E-Journal of Humanities, Arts and Social Sciences (EHASS)
ISSN – Online 2720-7722 | Print 2821-8949
Volume 7 Issue 3 2026 pp 677 - 698
Available online at: https://noyam.org/journals/ehass/
DOI: https://doi.org/10.38159/ehass.2026733

The integrity of online examinations in Undergraduate Programmes: A Systematic Review

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ABSTRACT

This systematic review, conducted using PRISMA guidelines, investigates the validity of online assessments in undergraduate programs. The study aimed to explore the current state of the literature on online exams, including the types of assessments employed, the mechanisms implemented to ensure academic integrity, and the effectiveness of these strategies. It further examined the prevalence of cheating in online assessments and the potential impact of these exams on student learning outcomes. The findings indicate that while online exams offer several advantages for both students and educators, substantial concerns remain regarding their validity and fairness. In particular, the review highlights challenges in contexts where access to technology and internet connectivity is limited. The study concludes by emphasising the need for further research to develop and evaluate robust methods for safeguarding academic integrity and ensuring equitable assessment practices in online environments. This study contributes to scholarship by systematically reviewing and synthesizing the current evidence on online exam integrity in undergraduate education. It identifies critical gaps in the implementation of secure online assessments in rural and resource-constrained settings and provides evidence-based recommendations for enhancing academic integrity in emerging online learning environments.

Keywords: Online Exam, Exam Integrity, Proctored Exams, Undergraduate Exams, Academic Dishonesty

INTRODUCTION

In educational programs, end-of-semester pen-and-paper assessments (exams) are utilized to inform crucial decisions about the student, the instructor, and the educational institution, according to the United Nations Educational, Scientific, and Cultural Organization.[1] The outcomes of these assessments may be used to determine a student's progression to higher levels of education, eligibility for financing, and as a precondition for some employment agencies.[2] Furthermore, the outcomes of these assessments are

[1] UNESCO, *COVID-19 Education Response Webinar: Managing High-Stakes Exams and Assessments during the Covid-19 Pandemic; Synthesis Report*, 2020.

[2] Kelum A.A. Gamage, Erandika K. de Silva, and Nanda Gunawardhana, "Online Delivery and Assessment during COVID-19: Safeguarding Academic Integrity," *Education Sciences* 10, no. 11 (October 25, 2020): 301, https://doi.org/10.3390/educsci10110301.

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PUBLICATION HISTORY - Received : 5th September, 2025 | Accepted: 21st January, 2026 | Published: 15th April, 2026.
TO CITE THIS ARTICLE – Mabovana, Anele, and Tshepo Rabotapi."The integrity of online examinations in Undergraduate programmes: A Systematic Review," *E-Journal of Humanities, Arts and Social Sciences* 7, no.3 (2026): 677 - 698

critical for sustaining the institutional integrity and reputation of higher education institutions, and in certain cases are a crucial factor in the distribution of student housing.[3]

The rapid shift from traditional venue based exams to online exams, necessitated by the COVID-19 pandemic, is believed to have compromised the quality and integrity of this assessment,[4] particularly in cases where students were not monitored by an invigilator during the assessment.[5] According to Gamage et al. and Fishman, 'honesty", "responsibility,' 'trust,' 'fairness,' and 'courage' are fundamental characteristics that students and academics should uphold to guarantee the integrity of the learning process.[6] Failing to follow these ideals might have a detrimental influence on the calibre of graduates produced by an institution, hence harming its image.[7] Although institutions of higher education have regulations aimed at preserving academic integrity, their execution remains ambiguous.[8] When academic staff members disagree on what constitutes academic integrity, academic misbehaviour may go unnoticed.[9] Moreover, overwhelming academic staff commitments such as supervision, research, community engagement, and other administrative tasks may lead to academic misconduct being overlooked,[10] thereby compromising the quality of qualifications and negatively affecting the institution's reputation.

According to Amigud et al., in South Africa, methods to guarantee the honesty of online exams are largely conceptual and narrowly focused.[11] The COVID-19 epidemic appears to have reawakened debates regarding online end-of-semester exams[12] and has brought up some concerns about the knowledge and abilities necessary for administering such exams.

Even though a policy framework for online education was proposed in South Africa in 2017. End-of-semester exams at universities had to be rescheduled during the COVID-19 epidemic, amid concerns regarding their implementation without compromising the integrity of the qualification and institution.[13] Although the idea of administering exams online is not completely novel in the context of South Africa, its implementation has been hampered by factors such as the socio-economic backgrounds of the students, a lack of ICT infrastructure, and minimal academic staff skills and knowledge to effectively manage these assessment types.[14] Thus, research on the validity of online assessments in South Africa is not as well developed as research on the validity of face-to-face assessments.[15] On the other hand, there are signs that online exams carry a significant danger to academic honesty that are beginning to appear.[16] To reduce the possibility of academic dishonesty on online exams, several universities switched to continuous assessments rather than online exams.[17]

Thus, this article reviews the different types of online exams used in undergraduate programs, including their formats, delivery modes, and assessment methods, to establish trends in the subject. The

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[3] Leelakrishna Reddy et al., "Integrity vs. Quality of Assessments: Are They Compromised on the Online Platform?," *Pedagogical Research* 7, no. 2 (March 3, 2022): em0121, https://doi.org/10.29333/pr/11840.

[4] Tembisa Ngqondi, Pardon Blessings Maoneke, and Hope Mauwa, "A Secure Online Exams Conceptual Framework for South African Universities," *Social Sciences & Humanities Open* 3, no. 1 (2021): 100132; Isabel Hilliger et al., "Trustworthy Remote Assessments: A Typology of Pedagogical and Technological Strategies," *Journal of Computer Assisted Learning* 38, no. 6 (December 20, 2022): 1507–20, https://doi.org/10.1111/jcal.12755.

[5] Gamage, Silva, and Gunawardhana, "Online Delivery and Assessment during COVID-19: Safeguarding Academic Integrity."

[6] Gamage, Silva, and Gunawardhana, "Online Delivery and Assessment during COVID-19: Safeguarding Academic Integrity"; Teddi Fishman, "Plagiarism in the Time of Pandemic [Abstract]," in *Plagiarism across Europe and beyond—Abstract Book* , ed. C. Hill, Z.R. Khan, and V. Kralíkova (Technology and Integrity in Academia and Beyond Research Group, 2020).

[7] Olivia L Holden, Meghan E Norris, and Valerie A Kuhlmeier, "Academic Integrity in Online Assessment: A Research Review," in *Frontiers in Education*, vol. 6 (Frontiers Media SA, 2021), 639814.

[8] Gamage, Silva, and Gunawardhana, "Online Delivery and Assessment during COVID-19: Safeguarding Academic Integrity."

[9] Gamage, Silva, and Gunawardhana, "Online Delivery and Assessment during COVID-19: Safeguarding Academic Integrity."

[10] Reddy et al., "Integrity vs. Quality of Assessments: Are They Compromised on the Online Platform?"

[11] Alexander Amigud and Thomas Lancaster, "246 Reasons to Cheat: An Analysis of Students' Reasons for Seeking to Outsource Academic Work," *Computers & Education* 134 (June 2019): 98–107, https://doi.org/10.1016/j.compedu.2019.01.017.

[12] Ngqondi, Maoneke, and Mauwa, "A Secure Online Exams Conceptual Framework for South African Universities."

[13] Ngqondi, Maoneke, and Mauwa, "A Secure Online Exams Conceptual Framework for South African Universities."

[14] UNESCO, *Global Education Monitoring Report, 2020: Inclusion and Education: All Means All* (UNESCO, 2020).

[15] Ngqondi, Maoneke, and Mauwa, "A Secure Online Exams Conceptual Framework for South African Universities."

[16] Reddy et al., "Integrity vs. Quality of Assessments: Are They Compromised on the Online Platform?" ; Rubén Comas-Forgas et al., "Exam Cheating and Academic Integrity Breaches during the COVID-19 Pandemic: An Analysis of Internet Search Activity in Spain," *Heliyon* 7, no. 10 (October 2021): e08233, https://doi.org/10.1016/j.heliyon.2021.e08233.

[17] Reddy et al., "Integrity vs. Quality of Assessments: Are They Compromised on the Online Platform?"

prevalence of academic dishonesty in online exams among undergraduate students, including the types of cheating behaviours observed and their frequency, is examined. The effectiveness of various measures implemented by universities to enhance the security and integrity of online exams is evaluated, such as proctoring software, randomized questions, and time limits. Finally, recommendations that could be implemented in the South African rural contexts are discussed. This systematic review aims to answer the following research questions:

- What are the different types of online examinations used in undergraduate programs, and how do they vary in terms of format, delivery mode, and assessment methods?
- What is the prevalence of academic dishonesty in online examinations among undergraduate students, and what are the most common types of cheating behaviours observed?
- How effective are the various measures implemented by universities to enhance the security and integrity of online examinations, such as proctoring software, randomized questions, and time limits?

