

REVIEW

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Under surveillance: mapping remote proctoring practices in the assessment of nursing students— a scoping review

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Abstract

Background Remote proctoring has become an essential tool for ensuring academic integrity during online assessments. Evidence highlights the use of several proctoring methods, such as live, AI-based, recorded, and hybrid systems. While these technologies offer significant benefits, they also present challenges, including technical issues, inadequate infrastructure, limited digital literacy, increased stress and anxiety, and privacy concerns.

Purpose To map the evidence on the use of remote proctoring in the assessment of nursing students.

Methods This scoping review employed the framework by Levac et al. (2010). Systematic searches were performed in CINAHL, MEDLINE, Emcare, Scopus, PsycInfo, and Web of Science, complemented by manual searches for studies published between 2015 and 2025. Of the 795 sources, six studies met the inclusion criteria and were included in the thematic analysis.

Results Six studies included an aggregate total of 1,567 nursing students, with individual samples ranging from 17 to 970. The proctoring modalities included live online monitoring, AI-based automated or recorded systems, lockdown browsers, CCTV, and mobile invigilation applications. Remote proctoring was generally perceived as deterring cheating and supporting assessment continuity. Reported challenges included student anxiety, false positives, poor internet connectivity, device incompatibility, browser extension failures, environmental scan errors, device freezing, and incomplete recordings.

Conclusion While remote proctoring can support academic integrity in online assessment, its implementation must balance exam security with student well-being, fairness, and equitable access to digital tools.

Keywords Academic integrity, Digital surveillance, Nursing students, Online assessment, Remote proctoring



Introduction

Remote proctoring has emerged as a crucial technological solution to address assessment challenges in online and distance education (Han et al. 2024; Malhotra and Chhabra 2026). This method encompasses technology-mediated invigilation that verifies identity, deters academic misconduct, and upholds examination integrity while students and invigilators are situated remotely (Han et al. 2024; Nigam et al. 2021; Patael et al. 2022). Proctoring modalities differ in their dependence on human versus machine oversight and in their monitoring formats, which can be synchronous or asynchronous. Live online proctoring incorporates real-time human surveillance via webcam, making it particularly suitable for high-stakes assessments (Castaño et al. 2021; Patael et al. 2022). Conversely, automated proctoring uses algorithms to detect unusual gaze patterns or unauthorized browser activity, thereby enabling scalable monitoring of large cohorts (Han et al. 2024; Oeding et al. 2024). Record-and-review models document sessions for subsequent analysis, while biometric tools provide identity verification through facial recognition (Han et al. 2024; Patael et al. 2022; Sasikala et al. 2022). Lockdown browsers restrict device functionality to mitigate digital cheating, and hybrid approaches integrate automated alerts with human judgment (Aplin-Snyder et al. 2021; Castaño et al. 2021; Han et al. 2024).

Academic integrity in online assessments presents ongoing challenges that necessitate coordinated strategies to uphold educational standards and professional ethics (Adama et al. 2023; Gamage et al. 2020). Research indicates significant risks of academic misconduct among nursing students (Adama et al. 2023). In their study, Adama et al. (2023) found that 31.7% of participants perceived a high risk of misconduct among younger students (ages 18–24), with collusion identified as a prevalent concern in nursing cohorts (24.5%). In a sample of 380 students, cheating was reported as more likely during longer assessments, particularly those lasting one to two weeks (46%) (Adama et al. 2023). Conversely, Aplin-Snyder et al. (2021) reported that graduate nursing students generally valued integrity and were willing to report cheating; however, those nearing graduation perceived existing deterrence measures as less effective, indicating potential “integrity fatigue” or diminished confidence in institutional enforcement.

The shift to online learning during the COVID-19 pandemic has intensified these integrity challenges (Gamage et al. 2020; Reedy et al. 2021). A study by Gamage et al. (2020) highlighted that remote assessments introduce unique security vulnerabilities, particularly in the absence of traditional invigilation. Similarly, Reedy et al. (2021) argued for a reevaluation of academic misconduct in digital contexts, where behaviors such as contract cheating, collusion via group messaging platforms, and unauthorized access to online materials can be difficult to detect and define consistently. Remote proctoring has been proposed as a solution, with Gudiño Paredes et al. (2021) noting that proctored online exams can enhance honesty through a greater sense of obligation and the awareness of being monitored. Emerging technologies also offer potential solutions, and Sakhipov et al. (2025) demonstrated that intelligent proctoring systems using facial recognition and behavioral monitoring can help reduce cheating. The literature indicates that online proctoring platforms emerged around 2008, with commercial vendors such as ProctorU, Proctorio, Examity, and ExamSoft operating well before the COVID-19 pandemic (Lee and Fanguy 2022). Although remote proctoring had been part of the educational landscape for some time, it was relatively rare and contentious prior to 2020.

Scholarly interest surged only after the pandemic began; for instance, Balash et al. (2023) reported a 720% increase in online proctoring use at the onset of COVID-19, emphasizing that this increase was largely reactive rather than stemming from intentional, strategic planning. In nursing education specifically, the pre-pandemic evidence base is notably limited. Existing investigations are predominantly descriptive, limited in scale, and primarily concentrate on short-term feasibility rather than long-term educational or ethical implications (Castaño et al. 2021).

There is a trend toward standardizing remote proctoring across various assessments in nursing education, including pre-admission tests and high-stakes exams (Castaño et al. 2021; Oeding et al. 2024). Acceptance of remote proctoring among students and faculty is viewed as a mechanism for academic integrity and public trust, because dishonesty is perceived as a threat to clinical competence and professional standards (Aplin-Snyder et al. 2021; Castaño et al. 2021; Oeding et al. 2024; Omran et al. 2022). Multiple remote proctoring modalities and commercially available systems, such as Respondus Monitor and ProctorU, are used for nursing student assessments (Castaño et al. 2021; Omran et al. 2022).

