A Critical Review of the Purposes and Authenticity of E-Assessment Policies and Practices

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Abstract: In general, the overall purpose of assessment is to account for the knowledge, skills, dispositions, and attitudes that learners possess as a result of their educational experiences. In recent times, there has been an increased emphasis on the role of technology-enhanced assessments, which have mainly been referred to as e-assessments, to improve assessment designs through the use of innovative digital tools. However, it is important that these changes are directed and driven by appropriate education policies to ensure that the attendant practices remain authentic by demonstrating alignment between the pedagogies used in curriculum coverage and the digitised assessment tools and modalities. This was a literature-based study examining the purposes of e-assessment and reflecting on the authenticity of attendant policies and practices in South Africa, in relation to the extant pedagogical practices and learners' classroom experiences. From the literature, four most-cited purposes of e-assessment were identified and described, namely (a) efficiency and scalability, (b) enhanced feedback, (c) data-driven insights, and (d) accessibility and flexibility. The policy challenges faced by the country in relation to authentic e-assessment are presented and described. These include questions of validity and reliability, equity and inclusion, pedagogical alignment, and academic integrity, while implementation challenges encompass technical, training and support, ethical and privacy concerns, technological infrastructure, cultural and linguistic relevance, and data management and privacy considerations. It is argued that a better understanding of these challenges and opportunities brought about by these reflections would contribute significantly towards the development and implementation of well-rounded digital education policies in South Africa.

Keywords: Assessment policy, e-assessment, pedagogical practices, authenticity, challenges, opportunities.

1. Introduction

E-assessment, or electronic assessment, is the use of digital tools and platforms to design, deliver, and manage assessments (Chirumamilla & Sindre, 2019; Doğan et al., 2020). The rise of e-assessment has transformed educational practices, aiming to enhance learning experiences, streamline administrative processes, and provide richer data for evaluating learner performance (Doğan et al., 2020). In South Africa, despite the publication of the White Paper on e-Education in 2004, which required that "every South African learner in the general and further education and training bands should be able to use ICTs confidently and creatively to help develop the necessary skills and knowledge needed to achieve personal goals and to be active participants in the global community by 2013" (De Beer, 2022, p. 1), this was not achieved by the set target date. Consequently, e-assessment remained in an early, experimental phase, generally limited to a few progressive and well-resourced schools when the COVID-19 pandemic struck

(Labuschagne, 2023, p. 3). Most teachers and learners had insufficient access to online platforms and lacked the necessary devices, such as computers and/or tablets, as well as internet connectivity to implement widespread e-assessment (Yakobi et al., 2022, p. 110).

In a significant way, the COVID-19 pandemic acted as a catalyst, forcing a rapid shift toward digital education and assessment across South Africa. As schools transitioned to remote education, there was a marked shift towards using online platforms for assessments. The COVID-19 period highlighted the need for more robust digital infrastructure and e-assessment tools. Some private and progressive public schools made major strides with e-assessment tools. Schools in urban areas, especially private schools, performed much better in adopting e-assessment, using computers and digital platforms to assess learners. However, the majority of South African schools still relied on traditional paper-based methods for assessments, as the digital divide and infrastructural challenges hindered the widespread adoption of both e-learning and e-assessment, particularly in rural and underserved areas. Other challenges included shortages of resources, leadership, government funding, and infrastructure (Yakobi et al., 2022, p. 110).

This situation still largely prevails across the country. South Africa has been gradually incorporating e-assessment technologies into its educational systems, but various challenges and considerations continue to affect widespread implementation. These are highlighted in this paper.

1.1 Problem statement

The purposes and authenticity of e-assessment policies and practices raise important questions about their effectiveness, equity, and impact on education (Mimirinis, 2019). Key principles include the importance of developing assessments offline to ensure quality and reliability, the use of Bloom's Taxonomy to structure assessments, and the selection of appropriate tools to match specific skills and learning objectives (vd Westhuizen, 2016; Mohan, 2023; Maphalala et al., 2024).The focus is also on maintaining the integrity and security of assessments while adapting to both synchronous and asynchronous learning environments. Indeed, as Maphalala et al. (2024) observe, securing online assessments against academic misconduct has been a major concern in e-assessment practices, thereby necessitating the use of proctoring software. Typically, e-proctoring systems "employ various methods, such as webcams, screen sharing, and biometric identification, to ensure the integrity and security of assessments delivered over the Internet" (Terblanche, vanRooyen & Enwereji, 2024, p. 1).

Post Covid-19, South Africa still faces challenges such as the lack of technological knowledge and internet connectivity, as well as poor digital infrastructure at schools, homes, towns, and cities (Labuschagne, 2023). These issues are compounded by the imperative of enforced utilisation of Annual Teaching Plans (ATPs), along with insufficient targeted and comprehensive continuous teacher professional development (CTPD) programmes and concomitant e-learning

materials that can facilitate the meaningful enactment of e-assessment in various educational settings (Labuschagne, 2023). At the centre of all this is an enabling policy framework to ensure that every student has access to data and internet resources.

This paper examines the purposes of e-assessment in South Africa's schooling sector and reflects on the authenticity of South Africa's policies and practices in relation to existing pedagogical practices and learners' classroom experiences. In doing so, it is envisaged that the paper will contribute towards a better understanding of the challenges and opportunities that must inform the development and implementation of digital education policies, including digitised assessment.

2. The Benefits and Purposes of E-Assessment

There is a danger that the rush towards the establishment of policies, frameworks, and practices for e-assessment may be driven by the desire to appear modern as well as the need to attain efficiencies, at the expense of validity and authenticity. In this paper, the four most-cited purposes and benefits of e-assessment are identified and described, namely (a) efficiency and scalability, (b) enhanced feedback, (c) data-driven insights, and (d) accessibility and flexibility. These are now briefly described. The paper ends by presenting some challenges and matters for consideration.

2.1 Efficiency and scalability

In the domain of education, one commonly cited benefit of e-assessment is its efficiency. As Didmanidze et al. (2023, p. 1) point out, e-learning and e-assessment "have become a transformative force, revolutionising the learning process to enhance accessibility, engagement, and efficiency." In particular, various forms of e-assessment offer significant improvements in efficiency and scalability, making them increasingly popular in educational and professional settings (Ion & Mercader, 2024; Zinke et al., 2024). They enable large numbers of learners to be assessed simultaneously and, through the automation of scoring and feedback processes, reduce the administrative burden on educators (Parker, 2023).