As an educator at a rural South African institution of higher education, conventional face-to-face invigilated exams at the conclusion of each semester have been the norm for undergraduate programs. Due to the COVID-19 epidemic and the switch to online platforms, the researchers were also compelled to perform exams remotely. Students at this institution benefited from the government's reaction to online learning, which permitted institutions of higher education to offer laptops and internet data access in order to facilitate the transition. However, the quick transition from in-person to online examinations contradicts the knowledge, abilities, and attitudes required to organize and run online examinations successfully. Even though a learning management system called Moodle existed previous to the epidemic, it had not been utilized for semester-ending examinations. Hence, academics with little to no expertise in remote testing migrated pen-and-paper exams to unmonitored internet environments. In addition, the country's planned blackouts, sometimes known as load shedding, demanded that the exams be offered at different times to accommodate students in various municipalities. As a result of these student accommodations, pass rates throughout this time period increased dramatically compared to in-person examinations.

Yet, due to the nature of these unsupervised online exams, faculty members were concerned about the integrity and legitimacy of the assessment outcomes in terms of the security measures utilized to avoid academic dishonesty. Research reveals that academic dishonesty is a significant problem in online assessments.[18] According to various scholars, academic dishonesty rose during the COVID-19 epidemic due to the absence of oversight or invigilation over students.[19] When student exam response scripts included identical solutions and discussion questions requiring a minimum of 200 words, which were answered quickly, more doubts were raised. Students may have taken advantage of the lack of oversight in this evaluation method and participated in academic dishonesty. In this context, academic dishonesty is defined as exchanging answers, taking an exam for another student, gaining access to unapproved materials, and completing the exam in groups. These issues lead to the compromise of the integrity of online tests and have significant repercussions for the integrity of qualifications, academics, and institutions. As a result of the COVID-19 pandemic, a quick change from face-to-face, proctored tests to online exams was anticipated. Concerns were raised regarding the academic staff's knowledge and expertise in establishing these types of assessments.

LITERATURE REVIEW

Qualifications, as well as the legitimacy of certificates and degrees, can be called into question when one cannot rely on the evaluation systems to produce accurate results; this can represent a challenge to

[18] UNESCO, *COVID-19 Education Response Webinar: Managing High-Stakes Exams and Assessments during the Covid-19 Pandemic; Synthesis Report*.

[19] Gamage, Silva, and Gunawardhana, "Online Delivery and Assessment during COVID-19: Safeguarding Academic Integrity"; Rebecca Awdry and Bob Ives, "Students Cheat More Often from Those Known to Them: Situation Matters More than the Individual," *Assessment & Evaluation in Higher Education* 46, no. 8 (November 17, 2021): 1254–68, https://doi.org/10.1080/02602938.2020.1851651; Ngqondi, Maoneke, and Mauwa, "A Secure Online Exams Conceptual Framework for South African Universities."

the validity of qualifications.[20] As a result of the inherent danger, the faith that individuals and communities have in educational establishments may come into doubt. This is of special significance in the context of COVID-19, in which a large number of educational institutions have been compelled to implement pedagogical models predicated on online student evaluations and distant learning.[21] Students have, in some instances, been required to take tests and exams online, in an environment that is not supervised and where it is difficult to verify that the student is completing the assessment of their abilities without resorting to unfair means. In these instances, it is difficult to ensure that the student is actually completing the assessment of their abilities.[22]

According to Gamage et al., the incidence of dishonesty in academic settings is currently at a worryingly high level.[23] According to Butler-Henderson and Crawford, the problem of fraudulent assessment exam taking is the one that is discussed the most in the literature on online assessments.[24] It has been hypothesized that the online assessment environment presents students and teachers with a greater number of challenges than the traditional classroom setting does.[25] According to the research, various variables, such as the pressure of having to do well, the absence of proctoring software, contract cheating (taking a test for another), and the usage of instant messaging programs and screen-casting tools, are all causes.[26] In addition, the perception that there were various opportunities to cheat, the absence of punitive measures in place towards cheating, and the content's irrelevance to the students' future career objectives surfaced as motivators for students to engage in academic dishonesty.[27]

In addition, a number of other ways for maintaining the integrity of online exams have been presented. Santos et al and Holden et al employed randomised questions as opposed to non-randomised questions in online tests; they came to the conclusion that students performed better in non-randomised assessments.[28] Because of the efficiency of this method, it is necessary to have a big question bank; yet, it may be challenging to use this method in large classroom settings such as those seen in the majority of undergraduate degree programs. It has been suggested that conventional venue-based tests include less evidence of academic dishonesty than non-proctored online exams.[29] This is due to the fact that students can access the internet on a different device or have someone else take the exam for them. According to Craig and Tugce, non-proctored online assessments should consequently be limited to

[20] Holden, Norris, and Kuhlmeier, "Academic Integrity in Online Assessment: A Research Review"; Delbert Goff, Jarrod Johnston, and Bryan Bouboulis, "Maintaining Academic Standards and Integrity in Online Business Courses," *International Journal of Higher Education* 9, no. 2 (February 6, 2020): 248, https://doi.org/10.5430/ijhe.v9n2p248.

[21] J. Crawford et al., "COVID-19: 20 Countries' Higher Education Intra-Period Digital Pedagogy Responses," *Journal of Applied Learning & Teaching* 3, no. 1 (April 1, 2020): 9–28, https://doi.org/10.37074/jalt.2020.3.1.7; Sonali Raje and Shannon Stitzel, "Strategies for Effective Assessments While Ensuring Academic Integrity in General Chemistry Courses during COVID-19," *Journal of Chemical Education* 97, no. 9 (2020): 3436–40; Evangelin Whitehead, "A Qualitative Study: Exploring the Perspectives of Educators on Online Teaching in the Covid-19 Crisis," *I-Manager's Journal of Educational Technology* 18, no. 4 (2022): 30.

[22] Gamage, Silva, and Gunawardhana, "Online Delivery and Assessment during COVID-19: Safeguarding Academic Integrity"; Comas-Forgas et al., "Exam Cheating and Academic Integrity Breaches during the COVID-19 Pandemic: An Analysis of Internet Search Activity in Spain."

[23] Gamage, Silva, and Gunawardhana, "Online Delivery and Assessment during COVID-19: Safeguarding Academic Integrity."

[24] Kerryn Butler-Henderson and Joseph Crawford, "A Systematic Review of Online Examinations: A Pedagogical Innovation for Scalable Authentication and Integrity," *Computers & Education* 159 (2020): 104024.

[25] Joseph Clare, Sonia Walker, and Julia Hobson, "Can We Detect Contract Cheating Using Existing Assessment Data? Applying Crime Prevention Theory to an Academic Integrity Issue," *International Journal for Educational Integrity* 13, no. 1 (December 8, 2017): 4, https://doi.org/10.1007/s40979-017-0015-4; Anuradha Joshi et al., "Online Assessment: Concept and Applications," *Journal of Research in Medical Education & Ethics* 10, no. 2 (2020): 49.

[26] Chula G King, Roger W Guyette Jr, and Chris Piotrowski, "Online Exams and Cheating: An Empirical Analysis of Business Students' Views.," *Journal of Educators Online* 6, no. 1 (2009): n1; Olivia Leslie Holden, Valerie A. Kuhlmeier, and Meghan Norris, "Academic Integrity in Online Testing: A Research Review," June 10, 2020, https://doi.org/10.31234/osf.io/rjk7g.

[27] Megan R. Krou, Carlton J. Fong, and Meagan A. Hoff, "Achievement Motivation and Academic Dishonesty: A Meta-Analytic Investigation," *Educational Psychology Review* 33, no. 2 (June 1, 2021): 427–58, https://doi.org/10.1007/s10648-020-09557-7.; Panagiotis Kiekkas et al., "Reasons for Academic Dishonesty during Examinations among Nursing Students: Cross-Sectional Survey," *Nurse Education Today* 86 (2020): 104314.

[28] Michael R Santos, Vincent Richman, and Jinglin Jiang, "Online Teaching: A Study for the Effectiveness of Randomized Exams.," *Journal of Instructional Pedagogies* 22 (2019); Holden, Norris, and Kuhlmeier, "Academic Integrity in Online Assessment: A Research Review."

[29] Bilal Öncül, "Dealing with Cheating in Online Exams: A Systematic Review of Proctored and Non-Proctored Exams," *International Technology and Education Journal* 5, no. 2 (2021): 45–54.

assignments that require higher-order thinking skills.[30] This recommendation was made in order to protect students' privacy.

