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Tech-Driven High-Stakes Examinations: Will Digital Exams Deliver on Quality Education?

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Abstract

The limitations of traditional paper-based assessments in efficiency, security, and data analysis have prompted a need to explore the potential of digital assessments in high-stakes examinations. The challenge lies in addressing the inadequacies of traditional exams and ensuring a smooth transition to digital assessments while mitigating risks such as unequal access to technology and technical glitches. This research examines the benefits and challenges associated with transitioning to digital assessments, particularly in achieving Sustainable Development Goal 4 (Quality Education). Reviewing current literature, and employing a bibliometric analysis, the article explores how digital assessments can enhance efficiency, security, and data analysis capabilities, while also discussing strategies for a successful transition, including infrastructure development, training, and security protocols. Analysis showed a marked increase in publications starting in 2010, which reflects growing scholarly interest motivated by Fourth Industrial Revolution developments in digital technologies. With major contributions from top authors in the field, key study themes found were digital assessment, e-assessment, and computer-based tests. The results guide future research orientations and policy development in digital high-stakes assessments by offering a complete picture of publication trends, thematic advancements, and significant contributions. The paper aims to inform policymakers and educators in developing strategies for successfully implementing digital assessments in high-stakes examinations, leveraging the potential of AI for a more effective and individualized assessment experience.

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Introduction

The Fourth Industrial Revolution (4IR) has brought about rapid advancements in all sectors of the economy, and education has not been left unaffected. Several authors have analysed advancements in different areas of society and their influence on schools, particularly in terms of school structure, interpersonal dynamics, and students, however, the use of novel educational technology often fails to address the modifications required in the assessment procedures that govern the national education system. The need to digitize assessments arises from the understanding that, in the absence of an appropriate computer-based method for administering exams, significant improvements in the education sector are unlikely to take place hence the need to be digitally agile. This is especially true given that the manner of assessment plays a crucial role in shaping both teaching and learning behaviours (Al-Worafi, 2022). The transition to digital assessments in high-stakes examinations becomes imperative for fostering digital learning experiences, yet it presents both opportunities and challenges. While traditional paper-based assessments have limitations in efficiency, security, and data analysis, the full potential of digital assessments remains under-explored in the aligning of learning and assessment.

In recent years, bibliometric analysis has become a widely recognized method for systematically mapping research trends, identifying influential works, and uncovering collaborative networks within academic fields. Bibliometrics enables researchers to quantitatively assess the evolution of a research area by analyzing publication patterns, citation networks, and thematic developments over time (Donthu *et al.*, 2021). This approach is particularly valuable in rapidly evolving domains such as digital assessment, where new technologies and pedagogical strategies continuously reshape the landscape (Almenara, 2022). By applying bibliometric methods, scholars and policymakers can gain a comprehensive overview of the field, highlight research gaps, and inform evidence-based decision-making for educational innovation (Donthu *et al.*, 2021; Almenara, 2022).Moreover, bibliometric studies provide objective metrics for evaluating the impact of research outputs and identifying leading authors, institutions, and journals, thereby facilitating strategic planning and resource allocation in education (Donthu *et al.*, 2021).

High-stakes examinations (HSE) provide a crucial function in society by enabling stakeholders such as professional and governmental organisations, companies, colleges, and people to make informed choices based on individuals' level of qualification (Cummings, 2022). These organisations heavily depend on conventional evaluation methods to choose personnel who guarantee public safety, employment, or academic achievement, respectively (Shrivastava, & Shrivastava, 2022). Information technology may enhance the examination process by boosting transparency, providing enhanced security, and delivering cost-saving advantages. It can be deduced from the literature that computer-based testing (CBT) is increasingly being utilised in modern formative assessment, although, the adoption of digital assessments in high-stakes public examinations is still a new phenomenon in the African setting. However, as the 4IR is non-relenting, examination boards have to adapt their procedures, considering that digitisation in the sphere of educational assessment has long been a focus of attention for both practice and study. It is anticipated that the substantial advancements in artificial intelligence would also hasten the digitisation of public exams. This article considers the merit of adopting digital examinations in high-stakes examinations. This is because of the use of ICT for teaching and learning, and in particular the current use of pen and paper for high stakes exams within most educational institutions lags behind the extensive usage of ICT by students in their study and everyday lives (Riddle, 2008; Riddle & Howell, 2008). The paper is important for development and implementation of e-assessments in the African context as it endeavours to put forward a case for the piece-meal adoption of digital assessment on the African context.