Typically, e-assessments include objective-type questions and other formats that can be graded automatically, thereby reducing the workload for educators and ensuring faster feedback for learners. Thus, one important benefit of e-assessment is that it helps learners better understand their performance and areas for improvement (Garcia, Macaballug & Perez, 2024; Ion & Mercader, 2024). Furthermore, e-assessment eliminates the need for paper, printing, and physical storage, leading to cost savings and environmental benefits (Perry et al., 2022; Alfarisy & Patria, 2023). Indeed, managing tests online simplifies scheduling, distribution, and invigilation, further reducing administrative burdens (Ghimire & Khanal, 2022).

Another aspect of the efficiency of e-assessment is accessibility. Test-takers can often choose the time and place for their assessment, thereby increasing accessibility for those with different

schedules or needs (Iderima, 2023). Furthermore, e-assessment platforms can be designed to accommodate various accessibility requirements, including screen readers and adjustable text sizes. Iderima (2023) further points out that accessibility is enhanced as wide-area networks expand connectivity, allowing remote networks to be connected across multiple long-distance locations, making e-assessment available anywhere, anytime. By doing so, this "empowers learners by offering flexibility, personalisation, and instant feedback, while also enabling educators to gather valuable insights for continuous improvement" (Iderima, 2023, p. 122).

Regarding scalability, e-assessments are easily scalable to large numbers of learners, making it feasible to administer standardised tests across multiple classrooms, schools, or even regions, thereby allowing for the collection of large datasets that can inform broader educational strategies and policies (Huber et al., 2022; Isaias et al., 2023). In particular, Huber et al. (2022) point to the potential benefit of e-assessment in enabling scaled-up assessment-for-learning. Furthermore, online platforms ensure that all test-takers have a consistent testing experience, which can help maintain standardisation and fairness (Gürbüz et al., 2024). In addition, digital assessments facilitate easy collection, analysis, and reporting of data on a large scale, providing valuable insights for educators and administrators (Fischer et al., 2020; Maki & Shea [eds.], 2023). Therefore, overall, e-assessments enhance the efficiency, scalability, and effectiveness of the assessment process, benefiting both educators and learners.

2.2 Enhanced feedback

E-assessments can provide immediate feedback, which is crucial for learning, allowing learners to understand their mistakes and learn from them promptly (Ghouali et al., 2020; Joshi et al., 2020). This immediate response helps learners identify their strengths and areas for improvement, thereby reinforcing learning, aiding better retention of information, and fostering a more responsive learning environment (Olasina, 2023). In a study involving South African and Nigerian students, Olasina (2023, p. 144) reported that e-assessments enhanced students' knowledge construction and accessibility by offering "benefits like instant feedback and personalised learning experiences, leading to improved problem-solving skills and decision-making."

Indeed, formative assessments and timely feedback support self-regulated learning, helping learners monitor their performance and make necessary adjustments. This enhances learner engagement and the attainment of learning outcomes (Gikandi et al., 2011; Mafenya, 2016; Anastasopoulou et al., 2024). In particular, immediate feedback from e-assessments plays a crucial role in facilitating effective learning by allowing learners to quickly address misconceptions and reinforce their understanding of the material. As Anastasopoulou et al. (2024, p. 115) elaborate, the integration of e-assessment into formative assessment has revolutionised modern education by enhancing the learning experience and transforming how

educators evaluate student progress to, inter alia, provide "real-time feedback, personalised learning pathways, and increased engagement."

2.3 Data-driven insights

One important purpose and benefit of e-assessment relates to the extent and depth of data that can be collected within a very short period of time (Kaspi & Venkatraman, 2023). Worldwide, many educational institutions have completely switched to online teaching and assessments following the Covid-19 pandemic. South Africa is also attempting to follow suit.The digital nature of e-assessments allows for the collection and analysis of extensive data on learner performance (Kaspi & Venkatraman, 2023; Mukherjee & Pandey, 2023; ALKursheh, 2024). The collected data can be used to personalise learning experiences, identify at-risk learners, and inform instructional strategies (Anastasopoulou et al., 2024). By harnessing the power of data, e-assessments can transform the assessment process from a simple measure of performance to a dynamic tool for enhancing educational outcomes (Parker, 2023; Didmanidze et al., 2023). This is because e-assessment platforms collect a wide range of data points, including time spent on questions, patterns of answers, and specific areas where learners struggle (Didmanidze et al., 2023). The data can be analysed to identify trends and pinpoint areas where learners need additional support. Using insights gained from e-assessment data, educators can tailor their teaching methods and materials to better suit individual learner needs. Personalised learning pathways can be created to address each learner's strengths and weaknesses, leading to improved overall performance (Parker, 2023). This is possible because advanced e-assessment systems use predictive analytics to foresee potential future performance based on current data. Educators can identify at-risk learners early and provide targeted interventions to prevent future academic difficulties (Bagunaid et al., 2022). Teachers can use the detailed analytics from e-assessments to refine their instructional strategies. For example, if data show that the majority of learners are struggling with a particular concept, teachers can revisit and reinforce that topic in their lessons.

Additionally, e-assessments streamline the administrative aspects of testing, such as grading and record-keeping, freeing up educators' time to focus more on teaching and learner interaction (Didmanidze et al., 2023). Automated grading ensures consistency and reduces the likelihood of human error (Chen & Xu, 2024; Gambo et al., 2024). Furthermore, e-assessments allow for continuous monitoring of learner progress over time by enabling educators to track improvements and regressions, thereby providing a clearer picture of a learner's learning journey. Benchmarking against class or school-wide performance can also highlight where interventions are needed (Chen, 2023). Importantly, e-assessments can be designed to be more accessible to learners with disabilities, offering accommodations such as text-to-speech, screen readers, adjustable font sizes, high-contrast modes, and alternative input methods (Nacheva-Skopalik & Green, 2020; Laamanen et al., 2021). Such accommodations ensure that all learners, regardless of their physical or cognitive abilities, can participate in classroom activities effectively. This inclusivity ensures that all learners have an equal opportunity to perform well.

2.4 Accessibility and flexibility

The flexibility offered by e-assessments makes them a powerful tool for accommodating diverse learner needs and schedules, as they can be accessed from various locations and devices (Alruwais et al., 2018; St-Onge et al., 2022). By providing location and device independence, accommodating different learning styles, and integrating accessibility features, e-assessments ensure that all learners have the opportunity to demonstrate their knowledge and skills in a manner that best suits their individual circumstances (Bagunaid et al., 2022). This flexibility is particularly beneficial for learners who balance school with other commitments, such as part-time jobs, those who are homebound due to illness or disability, those engaged in distance learning and inclusive education, as well as those involved in extracurricular activities or family responsibilities (Iderima, 2023). It also allows assessments to be taken during optimal times for individual peak performance, which can vary from learner to learner. This flexibility not only enhances learner performance but also promotes inclusivity and equity in education by eliminating the need for physical presence in a specific location, such as a classroom or examination hall (Alruwais et al., 2018). To facilitate this, e-assessments should generally be designed to be compatible with various types of devices—such as desktops, laptops, tablets, and smartphones. This ensures that learners can take assessments using the devices they are most comfortable with or that are readily available, thereby reducing barriers to participation.