Proctoring systems that are driven by artificial intelligence have emerged as promising solutions in the global setting. As a consequence, a large number of scholars feel that online proctoring should be employed to prevent academic dishonesty and protect academic and institutional integrity.[31] Despite the fact that it has been demonstrated that proctored exams are more successful in international situations.[32] Nevertheless, these solutions only pay a minor consideration to other aspects of online exams, such as the deployment of ICT infrastructure, which has created issues about the authenticity of Australian exams according to Cramp et al.[33]

The suggested conceptual framework for safe online exams in South African institutions intends to create a reliable and trustworthy system for online exams while limiting the possibility of cheating and other academic misconduct.[34] The architecture includes biometric authentication to verify online exam takers' identities. Facial and fingerprint recognition are used for authentication. Remote proctoring is recommended for exam monitoring. Webcam tracking, screen recording, and other methods can discover cheating. The framework also requires explicit online exam administration regulations, including student behaviour norms and academic misconduct penalties. There is no literature on implementing the suggested framework in rural areas with socioeconomic issues and poor ICT infrastructure.

A number of educational institutions in South Africa, such as the University of South Africa, the University of Johannesburg, and the University of Cape Town, have implemented a mobile invigilator application known as the "Invigilator App".[35] The program allows examiners to pick from a range of risk-reducing strategies throughout the test, such as image authentication, audio recording, location, and exam script comparison, in order to spot any suspicious behaviour that may occur.[36] Several of the problems that are associated with proctoring software are remedied by the Invigilator App. These problems include expensive acquisition and upkeep costs, demanding system requirements, and faster-than-average internet rates. The following are some of the benefits that the application offers: It is affordable, consumes minimal mobile data, and does not require a persistent internet connection. It is compatible with smartphones that are not very high-end and can be integrated into educational administration systems.[37]

There were, however, instances of students experiencing anxiety and a lack of privacy while taking proctored online exams, and these instances were found to have a negative impact on student performance.[38] These instances were reported in separate articles, but they are related to one another.

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[30] Tracy S Craig and Tugce Akkaya, "Forced to Improve: Open Book and Open Internet Assessment in Vector Calculus," *International Journal of Mathematical Education in Science and Technology* 53, no. 3 (2022): 639–46.

[31] Raghu Raman et al., "Adoption of Online Proctored Examinations by University Students during COVID-19: Innovation Diffusion Study," *Education and Information Technologies* 26, no. 6 (2021): 7339–58; Faten F Kharbat and Ajayeb S Abu Daabes, "E-Proctored Exams during the COVID-19 Pandemic: A Close Understanding," *Education and Information Technologies* 26, no. 6 (2021): 6589–6605; Jiyou Jia and Yunfan He, "The Design, Implementation and Pilot Application of an Intelligent Online Proctoring System for Online Exams," *Interactive Technology and Smart Education* 19, no. 1 (2022): 112–20.

[32] Daniel Woldeab and Thomas Brothen, "21st Century Assessment: Online Proctoring, Test Anxiety, and Student Performance," *International Journal of E-Learning & Distance Education/Revue Internationale Du e-Learning et La Formation à Distance* 34, no. 1 (2019); Tibor Guzsvinecz and Judit Szűcs, "Using Analytics to Identify When Course Materials Are Accessed Relative to Online Exams during Digital Education," *Education Sciences* 11, no. 10 (2021): 576; V. Reddy et al., *An Investigation into Educator Leave in the Southern African Ordinary Public Schooling System* (UNICEF Report. RSA, 2010).

[33] Joshua Cramp et al., "Lessons Learned from Implementing Remotely Invigilated Online Exams," *Journal of University Teaching and Learning Practice* 16, no. 1 (January 1, 2019), https://doi.org/10.53761/1.16.1.10.

[34] Ngqondi, Maoneke, and Mauwa, "A Secure Online Exams Conceptual Framework for South African Universities."

[35] Reddy et al., *An Investigation into Educator Leave in the Southern African Ordinary Public Schooling System*; Malinga Sibahle, "The Invigilator Uses AI to Keep Students Honest, ITWeb Senior News Journalist," Johannesburg, May 19, 2022.

[36] Sinethemba Sibisi, "UNISA Digs in Heels over Online Invigilation App," 2021, https://witsvuvuzela.com/2021/09/17/unisa-digs-in-heels-over-online-invigilation-app/; Sibahle, "The Invigilator Uses AI to Keep Students Honest, ITWeb Senior News Journalist."

[37] Sibisi, "UNISA Digs in Heels over Online Invigilation App"; Sibahle, "The Invigilator Uses AI to Keep Students Honest, ITWeb Senior News Journalist."

[38] Sarah Elaine Eaton and Kristal Louise Turner, "Exploring Academic Integrity and Mental Health during COVID-19: Rapid Review," *Journal of Contemporary Education Theory & Research (JCETR)* 4, no. 2 (2020): 35–41; Gürbüz Ocak and Gülçin Karakus, "Measuring Change in Undergraduate Students' Attitudes Towards On-Line Exams Depending on Gender and Some Technological Variables.," *Malaysian Online Journal of Educational Technology* 12, no. 1 (2024): 1–14.

There have been reports of incidents that are analogous to these concerning the Invigilator App. "The app may induce distraction and lack of attention as it demands selfies at set intervals during the test," one of these incidents stated.[39] Over the course of these distant assessments, red flags indicating a rising level of distrust between students and lecturers were raised.[40]

According to the available research, although academic dishonesty is not a new phenomenon in education, it was more prevalent during online exams.[41] Despite the fact that online proctoring software was not commonly used in traditional institutions of higher learning before the COVID-19 pandemic, it has recently emerged as a key strategy in the literature to secure the integrity of online exams.[42]

However, Khalil et al. warn of the danger of just accepting proctoring software without considering student data privacy.[43] Comas-Forgas et al., highlight the cost attached to proctoring software as a challenge for certain educational establishments, especially considering the fact that these solutions are not just plug-and-play.[44] As a consequence of this, educational institutions need to carefully evaluate the proper methods for preserving academic honesty and making sure that all students have the opportunity to be tested.[45]

It is also apparent from the published research that the vast majority of the proposed solutions were created in countries other than South Africa and may not be suitable for a setting in which there is restricted access to the internet and devices with high-end capabilities. Moreover, the current solutions appear to have been prompted by the COVID-19 epidemic, and they may not adapt to rural environments.

METHODOLOGY

The primary data of the study consists of research findings that investigate the various kinds of online exams that are given in online teaching and learning environments in higher education, the degree to which academic dishonesty is associated with this kind of assessment, and the most successful strategies for preventing academic dishonesty in terms of characteristics such as academic achievement scores. Under this framework, the outcomes of the investigations were analysed, and logical conclusions were drawn from those analyses. In order to accomplish the goals of this study, a comprehensive assessment of the relevant literature was carried out, and the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) methodology was utilized to identify the articles to be analysed.[46] As a result, prior to conducting database searches, an inclusion/exclusion criterion, as well as search keywords and search methodologies, have been stated. In this particular scenario, the ERIC database was mostly searched using keywords to look for possible studies that may be included in the investigation.

Keywords: included “Online exam”, “undergraduate exams”, “non proctored online exams”, “proctored online exams”, “exam integrity”, and “academic dishonesty”.The data was extracted from eligible studies using a standardized form.

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[39] Sibisi, “UNISA Digs in Heels over Online Invigilation App.”

[40] Meital Amzalag, Noa Shapira, and Niva Dolev, “Two Sides of the Coin: Lack of Academic Integrity in Exams during the Corona Pandemic, Students’ and Lecturers’ Perceptions,” *Journal of Academic Ethics* 20, no. 2 (2022): 243–63.

[41] Gamage, Silva, and Gunawardhana, “Online Delivery and Assessment during COVID-19: Safeguarding Academic Integrity”; Holden, Norris, and Kuhlmeier, “Academic Integrity in Online Assessment: A Research Review”; Barry J. Zimmerman, “Dimensions of Academic Self-Regulation,” in *Self-Regulation of Learning and Performance* (New York: Routledge, 2022), 3–21, https://doi.org/10.4324/9780203763353-1; Jill M Oeding, “Watch the Online Exam Proctoring Videos,” *Quarterly Review of Distance Education: Volume 23# 1* 23, no. 1 (2022): 79–89.

[42] Gamage, Silva, and Gunawardhana, “Online Delivery and Assessment during COVID-19: Safeguarding Academic Integrity”; Guzsvinecz and Szűcs, “Using Analytics to Identify When Course Materials Are Accessed Relative to Online Exams during Digital Education”; Craig and Akkaya, “Forced to Improve: Open Book and Open Internet Assessment in Vector Calculus.”

[43] Mohammad Khalil, Paul Prinsloo, and Sharon Slade, “In the Nexus of Integrity and Surveillance: Proctoring (Re) Considered,” *Journal of Computer Assisted Learning* 38, no. 6 (2022): 1589–1602.