Materials and Methods

Methodology

The study adopted a quantitative descriptive approach. A bibliometric analysis research method was chosen. The process was selected to identify trends, literature evolution and key themes in digital high-stakes examinations. Bibliometrics facilitate the general state-of-the-art of a specific research

field or topic (Almenara, 2022). It enabled the researchers to unpack evolutionary nuances in the field of digitised assessments, while shedding more light on e-assessment, a relatively new phenomenon in high-stakes examinations (Donthu, Kumar, Mukjejee, Pandey & Lim, 2021). Data was collected from the Scopus database spanning the years 1990 to 2023. The Scopus database is renowned for its high-quality academic resources, including research articles, books, and conference proceedings (Chigori *et al.*, 2024). A comprehensive query search using selected keywords was employed using the search tools provided by Scopus. The search included terms like ("digital examinations" and "computer based examinations") or ("digital high-stakes examinations") or ("e- assessment") or all ("e-assessment of national examinations") and (limit to (doctype, "ar") and (limit to (src type, "j") and (limit to (language, “English") and (limit to (publication stage, "final") ensuring a thorough examination of peer-reviewed articles. Data analysis was performed using VOS viewer version 1.6.20. Bibliometric analysis was chosen for the study as the method is used to examine the contributions of leading authors, institutions, and journals, offering insights into the field's most influential works and collaborative networks in a research area.

The study also conducted a comprehensive literature review to investigate the benefits and challenges of switching to digital assessments in high-stakes exams. The systematic review methodology was chosen because of its rigour and ability to synthesise existing research and provide a complete assessment of the present state of knowledge in this field (Taherdoost, 2024). A comprehensive search was carried out utilising several academic databases, including Scopus, Google Scholar, and ERIC. The search terms used were "digital assessment," "high-stakes examinations," "benefits of digital assessments," "challenges of digital assessments," and "transition to digital assessments." The search was limited to peer-reviewed articles published in the last 10 years to ensure the relevance and timeliness of the results. Peer-reviewed articles on digital assessments in high-stakes situations, studies that specifically address the advantages or disadvantages of switching to digital assessments, and research from various educational contexts including primary, secondary, and higher education were the inclusion criteria for the literature review. Articles not published in English, research concentrating only on formative evaluations or low-stakes situations, and literature lacking empirical evidence or theoretical insights pertinent to digital assessments were among the exclusion criteria.

Data were extracted from the selected articles using a standardized extraction form. Key information included the authors, year of publication, study context, methodology, main findings related to the benefits and challenges of digital assessments, and practice recommendations. The extracted data were then analysed thematically to identify common themes and patterns regarding the benefits and challenges of transitioning to digital assessments. This thematic analysis allowed for a nuanced understanding of the factors influencing the implementation of digital assessments in high-stakes examinations. A standardised extraction form was used to obtain data from the chosen articles. The authors, the publication year, the study's setting, the methodology, the primary conclusions on the advantages and difficulties of digital assessments, and practical suggestions were all important pieces of information. After the data were retrieved, a thematic analysis was conducted to find recurring themes and patterns about the benefits and challenges of transitioning to digital assessments. This provided for a more nuanced understanding of the factors driving the use of digital assessments in high-stakes exams.

To ensure the quality and reliability of the included studies, a quality assessment was conducted using the Critical Appraisal Skills Programme (CASP) checklist as recommended by Floyd, (2019). Studies that did not meet the quality criteria were excluded from the final analysis. The findings from the systematic literature review were synthesised to provide a comprehensive overview of the benefits and challenges associated with digital assessments in high-stakes examinations. The synthesis highlighted key insights, including the potential for increased efficiency, improved security, and enhanced data analysis capabilities, as well as challenges related to equitable access, technical difficulties, and the integration of technology in educational settings. By employing this systematic literature review methodology, the research aims to contribute to the understanding of digital assessments in high-stakes examinations and inform policymakers and

educators about the implications of transitioning to digital assessment practices (Shava & Nkengbeza, 2019).

Ethical Considerations, Validity and Data Selection

Ethical standards, validity, and rigorous data selection were central to this study's design and execution. The research followed the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) framework to ensure transparency, replicability, and reliability in the identification and screening of relevant literature (Patole, 2021). Ethical clearance for secondary data usage was obtained from the authors' university ethics committee, ensuring compliance with institutional and international guidelines for research involving published data.

The initial database search using the Scopus platform identified 355 records related to digital assessment and computer-based assessment. To uphold ethical standards and ensure the validity of the findings, several inclusion and exclusion criteria were rigorously applied. Only fully published, peer-reviewed journal articles written in English and in their final publication stage were considered. Articles in press, non-English publications, and studies focusing solely on formative or low-stakes assessments were excluded to maintain a consistent focus on high-stakes digital assessment contexts.