Nursing education faces significant challenges, including pressure to adopt remote proctoring to uphold academic integrity, and a lack of context-sensitive guidance on balancing exam security with educational quality, well-being, and fairness (Fawns and Schaepkens 2022; Oeding et al. 2024). Evidence reveals substantial trade-offs concerning performance, well-being, workload, and equity. The reliance on proctoring technology coexists with technostress among educators, student anxiety, and infrastructural barriers (Amerson 2023; Castaño et al. 2021; Furby 2021). In graduate nursing courses, the use of remote online proctoring software significantly altered final grade distributions, demonstrating its impact on performance patterns (Oeding et al. 2024). Despite the challenges, remote proctoring offers flexibility and scalability for geographically dispersed nursing students. Thus, this scoping review aims to map the evidence on the use of remote proctoring in the assessment of nursing students.

Methods

This scoping review employed the framework by Levac et al. (2010). This framework was selected to outline the scope and characteristics of the rapidly growing literature on digital assessment and remote proctoring in nursing education. The review was carried out in five stages: identifying the research question, identifying relevant studies, selecting relevant studies, charting data, and synthesizing results. It was reported following PRISMA-ScR guidelines (Tricco et al. 2018).

Stage 1: Identifying the research question

The review addressed the following research questions to map the studies regarding remote proctoring in nursing education:

- What remote proctoring modalities are used in nursing student assessment?
- What outcomes are associated with remote proctoring in nursing student assessment?
- What challenges are identified in remote proctoring in nursing student assessment?

Stage 2: Identifying relevant studies

A comprehensive search strategy was collaboratively developed with an academic librarian to enhance sensitivity, transparency, and reproducibility. Electronic searches were conducted in CINAHL, MEDLINE, Emcare, PsycInfo, Scopus, and Web of Science, and additional searches in Google Scholar and manual screening of reference lists ensured comprehensive coverage of emerging evidence. Controlled vocabulary and free-text keywords were utilized, including variations of online proctoring, remote invigilation, online assessment, academic integrity, and nursing education. Boolean operators, truncation, and phrase searching were employed as appropriate. The search was limited to studies published between 2015 and 2025 to reflect the accelerated growth of online proctoring technologies. Only English-language studies were included due to feasibility constraints. Below is an example of the search term combinations that were customized for different databases:

- **S1:** “online proctor*” OR “remote proctor*” OR “virtual proctor*” OR e-proctor* OR “automated proctor*” OR “AI proctor*” OR “online invigilat*” OR “remote invigilat*” OR “exam surveill*” OR “test monitor*”.
- **S2:** assessment* OR examination* OR exam* OR test* OR “electronic assessment*” OR “online assessment*” OR “remote assessment*” OR “computer-based assessment*”.
- **S3:** “nursing student*” OR “student nurse*”.
- **S4:** S1 AND S2 AND S3

Stage 3: Selecting relevant studies

The inclusion and exclusion criteria guided the selection process. Included studies focused on online proctoring within nursing education and reported empirical findings. Studies were excluded if they were outside the study scope, focused on non-nursing contexts, used unproctored online assessments, were reviews or opinion pieces, or had full texts unavailable. Study selection occurred in two sequential phases. Initially, titles and abstracts were independently screened by three reviewers against predefined eligibility criteria, and any disagreements were resolved through consensus. Subsequently, full-text articles of potentially relevant studies were retrieved and assessed for final inclusion. The methodological quality of the included studies was assessed using the Mixed Methods Appraisal Tool (MMAT) (Hong et al. 2018), with design-specific criteria applied, and the findings were summarized descriptively to emphasize strengths and limitations.

A total of 795 records were identified, including 775 from database searches (CINAHL = 89, Emcare = 7, MEDLINE = 32, PsycInfo = 27, Scopus = 193, Web of Science = 427) and 20 from manual searches of Google and Google Scholar. After removing 85 duplicates, 710 unique records were available for title and abstract screening, of which 660 were excluded. The full texts of 50 articles were assessed for eligibility, of which 44 were excluded for various reasons: instructional or learning-focused ($n=3$), unspecified mode of remote proctoring ($n=4$), review articles ($n=2$), and incorrect population ($n=35$). Ultimately, six studies met the inclusion criteria and were included in the data extraction and thematic analysis, comprising qualitative ($n=1$), quantitative ($n=2$), mixed-methods ($n=2$), and implementation-focused ($n=1$) studies. Although the systematic search included studies published between 2015 and 2025, all six studies were published between 2021 and 2024.

Figure 1 presents the PRISMA flow diagram, illustrating the study selection process, including identification, screening, eligibility assessment, and final inclusion of studies in the review.

Stage 4: Charting the data

Data charting employed a standardized extraction form developed a priori and pilot-tested on a subset of included studies to ensure consistency and completeness. The extracted data were charted using structured tables. Table 1 presents the main study characteristics, including author(s), year of publication, country, study title, study design, population, sample size, and modalities of remote proctoring. The remaining extracted data were synthesized and organized into summary tables according to key