[44] Comas-Forgas et al., “Exam Cheating and Academic Integrity Breaches during the COVID-19 Pandemic: An Analysis of Internet Search Activity in Spain.”

[45] Gregory M Hurtz and John A Weiner, “Comparability and Integrity of Online Remote vs. Onsite Proctored Credentialing Exams,” *Journal of Applied Testing Technology*, 2022, 36–45.

[46] David Moher et al., “Preferred Reporting Items for Systematic Reviews and Meta-Analyses: The PRISMA Statement,” *Bmj* 339 (2009).

Inclusion criteria:

- Research should be written in English.
- Records should be retrieved utilizing the designed search keywords.
- Studies should be published between the years 2018 and 2022.
- Only the most current publications were considered for inclusion, where there were multiple papers that described the same subject.

Exclusion criteria:

- Papers merely related to online exam methods
- Studies that were done for primary and secondary education.
- Studies not related to research questions are discarded.
- Studies that are not of high quality are discarded (i.e., studies published by non-reputable publishers without peer review, too short review time, and so on, studies with poor theoretical background, experimental evaluation, or structure).

Study selection

There were 89 entries found as a result of the search; however, after reviewing either the title or the abstract, 41 of those items were disqualified from further consideration. In the following phase, eleven reports were removed from consideration since they could not be collected due to necessary financial arrangements. In addition, after evaluating the entire texts of the reports for eligibility, 15 were not included since they did not meet the inclusion and exclusion criteria described earlier. As a consequence of this, 22 papers were chosen for the literature analysis concerning the integrity of online examinations in undergraduate programs. The PRISMA flow diagram that is illustrated in Figure 1 depicts the flow of information that is delivered during the various phases of the review.

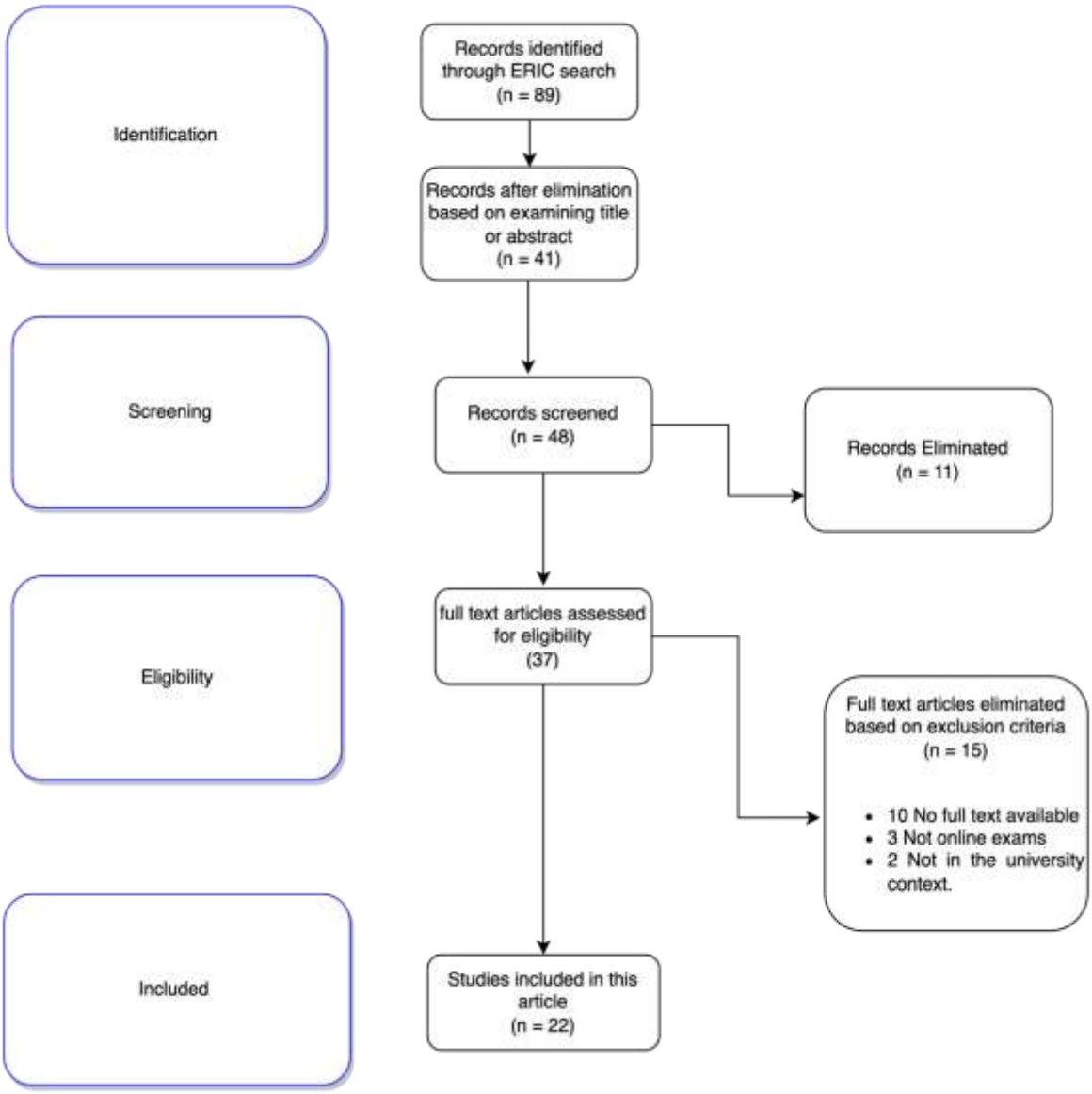

Figure 1: Prisma results

The Mixed Method Appraisal Tool system was used to evaluate the quality of each accepted article, and the scores were computed to determine whether the paper was of high, medium, or poor quality based on the matrix.[47] Table 1 contains a summary of this evaluation that was carried out.

PRESENTATION OF FINDINGS

Table 1 provides a concise summary of the 22 research articles that were judged to be relevant to the investigation. The following information is included in the table: a brief explanation of the setting within which the study took place; the type of study and/or methodology; and, when appropriate, specific elements of the online exam integrity that were discussed. Six out of the 22 papers that were chosen contained a literature review. 2 in-depth pilot studies, 1 in-depth case study, and 4 studies that involved questionnaires or interviews with faculty. The remainder of the studies were distributed among mixed methods and systematic reviews. There was not a single geographic context; instead, articles were applicable to case studies in a single country or area, numerous nations or regions, or the world as a whole. Moreover, three papers had a global viewpoint. The next part, under the discussion section, will go into further depth about the publications in connection with the three research questions.

[47] Quan Nha Hong et al., "Mixed Methods Appraisal Tool (MMAT), Version 2018," *Registration of Copyright* 1148552, no. 10 (2018): 1–7.

Table 1: Papers accepted for publication in the special issue titled "**The integrity of online examinations in undergraduate programmes: A systematic review"**

Title	Authors(years)	Context	Methodology	Score
Integrity vs. Quality of Assessments: Are They Compromised on the Online Platform?	Reddy et al.[48]	Higher education in South Africa	Survey (Lecturers, n =11)	High
Question banks for effective online assessments in introductory science courses	Krzic & Brown[49]	Online Introductory Science courses. In Canada	Case study (Students n = 300)	Medium
Online proctored assessment during COVID-19: Has cheating increased?	Ivo J. M. Arnold[50]	Online proctored assessments (OPAs) during the COVID-19 pandemic in the Netherlands	Mixed-methods approach	High
Cheating on Unproctored Online Exams: Prevalence, Mitigation Measures, and Effects on Exam Performance	Pleasants et al.[51]	Unproctored online exams in the USA	Mixed method	High
Academic integrity of university students during emergency remote online assessment: An exploration of student voices	Verhoef & Coetser[52]	Higher education in South Africa	Literature review	High
Interaction of Proctoring and Student Major on Online Test Performance	Alessio et al.[53]	undergraduate students enrolled in online courses. USA	Observation (Students n = 97)	High
Comparing Student Performance on Proctored and Non-Proctored Exams in Online Psychology Courses	Daffin & Jones[54]	Investigate the difference in student performance between proctored and non-proctored exams in online psychology courses, USA	Explorative study (students n= 1700)	High
Maintaining Academic Standards and Integrity in Online Business Courses	Goff et al.[55]	USA, online education in the field of business	Survey (Students n = 146)	Medium