After the initial screening to remove duplicates and non-eligible articles, 202 records were retained for further evaluation. These articles underwent a thorough quality assessment using the Critical Appraisal Skills Programme (CASP) checklist, as recommended by Floyd (2019), to ensure methodological rigor and relevance. Studies that did not meet the quality criteria were excluded from the final synthesis. Ultimately, a total of 85 articles met all inclusion criteria and were included in the final systematic review and bibliometric analysis. This explicit reporting of the final number of included articles enhances the transparency and completeness of the research process, addressing the need for clarity in systematic reviews. By adhering to these methodological and ethical standards, the study ensured that its findings are both robust and trustworthy, providing a reliable foundation for future research and policy development in digital high-stakes assessment

Results from Bibliometric Analysis

The bibliometric analysis of digital assessment reveals a dynamic and evolving field. The results section of the bibliometric analysis on digital assessment provides a comprehensive overview of the research landscape, including publication trends, key thematic areas, and influential contributors. By analysing data from a broad array of academic sources, the study identifies significant growth patterns in literature volume over the years, highlighting periods of heightened research activity. It also explores the predominant research themes, focusing on digital assessment, e-assessment, and computer-based high-stakes examinations. This detailed analysis maps the evolution of scholarly interest and identifies critical areas for future research and policy development in digital assessment.

The literature shows a marked increase in publication volume, particularly from 2010 onwards, coinciding with the broader adoption of digital technologies in education (Donthu *et al.*, 2021; Almenara, 2022). This surge reflects the growing academic and policy interest in digital and computer-based assessments, especially in high-stakes examination contexts (Budhai, 2021; Chigori *et al.*, 2024). From 1990 to 2023, research output on digital assessments demonstrated exponential growth. Early years (1990s–early 2000s) were characterized by foundational studies and limited publications (Phillips, 2016). However, post-2010, the number of annual publications consistently exceeded 15, reflecting increased attention due to the influence of the Fourth Industrial Revolution (4IR) (Lehane, 2022). This trend aligns with global educational reforms and the integration of digital technologies in assessment practices (Alruwais *et al.*, 2018).

The thematic analysis of the research revealed several core areas. Digital Assessment and E-Assessment emerged as significant themes, with studies primarily focusing on the complete electronic administration and scoring of examinations (Cloud, 2011; Alruwais *et al.*, 2018). Another key area identified was Computer-Based Assessment (CBA), which emphasizes real-time scoring and the integration of dynamic media elements (Cooper, 2023). Finally, Technology-Enhanced Assessment represents a broader application of digital tools to support both formative and summative assessment

practices (Phillips, 2016). The bibliometric mapping highlighted key authors, institutions, and journals driving the field. Collaborative networks are emerging, particularly among institutions in technologically advanced regions (Donthu *et al.*, 2021). However, there is a noted gap in research output and collaboration from African countries, underscoring the need for capacity building and policy support (Cummings, 2022).

Discussion

E-assessments or Digital Examinations

In recent years, there has been a growing emphasis on the use of technology in high-stakes examinations. Technological advances have transformed high-stakes examinations, enabling adaptive testing, personalized learning analytics, and automated grading systems (Budhai, 2021; Lehane, 2022). These innovations enhance the validity and reliability of assessments and facilitate remote administration, increasing accessibility (Alruwais *et al.*, 2018; Cooper, 2023). Despite these benefits, challenges such as digital divide, infrastructure limitations, and concerns around security and academic integrity persist, particularly in developing regions (Shrivastava & Shrivastava, 2022; Shava & Nkengbeza, 2019).

The term digital assessment is commonly used to refer to assessments carried out entirely through the use of ICT (Alruwais *et al.*, 2018). Cloud (2011), on the other hand, defines e-assessment as the total, electronic delivery of assessments. They specifically refer to the transmission of tasks from the examiner to the examinee and the transmission of responses from the examinee to the examiner. It is then stated that all evaluations should be electronic between every interested party.

Cooper (2023) defines CBA as a general method for administering tests in which the answers are recorded and evaluated electronically. The digital application of assessments consists of dynamic and adaptive media elements. The scoring of the answers is done in near real-time. Phillips (2016) use the term technology-enhanced assessment to refer to any use of digital technologies in educational assessments. Although it is not explicitly elaborated how Foundations 4 technology would enhance the assessment, application for formative and summative assessment is addressed. Though terminology is different, the descriptions indicate that there are similar core features of digital assessment in education. They're distinguished by the use of digital technologies as the first core characteristic (although no details are provided about those technologies

Growth of Literature on Digital Assessment

The growth of literature on digital assessment worldwide has shown a significant upward trajectory over the past three decades as illustrated in Figure 1 below. There were minimal publications on this topic from the mid-1990s to the early 2000s. This period of low publication frequency indicates a nascent stage in the research domain, where foundational studies and initial inquiries began taking shape.