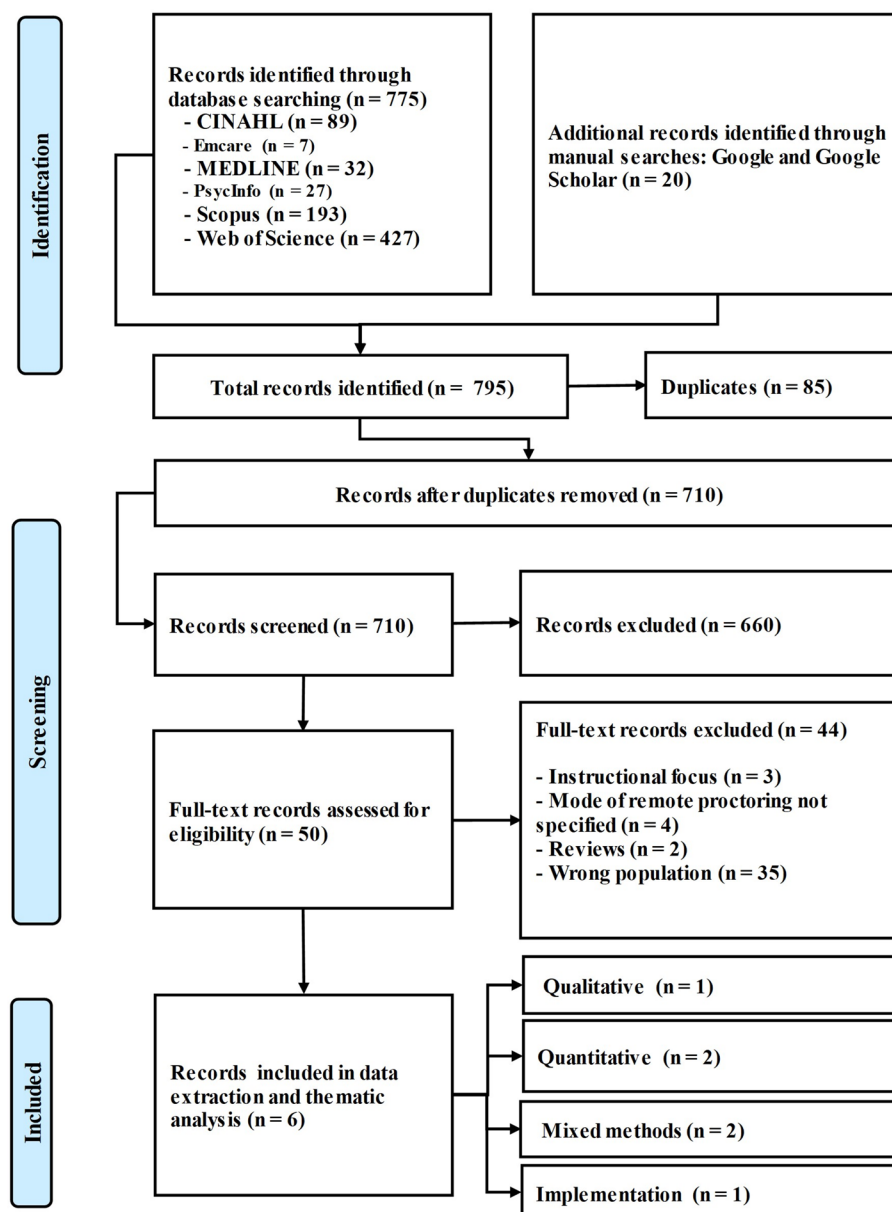


Fig. 1 PRISMA flow diagram

Table 1 Summary of the study characteristics

Authors and year	Country/region	Study title	Population and sample size	Design	Modalities of remote proctoring
Aplin-Snider et al. (2021)	USA	"Academic integrity in online examinations in a graduate nurse practitioner program: Student perceptions and lessons for nurse educators."	Nursing students ($n = 58$)	Mixed methods	– Webcam/video proctoring + lock-down browser
Castañó et al. (2021)	USA	"Implementing remotely proctored testing in nursing education."	Nursing students ($n = 254$)	Descriptive implementation design	– ProctorU® (live remote proctoring) – Respondus Monitor® with LockDown Browser®
Ford et al. (2023)	UK	"A realist evaluation of online examinations and remote proctoring for pre-registration nursing students."	Nursing students ($n = 87$)	Mixed methods	– Honorlock (AI-based remote proctoring)
Maboe and Tomas (2023)	Southern Africa	"Online assessments and COVID-19: A qualitative study of undergraduate nursing students in Southern Africa."	Nursing students ($n = 17$)	Qualitative	– Invigilator mobile app
McClure (2024)	USA	"Proctoring modalities and the influence on HESI Exit Exam® scores: A comparison of two nursing cohorts."	Nursing students (HESI Exit Exam®) ($n = 181$) [Cohort 2019: $n = 88$; cohort 2020: $n = 93$]	Quantitative	– ProctorU® (live remote proctoring)
Omran et al. (2022)	Egypt	"Facilitators and barriers of employing electronic exams as perceived by nursing students and their relation to satisfaction."	Nursing students ($n = 970$)	Quantitative	– Electronic test-center surveillance system

areas of interest: characteristics of online proctoring systems (Table 2), outcomes of remote proctoring (Table 3), and challenges associated with remote proctoring (Table 4).

Stage 5: Collating, summarizing, and reporting the results

Data were synthesized through thematic analysis. Data analysis followed the framework by Braun and Clarke (2006) to ensure structured and reliable processing. This involved familiarization through iterative readings, initial coding of key features, theme generation, review and refinement, theme definition and naming, and narrative synthesis to address the research questions. Both quantitative and qualitative data were integrated to provide comprehensive insights, which were interpreted in relation to the research questions and reported in accordance with PRISMA-ScR guidelines (Tricco et al. 2018).

Results

Study characteristics

Six studies were included in this review with an aggregated sample size of 1,567 nursing students. Individual study sample sizes ranged from 17 participants in Maboe and Tomas (2023) to 970 participants in Omran et al. (2022). All studies ($n = 6$) involved nursing students, including undergraduate (ADN, BSN, pre-registration), graduate (NP),

Table 2 Description of remote proctoring modalities

Proctoring platforms/mode	Description of proctoring mode	Country/region	Authors
Honorlock (AI-based remote proctoring)	AI-driven browser-extension proctoring integrated into the LMS (e.g., Blackboard), with webcam, microphone, and flagging of suspicious behavior.	UK	(Ford et al. 2023)
ProctorU® (live remote proctoring)	Synchronous live human invigilation via webcam, including identity checks, room scans, and continuous monitoring.	USA	(Castaño et al. 2021; McClure 2024)
Respondus Monitor® + LockDown Browser®	AI-supported automated/recorded proctoring with webcam recording, behavior analysis, and post-exam risk reports, used with a secure browser.	USA	(Castaño et al. 2021)
Invigilator mobile app	Mobile-phone-based remote invigilation: an app monitors students via the phone camera and their interactions during assessments.	Southern Africa	(Maboe and Tomas 2023)
Webcam/video proctoring + lockdown browser	Live/recorded webcam proctoring combined with a lockdown browser to restrict on-screen activity.	USA	(Aplin-Snider et al. 2021)
Electronic test-center surveillance system	Fixed desktop computers in the university lab with internet, linked to the electronic exam system, and monitored by central surveillance cameras.	Egypt	(Omran et al. 2022)