3. Questions Concerning the Authenticity of E-Assessment

Some of the most prominent issues raised in the literature concerning the authenticity of e-assessment include (a) validity and reliability, (b) equity and inclusion, (c) pedagogical alignment, and (d) academic integrity (Doğan et al., 2020; Ahmed & Sidiq, 2023; Tat & Kilic, 2024). These issues are briefly reflected upon below.

3.1 Validity and reliability

In recent times, many teachers and learners have been forced to engage in teaching and learning in a relatively unknown space – the digital space, mainly as a result of the Covid-19 pandemic. The pandemic has had the impact of an accelerated adoption of online assessments across the global educational spectrum (Terblanche et al., 2024). On the face of it, many schools, educators and learners may appear to have embraced the new reality of, inter alia, remote teaching and learning. However, at the back of their minds, many of them remain with many questions, while uncertainties linger, which still need to be addressed and clarified about different aspects of this new reality. Some of these questions include the accuracy, validity, security, integrity, and quality of e-assessment (Ningsih, 2024). In the middle of all this, there is a realisation that developing good online assessments that are reliable, fair, valid, and transparent is hard and often happens offline (Krans et al., 2022).

Some learners experience significant anxiety in traditional testing environments (Zhao, 2022; Solati et al., 2024). The ability to take e-assessments in a familiar and comfortable setting can help reduce this anxiety, potentially leading to better performance and a more valid assessment of their abilities and achievements (Meccawy et al., 2021). This control of the environment can make a substantial difference in how learners approach and complete their assessments. So, for assessments to be authentic and accurately measure the intended learning outcomes, concerns about the validity and reliability of e-assessments must be addressed, including any technical glitches that may arise, the potential for academic dishonesty, and the challenge of designing assessments that fail to go beyond rote memorisation to evaluate higher-order thinking skills. The reality of e-assessment, like other forms of assessment, is that it must be conducted before the learning, during the learning, and after the learning, because assessment has a triple function of diagnostic, formative, and summative (Aburumman, 2021; Venkateswari, 2020). Good teaching must be associated with learner assessment before, during, and after the learning.

3.2 Equity and inclusion

As already pointed out, the digital divide remains a significant barrier to e-education in many schools in South Africa. A considerable portion of the South African population lacks access to reliable internet connections and digital devices (Labuschagne, 2023; Terblanche et al., 2024). This digital divide is particularly pronounced in rural and underserved urban areas, where learners may not have the necessary technology to participate in e-assessments. Many schools in South Africa do not have the required infrastructure, such as stable electricity and adequate computer laboratories, to support e-assessments. This can severely limit learners' ability to engage with digital learning and e-assessment tools. Furthermore, economic inequalities mean that learners from low-income families may not be able to afford personal computers, tablets, or even internet access at home (Olasina, 2023). These disparities can lead to unequal opportunities in preparing for and taking e-assessments.

Additionally, learners with disabilities may require specific accommodations to ensure equal participation (Nacheva-Skopalik & Green, 2020). Therefore, addressing equity and inclusivity in e-assessments in South Africa requires a multifaceted approach that tackles the digital divide, infrastructure deficiencies, socioeconomic disparities, and technical skills gaps. By implementing targeted strategies such as improving access to technology, investing in infrastructure, providing financial support, enhancing digital literacy, and ensuring language and cultural sensitivity, South Africa can move towards a more inclusive and equitable e-assessment system (Olasina, 2023).

3.3 Pedagogical alignment

Authenticity in e-assessment also involves aligning assessments with pedagogical goals (Ahmed & Sidiq, 2023). Assessments should measure learning outcomes, whereby learners demonstratewhat they know and, more importantly, what they can do (skills) (Gane et al., 2018). Learning outcomes can be low-level orhigh-level in reference to Bloom's Taxonomy. The

taxonomy is a valuable resource for designing assessments, as it provides access to verbs that can be matched with learning outcomes. A taxonomy oflearning outcomes, along with accompanying language, helps the assessor scaffoldthe construction of their assessment items—bearing in mind the purpose of the assessment and ensuring alignment between instructional activities and the espoused learning outcomes (Bijsterbosch et al., 2024). Furthermore, the assessor must ensure the use of correct and appropriate language to avoid confusing respondents. Lastly, they must ensure that e-assessment is the most suitable tool for what is being assessed. It is unjustified to impose e-assessment where other assessment modalities are better suited for the task (Saleh et al., 2022). Cognisance should be taken of the many different types of assessments that can be used—ranging from tests toprojects to performance-based tasks to essays, among others. Each of these has a particular function that may be appropriate orinappropriate, depending on what needs to be assessed. Therefore, choosingthe right assessment tool or method is crucial. Additionally, effective e-assessments should be integrated into the learning process rather than being a separate, summative event (Agostini & Picasso, 2024). This integration ensures that assessments support learning and development. Without these practices, even the best technologywill not rectify a poorly designed assessment.

3.4 Academic integrity

E-assessment presents unique challenges and opportunities regarding academic integrity (Raza, 2023; Terblanche et al., 2024). While e-assessments offer numerous benefits such as flexibility, accessibility, and data-driven insights, maintaining academic integrity requires careful planning and the implementation of various strategies. The ease of accessing information online raises concerns about plagiarism and cheating, necessitating robust systems in schools to monitor and prevent dishonest practices. This can be achieved by using invigilation software or designing assessments that minimise opportunities for cheating (Huber et al., 2022; Sabrina et al., 2022). Copying and pasting answers from the internet or from other learners becomes more feasible in an online environment.

Identity verification is another challenge in e-assessment, as ensuring that the learner taking the assessment is the one enrolled in the course can be difficult without face-to-face verification (Farrow et al., 2021). Furthermore, unauthorized collaboration among learners during an assessment can be harder to detect online, while technical problems such as poor internet connectivity, software glitches, and hardware failures can lead to dishonest behaviour if learners exploit these issues to gain extra time or attempt multiple submissions (Labuschagne, 2023; Pillay & Balele, 2024).

