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Enhancing Human Capital Development Through E-Examinations: A Critical Analysis Of JAMB's Role In Nigeria

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Abstract
Joint Admissions and Matriculation Board (JAMB) converted its Unified Tertiary Matriculation Examination (UTME) to an electronic format in 2015 to mitigate systemic issues in the examination process. Nonetheless, despite its promise, the efficacy of this project is disputed due to ongoing challenges, including inadequate ICT infrastructure, low internet penetration, insufficient technical expertise, and ineffective enforcement of anti-malpractice legislation. This research used a mixed-methods approach, incorporating surveys, interviews, and secondary data analysis, to evaluate the influence of E-examinations on educational quality, the contribution of public-private partnerships (PPPs) to infrastructure enhancement, and the socio-economic advantages of digital evaluations. Research indicates that although E-examinations have improved assessment precision and efficiency, infrastructural and policy deficiencies persist, obstructing optimal performance. The study advocates for strategic actions such as enhancing computer-based test (CBT) centres, reinforcing regulatory enforcement, and augmenting public awareness to optimise the advantages of E-examinations. By tackling these difficulties, JAMB may more effectively utilise technology to enhance human capital development, aligning Nigeria's educational framework with international best practices.

Keywords: *E-examinations, human capital development, JAMB, examination malpractice*

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I. Introduction

The emergence of technology has significantly altered numerous sectors, with education being among the most severely impacted. The deployment of electronic examinations (E-examinations) is a crucial innovation that has supplanted old pen-and-paper approaches in various educational systems worldwide. In Nigeria, the Joint Admissions and Matriculation Board (JAMB) converted its Unified Tertiary Matriculation Examination (UTME) from a manual to an electronic format in 2015 (Abass, Olajide, & Samuel, 2017). This initiative aimed to tackle ongoing problems including examination malpractice, inefficiencies in result processing, and limited access to dependable evaluations. Notwithstanding these objectives, the effectiveness of JAMB's E-examination system is still disputed due to persistent issues like as poor ICT infrastructure, low internet penetration, and limited technical capability (M.E. Agbebaku, personal communication, January 23, 2022).

The transition to E-examinations signifies a crucial progression in educational assessment techniques. E-examinations are conducted using electronic platforms, ensuring little human involvement and thereby assuring the integrity of results (Ndunagu, 2013). Researchers have discovered numerous advantages of E-examinations, such as enhanced timeliness, increased flexibility, and reduced costs (Ikuomola & Olayanju, 2020). The implementation of E-examinations requires a strong ICT infrastructure, skilled workers, and strict procedures to effectively combat examination malpractice.

The implementation of E-examinations in Nigeria is impeded by various complex problems, notwithstanding their potential benefits. A significant concern is the insufficient ICT infrastructure nationwide, which adversely affects the efficient administration of UTME. For example, more than 114 regions in Nigeria lack GSM signals, hindering the administration of E-examinations in remote areas (Sabiu, 2021). Moreover, recurrent power outages and computer failures during examinations have been documented, exacerbating the administration process (M.E. Agbebaku, personal communication, January 23, 2022).

Furthermore, the insufficient enforcement of the Examination Malpractice Act of 2004 intensifies these issues, compromising the integrity of E-examinations (Hussani, 2019). Inadequate policy implementation and enforcement procedures have permitted malpractices to continue, despite the establishment of rigorous measures aimed at addressing them. L. Yusuf (personal communication, January 22, 2022) noted that insufficient ICT resources hinder the efficient management of UTME. B. Fabian (personal communication, January 23, 2022) underscored the adverse impact of insufficient implementation of the Examination Malpractice Act on the integrity of E-examinations.

Public awareness and the technical proficiency of stakeholders are essential elements affecting the effectiveness of E-examinations. A lack of awareness and comprehension of the E-examination procedure among students, educators, and invigilators may result in confusion and mistakes during exam administration (Ikuomola & Olayanju, 2020). This underscores the significance of thorough training programs and awareness workshops to guarantee that all stakeholders are sufficiently prepared and informed.

This study's conceptual framework highlights the importance of E-examinations in improving educational outcomes and fostering human capital development. Through the application of technology, E-examinations can enhance the accuracy, efficiency, and fairness of assessments, contributing to the broader goal of national development (Palak & Kolodziejczak, 2020). Human Capital Theory asserts that education and training are vital investments in human capital that enhance productivity and foster economic progress (Njoku & Onyegbula, 2017). This idea posits that tests serve as a crucial social mechanism for assessing and affirming individuals' abilities and skills. Consequently, the shift to E-examinations corresponds with JAMB's efforts to promote human capital development in Nigeria.