Table 3 Outcomes associated with remotely proctored assessments

Outcome domain	Outcome description	Authors
Academic integrity & deterrence	– AI alerts and live monitoring yielded few “high alert” cases ($\leq 5\%$). – Frequent minor alerts caused false positives and required time-intensive faculty review. – 98–100% of graduate NP students agreed webcam proctoring/lockdown browsers deterred cheating. – Integrity expectations and deterrent messages shaped students’ experiential burden.	(Aplin-Snider et al. 2021; Castaño et al. 2021)
Performance & progression	– The in-person proctored BSN cohort achieved significantly higher HESI scores and demonstrated greater NCLEX readiness than the remotely proctored (ProctorU) cohort. – Remote proctoring may be linked to lower performance outcomes and altered testing conditions that can influence student results. – All ADN students (100%) completed remotely proctored examinations and progressed without graduation delays despite technical challenges. – Remote proctoring enabled program continuity and uninterrupted progression during institutional closures.	(McClure 2024) (Castaño et al. 2021)
Stress and anxiety	– Remote proctoring reduced anxiety, offering greater comfort, and eliminating travel. – Increased anxiety was linked to connectivity issues. – Fear of false accusation or wrongful flagging was a key stressor. – Anxiety due to unfamiliarity with the mobile invigilator app. – Experiencing anxiety from being watched and finding it hard to concentrate.	(Ford et al. 2023; Maboe and Tomas 2023)

and HESI Exit cohorts (Aplin-Snider et al. 2021; Castaño et al. 2021; Ford et al. 2023; Maboe and Tomas 2023; McClure 2024; Omran et al. 2022). Of the six studies, three originated from the USA (Aplin-Snider et al. 2021; Castaño et al. 2021; McClure 2024). The remaining studies originated from the following countries/regions: the UK ($n = 1$) (Ford et al. 2023), Southern Africa ($n = 1$) (Maboe and Tomas 2023), and Egypt ($n = 1$) (Omran et al. 2022). In terms of study design, two studies utilized quantitative methods (McClure 2024; Omran et al. 2022), two employed mixed methods (Aplin-Snider et al. 2021; Ford et al. 2023), one used qualitative methods (Maboe and Tomas 2023), and one followed a descriptive/implementation design (Castaño et al. 2021).

Table 4 Challenges in remote proctoring of nursing student assessments

Category	Specific challenges	Authors
Internet connectivity issues	– Slow internet connectivity – Internet interruptions – Weak Wi-Fi frequently disrupted exams, especially in rural areas. – Limited data bundles	(Castaño et al. 2021; Ford et al. 2023; Maboe and Tomas 2023; Omran et al. 2022)
Power outages	– Power outages (load shedding)	(Maboe and Tomas 2023)
Device and system technical problems	– Device incompatibility – Browser extension faults – Environmental scan failure (esp. desktops/iPads) – Device freezes – Incomplete recordings – Video processing errors or delays	(Castaño et al. 2021; Ford et al. 2023; Maboe and Tomas 2023)
User experience and attitudes	– Computer illiteracy led to delays in accessing exams and the LMS. – Significant reservations regarding stress and technical reliability. – Approximately 40% preferred face-to-face exams. – The Invigilator app is perceived as distracting and time-consuming. – Questioned effectiveness for assessing clinical skills. – Less than 50% satisfied with the concentration during electronic exams. – Conditional acceptance is dependent on the integrity culture. – Insufficient time to complete exams, compounded by access delays and technical issues.	(Aplin-Snider et al. 2021; Ford et al. 2023; Maboe and Tomas 2023; Omran et al. 2022)

Regarding the publication timeline of the included studies, although the search strategy encompassed work published between 2015 and 2025, all studies that met the inclusion criteria ($n=6$) were published between 2021 and 2024. This indicates that the eligible evidence on remote proctoring in nursing student assessments is relatively recent, with no included studies published before 2021. The publication pattern suggests growing scholarly attention to remote proctoring in nursing education, particularly following the increased use of online assessment during and after the COVID-19 pandemic. Building on these study characteristics, the subsequent section describes the remote proctoring modalities used in the included studies.

Remote proctoring modalities

Six studies analyzed remote proctoring modalities used in the assessments of nursing students. Table 2 presents the remote proctoring modalities identified in the reviewed studies, describing the proctoring platform or mode, its key operational features, the country or region where it was implemented, and the study authors.

Two studies reported the use of AI-supported automated/recorded proctoring and lockdown browsers, namely Respondus Monitor with LockDown Browser and Honorlock (Castaño et al. 2021; Ford et al. 2023). Two studies employed commercial live remote proctoring (ProctorU) (Castaño et al. 2021; McClure 2024), while one study (Maboe and Tomas 2023) used institutionally deployed mobile invigilation applications (Invigilator app). Another study highlighted lockdown-browser approaches with webcam integration (Aplin-Snider et al. 2021). Remote proctoring systems collect surveillance data, encompassing visual, biometric, behavioral, and contextual information about students during online assessments. Utilizing tools such as Respondus Monitor, ProctorU, Honorlock, and LockDown Browser, these systems capture images of students’ faces, ID cards, and environments (Aplin-Snider et al. 2021; Castaño et al. 2021; Ford et al. 2023; McClure 2024). Continuous webcam video recordings of students and