Balancing the benefits of e-assessments with the need to maintain academic integrity involves a combination of technological solutions, thoughtful assessment designs, clear policies, and ongoing education (Huber et al., 2022). By addressing the unique challenges posed by e-assessments and implementing robust integrity measures, schools can uphold high standards of

honesty and fairness in the digital learning environment. Some strategies have been suggested to enhance academic integrity in e-assessments (Pagaling & McDermott, 2022; Turner et al., 2022).

4. Policies and Practices in Relation to Pedagogical Practices

This discussion is divided into two sections, as indicated below.

4.1 Policies and practices

South Africa's educational policies emphasise the need for continuous improvement and standardisation in e-assessment practices to accommodate the diverse educational needs across the country (Mafenya, 2016; Yakobi et al., 2022). Over time, the country has increasingly integrated e-assessment practices into its educational framework, driven by the demand for more flexible and accessible assessment methods. The e-assessment framework incorporates various forms of electronic assessments, such as e-testing, e-portfolios, and e-moderation, to ensure comprehensive evaluation methods (Keengwe, 2022). These assessments aim to be fair, reliable, valid, and transparent. To achieve this, there must be an effective alignment between espoused knowledge and skills on one hand and learning outcomes on the other. This necessitates the development of an e-assessment framework supported by policies and practices designed to leverage digital technologies to enhance educational outcomes, thus improving the quality and reach of education through digital means (Mafenya, 2016; Uunona & Goosen, 2023).

The South African Qualifications Authority (SAQA) outlines comprehensive policies for the recognition of prior learning (RPL), which also impact e-assessment practices. Considering that RPL seeks to foster inclusivity, equity, and redress, e-assessment in RPL must ensure that assessments are accessible and fair for all learners, irrespective of their diverse backgrounds and needs (Snyman & Van den Berg, 2018; Hlongwane, 2019). The policies are designed to support strategic planning and quality assurance in e-assessment practices. The authenticity of South Africa's e-assessment policies and practices can be evaluated by examining how well these policies integrate with existing pedagogical practices and the real classroom experiences of learners. For its part, the National Development Plan Vision 2030 highlights the importance of ICT in education, aiming for all learners to be ICT-capable.

4.2 Classroom experiences of learners

With respect to the classroom experiences of learners, there are three major issues to consider: accessibility and equity, engagement and motivation, and feedback and improvement (Kelly & Zakrajsek, 2023). Starting with accessibility and equity, one of the main challenges in implementing e-assessments in South Africa is ensuring that all learners have equal access to the necessary technology (Olasina, 2023; Didmanidze et al., 2023). This relates not only to hardware and software but also to reliable internet connectivity, device availability, and digital literacy

(Pillay & Balele, 2024). Thus, there is a need for policies that address these disparities to ensure that e-assessment is equitable.

The second point concerns engagement and motivation. E-assessments should be designed to engage learners and motivate them to perform well by, among other things, incorporating gamified elements, interactive content, and instant feedback mechanisms that make the learning process more dynamic and enjoyable (Anastasopoulou et al., 2024; Majjate et al., 2024). Indeed, interactive and adaptive e-assessments can make the assessment process more engaging for learners, while features such as gamification, multimedia elements, and adaptive difficulty levels can maintain learner interest and motivation (Parker, 2023). This personalised approach helps sustain engagement and appropriately challenge learners, thereby improving their learning outcomes.

Finally, feedback and improvement are vital aspects of assessment. Authentic e-assessment practices should provide timely and constructive feedback to help learners understand their strengths and areas for improvement (Mukherjee & Pandey, 2023; Parker, 2023). This feedback should be actionable and guide learners in their ongoing learning journey. Indeed, e-assessment practices can play a crucial role in modern education, and one of their key features should be the provision of timely and constructive feedback. This can significantly enhance the learning experience by ensuring that feedback is not only timely and constructive but also fosters continuous improvement and deeper understanding (Pillay & Balele, 2024).

There are various ways through which learners can receive immediate feedback from e-assessment tools. These include (a) automated feedback systems that provide instant grading, thereby allowing learners to receive immediate feedback on their performance; (b) personalised feedback, even with respect to open-ended questions, where teachers leave detailed comments to help learners understand their mistakes and learn from them. This may also include providing more nuanced feedback, such as highlighting areas where the learner made mistakes and suggesting resources for improvement; (c) providing learners with clear rubrics to help them understand the grading criteria and what was expected of them; (d) tracking learner performance in real-time, allowing teachers to identify and address issues promptly; (e) offering balanced feedback that highlights both strengths and areas for improvement, along with specific suggestions on how to improve, such as additional reading materials, practice exercises, or tips on study techniques; (f) setting up online forums where learners can ask questions about their feedback; (g) encouraging learners to provide feedback on the quality and usefulness of the feedback they receive; and (h) regularly updating e-assessment tools based on user feedback to enhance their effectiveness and usability (Mukherjee & Pandey, 2023; Parker, 2023; Pillay & Balele, 2024).

5. Challenges And Considerations

The above, notwithstanding, there are some challenges in implementing the policies and strategic plans aimed at achieving e-assessment as envisaged in planning documents. These include the following:

5.1 Technical challenges

The successful implementation of e-assessment depends on a reliable technology infrastructure (Ngqondi et al., 2021; Ahmed & Sidiq, 2023). Issues such as software malfunctions, cybersecurity threats, and inadequate technical support can undermine the effectiveness of e-assessments (Parker, 2023). Key aspects include system reliability and availability, ensuring that e-assessment platforms are consistently accessible to users without unexpected downtimes, which is crucial for maintaining the integrity of the assessment process (Raza, 2023; Terblanche et al., 2024). Furthermore, the technology infrastructure must be scalable to accommodate a large number of concurrent users, particularly during peak assessment periods (Tat & Kilic, 2024).

5.2 Training and support

Proper training ensures that technology is used to its full potential, enhances the learning and assessment experience, and minimises technical issues (Parker, 2023; Ion & Mercader, 2024). Effective training for both educators and learners is crucial for the successful implementation of e-assessment tools. By focusing on comprehensive, practical, and ongoing training programmes, schools can ensure that both groups are well-prepared to leverage digital assessments to enhance the learning experience (St-Onge et al., 2022). Therefore, both educators and learners need adequate training to use e-assessment tools effectively. Educators must be proficient in designing digital assessments and interpreting the data generated by these systems. Continuous professional development and technical support are essential to address these needs (Ahmed & Sidiq, 2023).

For educators, understanding e-assessment tools is very important. They should undergo detailed training sessions on the functionalities and features of e-assessment platforms (St-Onge et al., 2022). Training should focus on designing effective e-assessments that are fair, valid, and reliable, aligning with learning objectives. This should include hands-on practice to familiarise them with the tools and troubleshoot common issues. Educators should also learn to use e-assessment tools to provide timely and constructive feedback to their learners, as well as how to configure automated feedback options to enhance learner learning (Agostini & Picasso, 2024).