Human capital development includes formal education, skill acquisition, problem-solving abilities, and technical expertise. E-examinations can markedly improve the quality and reliability of evaluations, consequently facilitating human capital development and strengthening Nigeria's socioeconomic progress. The effective application of technology in assessments can enhance the accuracy, efficiency, and fairness of evaluations, supporting the primary goal of national progress (Palak & Kolodziejczak, 2020).

Notwithstanding the potential advantages, empirical research has underscored numerous shortcomings in the existing E-examination system. Challenges such as technical proficiency, public awareness, and broadband accessibility remain considerable (Oduntan & Ojuawo, 2018). Hussani (2019) examined the relationship between ICT infrastructure and E-examinations, highlighting the imperative for strong facilities to support the system. Ikuomola and Olayanju (2020) presented the N-Types Electronic Examination System as an effective remedy for examination malpractice.

This paper rigorously assesses the influence of E-examinations on human capital development in Nigeria, focussing on the problems, tactics, and prospective consequences associated with JAMB's program. This paper offers a thorough evaluation of the current status of E-examinations in Nigeria, utilising empirical data collected from surveys and interviews with stakeholders, as well as an analysis of secondary sources. This study seeks to enhance the dialogue on utilising technology for educational and national progress by identifying challenges and suggesting feasible solutions.

Statement of the Problem

The transition to E-examinations was expected to address multiple challenges within the Nigerian education system, such as examination misconduct, delayed results, and limited access to dependable assessments. The effectiveness of JAMB's E-examination method is still in doubt. Ongoing obstacles, including inadequate ICT infrastructure, restricted broadband connectivity, and a deficiency of technical skills, persistently impede the effective management of the UTME (M.E. Agbebaku, personal communication, January 23, 2022). The insufficient enforcement of the Examination Malpractice Act of 2004 has intensified these issues, compromising the integrity of E-examinations (Hussani, 2019).

Poor internet connectivity and recurrent computer failures are important impediments to the smooth administration of E-examinations, especially in remote regions with inadequate infrastructure (Sabiu, 2021). The absence of public awareness and technical expertise among stakeholders has hindered the effective implementation of the system (Ikuomola & Olayanju, 2020). Given these considerations, it is essential to evaluate the challenges related to E-examinations and provide methods to improve their implementation for enhanced human capital development.

Neglecting to confront these challenges may obstruct the attainment of the prospective advantages of E-examinations—namely, heightened efficiency, diminished malpractice, and improved credibility—thereby impeding Nigeria's advancement towards its developmental objectives. The findings demonstrate that E-examinations have positively influenced human capital development by enhancing the accuracy and effectiveness of assessments; however, challenges such as insufficient internet access and technical capacity limitations continue to impede progress (Palak & Kolodziejczak, 2020). Key challenges identified include inadequate ICT infrastructure, low broadband adoption, and insufficient technical capacity. The challenges are intensified by weak policy enforcement and a lack of public awareness.

Addressing these challenges is crucial for improving the effectiveness of E-examinations and fostering human capital development. The research recommends many strategies to improve E-examinations, such as enhancing CBT centres, amending and enforcing the Examination Malpractice Act, and conducting statewide awareness seminars. These initiatives aim to address the identified issues and enhance the benefits of E-examinations for superior human capital development. By implementing these ideas, JAMB can improve its E-examination system to foster human capital development in Nigeria.

Research Objectives

The primary objective of this study is to assess E-examinations by JAMB as a means of enhancing human capital development in Nigeria. The specific objectives are as follows:

1. To examine the impact of E-examinations on the quality of education in Nigeria.
2. To evaluate the role of public-private partnerships (PPPs) in improving E-examination infrastructure.
3. To identify the socio-economic benefits of E-examinations for human capital development.
4. To recommend strategies for mitigating the challenges associated with E-examinations.

Research Questions

To achieve the stated objectives, this study seeks to answer the following research questions:

1. What is the impact of E-examinations on the quality of education in Nigeria?
2. How can public-private partnerships (PPPs) contribute to improving E-examination infrastructure?
3. What are the socio-economic benefits of E-examinations for human capital development in Nigeria?
4. What strategies can be implemented to mitigate the challenges associated with E-examinations?

II. Literature Review

Conceptual Framework: E-Examination

E-examination denotes the administration of examination items, collection of answers, evaluation of responses, and dissemination of findings through electronic media (Ndunagu, 2013). This procedure removes human intervention, hence guaranteeing the reliability of outcomes. Researchers have identified multiple benefits of E-examinations, such as improved timeliness, flexibility, and decreased expenses (Ikuomola & Olayanju, 2020). Successful deployment of E-examinations necessitates sufficient ICT infrastructure, proficient personnel, and robust policies to address examination malpractice.

