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Beyond Forgeries: Advancing UTME Security Measures for Transparency and Reliability in Nigeria

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About Article

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ABSTRACT

The research critically examines the current security features of the Unified Tertiary Matriculation Examination (UTME) results in Nigeria, highlighting their vulnerabilities and proposing pragmatic solutions to enhance result authentication. The study emphasizes the importance of robust security measures in maintaining the integrity of the examination system, especially in the face of increasing attempts at result manipulation and forgery. While acknowledging the existing security features, including the candidate's photo, watermark, and QR code, the research reveals significant weaknesses, such as the absence of advanced security elements and the limited functionality of the QR code verification system. To address these challenges, the study advocates for a comprehensive approach, recommending measures such as exclusive issuance of result slips by the Joint Admission and Matriculation Board (JAMB), real-time third-party authentication systems, and accessible lists of top scorers. The proposed solutions aim to streamline the verification process, boost public trust in JAMB's operations, and generate additional revenue for the examination board. The research underscores the necessity of continuous improvement and adaptation in security measures to ensure the credibility and reliability of UTME results.

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1. INTRODUCTION

Quality education is the bedrock of sustainable development in any society. This entails quality tutorship, mentoring and monitoring of students' academic well-being as they progress through the ranks of learning. In Nigeria, the quality of education is assured by both a series of internal and external examinations conducted for appropriate levels of students (Anzene, 2014). Internal examinations are usually conducted by particular schools for their students (Onuoha, et al, 2013) and graded thrice (3 times) a session for secondary, primary and nursery schools while tertiary institutions conduct theirs twice a session.

External examinations are organized by the Educational Resource Centers (ERC) for state entrance examinations and the National Examination Council (NECO) for national entrance examinations into Junior and Senior Secondary Schools. Upon graduating from Senior Secondary School, students are expected to earn at least five (5) credits in any five (5) subjects including Mathematics and English Language in one (1) or two (2) sittings in the examination conducted by one (1) or two (2) of the following examination bodies: the West African Examination Council (WAEC), NECO or National Business and Technical Education Board (NABTEB) (Obioma & Salau, 2007). In order to gain entrance into any tertiary institution in Nigeria, it is required that prospective students apply to any four (4) institutions of choice through the Joint Admission and Matriculation Board (JAMB). This body, JAMB, is responsible for conducting an entrance examination known as the Unified Tertiary Matriculation Examination (UTME) for applicants into tertiary institutions yearly (Danladi & Dodo, 2019). This examination body according to Umar and Ikechukwu (2022) is among the key players in the Nigerian educational sector. Over the years and in current times, these examination bodies have had to combat malpractices encountered before, during and after examinations. These malpractices aim to aid students who are either academically weak or lazy by either inflating scores, using foreign materials during examinations, impersonating or being aided by some unscrupulous individuals among the invigilating team (Anzene, 2014).

In this research, an investigation is carried out into the post-exam malpractices encountered by JAMB recently relating to one Miss Mmesoma Ejikeme and the inflation of her UTME result (BBC, 2023) with respect to the effectiveness of the security features in the current UTME result printout put in place by JAMB to ensure UTME result integrity. Thus, the questions are: are the current security features sufficient to curb subsequent result forgery cases? How functional is the Quick Response (QR) code UTME verification feature? What improvements to the current security features can be made to ensure the authentication of printouts by third-party bodies?

2. LITERATURE REVIEW

According to Onuoha et al. (2013) public (external) examinations in Nigeria have become a source of worry for the educationist and government alike. This they claim stems from the manner these examinations are handled by unpatriotic students, parents, examination body monitors, supervisors, school administrators and teachers who aid and abet examination malpractices for one

favour or another at the expense of educational standards and the quality of graduates produced. Adewale (2004) points out that examination malpractices would continue to gain grounds until the current emphasis on paper qualification is channeled to skills acquired by students to function well in society. According to him, examination malpractice can be categorized as pre-examination, examination and post-examination based on the notion of the time the act took place (Adewale, 2004). Post-examination malpractice may involve swapping of answer scripts, inflation of examination scores or illegally issuing certificates or statements of results to aid candidates in gaining admission into tertiary institutions or gaining an appointment (Adewale, 2004).