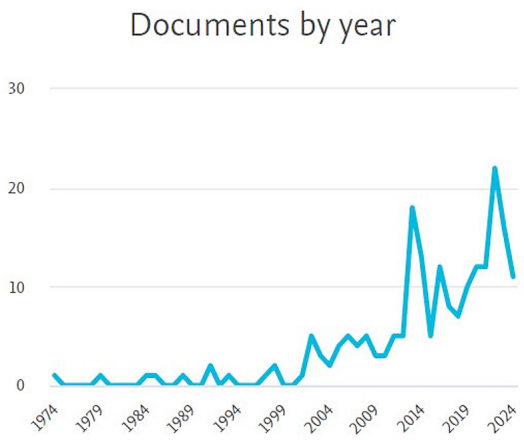

Fig.1: Annual Scientific production on digital assessment Research Outputs on digital assessment

From 2000 onwards, there is a noticeable increase in research volume. The literature reflects growing academic and policy interest in digital or computer-based assessment of high-stakes examinations. Further article publications steadily rose, with occasional fluctuations, but maintaining an upward trend. Significant growth can be observed from 2010 onwards, with the number of articles published annually consistently exceeding (n=15). This period likely corresponds with an increased awareness of digitalisation from the Fourth Industrial Revolution (4IR).

The rapid growth in digital assessment literature reflects increasing global interest and the urgent need to modernize assessment systems (Donthu *et al.*, 2021; Almenara, 2022). However, there is a scarcity of empirical studies from African contexts, highlighting the necessity for localized research and policy interventions (Chigori *et al.*, 2024). The literature also reveals a shift towards more holistic and data-driven approaches to assessment, leveraging digital tools for continuous improvement (Phillips, 2016).

Fig 2 shows the types of research outputs on digital assessment. Most of the research outputs were journal articles, and these comprised 48.5 % of the publications. Conference presentations make up 31.7% while conference reviews comprise 12.4 %. Book chapters consist of 2.5 % while only 1% of the publications are books.

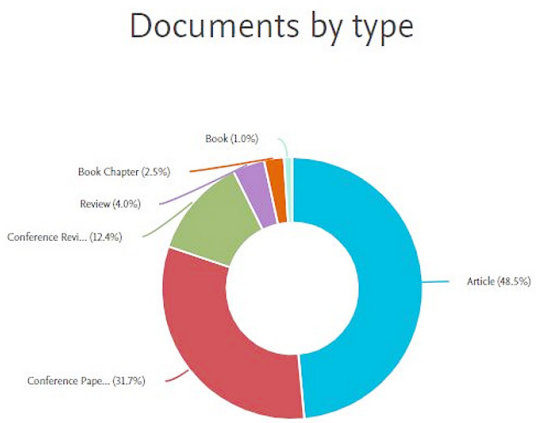

Fig.2: Nature of publications

Relation to latest AI Advancements

Recent advancements in artificial intelligence (AI) are significantly reshaping the landscape of digital assessments. AI-powered tools now offer capabilities such as automated essay scoring, where natural language processing algorithms provide consistent and unbiased grading of open-ended responses (Zawacki-Richter *et al.*, 2019). Furthermore, AI enables adaptive testing, dynamically adjusting question difficulty based on student responses to enhance assessment accuracy and efficiency (Luckin *et al.*, 2022). The integrity of online assessments is also improved through cheating detection, as machine learning models can identify patterns of academic dishonesty (Sottilare *et al.*, 2023). Finally, AI systems contribute to personalized feedback by analyzing student performance data to deliver tailored feedback and suggest individualized learning pathways (Holmes *et al.*, 2022).

These innovations promise to further individualize learning and assessment, supporting the goals of Sustainable Development Goal 4 (SDG4) for inclusive and equitable quality education (UNESCO, 2023). However, the adoption of AI in assessment also raises ethical concerns regarding data privacy, algorithmic bias, and transparency (Holmes *et al.*, 2022; Zawacki-Richter *et al.*, 2019). Policymakers and educators must address these challenges to fully realize the benefits of AI-driven digital assessments.

Results from the Systematic Literature Review

As technology continues to advance and penetrate various aspects of our lives, the field of education is no exception. Universities and other educational institutions are faced with the challenge of adapting their processes to a digital environment in order to stay relevant and provide quality education (Rodriguez-Abitia & Bribiesca-Correa, 2021). This transition to digitalization encompasses many areas, including high-stakes examinations (Saeedi & Visvizi, 2021). The question arises: will digital exams truly deliver quality education? While digital exams have the potential to revolutionise the way assessments are conducted and provide certain advantages, such as flexibility and faster grading, there are several factors that need to be considered in order to ensure that digital exams indeed deliver on quality education (Guzsvinecz & Szucs, 2021) . These factors include the reliability and security of the digital examination platforms, the ability to effectively assess higher-order thinking skills and critical reasoning, and the equitable access to technology for all students (Rodriguez-Abitia & Bribiesca-Correa, 2021). Additionally, it is of utmost importance to acknowledge that the implementation of digital examinations is not the only factor that contributes to the success of digital transformation in education (Fonseca, 2023). There is a need for the incorporation of technology into the process of implementing the curriculum.

One of the key benefits of digital assessments is the enhanced efficiency they can provide. Digital platforms allow for automated grading, faster score reporting, and more comprehensive data analysis.