their workspaces are standard, with some platforms incorporating 360-degree room scans or CCTV feeds from test centers (Castaño et al. 2021; Ford et al. 2023; McClure 2024; Omran et al. 2022). Audio monitoring captures microphone input to identify speech and ambient sounds indicative of potential collaboration or external assistance (Castaño et al. 2021; Ford et al. 2023). Identity verification data are captured and include images of official documents such as student IDs, driver's licenses, and passports, as well as biometric checks, such as facial recognition, predominantly in systems like ProctorU, Respondus Monitor, and Honorlock (Castaño et al. 2021; McClure 2024). Screen and device data logging includes screen recordings, browser activity, lockdown events such as disabled copy-paste functions, and, in some cases, keystroke or mouse tracking, especially within platforms like LockDown Browser, Respondus Monitor, ProctorU, and Honorlock (Aplin-Snider et al. 2021; Castaño et al. 2021; McClure 2024). Certain mobile invigilation systems monitor movements and verify venue access to confirm that students are in authorized environments (Maboe and Tomas 2023). These systems also produce detailed time-stamped event logs and metadata—including instances of frame exits, low face detection, multiple logins, vocalizations, suspicious movements, network instability, and exam start/end markers—to identify potentially suspicious behavior (Castaño et al. 2021; Ford et al. 2023).

Outcomes associated with remote proctoring

This review showed that remote proctoring has important implications for maintaining fair assessment practices, shaping students' learning outcomes, and influencing students' overall well-being during online examinations. Table 3 provides an overview of the reported outcomes of remotely proctored assessments in the included studies, focusing on academic integrity, students' performance and progression, and experiences of stress and anxiety during online assessment.

Two studies (Aplin-Snider et al. 2021; Castaño et al. 2021) found that remote proctoring technologies were perceived as effective deterrents against cheating, though concerns about false alerts were noted. In a mixed-methods study involving graduate nurse practitioners, Aplin-Snider et al. (2021) found that the majority of students believed that webcam proctoring and lockdown browsers deterred cheating, underscoring the importance of exam integrity. However, Castaño et al. (2021) reported that while high-risk alerts were rare, frequent minor flags necessitated intensive, time-consuming faculty reviews.

Performance outcomes remain inconsistent (Castaño et al. 2021; McClure 2024). McClure (2024) found that in-person proctored cohorts achieved significantly higher HESI scores and NCLEX readiness than those using remote proctoring, suggesting that remote modalities may alter testing conditions or negatively impact results. Conversely, Castaño et al. (2021) demonstrated that remote proctoring kept student progression and completion during campus closures, effectively maintaining program continuity despite technical difficulties.

Three studies examined the psychological and experiential dimensions of online proctoring, encompassing anxiety and perceived burden (Aplin-Snider et al. 2021; Ford et al. 2023; Maboe and Tomas 2023). In the UK, Ford et al. (2023) found mixed perceptions among pre-registration nursing students regarding home-based remotely proctored exams, with some experiencing reduced anxiety due to comfort and no travel,

while others faced anxiety from connectivity issues and fears of wrongful accusations of cheating. In Southern Africa, Maboe and Tomas (2023) reported that nursing students found their initial experiences with online assessments and a mobile invigilator app anxiety-inducing, primarily due to unfamiliarity with platforms and concentration difficulties under surveillance. Aplin-Snider et al. (2021) noted that integrity expectations and deterrent messaging influenced students' experiences during proctored exams.

Challenges of remote proctoring

The implementation of remote proctoring was shaped by several interrelated factors, including technical feasibility, infrastructure readiness, usability, student satisfaction, and assessment preferences. Table 4 outlines key challenges associated with the remote proctoring of nursing student assessments, including internet connectivity issues, power outages, device- and system-related technical problems, and concerns about user experience and attitudes toward remotely proctored examinations.

Four studies reported internet connectivity issues (Castaño et al. 2021; Ford et al. 2023; Maboe and Tomas 2023; Omran et al. 2022), while one indicated that load shedding affected remote proctoring (Maboe and Tomas 2023). Castaño et al. (2021) demonstrated that while Respondus Monitor and ProctorU enabled all students in a large ADN program to complete proctored exams, significant issues arose, including internet interruptions, device malfunctions, incomplete recordings, processing delays, and problematic environmental scans, especially on desktops or iPads.

A study by Ford et al. (2023) reported that although most UK students using Honorlock rated their digital literacy positively and benefited from preparatory resources, approximately one-fifth encountered technical issues with the browser extension and connectivity, highlighting the need for robust support systems. Maboe and Tomas (2023) identified chronic bandwidth limitations, power outages, and device incompatibility among students in Southern Africa, indicating that infrastructural inequities can severely disrupt proctored assessments and exacerbate educational disadvantages.

Four studies reported challenges associated with user experience and attitudes towards remote proctoring (Aplin-Snider et al. 2021; Ford et al. 2023; Maboe and Tomas 2023; Omran et al. 2022). In the US, although proctoring is viewed as adequate for maintaining integrity, conditional acceptance is dependent on the integrity culture (Aplin-Snider et al. 2021). In the UK, Ford et al. (2023) found that approximately half of the pre-registration students preferred retaking exams online, around two-fifths preferred face-to-face exams, and a minority were indifferent. In Southern Africa, Maboe and Tomas (2023) noted that while students valued the flexibility, immediate feedback, and reduced travel associated with online assessments, many found the Invigilator app distracting and time-consuming. Furthermore, participants questioned the effectiveness of remote proctoring for assessing clinical skills, highlighting perceived limitations in evaluating practice-based competencies within virtual environments (Maboe and Tomas 2023). A study conducted in Egypt by Omran et al. (2022) found that less than half of the students were satisfied with their ability to concentrate during electronic exams.