In order to curb most of these vices Danladi and Dodo (2019) reported that JAMB in 2013 introduced an online form of examination known as Computer Based Test (CBT). This CBT was expected to boost efficiency in the administration of examinations, and the scoring of tests, reduction in logistics and related costs, improve the security of examinations and the processes involved and ultimately lead to improved quality of education. The integrity of examination managers, that is, private owners of CBT centres, however, is a thing to worry about as experiences from how private schools conduct Senior Secondary Certificate Examinations (SSCE) show that there is a likelihood of system abuse if proper precautionary measures are not put in place by JAMB and the government (Danladi & Dodo, 2019). In July of 2023, JAMB through her X (erstwhile known as Twitter) page refutes claims by an alleged 2023 UTME highest scorer Ms Ejikeme Joy Mmsoma (JAMB, 2023) during an interview granted by Channels Television on the 'Sunrise Daily' programme (Channels, 2023).

Ms Ejikeme Joy Mmsoma had claimed a score of 362 out of 400 to become the highest scorer in the 2023 UTME examination thus attracting recognition and a 3 million naira scholarship from Chief (Dr.) Innocent Chukwuma (Vanguard, 2023). On the contrary, as gathered from Channels (2023) JAMB holds that the claims were false and fraudulent on the grounds that Ms Ejikeme Joy Mmsoma's real score was 249 and the result printout she paraded was a JAMB results notification last used or issued in 2021 which was found to be easy to mutilate using graphic software tools. This, however, has no impact on the integrity of the scores on JAMB's database. Moreover, an independent investigation panel set up by the Anambra state government (where the candidate resides) on this issue revealed that the paraded score of 362 was false (Obianeri, 2023).

Similar cases have occurred and even lawsuits have been charged JAMB for results irregularities in the past which all turned out to be false and JAMB vindicated (Suleiman, 2023). Notwithstanding, BBC (BBC, 2023) reported that JAMB noted the characteristic features of an authentic UTME result as obtainable from 2022 to 2023. Among these features are the photo of the candidate, a watermark composed of the candidate's JAMB registration number and a QR code containing the aggregate score and the name of the candidate. In the interest of any member of the general public that may wish to honour high-scoring UTME candidates JAMB urged such to make a formal request for the list of the eligible candidates to avoid being defrauded (Channels, 2023). Onyolu (2023) replying to



JAMB on their X page noted that the QR code that was meant to display the candidate's name and aggregate score appears unreadable when scanned with a QR code scanner.

3. METHODOLOGY

This research employs a comprehensive methodology that integrates data from diverse sources, including academic literature sourced from Google Scholar, official JAMB communications extracted from their tweets and reply tweets, as well as information gathered from reputable newspapers. Additionally, the study incorporates the analysis of JAMB UTME result printouts spanning the period from 2022 to 2023. The methodology combines document analysis, social media content analysis, and examination of real-world sample documents to provide a nuanced and multifaceted assessment of the subject matter. Throughout the research process, strict adherence to ethical standards and rigorous data verification have been maintained to ensure the credibility and validity of the findings.

4. RESULT AND DISCUSSION

4.1. Current Security Features

As gathered from the reviewed literature and sample UTME results obtained the security features of UTME results from 2022 to 2023 are listed below:

4.1.1. Candidate's Photo: This photo is located at the top right-hand side of the result sheet just below the header of the document. It features the image of the candidate and a watermark of an inscription in the format "UTME 2023". Where 2023 represents the year, the candidate sat for that exam.

4.1.2. Horizontal Divider Lines: The document is divided into four (4) significant sections by three (3) horizontal lines with the middle line of a thickness of about 2px and the other two (2) of about 4px.