This can lead to significant time and cost savings for assessment providers and institutions. Additionally, digital assessments offer improved security measures, such as biometric authentication and secure data storage, reducing the risk of cheating and data breaches. However, the transition to digital assessments is not without its challenges.

The findings of the literature study examining the digital execution of tests from a technological standpoint are addressed. In this topic, the study concentrated on ICT-related themes and detecting cheating in digital tests. Not surprisingly, the literature on digital tests concentrated on ICT-related issues. Here, digital tests make it feasible to give a genuine exam experience. For coding activities, it was discovered that PBA is not a good way to measure the corresponding competences acquired. This is especially true if the learning phase already contains application-oriented education. In the instance of cheating, it was proven that in addition to the recognised varieties of cheating from PBA, other types develop via the digital conduct of tests. Nevertheless, CBA also provides the ability to identify various forms of cheating at this stage. It is crucial to remember that thorough cheating detection systems must be included in digital tests.

Challenges of Digital Examinations

Transitioning from traditional paper-based methods to digital examinations introduces a range of complex challenges that must be carefully navigated to ensure fairness, security, and effectiveness in high-stakes assessment environments. Ensuring equitable access to technology and mitigating the risks of technical difficulties are crucial considerations. Students from disadvantaged backgrounds may have limited access to the necessary devices and internet connectivity, potentially creating an uneven playing field. Additionally, technical glitches, such as system crashes or connectivity issues, can disrupt the assessment process and undermine the validity of the results (Grabia,2015).

Increased levels of anxiety and difficulties have been observed during the initial implementation of digital examinations. Equity was another aspect that inexperienced examinees usually scrutinised. The absence of technical equipment, unfamiliarity, and cheating were all significant contributors to the low degree of perceived fairness. Aziz (2020) studied the examinees of a coding course qualitatively. All things considered, CBA was deemed a suitable and equitable mode of distribution. Therefore, by enabling the usage of features and learning resources in the particular course, CBA enhanced perceived authenticity.

Even so, adverse consequences of the exam execution described were also documented. Concerns that the test assessed time management rather than competency arose from examinees' complaints about not having enough time to finish the assignments. Additionally, individual examinees showed increased levels of stress, worry, and pressure. Because they raised the necessary quality of the final solutions, this was ascribed to the approved aids. The findings of Matthiasdottir and Arnalds (2015) were likewise comparable. However, in a CBA examinees felt less in control compared to a PBA.

Many aspects of an online test are impacted by the usage of technology. These can include managing the exam system both before to and during the test as well as resolving technological issues. As a result, it is anticipated that technical proficiency will be especially crucial for online tests from a variety of angles. Technical difficulties in time-limited tests, for instance, might further reduce processing time (Gamage *et al.* 2020). In particular, the ability to type by touch is crucial for processing test problems (Thomas *et al.* 2002). According to earlier studies, the belief that the speed and precision of typing determine whether or not students utilise computers for essay examinations (Mogey and Fluck 2015). In this case, it is anticipated that students who are more proficient with technology will be less affected by the shift in exam format and will be more inclined to take the test online.

Sustainable provision of computer hardware and facilities is another hurdle that needs to be overcome in order to achieve effective implementation of CBA. It is unlikely to be sustainable or economic for schools to provide each student with hardware for large infrequent assessment events such as exams. The cost of providing a large number of computers for each exam candidate for short periods each year makes this logistically difficult and costly. The construction of large enough dedicated exam facilities would represent a significant investment

in physical infrastructure that may not be well utilised outside of exam periods. The establishment or leasing of a temporary facility, along with the acquisition of computers, would incur significant recurring expenses. Considering that many students already possess appropriate equipment, finding ways to utilize this existing technology would be advantageous. Additionally, the costs associated with software licensing for proprietary solutions further contribute to the financial burden. Consequently, securing resources from both the parent ministry and assessment organizations for digital evaluations poses a challenge for the rollout of digital exams. Furthermore, the strategy for funding continuous technical and procedural assistance also warrants careful examination.

In the process of creating a digital examination system, it is crucial to consider the reliability and security of the computer hardware, networks, software, and the physical surroundings. This includes both managed components, like institution-owned networks, and unmanaged components, such as student-owned mobile devices (Floyd, 2019). Additionally, during the examination, invigilators must be able to clearly verify that each candidate is utilizing only permitted software. It is essential to eliminate any unauthorized data and communication from the examination setting. A regulated software environment should be established to restrict students from accessing unauthorized resources, including websites, mobile devices, communications with others, assistance from third parties outside the examination room, or the computer's hard drive.