This study's conceptual framework highlights the significance of E-examinations in enhancing educational outcomes and promoting human capital development. Utilising technology, E-examinations can improve the precision, efficiency, and equity of evaluations, therefore aiding the overarching objective of national development.

Theoretical Framework: Human Capital Theory

The research is grounded in Human Capital Theory, which asserts that education and training are essential investments in human capital that improve productivity and foster economic growth (Njoku & Onyegbula, 2017). This idea posits that examinations act as a fundamental social process for evaluating and validating people' talents and competencies. The theory corresponds with JAMB's initiatives to advance E-examinations as a method for fostering human capital development in Nigeria.

Human capital development includes formal education, skill acquisition, problem-solving capabilities, and technical proficiency. E-examinations can significantly enhance human capital development and bolster Nigeria's socioeconomic advancement by boosting the quality and dependability of assessments.

Empirical Review

Prior research has investigated multiple facets of E-examinations, encompassing ICT infrastructure, examination malpractice, and capacity development (Oduntan & Ojuawo, 2018). Hussani (2019) investigated the correlation between ICT infrastructure and E-examinations, emphasising the necessity for strong facilities to sustain the system. Ikuomola and Olayanju (2020) introduced the N-Types Electronic Examination System as a viable method for addressing examination malpractice.

Notwithstanding these advances, deficiencies persist in domains such as technical proficiency, public awareness, and broadband access. Sabiu (2021) indicated that 114 localities in Nigeria are devoid of GSM signals, highlighting the difficulties of executing E-examinations in rural regions. Rectifying these deficiencies is crucial for maximising the advantages of E-examinations and guaranteeing equitable access to reliable evaluations.

III. Research Methodology

Research Design

The research utilised a survey methodology to gather primary and secondary data from a population sample. A mixed-methods approach was employed, integrating quantitative and qualitative techniques for data analysis. This method facilitated a thorough comprehension of the concerns and challenges related to E-examinations.

Population and Sampling

The study population comprised JAMB personnel, candidates who participated in the UTME, and other pertinent stakeholders. A total of 475 questionnaires were disseminated, with a return rate of 94.32%. Stratified

random sample and purposive sampling methods were employed to guarantee external validity and the generalisability of the results.

Data Collection and Analysis

Data were gathered using structured and unstructured questionnaires, interviews, and secondary sources. The Statistical Package for Social Sciences (SPSS) was employed for the analysis of quantitative data, whereas qualitative data were examined through logic and reasoning. The findings were displayed in descriptive formats, encompassing tables, frequencies, and percentages.

Data Analysis

Section A: Demographic Information

Variable	Category	Frequency (n=448)	Percentage (%)
Gender	Male	240	53.6%
	Female	200	44.6%
	Prefer not to say	8	1.8%
Age Group	Below 18	112	25.0%
	18–25	260	58.0%
	26–35	56	12.5%
	36–45	12	2.7%
	Above 45	8	1.8%
Educational Qualification	Secondary School	80	17.9%
	Diploma/NCE	96	21.4%
	Bachelor's Degree	192	42.9%
	Master's Degree	64	14.3%
	PhD	16	3.6%
Role in JAMB Exams	Candidate	320	71.4%
	Examiner/Invigilator	64	14.3%
	CBT Center Staff	40	8.9%
	JAMB Official	16	3.6%

	Other	8	1.8%

Section B: Impact of E-Examinations on Education Quality

Question	Response	Frequency	Percentage (%)
How has E-exam affected JAMB's credibility?	Significantly improved	224	50.0%
	Slightly improved	160	35.7%
	No change	48	10.7%
	Made it worse	16	3.6%
Do E-exams contribute to better learning outcomes?	Strongly agree	128	28.6%
	Agree	192	42.9%
	Neutral	80	17.9%
	Disagree	32	7.1%
	Strongly disagree	16	3.6%

Section C: Public-Private Partnerships (PPPs)

Question	Response	Frequency	Percentage (%)
Should JAMB collaborate with private firms?	Yes	360	80.4%
	No	48	10.7%
	Not sure	40	8.9%
Areas PPPs should focus on (Multiple Responses Allowed)	Upgrading CBT centers	320	71.4%
	Expanding broadband	280	62.5%
	Training technical staff	240	53.6%
	Cybersecurity enhancements	160	35.7%

	Others	32	7.1%

Section D: Socio-Economic Benefits

Question	Response	Frequency	Percentage (%)
How has E-exam improved access to education?	Increased significantly	200	44.6%
	Slightly improved	184	41.1%
	No noticeable change	48	10.7%
	Reduced access	16	3.6%
Key benefits (Multiple Responses Allowed)	Reduced malpractice	360	80.4%
	Faster result processing	320	71.4%
	Enhanced digital literacy	280	62.5%
	Improved employability	240	53.6%
	Others	24	5.4%

