, B., Veena, G., Vachharajani, H., & Nedungadi, P. (2021). Adoption of online proctored examinations by university students during COVID-19: Innovation diffusion study. *Education and Information Technologies*, *26*, 1–20.

Reedy, A., Pfitzner, D., Rook, L., & Ellis, L. (2021). Responding to the COVID-19 emergency: Student and academic staff perceptions of academic integrity in the transition to online exams at three Australian universities. *International Journal for Educational Integrity*, *17*(1), 1–32.

Sakya, G., Singh, S., Mishra, S., & Tiwari, S. M. (2021). Intelligent invigilation using video surveillance. In *Computer communication, networking and IoT* (pp. 401–411). Springer.

Selwyn, N., O'Neill, C., Smith, G., Andrejevic, M., & Gu, X. (2021). *A necessary evil? The rise of online exam proctoring in Australian universities*. Media International Australia.

Setiaji, B., Hayaty, M., Setyanto, A., & Santoso, H. B. (2020, November). Assessing user experience of a secure Mobile exam application using UEQ+. In *2020 3rd international conference on information and communications technology (ICOIACT)* (pp. 246–251). IEEE.

Silverman, S. (2017). *Why reputation is everything*. Retrieved from. https://www.bizjournals.com/bizjournals/how-to/growth-strategies/2017/09/why-reputation-is-everything.html

Stadler, M., Kolb, N., & Sailer, M. (2021). The right amount of pressure: Implementing time pressure in online exams. *Distance Education*, *42*(2), 219–230.

Teräs, M., Suoranta, J., Teräs, H., & Curcher, M. (2020). Post-Covid-19 education and education technology 'solutionism': A seller's market. *Postdigital Science and Education*, *2*(3), 863–878.

Watters, A. (2020). 'Luddite sensibilities' and the future of education. [web log post]. Hack. *Education* Retrieved from. http://hackeducation.com/2020/07/29/luddite-sensibilities

Watters, A., & Prinsloo, P. (2020). *Building anti-surveillance ed-tech!* Contact North. TeachOnline.ca. Retrieved from. https://contactnorth.zoom.us/rec/play/6Md8Irqv_To3EtaS4QSDBv98W43pJqOs1SgW-fZZmk3nAXlQMVr0NLMSZep-_8h7rYlfJf12KP6GU2zV

Williamson, B. (2021). Making markets through digital platforms: Pearson, edu-business, and the (e) valuation of higher education. *Critical Studies in Education*, *62*(1), 50–66.

Williamson, B., Eynon, R., & Potter, J. (2020). Pandemic politics, pedagogies and practices: Digital technologies and distance education during the coronavirus emergency. *Learning, Media and Technology*, *45*(2), 107–111. https://doi.org/10.1080/17439884.2020.1761641