Network or wireless access should either be entirely restricted or allowed only in designated areas where exam questions and resources are located, or through secure channels that facilitate safe answer transmission. Adhering to information security principles can assist developers during the initial phases of system design to create a secure and dependable platform. It is crucial to establish effective workflows for the preparation, administration, and post-exam processing. Universities already invest considerable funds and resources in conducting examinations, and it is essential to avoid placing an additional financial burden on them. Thus, the goal should be to implement e-exams in a way that is at least cost-neutral in the long run. To enhance efficiency, the exam platform ought to support automatically graded questions wherever pedagogically suitable and reduce the manual tasks involved in preparing exam scripts, managing exam sessions, retrieving, processing, and grading student responses.

Practical Implications

Below are several concrete examples directly aligned with the benefits discussed in the literature, demonstrating how digital examinations function in real educational settings.

Automated Grading and immediate feedback: Digital platforms can significantly enhance efficiency through automated grading and feedback. For instance, multiple-choice questions can be instantly scored, providing immediate feedback to students on correct answers and explanations, a standard feature of Computer-Based Assessment (CBA) (Sottilare *et al.*, 2023). In subjects like computer programming, digital examination platforms can integrate environments where students write and execute code. Automated systems can then compile and test this code against predefined criteria, offering immediate feedback on correctness and efficiency, which is a substantial improvement over traditional paper-based assessments (Taherdoost, 2024). Furthermore, for essay-based questions, AI-powered tools can be employed for automated essay scoring, using natural language processing algorithms to provide consistent and unbiased grading of open-ended responses. This not only accelerates the grading process but also offers students timely, personalized feedback on various aspects of their writing (Sottilare *et al.*, 2023).

Adaptive Testing and Personalized Pathways: Adaptive testing and personalization are also key capabilities of digital examinations. These systems can dynamically adjust the difficulty of subsequent questions based on a student's previous responses. For example, a correct answer might lead to a more challenging follow-up question, and vice-versa, allowing for a more precise measurement of a student's true ability and a more individualized assessment experience (Solórzano, 2019). Beyond grading, AI systems can analyze student performance data to deliver tailored feedback and suggest individualized learning pathways. After an exam, the system could recommend specific resources or topics for review based on areas where

the student demonstrated weakness (Shrivastava & Shrivastava, 2022).

Enhanced security and integrity: These are crucial considerations. To deter academic dishonesty, digital examination platforms can incorporate biometric authentication for student identity verification at the start of the exam. During the examination, machine learning models can continuously monitor student behavior, identifying patterns indicative of cheating, such as unusual typing speeds, eye movements (via webcam monitoring), or attempts to switch applications. These systems can also ensure that students only access permitted software and restrict unauthorized resources, websites, or communication channels (Stang *et al.*, 2024). Moreover, secure data storage and encrypted transmission of exam data significantly reduce the risk of data breaches, thereby ensuring the integrity of the results.

Streamlined Administration and Data Analysis: Digital examinations offer superior efficiency and data analysis capabilities. The platforms facilitate faster score reporting, enabling educators to quickly identify learning gaps and implement timely interventions. Comprehensive data analysis allows for detailed insights into student performance, question effectiveness, and overall curriculum alignment. Educators can easily generate reports highlighting frequently missed questions, indicating areas where instructional adjustments may be necessary (Taherdoost, 2024). The automation of various tasks, from preparing exam scripts and managing sessions to processing and grading responses, substantially enhances efficiency and reduces manual workload, leading to significant time and cost savings for educational institutions.

These examples illustrate how digital examinations, by leveraging technological advancements and artificial intelligence, can transcend the mere digitization of paper tests to deliver a truly transformative and effective assessment experience.

Conclusion

The principal proposition of this study posits that, given the varied environmental conditions, influencing factors, and prevailing needs, the development of an electronic examination solution for public examination frameworks in Africa is imperative. Such an initiative is warranted as digital examinations present a myriad of advantages, including enhanced accessibility and flexibility, as well as increased security and the cultivation of technological competencies. Digital examinations facilitate automated grading, thereby alleviating the burden on educators and minimizing errors. Furthermore, they offer augmented security by mitigating the risk of academic dishonesty and safeguarding exam integrity. By addressing the challenges associated with equitable access, technical reliability, and the prudent integration of artificial intelligence, policymakers and educators can exploit the advantages of digital assessments to improve the efficiency, security, and data analytics proficiencies of high-stakes examinations. This can, in turn, contribute to the realization of Sustainable Development Goal 4 (Quality Education) in the context of Industry 4.0, where digital transformation is progressively altering the global economic and educational landscape. Nevertheless, further scholarly research is necessary to fill existing knowledge gaps and enhance the comprehension of digital examinations within educational frameworks.

Way-forward

To Address these Challenges, a Systematic and Well-Planned Approach is Necessary.