Discussion

This scoping review synthesized six empirical studies on remote proctoring in nursing education, highlighting considerable diversity in modalities, outcomes, implementation, and contextual challenges. The review identified significant variation in remote proctoring modalities used in the assessment of nursing students, encompassing AI-based systems, live human invigilation, recorded webcam monitoring, lockdown browsers, mobile-phone-based invigilation, and electronic test-center surveillance (Aplin-Snyder et al. 2021; Castaño et al. 2021; Ford et al. 2023; Maboe and Tomas 2023; McClure 2024; Omran et al. 2022). This diversity reflects disparities in technological infrastructure, institutional capacity, and assessment context rather than a uniform adoption of a single solution. AI-enabled platforms such as Honorlock and Respondus Monitor with Lock-Down Browser provide automated, scalable oversight through webcam and microphone monitoring, browser restrictions, and behavioral flagging (Castaño et al. 2021; Ford et al. 2023), while platforms like ProctorU ensure synchronous human oversight through identity verification and continuous real-time observation (Castaño et al. 2021; McClure 2024). Importantly, context-adapted approaches—such as mobile-based invigilation in Southern Africa and electronic test-center models in Egypt—illustrate how institutions in resource-constrained environments have developed pragmatic alternatives to proprietary AI systems (Maboe and Tomas 2023; Omran et al. 2022). Universities turned to commercial platforms such as Respondus Monitor, ProctorU, Honorlock, and the Invigilator app due to their seamless integration with learning management systems, vendor partnerships, and scalability for large student cohorts (Castaño et al. 2021; Ford et al. 2023; Simelane-Mnisi 2023). These findings challenge the assumption that remote proctoring represents a monolithic practice; rather, it constitutes a spectrum of technologically mediated assessment security strategies, each with distinct trade-offs.

Remote proctoring has become a practical strategy for supporting academic integrity in nursing student assessments, despite the challenges associated with its implementation and use. The literature shows that the shift to emergency remote teaching has sparked a “technology arms race” fueled by fears of unproctored dishonesty (Khalil et al. 2022). Furthermore, reputational and regulatory pressures drove the adoption of remote proctoring tools and ensured that online exams met the standards required for patient-safety-critical programs (Aplin-Snyder et al. 2021; Castaño et al. 2021; Khalil et al. 2022). However, integrity was assumed without adequately addressing privacy, equity, or trade-offs in outcomes (Khalil et al. 2022).

The outcomes of remote proctoring indicate that these systems produce measurable deterrence; for example, in one graduate nurse practitioner program, 98–100% of students reported that webcam monitoring and lockdown-browser proctoring effectively maintained test integrity (Aplin-Snyder et al. 2021). AI-powered platforms monitor webcams, screens, keystrokes, and room environments, flagging unusual behaviors for faculty review, while mobile solutions like the Invigilator app verify identity through selfies and GPS data (Arnò et al. 2021; Castaño et al. 2021; Simelane-Mnisi 2023). However, this deterrence is not foolproof, as South African lecturers noted continued dishonesty despite active monitoring, with some students exploiting surveillance gaps through what Khalil et al. (2022) refer to as “subterranean ethics.” Consequently, proctoring often fosters compliance through fear of detection rather than promoting intrinsic academic values; many students view these systems as burdensome and believe that determined

peers can bypass them (Aplin-Snyder et al. 2021; Simelane-Mnisi 2023). Proctoring can negatively impact students' performance: BSN students using ProctorU performed worse than their in-person counterparts, even with reliable tests (McClure 2024). Cognitive and emotional burdens—such as connectivity issues, interface demands, and fears of false accusations—divert attention and amplify anxiety (Ford et al. 2023; Malhotra and Chhabra 2026; McClure 2024). Student experiences are mixed—while some feel comfortable at home, others experience stress due to perceived fragility and scrutiny (Ford et al. 2023; Maboe and Tomas 2023; Simelane-Mnisi 2023). Although remote proctoring tools can help reduce cheating and maintain standards for high-stakes assessments, they also impose performance penalties, exacerbate inequalities, and normalize intrusive surveillance (Ford et al. 2023; McClure 2024).

Despite these perceived benefits, the implementation of remote proctoring is constrained by substantial technological, infrastructural, and ethical challenges. The effectiveness of remote proctoring implementation depends not only on the availability of digital proctoring technologies but also on reliable internet connectivity, suitable devices, user-friendly platforms, adequate technical support, and assessment approaches that align with student expectations (Aplin-Snyder et al. 2021; Castaño et al. 2021; Ford et al. 2023; Maboe and Tomas 2023; McClure 2024; Omran et al. 2022). Consequently, successful deployment requires a holistic consideration of both technological and human factors within the broader context of nursing student assessment. Infrastructure inequities and technical challenges pose significant obstacles to electronically proctored examinations. In low-resource settings, students grapple with frequent internet interruptions, high broadband and data costs, electricity shortages, and load shedding (Castaño et al. 2021; Ford et al. 2023; Khalil et al. 2022; Maboe and Tomas 2023). Device- and system-related technical issues, such as device incompatibility, browser extension failures, and environmental scan errors, highlight insufficient cross-platform optimization, especially on desktops and iPads (Castaño et al. 2021; Ford et al. 2023). Performance problems, including device freezing, incomplete recordings, and video processing delays, compromise reliability, auditability, and fairness in assessment (Castaño et al. 2021). Reviewing three-hour flagged videos without clear guidelines increases workload and anxiety (Castaño et al. 2021; Khalil et al. 2022).

Privacy protections often lag behind reputational concerns (Khalil et al. 2022; Labayen et al. 2021). Institutions rarely consider the implications of capturing audio-visual and behavioral data from private spaces, and AI algorithms are seldom transparent about their training methods or demographic error rates, despite their significant impact on academic decisions (Khalil et al. 2022; Nigam et al. 2021). Regulatory frameworks like the General Data Protection Regulation and South Africa's Protection of Personal Information Act offer limited governance, while cross-border vendor contracts create complex compliance challenges (Simelane-Mnisi 2023). Students are generally more accepting of biometrics than teachers—83% expressed surveillance fears, 58% reported discomfort, and 72% raised concerns about data privacy, yet 78% supported future usage (Labayen et al. 2021). AI's lack of transparency regarding biases and regulations, along with challenges in cross-border data flows, remains problematic (Khalil et al. 2022; Nigam et al. 2021; Simelane-Mnisi 2023). The literature shows that where high-stakes proctoring is necessary, it must be governed by robust data protection standards, clear

communication with students, and dedicated invigilation structures that relieve individual faculty of the burden of forensic responsibilities (Castaño et al. 2021; Simelane-Mnisi 2023).