[48] Reddy et al., "Integrity vs. Quality of Assessments: Are They Compromised on the Online Platform?"
[49] Maja Krzic and Sandra Brown, "Question Banks for Effective Online Assessments in Introductory Science Courses," *Natural Sciences Education* 51, no. 2 (January 5, 2022), https://doi.org/10.1002/nse2.20091.
[50] Ivo J. M. Arnold, "Online Proctored Assessment during COVID-19: Has Cheating Increased?," *The Journal of Economic Education* 53, no. 4 (October 2, 2022): 277–95, https://doi.org/10.1080/00220485.2022.2111384.
[51] Jacob Pleasants, John M Pleasants, and Barbara Pleasants, "Cheating on Unproctored Online Exams: Prevalence, Mitigation Measures, and Effects on Exam Performance," *Online Learning* 26, no. 1 (March 1, 2022), https://doi.org/10.24059/olj.v26i1.2620.
[52] A. H. Verhoef and Y. M. Coetser, "Academic Integrity of University Students during Emergency Remote Online Assessment: An Exploration of Student Voices," *Transformation in Higher Education* 6, no. 10 (2021): a132.
[53] Helaine Mary Alessio et al., "Examining the Effect of Proctoring on Online Test Scores," *Online Learning* 21, no. 1 (March 21, 2017), https://doi.org/10.24059/olj.v21i1.885.
[54] Lee William Daffin Jr. and Ashley Anne Jones, "Comparing Student Performance on Proctored and Non-Proctored Exams in Online Psychology Courses," *Online Learning* 22, no. 1 (March 1, 2018), https://doi.org/10.24059/olj.v22i1.1079.
[55] Goff, Johnston, and Bouboulis, "Maintaining Academic Standards and Integrity in Online Business Courses."

In the nexus of integrity and surveillance: Proctoring (re) considered	Khalil et al.[56]	Norway, online education and the use of proctoring technology in monitoring student performance during remote examinations.	Systematic review (studies n = 15)	High
Trustworthy remote assessments: A typology of pedagogical and technological strategies	Hilliger et al.[57]	Global, the increasing need for remote assessment in education due to the COVID-19 pandemic and the challenges that come with ensuring the integrity and validity of remote assessments	Qualitative	Medium
The fear of Big Brother: The potential negative side-effects of proctored exams	Conijn et al.[58]	Netherlands, proctored exams in higher education.	Survey (students, n =1760, Courses = 105)	Medium
Dealing with Cheating in Online Exams: A Systematic Review of Proctored and Non-Proctored Exams	Oncul.[59]	Turkey, investigate the different methods of preventing and detecting cheating in online exams.	Systematic review (studies n = 15)	High
Strategies to Address Cheating in Online Exams	Abood & Maizer,[60]	Jordan, explore the issue of cheating in online exams and propose strategies to prevent and address cheating.	Literature review	High
21st Century Assessment: Online Proctoring, Test Anxiety, and Student Performance	Woldeab & Brothen,[61]	USA, explore the impact of online proctoring on test anxiety and student performance in the context of 21st-century assessment.	Survey (students n = 631)	Medium
An Analysis of Academic Dishonesty in Online Classes	Peterson[62]	Online exams, United States	Literature review	High

[56] Khalil, Prinsloo, and Slade, "In the Nexus of Integrity and Surveillance: Proctoring (Re) Considered."
[57] Hilliger et al., "Trustworthy Remote Assessments: A Typology of Pedagogical and Technological Strategies."
[58] Rianne Conijn et al., "The Fear of Big Brother: The Potential Negative Side-effects of Proctored Exams," *Journal of Computer Assisted Learning* 38, no. 6 (December 8, 2022): 1521–34, https://doi.org/10.1111/jcal.12651.
[59] Öncül, "Dealing with Cheating in Online Exams: A Systematic Review of Proctored and Non-Proctored Exams."
[60] Harith Abood and Maha Abu Maizer, "Strategies to Address Cheating in Online Exams," *International Journal of Technology in Education* 5, no. 4 (October 25, 2022): 608–20, https://doi.org/10.46328/ijte.256.
[61] Woldeab and Brothen, "21st Century Assessment: Online Proctoring, Test Anxiety, and Student Performance."
[62] Jennifer Peterson, "An Analysis of Academic Dishonesty in Online Classes," *Mid-Western Educational Researcher* 31, no. 1 (2019): 24–36.

Contract cheating: an increasing challenge for global academic community arising from COVID-19	Hill et al.[63]	Australia: The rise in contract cheating during the COVID-19 pandemic	Literature review	Medium
Security for Online Exams: Digital Proctoring	Bertiz & Hebebci.[64]	The United States explores the various digital proctoring techniques that can be used to ensure that online exams are fair and secure.	Literature review	High
A systematic review of research on cheating in online exams from 2010 to 2021	Noorbehbahani et al.[65]	Iran has been cheating in online exams since 2010	Systematic review (studies n = 58)	High
Online Delivery and Assessment during COVID-19: Safeguarding Academic Integrity	Gamage et al.[66]	United Kingdom, online teaching and assessment, and the challenges it poses to academic integrity in higher education	Qualitative	High
Moving Assessment Online: Experiences within a School of Pharmacy	Morgan et al.[67]	USA, the experiences and perspectives of faculty members who moved their assessments online in response to the COVID-19 pandemic in a School of Pharmacy.	Qualitative	High
Preferences and Scores of Different Types of Exams during COVID-19 Pandemic in the Faculty of Veterinary Medicine in Spain: A Cross-Sectional Study of Paper and E-exams	García et al.[68]	Preferences and Scores of Different Types of Exams during the COVID-19 Pandemic in the Faculty of Veterinary Medicine in Spain	Analysis (students n = 332)	Medium
A secure online exams conceptual framework for South African universities	Ngqondi et al.[69]	Explores the challenges of implementing secure	Literature review	High

[63] Guzyal Hill, Jon Mason, and Alex Dunn, "Contract Cheating: An Increasing Challenge for Global Academic Community Arising from COVID-19," *Research and Practice in Technology Enhanced Learning* 16, no. 1 (2021): 24.
[64] Yasemin Bertiz and Mustafa Hebebci, *Security for Online Exams: Digital Proctoring*, 2021.
[65] Fakhroddin Noorbehbahani, Azadeh Mohammadi, and Mohammad Aminazadeh, "A Systematic Review of Research on Cheating in Online Exams from 2010 to 2021," *Education and Information Technologies* 27, no. 6 (2022): 8413–60.
[66] Gamage, Silva, and Gunawardhana, "Online Delivery and Assessment during COVID-19: Safeguarding Academic Integrity."
[67] Kelsey Morgan et al., "Moving Assessment Online: Experiences within a School of Pharmacy.," *Online Learning* 25, no. 1 (2021): 245–52.
[68] Pablo-Jesús Marín García, Alberto Arnau-Bonachera, and Lola Llobat, "Preferences and Scores of Different Types of Exams during COVID-19 Pandemic in Faculty of Veterinary Medicine in Spain: A Cross-Sectional Study of Paper and E-Exams," *Education Sciences* 11, no. 8 (July 27, 2021): 386, https://doi.org/10.3390/educsci11080386.
[69] Ngqondi, Maoneke, and Mauwa, "A Secure Online Exams Conceptual Framework for South African Universities."

		online exams in South African universities		

DISCUSSION

As was pointed out earlier, the primary objective of this piece was to study the validity of online examinations utilized in undergraduate programs. The three research questions were used to organize the subsequent debate. The majority of the papers that were included in the final corpus (n = 22) reported on different aspects of online proctoring, such as systematic reviews, comparative assessments, reporting on student and faculty experiences, and debates on different alternatives to online proctoring.

Research Question 1

What are the different types of online examinations used in undergraduate programs, and how do they vary in terms of format, delivery mode, and assessment methods?

The rising prevalence of online assessments in undergraduate programs is due to their flexibility and convenience for both instructors and students.[70] Multiple-choice questions (also known as MCQs) are the format that makes up the majority of online examinations that are given in undergraduate degree programs. According to the findings of a study that was conducted by Yilmaz & Toker, which included 3830 courses taught by 805 academics through the learning management system of Usak University (Turkey), and 29511 undergraduate students, academics preferred to implement MCQs on their online examinations in undergraduate courses.[71] This is most likely attributable to the simplicity with which MCQs may be graded and administered. In addition, student performance on closed-ended questions was much greater than that of open-ended ones. It was also discovered that the percentage of students who passed the exam successfully increased when the questions were not presented individually but rather as a group. However, some courses also use other types of examination formats such as essays, short-answer questions, and problem-based questions.[72] These formats may be more appropriate for courses that require critical thinking and analysis. In cases where these exams are administered remotely, proctoring is advised by Holden et al.[73] Oral online exams also emerged in the global context;[74] however, there's insufficient evidence regarding their effectiveness.