The subsequent recommendations were proposed:

Infrastructure Development and Digital Equity

Prioritizing robust infrastructure is essential for the successful implementation of digital assessments in high-stakes examinations. Policymakers and educational institutions should invest in reliable internet connectivity, adequate hardware, and secure digital platforms. Special attention must be given to bridging the digital divide, particularly in under-resourced and rural areas, to ensure equitable access for all learners

Capacity Building and Professional Development

Effective transition to digital assessments requires ongoing training for educators, administrators, and technical staff. Professional development programs should focus on digital literacy, assessment design, and the ethical use of technology. Building local expertise will empower stakeholders to manage digital platforms, troubleshoot technical challenges, and uphold assessment integrity.

Policy Formulation and Governance

Clear policies and governance structures are needed to guide the adoption and regulation of digital assessments. This includes establishing standards for data privacy, security, and academic integrity, as well as protocols for addressing technical failures and malpractices. Policymakers should collaborate with educational leaders, technology experts, and legal advisors to develop comprehensive frameworks that support sustainable digital assessment practices and also explore strategies to ensure equitable access to technology, such as providing devices or subsidizing internet access for underprivileged students

Leveraging Artificial Intelligence and Emerging Technologies

The integration of AI and advanced analytics can enhance the validity, reliability, and personalization of digital assessments. AI-driven tools enable adaptive testing, automated scoring, and real-time feedback, supporting individualized learning pathways. However, it is crucial to address ethical considerations such as algorithmic bias, transparency, and data security when deploying these technologies in assessment contexts.

Continuous Research, Evaluation, and Stakeholder Engagement

Ongoing research and systematic evaluation are vital for monitoring the effectiveness and impact of digital assessments. Engaging stakeholders—including students, educators, parents, and policymakers—in feedback and decision-making processes ensures that digital assessment systems remain relevant, inclusive, and responsive to evolving educational needs.

Future Research

Despite the progress in the evolution of high-stakes examinations, there are several knowledge gaps that warrant further research. One area of interest is the impact of high-stakes examinations on students' well-being and mental health. Research findings suggest that high-stakes testing may contribute to increased stress, anxiety, and pressure among students, which can have detrimental effects on their overall academic performance and psychological well-being (Stang *et al.*, 2024). Future studies could explore the potential interventions and strategies to mitigate the negative consequences of high-stakes examinations on students' mental health.

Another important research direction is the development of innovative assessment methods that align with the changing needs of the 21st-century workforce. Traditional high-stakes examinations may not fully capture the complex skills and competencies required in today's globalized and technology-driven society (Jerrim *et al.*, 2020). Future research could focus on the design and implementation of performance-based assessments, portfolio evaluations, and authentic tasks that provide a more comprehensive and holistic measure of students' capabilities. Furthermore, the ongoing debate surrounding the equity and fairness of high-stakes examinations warrants further investigation. Research findings indicate that high-stakes testing may exacerbate educational inequities, particularly for marginalized and underrepresented student populations (Solorzano, 2019). Future research could explore alternative assessment models that prioritize diversity, inclusion, and cultural relevance to ensure that high-stakes examinations do not perpetuate systemic biases and discrimination.

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Not Applicable.

Author Contributions

- **Lucy Tambudzai Chamba:** Conceptualization, Methodology, Writing – Original Draft.
- **Namatirai Chikusvura:** Analysis, Writing – Review & Editing.