For learners, skill development is essential, particularly in navigating e-assessment platforms. They should be provided with step-by-step guides and video tutorials to help them understand how to use the tools effectively (Alruwais et al., 2018). Furthermore, familiarity with e-assessments can be enhanced through 'practice tests', which help learners become comfortable with the formats and timing of digital assessments (Ahmed & Sidiq, 2023). Training should also

include strategies for managing test anxiety and ensuring a calm, focused approach to e-assessments (Tat & Kilic, 2024). Joint training initiatives, such as educator-learner workshop sessions, are important where both groups learn together. Continuous technical support and troubleshooting assistance for both educators and learners are vital to address issues as they arise (Parker, 2023; Ion & Mercader, 2024). Additionally, it is important to collect feedback from both educators and learners about their experiences with the e-assessment tools to identify areas for further improvement and additional training needs.

5.3 Ethical and privacy concerns

The use of e-assessments raises ethical issues related to data privacy and security (Anastasopoulou et al., 2024; Majjate et al., 2024). Schools must ensure that learner data is protected and used responsibly. These ethical issues include data privacy with respect to (a) confidentiality – considering that e-assessments involve the collection and storage of sensitive personal information, including learner identities, performance data, and sometimes biometric data for authentication purposes; ensuring the confidentiality of this data is paramount to protecting learner privacy; (b) ensuring that only the necessary data is collected and retained for the shortest time required, i.e., data minimisation (Anastasopoulou et al., 2024); (c) ensuring that strong encryption methods are employed to protect data during transmission and storage, thereby preventing unauthorised access (Ally, 2024); (d) having robust access control mechanisms to ensure that only authorised personnel can access sensitive data (Kiennert et al., 2017); (e) ensuring that participants are fully informed about what data is being collected, how it will be used, who will have access to it, and the measures in place to protect it (Ally, 2024); (f) ensuring that consent to participate in e-assessments is obtained freely, without coercion, and that participants have the option to opt out; and (g) minimising and, where possible, completely eliminating intrusiveness (Babo et al., 2020).

Online invigilation tools, which may involve webcam monitoring, screen recording, and keystroke tracking, can be perceived as intrusive and raise concerns about surveillance and the potential for misuse of data (Maphalala et al., 2024). Furthermore, fairness and equity must be guaranteed, such that the use of surveillance tools, where necessary, is balanced against the need for academic integrity with respect to learners' privacy and equity considerations (Selwyn, 2020). It is also important to ensure that automated grading/marking and invigilation systems do not incorporate biases that disadvantage certain groups of learners, inadvertently or otherwise, which could lead to unfair assessment outcomes (Gambo et al., 2024). Lastly, it is important to ensure that all learners have equal access to the necessary technology and internet connectivity to participate in e-assessments, thereby avoiding exacerbating existing inequalities (Noble, 2018).

Overall, while e-assessments offer many advantages, addressing the ethical issues related to data privacy and security is crucial. Implementing robust data protection measures, ensuring transparency and informed consent, mitigating the intrusiveness of surveillance technologies,

and addressing potential biases are all essential steps in the ethical deployment of e-assessments. Transparency about data collection practices and obtaining informed consent from learners are crucial components of ethical e-assessment practices.

5.4 Technological infrastructure

The effectiveness of e-assessment depends heavily on the technological infrastructure available in schools. In many parts of South Africa, especially in rural areas, schools lack the necessary resources to support e-learning and e-assessment (Yakobi et al., 2022). The successful implementation of e-assessments hinges on a reliable and robust technological infrastructure that ensures system reliability, scalability, security, accessibility, technical support, and effective data management (Tat & Kilic, 2024). These factors collectively ensure a seamless and effective assessment experience for all stakeholders involved. Additionally, adequate technical support is essential to address any issues that arise during e-assessments, ensuring a smooth experience for both administrators and learners (Tat & Kilic, 2024). As Tat & Kilic (2024) further elaborate, the lack of technical support can have significant adverse consequences for e-assessments. Furthermore, security measures are crucial to protecting the integrity of e-assessments, including secure login processes, data encryption, and robust invigilation solutions to prevent cheating (Ketab, 2017; Sabrina et al., 2022). The infrastructure must support a variety of devices and internet connections to ensure that all learners can access the assessments equally (Yakobi et al., 2022; Labuschagne, 2023). Moreover, efficient data management systems are necessary to handle the large volumes of data generated by e-assessments, ensuring secure storage, easy retrieval, and effective analysis of assessment results (Striewe, 2022; Al-Ali, 2024). Although South Africa's policies seek to address the evident infrastructure gaps in the country, much still remains to be done beyond the capabilities and mandates of schools. The macro issues of internet connectivity and other enabling ICT capabilities extend beyond what schools can provide.

5.5 Cultural and linguistic relevance

E-assessment tools and content must be culturally relevant for South African learners (Yakobi et al., 2022; Khoza & Mpungose, 2024). This entails creating content that reflects the diverse cultural contexts of South African learners to make learning and assessments more relevant and engaging, as well as developing e-assessment platforms that support multiple South African languages to ensure inclusivity for all. Cultural relevance and contextual appropriateness require that assessment content reflects the diverse cultural contexts of South African learners, including references to local events, traditions, and societal norms (Ahmed & Sidiq, 2023; Khoza & Mpungose, 2024). Using culturally relevant content increases learner engagement with assessment tasks and motivates learners by making these tasks more relatable and meaningful

Regarding linguistic relevance, South Africa has twelve official languages. This requires consideration of the diverse linguistic backgrounds of learners and ensuring that assessments are fair and comprehensible by providing instructions, questions, and feedback in the learner's

home or preferred language (Yakobi et al., 2022). Additionally, assessments must take into account the varying levels of language proficiency among learners and ensure that language barriers do not unfairly impact performance. This means that e-assessment tools should support multiple languages to accommodate all learners (Singh & Gokool, 2018; Naidoo & Gokool, 2020).