Exams in undergraduate programs often take one of two forms: either synchronously or asynchronously. These are the two basic distribution modalities that are utilized. Students who are taking synchronous exams are required to take the exam at the same time, typically through the use of video conferencing software that is integrated into the institution's learning management system.[75] In Asynchronous exams, on the other hand, students are provided the opportunity to complete the test at their own leisure within the constraints of a given period of time. In light of this, take-home exams have emerged in the South African context during the COVID-19 pandemic as an alternative to online exams since they assess higher-order thinking skills such as critical thinking, analysis, and synthesis.[76] Nonetheless, there is a difficulty involved in maintaining academic honesty while using take-home exams.[77] Students could have access to resources or get help from other people, both of which could cast doubt on the validity of the assessment. Questions that involve unique thought and creative problem-solving might be designed by teachers as a way to help students avoid falling victim to this danger.[78] Lecturers can also utilize plagiarism detection software to uncover instances of academic dishonesty.[79]

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[70] Ngqondi, Maoneke, and Mauwa, "A Secure Online Exams Conceptual Framework for South African Universities."
[71] Erdi Okan Yilmaz and Türker Toker, "How Did the Covid–19 Outbreak Affected the Digital Competencies of Teachers," *Milli Eğitim Dergisi* 51, no. 235 (August 15, 2022): 2713–30, https://doi.org/10.37669/milliegitim.896996.
[72] Reddy et al., "Integrity vs. Quality of Assessments: Are They Compromised on the Online Platform?"
[73] Holden, Norris, and Kuhlmeier, "Academic Integrity in Online Assessment: A Research Review."
[74] Öncül, "Dealing with Cheating in Online Exams: A Systematic Review of Proctored and Non-Proctored Exams."
[75] Ngqondi, Maoneke, and Mauwa, "A Secure Online Exams Conceptual Framework for South African Universities"; Reddy et al., "Integrity vs. Quality of Assessments: Are They Compromised on the Online Platform?"
[76] UNESCO, *Education for Sustainable Development: A Roadmap* (Paris: UNESCO, 2020).
[77] Gamage, Silva, and Gunawardhana, "Online Delivery and Assessment during COVID-19: Safeguarding Academic Integrity."
[78] Ngqondi, Maoneke, and Mauwa, "A Secure Online Exams Conceptual Framework for South African Universities."
[79] Gamage, Silva, and Gunawardhana, "Online Delivery and Assessment during COVID-19: Safeguarding Academic Integrity."

Research Question 2

What is the prevalence of academic dishonesty in online examinations among undergraduate students, and what are the most common types of cheating behaviours observed?

Among undergraduate students, academic dishonesty in the form of cheating on tests and exams has been the subject of investigation in a number of studies. According to the findings of a meta-analysis of 15 separate studies that was carried out by Oncul, the prevalence of academic dishonesty was shown to be greater among undergraduate students.[80] According to the findings of the study, the incidence of academic dishonesty was much greater in online classes in comparison to more conventional in-person classes.

Goff et al., discovered that students acknowledged cheating in their research on preserving academic integrity in an online Business course.[81] They linked this finding to the absence of proctoring software in place to ensure the security of the assessment. These tendencies have the potential to create an unjust system in which students who cheat are rewarded with greater scores than students who do not cheat, which encourages students who would normally be honest to cheat.[82] There is a widespread agreement that increased access to technological resources and the affordances such resources have "ushered in new opportunities in both scope and scale for cheating in higher education."[83] It has grown "so widespread that some students consider cheating merely one of many tools in their academic armoury."[84] This behaviour may have a detrimental effect on the students' ability to learn new information and improve their abilities, as well as put the credibility of the educational establishment in jeopardy.

Students most frequently admitted to seeking answers on the internet, making illegal use of resources, and working together with other students while they should have been studying. According to Bertiz & Hebebci and Oncul students who felt greater amounts of pressure to do well were also more inclined to cheat.[85] The basic reasons why students cheat may be broken down into four categories.[86] These categories are as follows: teacher-related reasons, institutional reasons, internal reasons, and environmental reasons.

Teacher-related reasons: Reasons relating to the instructor include unethical behaviour such as favouring certain students over others, teachers' lack of interest in student learning, and course difficulty, in which students blame the teacher for their failure to comprehend the course's complicated subject matter.[87]

Institutional reasons: According to Maeda's research, institutions of learning with more stringent policies and a stronger commitment to bolstering academic integrity saw a significant reduction in the amount of cheating that occurs amongst their student body.[88] Students in an isolated setting have considerably less respect for their instructors since they do not have the opportunity to communicate with their teachers face-to-face. This results in an increase in students acting in inappropriate ways.[89]

Internal reasons: A lack of interest in the subject matter being taught by the instructor on the part of the student, which may be due to the student having the mentality that the subject matter being taught is irrelevant to their career aspirations or future life.[90] Internal factors such as performance pressure, a lack

[80] Öncül, "Dealing with Cheating in Online Exams: A Systematic Review of Proctored and Non-Proctored Exams."
[81] Goff, Johnston, and Bouboulis, "Maintaining Academic Standards and Integrity in Online Business Courses."
[82] Ngqondi, Maoneke, and Mauwa, "A Secure Online Exams Conceptual Framework for South African Universities."
[83] Khalil, Prinsloo, and Slade, "In the Nexus of Integrity and Surveillance: Proctoring (Re) Considered."
[84] Khalil, Prinsloo, and Slade, "In the Nexus of Integrity and Surveillance: Proctoring (Re) Considered."
[85] Bertiz and Hebebci, *Security for Online Exams: Digital Proctoring*.Öncül, "Dealing with Cheating in Online Exams: A Systematic Review of Proctored and Non-Proctored Exams."
[86] Noorbehbahani, Mohammadi, and Aminazadeh, "A Systematic Review of Research on Cheating in Online Exams from 2010 to 2021."
[87] Mitsuko Maeda, "Exam Cheating among Cambodian Students: When, How, and Why It Happens," *Compare: A Journal of Comparative and International Education*, 2021.
[88] Maeda, "Exam Cheating among Cambodian Students: When, How, and Why It Happens."
[89] Gamage, Silva, and Gunawardhana, "Online Delivery and Assessment during COVID-19: Safeguarding Academic Integrity."
[90] Peterson, "An Analysis of Academic Dishonesty in Online Classes."

of confidence in the student's abilities, a lack of skills to find resources, a student's unwillingness to follow recommended practices, an inability to seek help, and poor time management are some of the factors that can lead to academic dishonesty. External factors include pressure to perform and a lack of confidence in the institution.[91]

Environmental reasons: The behaviour of classmates may affect other students in such a way that their reasons for cheating appear to be legitimate.[92] In addition, there is a great deal of pressure placed on those individuals who do not cooperate with their classmates or who refuse to take part in the work done by their group. It has been shown that those individuals are criticized for being strange and cruel.[93]

Undergraduate students frequently engage in several forms of cheating when taking exams online.[94] These behaviours may be broken down into several categories. Among these are:

Looking up answers online: This is one of the most widespread forms of academic dishonesty and is especially frequent in unsupervised online exams taken by undergraduate students. Students have the option of using search engines, internet forums, or social media platforms in order to research the solutions to questions on exams.[95]

Using unauthorized materials: According to the findings of research carried out by Gamage et al., a significant number of undergraduate students admitted to utilizing unapproved materials during examinations.[96] According to the findings of yet another study, the usage of unlicensed resources was shown to be more widespread in classes with lower levels of perceived fairness and more challenging tests.[97] It has also been discovered that students with lower levels of academic success, students with lower levels of motivation, and students with lower levels of academic self-efficacy are more likely to make use of resources that are not approved.[98]

Collaborating with other students: Students may collaborate with their peers to share answers or discuss exam questions during the exam; this form of academic dishonesty was the most common among South African institutions of higher education.[99]

Impersonation: Students have the option of impersonating someone else or using a false identity in order to take the examination on their behalf. According to Hill et al., findings, the systems necessary to combat the spread of contract cheating are not keeping up with its rapid speed of development.[100]

Research Question 3

How effective are the various measures implemented by universities to enhance the security and integrity of online examinations, such as proctoring software, randomized questions, and time limits?