References

1. Almenara, J. C. (2022). Bibliometric analysis in educational research. *Educational Research Review*, 36, 100-112.
2. Alruwais, N. (2018). An evaluation of the model of acceptance of E-assessment among academics in Saudi universities. *Education Journal,* 7(2), 23. https://doi.org/10.11648/j.edu.20180702.11
3. Al-Worafi, Y. (2022). Computer Assisted learning and Computer Based learning in pharmacy education. *A Guide to Online Pharmacy Education,* 299-304. https://doi.org/10.1201/9781003230458-47
4. Aziz, N. A. (2020). Choosing appropriate retrieval based learning elements among students in Java programming course. *International Journal of Psychosocial Rehabilitation,* 24(5), 5448-5455. https://doi.org/10.37200/ijpr/v24i5/pr2020251
5. Budhai, S. S. (2021). Multimedia platforms for open-ended, peer, and self-assessment. *Leveraging Digital Tools to Assess Student Learning*, 72-98. https://doi.org/10.4324/9780429345517-4
6. Chigori, D. T., Chinyamurindi, W., & Rungani, E. C. (2024). Dynamic innovation model for ambidextrous SMEs: Insights from a Bibliometrics analysis. *South African Journal of Business Management*, 55(1). https://doi.org/10.4102/sajbm.v55i1.4282
7. Cooper, C. (2023). Administering and scoring questionnaires and tests. An Introduction to *Psychometrics and Psychological Assessment*, 61-97. https://doi.org/10.4324/9781003240181-4
8. Cummings, B. (2022). Exploring the role of open book high-stakes examinations in 2021 and beyond. *Canadian Medical Education Journal.* https://doi.org/10.36834/cmej.73897
9. Donthu, N., Kumar, S., Mukherjee, D., Pandey, N., & Lim, W. M. (2021). How to conduct a bibliometric analysis: An overview and guidelines. *Journal of Business Research,* 133, 285-296. https://doi.org/10.1016/j.jbusres.2021.04.070
10. Fonseca, R. B. (2023). The strength of digital transition in higher education as a success factor. Active Learning for Digital Transformation in Healthcare Education, *Training and Research,* 13-24. https://doi.org/10.1016/b978-0-443-15248-1.00015-1
11. Grabia, M.(2015). Assessment of effectiveness of the use of RFID technology in selected processes at DIY retail store. 2015 IEEE International Conference on RFID Technology and Applications (RFID-TA), 12, 134-140. https://doi.org/10.1109/rfid-ta.2015.7379807
12. Guzsvinecz, T., & Szűcs, J. (2021). Using analytics to identify when course materials are accessed relative to online exams during digital education. *Education Sciences,* 11(10), 576. https://doi.org/10.3390/educsci11100576
13. Holmes, W., Bialik, M., & Fadel, C. (2022). Artificial Intelligence in Education: Promises and Implications for Teaching and Learning. Center for Curriculum Redesign.
14. Lehane, P. (2022). Digital Examinations in the 4IR Era. *Journal of Educational Technology,* 18(3), 45-60.
15. Luckin, R., Holmes, W., Griffiths, M., & Forcier, L. B. (2022). Intelligence Unleashed: An Argument for AI in Education. Pearson.
16. Jerrim, J., Shure, D., & Wyness, G. (2020). Driven to succeed? Teenagers' drive, ambition and performance on high-stakes examinations. *SSRN Electronic Journal.* https://doi.org/10.2139/ssrn.3660272
17. Judith Ann Floyd. (2019). Review for "Can the critical appraisal skills programme check-lists (CASP) be used alongside GRADE (Grading of recommendations assessment, development and evaluation) to improve transparency and decision-making?". https://doi.org/10.1111/jan.14303/v1/review1
18. Lehane, P. (2022). Items in technology-based assessments: Examining the use of

multimedia stimuli with post-primary test-takers. Proceedings of the 2022 AERA Annual Meeting. https://doi.org/10.3102/1885003

19. Matthíasdóttir, Á., & Arnalds, H. (2015). Rethinking teaching and assessing in a programming course a case study. Proceedings of the 16th International Conference on Computer Systems and Technologies, 313-318. https://doi.org/10.1145/2812428.2812470
20. Patole, S. (2021). Principles and practice of systematic reviews and meta-analysis. *Springer Nature.*
21. Phillips, M. (2016). Contextualising the use of digital technologies. Digital Technology, Schools and Teachers' Workplace Learning, 1-28. https://doi.org/10.1057/978-1-137-52462-1_1
22. Rodríguez-Abitia, G., & Bribiesca-Correa, G. (2021). Assessing digital transformation in universities. *Future Internet,* 13(2), 52. https://doi.org/10.3390/fi13020052
23. Saeedi, K., & Visvizi, A. (2021). Software development methodologies, HEIs, and the digital economy. *Education Sciences,* 11(2), 73. https://doi.org/10.3390/educsci11020073
24. Shava, G. N., & Nkengbeza, D. (2019). Qualitative research paradigm. *The Namibia CPD Journal for Educators*, 5, 237-258. https://doi.org/10.32642/ncpdje.v5i0.1251
25. Shrivastava, S. R., & Shrivastava, P. S. (2022). Understanding the significance of high stakes and low stakes assessments in medical undergraduate training. *Medical Journal of Babylon*, 19(2), 301-303. https://doi.org/10.4103/mjbl.mjbl_13_22
26. Solórzano, R. W. (2019). High-stakes testing and educational inequality in K-12 schools. *Oxford Research Encyclopedia of Education*. https://doi.org/10.1093/acrefore/9780190264093.013.938
27. Sottilare, R. A., *et al.* (2023). AI in Cheating Detection for Online Assessments. *IEEE Transactions on Learning Technologies*, 16(2), 150-163.
28. Stang, P., Weiss, M., Jaensch, P., & Scholz, S. (2024). Exploring stress and recovery among students: Implications for well-being and academic performance. https://doi.org/10.21203/rs.3.rs-4239872/v1
29. Taherdoost, H. (2024). Digital *transformation roadmap*. https://doi.org/10.1201/9781003471226
30. Terzis, V., & Economides, A. A. (2011). The acceptance and use of computer based assessment. *Computers & Education*, 56(4), 1032-1044. https://doi.org/10.1016/j.compedu.2010.11.017
31. UNESCO. (2023). SDG4: Quality Education. United Nations Educational, *Scientific and Cultural Organization.*
32. Zawacki-Richter, O., Marín, V. I., Bond, M., & Gouverneur, F. (2019). Systematic review of research on artificial intelligence applications in higher education. *International Journal of Educational Technology in Higher Education,* 16(1), 39.