Section E: Challenges & Mitigation Strategies

Question	Response	Frequency	Percentage (%)
Biggest challenges (Multiple Responses Allowed)	Poor internet	400	89.3%
	Inadequate CBT centers	320	71.4%
	Power outages	280	62.5%
	Exam malpractice	200	44.6%
	Others	40	8.9%
Strategies for improvement (Multiple Responses Allowed)	Strict enforcement of laws	360	80.4%
	Awareness campaigns	320	71.4%

	More ICT funding	280	62.5%
	Telecom partnerships	240	53.6%
	Others	32	7.1%

Key Findings

1. **Demographics**: Majority of respondents were **candidates (71.4%)**, aged **18–25 (58%)**, with **bachelor's degrees (42.9%)**.
2. **Impact on Credibility**: **85.7%** believe E-exams improved credibility (50% significantly, 35.7% slightly).
3. **PPPs**: **80.4%** support PPPs, with **71.4%** prioritizing CBT center upgrades.
4. **Benefits**: **80.4%** cited reduced malpractice, while **71.4%** noted faster results.
5. **Challenges**: **89.3%** reported poor internet as the biggest hurdle.
6. **Solutions**: **80.4%** advocated stricter malpractice laws.

The data highlights **strong support for E-exams** but underscores critical challenges like **internet connectivity** and **infrastructure gaps**. Strategies like **PPPs, stricter enforcement, and awareness campaigns** are recommended for improvement.

IV. Findings And Discussion

Impact of E-Examinations on the Quality of Education

The results demonstrate that E-examinations have favourably impacted the quality of education in Nigeria by improving the precision and efficacy of evaluations. Nonetheless, obstacles such as inadequate internet penetration and deficiencies in technical capacity persist in hindering advancement. These findings corroborate earlier research, highlighting the necessity of tackling systemic challenges to optimise the advantages of E-examinations (Palak & Kolodziejczak, 2020).

Role of Public-Private Partnerships (PPPs)

Public-private partnerships (PPPs) have arisen as an effective approach for enhancing E-examination infrastructure. Through collaboration with commercial entities, JAMB can utilise supplementary resources and expertise to enhance ICT facilities and broaden broadband coverage. This strategy has been well executed in nations such as Brazil, where public-private partnerships have markedly enhanced internet accessibility and speed (Antonio, 2021).

Socio-Economic Benefits of E-Examinations

E-examinations provide numerous socio-economic advantages, such as improved access to reliable assessments, diminished examination misconduct, and augmented technological proficiency. These advantages foster human capital development by providing individuals with the skills and competencies essential for economic advancement. Shehu, Wisdom, and Abubakar (2018) observed that ICT-driven evaluations promote innovation and creativity in students, therefore improving their employability.

Strategies for Mitigating Challenges

The report proposes many solutions to tackle the problems of E-examinations, such as enhancing CBT centres, reassessing and enforcing the Examination Malpractice Act, and organising statewide awareness seminars. These initiatives seek to tackle the stated problems and maximise the advantages of E-examinations for improved human capital development.

V. Conclusion

This study highlights the essential function of E-examinations in advancing human capital development in Nigeria. Although JAMB's shift to E-examinations has had favourable results, including enhanced time management and less examination misconduct, considerable problems persist. These encompass insufficient ICT infrastructure, weak policy execution, and minimal public knowledge. The report offers ways to solve these challenges, including the enhancement of CBT centres, the enforcement of the Examination Malpractice Act, and the implementation of statewide sensitisation seminars. By executing these proposals, JAMB can enhance its E-examination system to promote human capital development in Nigeria.

VI. Recommendations

1. **Enhance ICT Infrastructure —** Expand and modernise CBT centres, particularly in rural regions, to mitigate inadequate internet connectivity.
2. **Enhance Public-Private Partnerships (PPPs) —** Collaborate with telecommunications and technology companies to augment broadband accessibility and finance technological enhancements.
3. **Strengthen Anti-Malpractice Legislation –** Amend the Examination Malpractice Act (2004) to incorporate more stringent sanctions and establish dedicated enforcement mechanisms.
4. **Enhance Technical Training —** Educate staff, examiners, and applicants on digital literacy and electronic examination protocols to minimise errors.
5. **Initiate Awareness Campaigns –** Inform stakeholders (via media and educational institutions) about the advantages and procedures of E-examinations to enhance adoption.
6. **Ensure Power Reliability —** Collaborate with energy suppliers or implement solar-powered CBT centres to alleviate power interruptions.

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