As institutions move more and more toward using online exams, protecting their confidentiality and authenticity has emerged as a primary concern.[101] Proctoring software, randomized questions, and time constraints are just a few of the many countermeasures that educational institutions have introduced in response to this problem. These tactics are broken down in the following sections:

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[91] Maeda, "Exam Cheating among Cambodian Students: When, How, and Why It Happens."
[92] Holden, Norris, and Kuhlmeier, "Academic Integrity in Online Assessment: A Research Review."
[93] Maeda, "Exam Cheating among Cambodian Students: When, How, and Why It Happens."
[94] Holden, Norris, and Kuhlmeier, "Academic Integrity in Online Assessment: A Research Review."
[95] Öncül, "Dealing with Cheating in Online Exams: A Systematic Review of Proctored and Non-Proctored Exams"; Noorbehbahani, Mohammadi, and Aminazadeh, "A Systematic Review of Research on Cheating in Online Exams from 2010 to 2021."
[96] Gamage, Silva, and Gunawardhana, "Online Delivery and Assessment during COVID-19: Safeguarding Academic Integrity."
[97] Holden, Norris, and Kuhlmeier, "Academic Integrity in Online Assessment: A Research Review."
[98] Ngqondi, Maoneke, and Mauwa, "A Secure Online Exams Conceptual Framework for South African Universities."
[99] Ngqondi, Maoneke, and Mauwa, "A Secure Online Exams Conceptual Framework for South African Universities"; Reddy et al., "Integrity vs. Quality of Assessments: Are They Compromised on the Online Platform?"
[100] Hill, Mason, and Dunn, "Contract Cheating: An Increasing Challenge for Global Academic Community Arising from COVID-19."
[101] Gamage, Silva, and Gunawardhana, "Online Delivery and Assessment during COVID-19: Safeguarding Academic Integrity."

Proctoring Software: The usage of proctoring software has become increasingly widespread in recent years in order to keep an eye on students when they take online exams. According to Garcia et al. and Ngqondi et al., some of the features that are commonly included in proctoring software include user authentication, the storing of browser history, and the locking of other computer functionalities, with the exception of the online exam.[102]

According to Alessio et al. from Miami University, there are significant disparities in test scores between proctored and non-proctored examinations. They discovered that 63 percent of all students enrolled in classes with non-proctored tests received a "A," but just 17 percent of all students enrolled in classes with proctored exams received a "A."[103] Another troubling result from Alessio et al. was that students who were enrolled in proctored portions discontinued the class at a rate that was twice as high as students who were enrolled in non-proctored parts.[104] In a study that was very similar to this one, conducted by Daffin and Jones, 1700 students who were enrolled in an online psychology course at Washington State University were observed to have improved their performance by 10% to 20%. It was also observed that students required more time to finish non-proctored exams in comparison to proctored exams.[105] These findings are consistent with those of the systematic review on proctoring versus non-proctored exams, Oncul, who states that proctoring is a crucial aspect in mitigating academic dishonesty in online exams and that non-proctored solutions may be utilized for other forms of assessment.[106] These findings are in line with those of the systematic review on proctoring versus non-proctored by Oncul.[107] When researchers in Spain analysed the test scores of 126,653 undergraduate students in 2020 who took their exams in person or online, they discovered that 28 of the undergraduate programs had a substantial improvement in test scores when the programs were made available online.

They explained the improvement in test results by saying that it was caused by the speedy recovery from the epidemic. In addition, Abood and Maizer, in their survey of 120 staff members at an Arab Open University on strategies to mitigate cheating in online exams, stated that a number of staff members faced challenges, especially with the effort needed for the preparation of online exams, coupled with the ever-increasing methods available to students to engage in academic dishonesty. As a result, other forms of assessment were adopted, such as project applications as opposed to online examinations.[108]

Garca et al. examined the exam results of 330 students enrolled in an undergraduate program in veterinary medicine. Their exam was conducted in one of three ways: in an online format at home using the Respondus Lockdown Browser system (Modality 1), in an online format in person with the supervision of a teacher using the Respondus Lockdown Browser system (Modality 2), or in a paper format in person with the supervision of a teacher (Modality 3). (Modality 3). The findings indicated that the students favoured Modality 1 more than the other two options (online at home with the Respondus Lockdown Browser system). Nevertheless, there were no statistically significant differences discovered between the scores that were acquired by students using any of the three modalities that were evaluated.[109] Likewise, in the United States of America, Pleasants et al., in their research on student behaviour during non-proctored tests that were offered online for an introductory Biology course, found that students were more likely to cheat. They discovered that 70% of the pupils were caught cheating, but when they warned of the introduction of an invigilating program tool, it was claimed that the cheating

[102] Marín García, Arnau-Bonachera, and Llobat, "Preferences and Scores of Different Types of Exams during COVID-19 Pandemic in Faculty of Veterinary Medicine in Spain: A Cross-Sectional Study of Paper and E-Exams"; Ngqondi, Maoneke, and Mauwa, "A Secure Online Exams Conceptual Framework for South African Universities."
[103] Alessio et al., "Examining the Effect of Proctoring on Online Test Scores."
[104] Alessio et al., "Examining the Effect of Proctoring on Online Test Scores."
[105] Daffin Jr. and Jones, "Comparing Student Performance on Proctored and Non-Proctored Exams in Online Psychology Courses."
[106] Öncül, "Dealing with Cheating in Online Exams: A Systematic Review of Proctored and Non-Proctored Exams."
[107] Öncül, "Dealing with Cheating in Online Exams: A Systematic Review of Proctored and Non-Proctored Exams."
[108] Abood and Abu Maizer, "Strategies to Address Cheating in Online Exams."
[109] Marín García, Arnau-Bonachera, and Llobat, "Preferences and Scores of Different Types of Exams during COVID-19 Pandemic in Faculty of Veterinary Medicine in Spain: A Cross-Sectional Study of Paper and E-Exams."

had reduced to 15%.[110] There was a greater amount of evidence of academic dishonesty in the examinations that were not proctored; nonetheless, there was no discernible difference in the students' overall performance on the exams. Arnold, from Erasmus University Rotterdam, Netherlands, used data from an undergraduate economics course to compare online to face-to-face proctored assessments. He concluded that non-proctored online assessments may suffer more from cheating and suggests that educational institutions implement proctoring in high-stakes online assessments.[111]

In the context of South Africa, the bulk of the country's higher education institutions have transitioned away from relying on exams in favour of continuous evaluation approaches.[112] This provision was implemented because of the socioeconomic backgrounds of students, the lack of ICT infrastructure, the knowledge and skills that need to be acquired by the stakeholders (students and academic staff) as the concept of online exams was new for some institutions, and to reduce the likelihood of students cheating on their exams. The safe exam system presented by Ngqondi et al. combines comparable proctoring characteristics with those found internationally, such as lockdown browsers, to prevent cheating on the examination.[113] According to the findings of Reddy et al., who surveyed eleven professors of physics at the University of Johannesburg for their research, the invigilator app proved to be an efficient tool in the fight against academic dishonesty.[114]

Several students have reported feeling anxious and uncomfortable during proctored exams, and there have been issues expressed over the privacy and ethical implications of using proctoring software. According to the findings of the multi-level studies carried out by Conijn et al., proctoring had no influence on the incentive to cheat or the difficulty of the exam; rather, students reported increased levels of exam anxiety.[115] Woldeab and Brothen carried out a study with a total of 631 students to investigate the impact of online proctored tests on student test anxiety as well as exam scores. They discovered that there was a strong association between test anxiety and poorer exam scores, and that this was especially true for students who suffered from high test anxiety and took examinations in an online proctored environment.[116] In addition, students in the School of Pharmacy at Shenandoah University were polled using a 12-item questionnaire. The findings show that modifications to testing processes, whether with proctored or non-proctored techniques, appeared to raise student stress.[117] This anxiety was attributed to a wide range of factors, including a low level of computer literacy skills, particularly in undergraduate programs in rural institutions,[118] access to dependable technology and stable internet access, as well as a designated study space, among other things.[119] In their assessment of criteria for selecting proctoring technologies to assure academic and institutional integrity in online exam environments, [120] the researchers found that student privacy did not receive the consideration it ought to have been given while making their selections. Similar instances of anxiousness, which in some cases interfered with a student's ability to concentrate while they were taking the test, were spotted using the Invigilator App.[121]

Randomized Questions: During online examinations, students often receive randomized questions as a method of deterring them from discussing their answers with one another. Reddy et al. in their survey of eleven Physics instructors at the University of Johannesburg, on the integrity and quality of online assessments, it was found that a number of lecturers had good views on question randomisation. This was found in the results of the survey.[122] For this strategy to work, a substantial question bank is required, and this is especially true for universities with significant numbers of first-year

[110] Pleasants, Pleasants, and Pleasants, "Cheating on Unproctored Online Exams: Prevalence, Mitigation Measures, and Effects on Exam Performance."
[111] Arnold, "Online Proctored Assessment during COVID-19: Has Cheating Increased?"
[112] UNESCO, *Global Education Monitoring Report, 2020: Inclusion and Education: All Means All*.
[113] Ngqondi, Maoneke, and Mauwa, "A Secure Online Exams Conceptual Framework for South African Universities."
[114] Reddy et al., "Integrity vs. Quality of Assessments: Are They Compromised on the Online Platform?"
[115] Conijn et al., "The Fear of Big Brother: The Potential Negative Side-effects of Proctored Exams."
[116] Woldeab and Brothen, "21st Century Assessment: Online Proctoring, Test Anxiety, and Student Performance."
[117] Morgan et al., "Moving Assessment Online: Experiences within a School of Pharmacy."
[118] Ngqondi, Maoneke, and Mauwa, "A Secure Online Exams Conceptual Framework for South African Universities."
[119] Conijn et al., "The Fear of Big Brother: The Potential Negative Side-effects of Proctored Exams."
[120] Khalil, Prinsloo, and Slade, "In the Nexus of Integrity and Surveillance: Proctoring (Re) Considered."
[121] Sibisi, "UNISA Digs in Heels over Online Invigilation App."
[122] Reddy et al., "Integrity vs. Quality of Assessments: Are They Compromised on the Online Platform?"