This review identified that the included studies were published after 2020. This concentration highlights the accelerated adoption of remote proctoring technologies in response to COVID-19-related disruptions in nursing education (Adama et al. 2023; Maboe and Tomas 2023), as well as the limited pre-pandemic empirical research on their application, implementation, and outcomes in this context. This scoping review is strengthened by the geographical and socioeconomic diversity of the included studies, including evidence drawn from the USA (Aplin-Snyder et al. 2021; Castaño et al. 2021; McClure 2024), UK (Ford et al. 2023), Southern Africa (Maboe and Tomas 2023), and Egypt (Omran et al. 2022), which provides representation across different regional and income contexts. This broad distribution enhances the relevance of the findings and supports a more balanced understanding of remote proctoring across varied educational and resource settings.

Limitations and recommendations

The limitations of this scoping review include the following: only six empirical studies met the inclusion criteria, limiting the breadth and generalizability of the findings. Furthermore, the variability in study designs, proctoring modalities, and outcome measures complicates comparative synthesis and hinders causal inference. Most studies relied on self-reported perceptions instead of longitudinal or objective measures of learning and professional outcomes. Future research should utilize longitudinal, multi-site, and theory-informed designs to assess the sustained academic, psychological, and equity impacts of remote proctoring in diverse nursing contexts. Nursing programs must implement context-sensitive, ethically grounded proctoring policies, supported by integrity-by-design assessment approaches that prioritize authentic learning, student well-being, and equity. Future studies should build on evidence from this review by including more countries, particularly from low- and middle-income settings, to further examine how infrastructure, digital access, institutional resources, and student support systems influence the implementation and outcomes of remote proctoring in nursing student assessment. Such research will be essential to guide nursing programs in designing equitable, context-sensitive assessment strategies in increasingly digital learning environments.

Conclusion

This scoping review demonstrates that remote proctoring has become an integral part of nursing student assessment, serving as a mechanism to uphold academic integrity amid the rise of online and hybrid assessment models. The evidence shows that various proctoring modalities—including live, AI-based, recorded, and hybrid systems—can deter academic misconduct and support assessment continuity, particularly during periods of educational disruption. However, these advantages come with significant challenges. Remote proctoring may alter performance outcomes, increase student anxiety, create technostress for educators, and exacerbate equity concerns related to infrastructure, privacy, and access. Importantly, the findings indicate that no single proctoring approach is universally effective; success is highly context-dependent. Moving forward, nursing programs must carefully balance the use of remote proctoring to uphold academic

integrity with ethical obligations to student well-being, fairness, and inclusivity. A shift toward context-sensitive, equity-oriented implementation of remote proctoring—combined with diversified assessment strategies—offers a more sustainable pathway to align remote proctoring practices with the professional values and educational goals of nursing.

Acknowledgements

We gratefully acknowledge the contributions of the authors of all included studies. Their work provided the foundation for this review.

Author contributions

AH: Writing – original draft, Methodology, Investigation, Formal analysis, Data curation, Conceptualization. NM: Writing – review & editing, Methodology, Data curation, Conceptualization. GM: Writing – review & editing, Methodology, Investigation, Formal analysis, Supervision, Conceptualization.

Funding

This study is funded by the Harnessing Talent (HANT) Postdoctoral Fellowship (PDF) from Durban University of Technology (DUT) in Durban, South Africa.

Data availability

All data generated or analyzed during this study are included in this published article.

Declarations

Ethics approval

Not applicable.

Consent to participate

Not applicable.

Consent for publication

The authors agree to the journal's terms for publication of the manuscript.

Competing interests

The authors declare no competing interests.

Received: 28 February 2026 / Accepted: 30 June 2026

Published online: 20 July 2026

References

- Adama EA, Graf A, Adusei-Asante K, Afrifa-Yamoah E (2023) COVID-19 and alternative assessments in higher education: implications for academic integrity among nursing and social science students. *Int J Educational Integr* 19:1–19. <https://doi.org/10.1007/s40979-023-00129-0>
- Amerson GG (2023) Nurse educators: the relationship between online proctoring during COVID-19 and technostress, age, and years of experience using computer technology. Thesis, University of Alabama. <https://ir-api.ua.edu/api/core/bitstreams/e16d3b43-d096-46c3-aa1a-726fe1650fc3/content>. Accessed 20 December 2025
- Aplin-Snyder C, Buterakos R, Creech C, Schapel SA, Feige BD (2021) Academic integrity in online examinations in a graduate nurse practitioner program: Student perceptions and lessons for nurse educators. *Nurse Educ Today*. 107. <https://doi.org/10.1016/j.nedt.2021.105099>
- 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. *Int J Distance Educ Technol* 19:41–62. <https://doi.org/10.4018/IJDET.20210401.oa3>
- Balash DG, Korkes E, Grant M, Aviv AJ, Fainghten RA, Sherr M (2023) Educators' perspectives of using (or not using) online exam proctoring. The 32nd USENIX Security Symposium (USENIX Security 23), Anaheim, California, USA, 2023. USENIX Association, p 5091–5108. Accessed 20 May 2026 <https://www.usenix.org/system/files/usenixsecurity23-balash.pdf>
- Braun V, Clarke V (2006) Using thematic analysis in psychology. *Qualitative Res Psychol* 3:77–101. <https://doi.org/10.1191/1478088706qp063oa>
- Castaño M, Noeller C, Sharma R (2021) Implementing remotely proctored testing in nursing education. *Teach Learn Nurs* 16:156–161. <https://doi.org/10.1016/j.teln.2020.10.008>
- Fawns T, Schaepkens S (2022) A matter of trust: Online proctored exams and the integration of technologies of assessment in medical education. *Teach Learn Med* 34:444–453. <https://doi.org/10.1080/10401334.2022.2048832>
- Ford C, Jillian Park L, Leader C (2023) A realist evaluation of online examinations and remote proctoring for pre-registration nursing students. *Adv Online Educ*. 2023;2(1):82–98. <https://researchportal.northumbria.ac.uk/ws/portalfiles/portal/122007797/8024.pdf>. Accessed 20 December 2025
- Furby L (2021) Remote proctoring: What is the takeaway from the student perspective? *Nurs Educ Perspect* 42:267. <https://doi.org/10.1097/01.NEP.0000000000000850>
- Gamage KA, Silva EKd, Gunawardhana N (2020) Online delivery and assessment during COVID-19: Safeguarding academic integrity. *Educ Sci* 10:301. <https://doi.org/10.3390/educsci10110301>
- Gudiño Paredes S, Jasso Peña FdJ, de La Fuente Alcazar JM (2021) Remote proctored exams: Integrity assurance in online education? *Distance Educ* 42:200–218. <https://doi.org/10.1080/01587919.2021.1910495>