5.6 Data privacy

With the increased use of digital platforms for assessments, ensuring the privacy of learners' data is paramount (Anastasopoulou et al., 2024; Majjate et al., 2024). Accordingly, digital platforms must incorporate various security measures, such as randomised question order, secure login, and browser lockdown to prevent unauthorised access. The data must remain secure from interception or breaches, both in transit and at rest. Access should be granted based on the principle of least privilege, and multi-factor authentication (MFA) should be used as it adds an additional layer of security by requiring users to provide two or more verification factors to gain access (Terblanche et al., 2024). Furthermore, there should be clear policies in place to, inter alia, direct how long data is retained and how it should be disposed of once it is no longer needed (Parker, 2023). In addition, explicit consent should be obtained from learners and/or their guardians, as applicable, before access by third parties is granted. There should also be clear and accessible privacy policies outlining data handling practices (Raza, 2023). Regular security audits and vulnerability assessments should be conducted to identify and address potential security risks and weaknesses in the e-assessment platform, as well as a well-defined incident response plan to ensure that any data breaches or security incidents are handled promptly and effectively—thereby minimising damage and restoring security quickly (Okada et al., 2019). Finally, clear procedures should be in place for notifying affected individuals in the event of data breaches, and e-assessment platforms should comply with relevant data protection regulations, such as South Africa's Protection of Personal Information Act (POPIA) (Rodrigues et al., 2017; Stallings, 2017). Thus, policies must include robust measures to protect learners against data breaches and misuse.

6. Conclusion

E-assessment policies and practices have the potential to revolutionise education by enhancing efficiency, feedback, data-driven insights, and accessibility. However, the authenticity of these assessments depends on addressing concerns related to validity, equity, pedagogical alignment, academic integrity, and ethical considerations. For e-assessments to be truly effective and fair, countries and schools must invest in reliable technology, provide adequate training and support, and uphold rigorous ethical standards. By doing so, they can harness the full potential of e-assessments to improve learning outcomes and educational equity. In South Africa, ensuring the authenticity of the country's e-assessment policies and practices requires a concerted effort to align them with current pedagogical practices and the real-world experiences of learners in the

classroom. This involves addressing issues of access, teacher preparedness, engagement, feedback, infrastructure, cultural relevance, and data security. By taking these steps, South Africa can leverage the potential of e-assessments to enhance learning outcomes and provide a more equitable and effective education system. Indeed, it should not be the case that a country rushes towards the establishment of policies, frameworks, and practices for e-assessment, driven mainly by the desireto appear modern, while failing to explicitly address how the e-assessments intersect with the learning processes. The danger is that such a rush may achieve some efficiencies and other practical advantages but may do so at the expense of validity and authenticity, especially for developing countries.

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References

Aburumman, M. F. (2021). E-assessment of students' activities during COVID-19 pandemic: Challenges, advantages, and disadvantages. *International Journal of Contemporary Management and Information Technology*, *2*(1), 1-7.

Agostini, D., & Picasso, F. (2024). Large language models for sustainable assessment and feedback in higher education: Towards a pedagogical and technological framework. *Intelligenza Artificiale*, *18*(1), 121-138.

Ahmed, M. R., & Sidiq, M. A. (2023). Evaluating online assessment strategies: A systematic review of reliability and validity in e-learning environments. *Computer*, *6*(12), 1-18.

Al-Ali, M. (2024). Assessment Management in Higher Education. *International Review of Management and Marketing*, *14*(3), 105–112.

Alfarisy, F., & Patria, A. N. (2023). Designing Online English Test: View from Natural Environmental Preservation. In *E3S Web of Conferences* (Vol. 448, p. 02008). EDP Sciences.

ALKursheh, T. (2024). Higher Tertiary Education Perspectives: Evaluating the Electronic Assessment Techniques of the Blackboard Platform for Fairness and Reliability. *Innoeduca. International Journal of Technology and Educational Innovation*, *10*(1), 144-165.

Ally, S. (2024). A national e-assessment implementation framework: Assessing readiness in secondary schools and teacher education in Tanzania. *Journal of Issues and Practice in Education*, *16*(1), 1–30.

Alruwais, N., Wills, G., & Wald, M. (2018). Advantages and challenges of using e-assessment. *International Journal of Information and Education Technology*, *8*(1), 34-37.

Anastasopoulou, E., Konstantina, G., Tsagri, A., Schoina, I., Travlou, C., Mitroyanni, E., & Lyrintzi, T. (2024). The Impact of Digital Technologies on Formative Assessment and the Learning Experience. *Technium Education and Humanities*, *10*, 115–126.

Babo, R., Babo, L. V., Suhonen, J. T., & Tukiainen, M. (2020). E-Assessment with Multiple-Choice Questions: A 5 Year Study of Students' Opinions and Experience.

Bagunaid, W., Chilamkurti, N., & Veeraraghavan, P. (2022). Aisar: Artificial intelligence-based student assessment and recommendation system for e-learning in big data. *Sustainability*, *14*(17), 10551.

Bijsterbosch, E., Béneker, T., Kuiper, W., & van der Schee, J. (2019). Teacher professional growth on assessment literacy: A case study of prevocational geography education in the Netherlands. *The Teacher Educator*, *54*(4), 420-445.

Chen, D. (2023). *Use of Technology-Based Assessments: A Systematic Review*. Global Education Monitoring Report.

Chen, D., & Xu, F. (2024). Design and implementation of machine learning algorithms in automatic grading of students' assignments. *Journal of Electrical Systems*, *20*(3s), 899-919.

Chirumamilla, A., & Sindre, G. (2019). E-assessment in programming courses: Towards a digital ecosystem supporting diverse needs?. In *Digital Transformation for a Sustainable Society in the 21st Century: 18th IFIP WG 6.11 Conference on e-Business, e-Services, and e-Society, I3E 2019, Trondheim, Norway, September 18–20, 2019, Proceedings 18* (pp. 585-596). Springer International Publishing.

De Beer, M. (2022). *Intermediate Phase Educators' Experiences of the Use of Online Tools to Enact Formative Assessment in Social Sciences Teaching and Learning* [Doctoral dissertation, University of Johannesburg].

Didmanidze, I., Tavdgiridze, L., Zaslavskyi, V., Khasaia, I., Dobordginidze, D., & Olga, Y. (2023, October). The Impact of Digital Technologies in Education. In *2023 13th International Conference on Dependable Systems, Services and Technologies (DESSERT)* (pp. 1-7). IEEE.

Doğan, N., Kıbrıslıoğlu, N., Kelecioğlu, H., & Hambleton, R. K. (2020). An overview of e-assessment. *Hacettepe Üniversitesi Eğitim Fakültesi Dergisi*, *35*(Special Issue), 1-5.

Farrow, R., Ferguson, R., Weller, M., Pitt, R., Sanzgiri, J., & Habib, M. (2021). Assessment and recognition of MOOCs: the state of the art. *Journal of Innovation in Polytechnic Education*, *3*(1), 15-26.