undergraduate students. Question banks and the randomization of questions were found to be effective in reducing instances of academic dishonesty, according to research conducted by Krzic and Brown, which was carried out at the University of British Columbia on 300 students enrolled in an introductory soil science course.[123] Nonetheless, it is possible that some students will still be able to cheat by discussing the test questions with other students who have already completed the test.[124]

Time Limits: During exams, the usage of time limitations is another approach that is employed to prevent students from accessing other resources. According to the findings of research that involved 228 university students, setting time limitations can be an effective way to reduce cheating behavior. This was found to be especially true for high-ability students, who are more inclined to cheat.[125] A handful of the University of Johannesburg Physics lecturers placed time limitations on their online examinations as a security measure to avoid cheating. In addition, students were barred from backtracking, which meant that they were unable to go back to questions that they had previously responded to.[126] This strategy is essential for use in classes with a high number of students; nevertheless, if a student makes the error of omitting a question, they will not be able to return to it, which may lead to dissatisfaction on their part. Students may have considerable difficulties, such as worry and tension, as a result of time constraints, which may have an influence on how well they perform on the examination.[127]

The primary data of the study consists of research findings that investigate the various kinds of online exams that are given in online teaching and learning environments in higher education, the degree to which academic dishonesty is associated with this kind of assessment, and the most successful strategies for preventing academic dishonesty in terms of characteristics such as academic achievement scores. Several studies state that it is essential to emphasize the implementation of online examinations in undergraduate programs does not come without its fair share of difficulties.[128] When students have access to outside resources, preserving the exam's integrity can be a difficult task.[129] This is especially true in situations when students are allowed to bring in their own materials (write on their own devices).[130] Concerns regarding academic dishonesty are quite common among undergraduate students taking exams online. "This image influences judgments about online programs and even the reputation of the institutions delivering the classes."[131] Students are able to participate in a wide variety of dishonest behaviours, including seeking answers on the internet, making use of resources that have not been permitted, working together with other students, impersonating someone else, and paying someone else to take the exam.[132] Academic dishonesty on online exams can be reduced with the use of preventative techniques such as proctoring software, developing questions that assess higher-order thinking abilities, employing randomized question pools, and establishing explicit expectations and punishments.[133] It is absolutely necessary to find a solution to this problem in order to guarantee the reliability and objectivity of results from online exams. Nevertheless, there is a possibility that these methods may also have possible downsides, such as issues over students' right to privacy, ethical implications, and increased worry and stress levels among students.[134] Students identified several strategies that could be implemented to promote academic integrity in online assessments, including the creation of a clear assessment policy, the provision of detailed instructions, and the utilization of anti-plagiarism software, according to a study that was conducted by Verhoef and Coetser.[135] In the South African context, riddled with challenges ranging from a lack of ICT infrastructure and diverse student socio-economic

[123] Krzic and Brown, "Question Banks for Effective Online Assessments in Introductory Science Courses."
[124] Gamage, Silva, and Gunawardhana, "Online Delivery and Assessment during COVID-19: Safeguarding Academic Integrity."
[125] Abood and Abu Maizer, "Strategies to Address Cheating in Online Exams."
[126] Reddy et al., "Integrity vs. Quality of Assessments: Are They Compromised on the Online Platform?"
[127] Ngqondi, Maoneke, and Mauwa, "A Secure Online Exams Conceptual Framework for South African Universities."
[128] Gamage, Silva, and Gunawardhana, "Online Delivery and Assessment during COVID-19: Safeguarding Academic Integrity."
[129] Reddy et al., "Integrity vs. Quality of Assessments: Are They Compromised on the Online Platform?"
[130] Gamage, Silva, and Gunawardhana, "Online Delivery and Assessment during COVID-19: Safeguarding Academic Integrity."
[131] Peterson, "An Analysis of Academic Dishonesty in Online Classes."
[132] Öncül, "Dealing with Cheating in Online Exams: A Systematic Review of Proctored and Non-Proctored Exams."
[133] Reddy et al., "Integrity vs. Quality of Assessments: Are They Compromised on the Online Platform?"
[134] Conijn et al., "The Fear of Big Brother: The Potential Negative Side-effects of Proctored Exams."
[135] Verhoef and Coetser, "Academic Integrity of University Students during Emergency Remote Online Assessment: An Exploration of Student Voices."

backgrounds, Ngqondi et al. suggest the adoption of alternate assessment types such as projects and e-portfolios for the South African institutions of higher education.[136] Therefore, prior to putting these procedures into effect in online exams, institutions of higher learning have to first do thorough research and analysis on them, taking into account both their potential advantages and disadvantages.

RECOMMENDATIONS

The recommendations derived from this systematic review support the validity of online assessment and academic integrity in higher education. By translating empirical findings into actionable strategies, the study bridges the gap between research and institutional practice. Collectively, these recommendations advance theoretical and practical understanding across several critical dimensions.

Firstly, the proposed measures bridge research and implementation by operationalising the review's insights and findings, namely, the need to uphold integrity, fairness, and accessibility into concrete institutional strategies. This integration strengthens the link between empirical evidence and policy development within digital education contexts.

Secondly, emphasis on adopting secure, mobile-friendly online exam technologies adapted to local contexts represents a significant contribution to the global literature, particularly through its contextual sensitivity to resource-constrained environments such as rural South Africa. By addressing infrastructural and connectivity challenges, the study expands current understandings of assessment validity beyond high-resource settings, thereby contributing to the localisation of global pedagogical frameworks.

Thirdly, the recommendation is to develop comprehensive training programmes for academic staff, students and support staff to enhance scholarly discussions surrounding digital pedagogy and assessment literacy. It highlights the importance of equipping both educators and learners with the competencies necessary to design, administer, and participate in credible online assessments, thus reinforcing the pedagogical dimension of academic integrity.

Fourthly, there is a need for clear institutional policies and consistent penalties for academic dishonesty, which advances theoretical perspectives on governance and ethical accountability in digital learning environments. It highlights the role of transparent regulatory frameworks in maintaining the credibility and legitimacy of online qualifications.

Furthermore, the recommendation to invest in ICT infrastructure and student support services situates the discourse on assessment validity within a broader framework of equity and inclusion. By recognising access to technology as a determinant of assessment fairness, the study contributes to the evolving understanding of validity as an ethical as well as a psychometric construct.

Ultimately, the emphasis on fostering a culture of academic integrity and regularly evaluating assessment strategies underscores the importance of developing dynamic, reflexive, and context-responsive assessment systems. This aligns with contemporary scholarship advocating for continuous innovation in assessment design that balances rigor, flexibility, and authenticity.

In sum, these recommendations contribute to scholarship by articulating a contextually grounded, equity-oriented, and pedagogically informed framework for enhancing the validity, integrity, and inclusivity of online assessments in higher education. They extend existing theoretical models of assessment validity to encompass sociotechnical, ethical, and cultural dimensions, thereby offering a comprehensive foundation for future research and institutional practice.

CONCLUSION

This systematic review aimed to investigate the integrity of online examinations in undergraduate programs, with a particular focus on challenges and solutions relevant to the South African higher education context. By synthesising evidence from recent literature, the study highlighted significant concerns around academic dishonesty due to unproctored environments, infrastructure limitations such as unreliable internet and electricity, and variable academic staff expertise in online assessment administration. Despite the growing adoption of online exams accelerated by the COVID-19 pandemic,

[136] Ngqondi, Maoneke, and Mauwa, "A Secure Online Exams Conceptual Framework for South African Universities."

substantial risks to exam validity and fairness remain, particularly in rural and resource-constrained settings.

The review also identified promising strategies to safeguard integrity, including the use of mobile-compatible proctoring applications, biometric authentication, randomized question banks, and clear institutional policies. However, the need for context-appropriate technological solutions, comprehensive training for staff and students, and improved ICT infrastructure was emphasized as critical to bridging existing gaps.

In closing, ensuring academic integrity in online exams requires an integrated approach that combines effective technology, robust policy frameworks, and community engagement to foster a culture of honesty. South African institutions must tailor their strategies to local realities while continuously evaluating and adapting their assessment methods. This will help sustain the credibility of qualifications, protect institutional reputations, and support equitable and valid assessment practices in the evolving landscape of higher education.

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