- Han SN, Nikou S, Ayele WY (2024) Digital proctoring in higher education: a systematic literature review. *Int J Educational Manage* 38:265–285. <https://doi.org/10.1108/IJEM-12-2022-0522>
- Hong QN, et al (2018) Mixed methods appraisal tool (MMAT), version 2018. Registration of Copyright. 1148552:1–7. http://mixedmethodsappraisaltoolpublic.pbworks.com/w/file/attach/127916259/MMAT__criteriamanual_2018-08-01_ENG.pdf. Accessed 4 December 2025
- Khalil M, Prinsloo P, Slade S (2022) In the nexus of integrity and surveillance: Proctoring (re)considered. *J Comput Assist Learn* 38:1589–1602. <https://doi.org/10.1111/jcal.12713>
- Labayen M, Veal R, Flórez J, Aginako N, Sierra B (2021) Online student authentication and proctoring system based on multi-modal biometrics technology. *IEEE Access* 9:72398–72411. <https://doi.org/10.1109/ACCESS.2021.3079375>
- Lee K, Fanguy M (2022) Online exam proctoring technologies: Educational innovation or deterioration? *Br J Edu Technol* 53:475–490. <https://doi.org/10.1111/bjet.13182>
- Levac D, Colquhoun H, O'Brien KK (2010) Scoping studies: Advancing the methodology. *Implement Sci* 5:69. <https://doi.org/10.1186/1748-5908-5-69>
- Maboe KA, Tomas N (2023) Online assessments and COVID-19: A qualitative study of undergraduate nursing students in Southern Africa. *Int J Afr Nurs Sci* 19:1–7. <https://doi.org/10.1016/j.ijans.2023.100590>
- Malhotra M, Chhabra I (2026) Ensuring academic integrity through automated online exam proctoring a decade long systematic review. *Discover Educ* 2026:1–62. <https://doi.org/10.1007/s44217-026-01224-3>
- McClure A (2024) Proctoring modalities and the influence on HESI Exit Exam® scores: a comparison of two nursing cohorts. Thesis, Texas A&M University-Corpus Christi. <https://tamucc-ir.tdl.org/server/api/core/bitstreams/40e8910f-d1a9-4e84-991b-a557c561e670/content>. Accessed 20 December 2025
- Nigam A, Pasricha R, Singh T, Churi P (2021) A systematic review on AI-based proctoring systems: past, present and future. *Educ Inform Technol* 26:6421–6445. <https://doi.org/10.1007/s10639-021-10597-x>
- Oeding J, Gunn T, Jones A (2024) The impact of remote online proctoring versus no proctoring: A study of graduate courses. *Online Journal of Distance Learning Administration* 27. <https://ojdla.com/articles/the-impact-of-remote-online-proctoring-g-versus-no-proctoring-a-study-of-graduate-courses>. Accessed 23 December 2025
- Omran E, Fathy A, Elsaied H, Abd-elmonem A (2022) Facilitators and barriers of employing electronic exams as perceived by nursing students and the relation to their satisfaction. *Evidence-Based Nurs Res* 4:33–43. <https://doi.org/10.47104/ebnroj.s3.v4i4.256>
- Patael S, Shamir J, Soffer T, Livne E, Fogel-Grinvald H, Kishon-Rabin L (2022) Remote proctoring: Lessons learned from the COVID-19 pandemic effect on the large scale online assessment at Tel Aviv University. *J Comput Assist Learn* 38:1554–1573. <https://doi.org/10.1111/jcal.12746>
- Reedy A, Pfizner 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. *Int J Educational Integr* 17:1–32. <https://doi.org/10.1007/s40979-021-00075-9>
- Sakhipov A, Omirzak I, Fedenko A (2025) Beyond face recognition: A multi-layered approach to academic integrity in online exams. *Electron J e-Learning* 23:81–95. <https://doi.org/10.34190/ejel.23.1.3896>
- Sasikala N, Sundaram BM, Kumar VN, Sumanth J, Hrithik S (2022) Face recognition based automated remote proctoring platform. In: 2022 Second International Conference on Artificial Intelligence and Smart Energy (ICAIS); 2022; Coimbatore, India. Piscataway (NJ): IEEE; 2022. p. 1753–1760. <https://ieeexplore.ieee.org/document/9743134>. Accessed 23 December 2025
- Simelane-Mnisi S (2023) Effectiveness in maintaining academic integrity while using online proctoring for online assessment. In: Singh UG, Nair CS (eds) *digitAL2K2023: The International Conference on Teaching, Assessment and Learning in the Digital Age*, Cape Town, South Africa, 2023. *digitAL2K*, p 280–291. https://www.researchgate.net/publication/377406884_digitAL_2023_Conference_Proceedings. Accessed 23 December 2025
- Tricco AC et al (2018) PRISMA extension for scoping reviews (PRISMA-ScR): checklist and explanation. *Ann Intern Med* 169:467–473. <https://doi.org/10.7326/M18-0850>

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