Fischer, C., Pardos, Z. A., Baker, R. S., Williams, J. J., Smyth, P., Yu, R., ... & Warschauer, M. (2020). Mining big data in education: Affordances and challenges. *Review of Research in Education*, *44*(1), 130-160.

Gambo, I., Abegunde, F. J., Gambo, O., Ogundokun, R. O., Babatunde, A. N., & Lee, C. C. (2024). GRAD-AI: An automated grading tool for code assessment and feedback in programming course. *Education and Information Technologies*, 1-41.

Gane, B. D., Zaidi, S. Z., & Pellegrino, J. W. (2018). Measuring what matters: Using technology to assess multidimensional learning. *European Journal of Education*, *53*(2), 176-187.

Garcia, R. E., Macaballug, M. E. R., & Perez, E. I. (2024). Remote assessment of learning during the pandemic: junior high school teachers' experiences. *Int J Eval & Res Educ*, *13*(2), 731-741.

Ghimire, S., & Khanal, J. (2022). Experiences of University Staff in Online Proctored Examination: A Phenomenological Study. *J Mod Educ Res*, *1*(8), 1-15.

Ghouali, K., Benmoussat, S., & Ruiz Cecilia, R. (2020). E-assessment on the spotlight: Present and future prospects. *REIDOCREA, 9,* 52-62.

Gikandi, J. W., Morrow, D., & Davis, N. E. (2011). "Online formative assessment in higher education: A review of the literature." Computers & Education, 57(4), 2333-2351.

Gürbüz, A., Canlı, B. & Abi, M. (2024). The opportunities and burdens of online test processes. *Adiyaman Univesity Journal of Educational Sciences, 14*(1), 1-9.

Hlongwane, I. (2019). Compliance with quality assurance principles of recognition of prior learning (RPL) by library and information science schools in South Africa. *Innovation: journal of appropriate librarianship and information work in Southern Africa*, *2019*(58), 78-95.

Huber, E., Harris, L., Wright, S., Raduescu, C., White, A., Cram, A., ... & Brodzeli, A. (2022). Cost-effective, scalable online assessment solutions to assure academic integrity, privacy and equity of access: Towards a framework for success.

Iderima, C. E. (2023). Implications Of Computer Based Testing On Open And Distance Learning. *International Journal of Innovative Information Systems & Technology Research 11*(3), 122-134.

Ion, G., & Mercader, J. C. (2024). D-Eva Programme: Supporting Academics to Use Digital Tools for Students' Assessment. In *Digital Assessment in Higher Education: Navigating and Researching Challenges and Opportunities* (pp. 225-240). Singapore: Springer Nature Singapore.

Isaias, P., Miranda, P., & Pifano, S. (2023, November). E-Assessment Systems: An Evaluation Framework from the Perspective of Higher Education Experts. In *2023 International Symposium on Computers in Education (SIIE)* (pp. 1-6). IEEE.

Joshi, A., Virk, A., Saiyad, S., Mahajan, R., & Singh, T. (2020). Online assessment: Concept and applications. *Journal of Research in Medical Education & Ethics*, *10*(2), 49-59.

Kaspi, S., & Venkatraman, S. (2023). Data-Driven Decision-Making (DDDM) for Higher Education Assessments: A Case Study. *Systems*, *11*(6), 306.

Keengwe, J. (Ed.). (2022). *Handbook of research on digital-based assessment and innovative practices in education*. IGI Global.

Kelly, K., & Zakrajsek, T. D. (2023). *Advancing online teaching: Creating equity-based digital learning environments*. Taylor & Francis.

Ketab, S. (2017). E-invigilation of e-assessments. A thesis submitted to Plymouth University in partial fulfilment for the degree of Doctor of Philosophy, School of Computing, Electronics and Mathematics, Faculty of Science and Engineering.

Khoza, S. B., & Mpungose, C. B. (2024). Academics' Responses to COVID-19 and 4IR Resources for Authentic E-Assessment. *Curriculum Development and Evaluation: Curriculum Components in Action*, *24*, 135.

Kiennert, C., Rocher, P. O., Ivanova, M., Rozeva, A., Durcheva, M., & Garcia-Alfaro, J. (2017, July). Security challenges in e-assessment and technical solutions. In *2017 21st International Conference Information Visualisation (IV)* (pp. 366-371). IEEE.

Krans, N. A., Ammar, A., Nymark, P., Willighagen, E. L., Bakker, M. I., & Quik, J. T. K. (2022). FAIR assessment tools: evaluating use and performance. *NanoImpact*, *27*, 100402.

Laamanen, M., Ladonlahti, T., Uotinen, S., Okada, A., Bañeres, D., & Koçdar, S. (2021). Acceptability of the e-authentication in higher education studies: views of students with special educational needs and disabilities. *International Journal of Educational Technology in Higher Education*, *18*, 1-17.

Labuschagne, C. (2023). *Online formative assessment challenges experienced by Grade 10 Physical Sciences teachers* (Doctoral dissertation, University of Johannesburg).

Mafenya, N. P. (2016). *Effective assessment in open distance and e-learning: using the signature courses at the University of South Africa as a model for future practice* [Doctoral dissertation, University of South Africa].

Majjate, H., Bellarhmouch, Y., Jeghal, A., Yahyaouy, A., Tairi, H., & Zidani, K. A. (2024). Assessing the impact of ethical aspects of recommendation systems on student trust and engagement in E-learning platforms: A multifaceted investigation. *Education and Information Technologies*, 1-25.

Maki, P. L., & Shea, P. (Eds.). (2023). *Transforming digital learning and assessment: A guide to available and emerging practices and building institutional consensus*. Taylor & Francis: Abingdon, UK, 2023.

Maphalala, M. C., Mpofu, N., & Adigun, O. T. (2024). The Dynamics of e-Assessment in South African Higher Education: Narratives for and Against Proctoring in Higher Education During Covid-19 and Beyond. In *Online Teaching and Learning in Higher Education: Issues and Challenges in an African Context* (pp. 183-199). Cham: Springer Nature Switzerland.

Meccawy, Z., Meccawy, M., & Alsobhi, A. (2021). Assessment in 'survival mode': student and faculty perceptions of online assessment practices in HE during COVID-19 pandemic. *International Journal for Educational Integrity*, *17*, 1-24.

Mimirinis, M. (2019). Qualitative differences in academics' conceptions of e-assessment. *Assessment & Evaluation in Higher Education*, *44*(2), 233-248.

Mohan, R. (2023). *Measurement, evaluation and assessment in education*. PHI Learning Pvt. Ltd.

Mukherjee, S., & Pandey, P. (2023). Empowering future oriented learning ecosystem through E-assessment tools. *International Journal of Advanced Research and Development, 8*(6), 5-9.

Nacheva-Skopalik, L., & Green, S. (2020). Intelligent adaptable e-assessment for inclusive e-learning. In *Learning and Performance Assessment: Concepts, Methodologies, Tools, and Applications* (pp. 1185-1199). IGI Global.

Naidoo, S., & Gokool, R. (2020). Towards the implementation of E-assessment in L2 IsiZulu: An examination of four listening comprehension tests. In *ICT-based assessment, methods, and programs in tertiary education* (pp. 149-168). IGI Global.

Ngqondi, T., Maoneke, P. B., & Mauwa, H. (2021). A secure online exams conceptual framework for South African universities. *Social Sciences & Humanities Open*, *3*(1), 100132.

Ningsih, W. (2024). Lecturers' Perceptions of The Use Of E-Evaluation In Assessing The Academic Achievement of Students Of The Islamic Religious Education Study Program. *Fitrah: Journal of Islamic Education*, *5*(1), 74-97.

Noble, S. U. (2018). "Algorithms of Oppression: How Search Engines Reinforce Racism." NYU Press.

Okada, A., Noguera, I., Alexieva, L., Rozeva, A., Kocdar, S., Brouns, F., ... & Guerrero-Roldán, A. E. (2019). Pedagogical approaches for e-assessment with authentication and authorship verification in Higher Education. *British Journal of Educational Technology*, *50*(6), 3264-3282.

Olasina, G. (2023). Using new assessment tools during and post-COVID-19.*International Journal of Technology and Educational Innovation, 10*(1), 144-165. https://doi.org/10.24310/ijtei.101.2024.17813

Pagaling, R., Eaton, S.E., & McDermott, B. (2022, April 4). Academic Integrity: Considerations for Accessibility, Equity, and Inclusion. University of Calgary. Calgary, Canada. http://hdl.handle.net/1880/11451

Parker, O. (2023). Cloud Computing and AI in Education: Revolutionizing Personalized Learning While Ensuring Data Security. http://dx.doi.org/10.13140/RG.2.2.24764.65921

Perry, K., Meissel, K., & Hill, M. F. (2022). Rebooting assessment. Exploring the challenges and benefits of shifting from pen-and-paper to computer in summative assessment. *Educational Research Review*, *36*, 100451.

Pillay, P., & Balele, R. (2024). First-year pre-service teachers' e-formative feedback experiences at a university during emergency remote learning in South Africa. In *Edulearn24 Proceedings* (pp. 8955-8962). IATED.

Raza, A. (2023). Harnessing AI and Cloud Technology for Personalized Learning: Ensuring Data Integrity in Modern Education. http://dx.doi.org/10.13140/RG.2.2.15643.68643

Rodrigues, R., de la Torre, J., & Carcedo, J. (2017). Ethics of Emerging Information and Communication Technologies: On the Implementation of Responsible Research and Innovation. *Science and Engineering Ethics, 23*(4), 1139-1157.

Sabrina, F., Azad, S., Sohail, S., & Thakur, S. (2022). Ensuring academic integrity in online assessments: a literature review and recommendations. *International Journal of Information and Education Technology, 12*(1), 60–70. https://doi.org/10.18178/ijiet.2022.12.1.1587.

Saleh, M. N. E. D., Salem, T. A. R. O., Alamro, A. S., & Wadi, M. M. (2022). Web-based and paper-based examinations: Lessons learnt during the COVID-19 pandemic lockdown. *Journal of Taibah University Medical Sciences*, *17*(1), 128-136.

Selwyn, N. (2020). The risks of learner surveillance. *The British Journal of Sociology of Education, 41*(5), 638-646.

Singh, U. G., & Gokool, R. (2018). Students' perceptions of the Moodle Quiz E-assessment tool in an isiZulu language course. *Journal for Language Teaching*, *52*(1), 128-150.

Snyman, M., & Van den Berg, G. (2018). The significance of the learner profile in recognition of prior learning. *Adult Education Quarterly*, *68*(1), 24-40.

Solati, A., Amani, A., & Armat, M. R. (2024). Impact of learning environment on reading anxiety: a study of medical students in online and traditional settings. *BMC Medical Education*, *24*, 1502.

Stallings, W. (2017). "Effective Cybersecurity: A Guide to Using Best Practices and Standards." Addison-Wesley.

St-Onge, C., Ouellet, K., Lakhal, S., Dubé, T., & Marceau, M. (2022). COVID-19 as the tipping point for integrating e-assessment in higher education practices. *British Journal of Educational Technology*, *53*(2), 349-366.

Striewe, M. (2022). Where Does All the Data Go? A Review of Research on E-Assessment Data. *CSEDU, 1*, 157-164.

Tat, O., & Kilic, A. F. (2024). Electronic assessment anxiety scale: Development, validity and reliability. *Turkish Online Journal of Distance Education*, *25*(4), 16-32.

Terblanche, E. A. J., van Rooyen, A. A., & Enwereji, P. C. (2024). Auditing students' perceptions of online assessments and e-proctoring systems. *Discover Education*, *3*(1), 207, 1-19.

Turner, K. L., Adams, J. D., & Eaton, S. E. (2022). Academic integrity, STEM education, and COVID-19: a call to action. *Cultural studies of science education*, *17*(2), 331-339.

Uunona, G. N., & Goosen, L. (2023). Leveraging ethical standards in artificial intelligence technologies: A guideline for responsible teaching and learning applications. In *Handbook of research on instructional technologies in health education and allied disciplines* (pp. 310-330). IGI Global.

Venkateswari, S. L. (2020). Using E-Assessment to Attain the Desired Learning Outcome in Higher Education. *Language in India*, *20*(4), 15-26.

vd Westhuizen, D. (2016). Guidelines for online assessment for educators. Commonwealth of Learning, 4710 Kingsway, Suite 2500 Burnaby, British Columbia Canada.

Yakobi, S., Yakobi, K., Lose, T., & Kwahene, F. (2022). E-Assessment Implementation and Implications for the Success of Historically Disadvantaged Institutions (HDIs) in South Africa. *Journal of Educational Studies*, *21*(4), 110-122.

Zhao, B. (2022). The role of classroom contexts on learners' grit and foreign language anxiety: online vs. traditional learning environment. *Frontiers in Psychology*, *13*, 869186.

Zinke, N., Lenski, S., Brocker, A., Merkt, M., Gropengießer, K., Stürmer, S., & Schröter, H. (2024). Towards Fair and Diversity-Appropriate E-assessments. In *Assessment Analytics in Education: Designs, Methods and Solutions* (pp. 373-394). Cham: Springer International Publishing.