4.1.3. Document Sections: The sample documents appear to have four (4) sections divided by three (3) horizontal lines as described above. These begin with the header that contains the JAMB logo in the top-left-hand corner, a title carrying its full name, followed by the headquarters address in smaller fonts, then the title "Unified Tertiary Matriculation Examination (UTME 2023)" (2023 being the year of examination) immediately followed by the title "Result Slip" and the date the result was printed at the bottom right-hand corner.

The next section contains the candidate's biodata, photo, registration number (which ends with two (2) letters in uppercase), examination number (which begins with an uppercase letter trailed by numbers much shorter in length than the registration number), and the breakdown of the candidate's score in each subject taken. The third section contains the candidate's choice of institutions and courses, the address of the examination centre and a reference number at the bottom right-hand corner. The last section is more like a footer with some instructions, a QR code and text in the bottom right-hand corner that reads "REGISTRAR".

4.1.4. Watermark: The document contains a watermark composed of the candidate's registration number printed in grey colour. This watermark starts just after the header section

clipped off just before the footer section and is orderly rendered in six (6) to seven (7) columns.

4.1.5. QR Code: A QR code containing the name and aggregate score of the candidate is printed centralized at the bottom of the document.

4.1.6. Paper Orientation: The document is printed on an A4-sized paper in portrait paper orientation.

4.1.7. Printing Instruction: The instruction "To be Printed with Colour Printer" is inscribed at the left-hand margin of the document in a bottom-to-top orientation starting from just below the middle divider line up to the result breakdown section.

4.2. Challenges and Vulnerabilities

In order to assess the challenges and vulnerabilities of the current security features it is necessary to do so in consonance with the research questions asked at the beginning of this review.

4.2.1. Are the Current Security Features Sufficient to Curb Subsequent Result Forgery Cases?

The security features though laudable have weaknesses as stated below:

a) Results are printable by candidates and not issued directly and physically by JAMB.

b) Lack of holograms, paper watermarks or fluorescent security fibres.

The use of paper watermarks, holograms and fluorescent fibres as found on paper currencies is an effective way of securing important documents such as currencies, tickets, certificates, contracts and so on as long as the printing of the document in question is not in the hands of the recipients but in the hands of the issuing authorities. The UTME result slip, however, is printed by the candidate giving room for possible mutilation or fraudulent customization of the results.

4.2.2. How Functional is the QR Code UTME Verification Feature?

The Quick Response (QR) code is a type of two (2) dimensional matrix barcode system used in storing and transmitting huge amounts of textual data. It is meant to be read using a QR code scanner to reveal the content therein which could be some texts or a web address to some item online.

The current implementation of the UTME results is said to only carry the candidate's name and aggregate score. This in itself can be easily generated by fraudulent candidates as seen in Figure 1. Moreover, from the inspection of the QR codes on all the samples obtained none was found to be humanly readable after scanning.

The outputs of the scans looked like a string of cypher texts that are yet to be decrypted for human consumption. For instance, the output of scanning Figure 2a as found in Figure 3 looks nothing close to the name and aggregate score of the candidate.

4.2.3. What Improvements to the Current Security Features Can be Made to Ensure the Authentication of Printouts by Third-party Bodies?

Improving the current security features of the UTME results may require adopting any of the following:

a) Making JAMB the Only Source of Physical UTME Result Slip



Name	Ejikeme Joy Mmesoma
UTME SUBJECTS	SCORES
Use of English	90
Physics	80
Biology	95
Chemistry	91
AGGREGATE	356
Ejikeme Joy Mmesoma :: Aggregate 356	



Figure 1. An Illustration of Fake QR Content Made to Match Fake UTME Result



(a) QR Code UTME 2023



(b) QR Code UTME 2023



(c) QR Code UTME 2022



(d) QR Code UTME 2022

Figure 2. QR Code Samples from 2022 and 2023 UTME Results

The first weakness in the security features of the UTME results is that candidates now have the right and ability to print original copies of the UTME results online. This alone makes it impossible to embed state-of-the-art paper watermarks, fluorescent security fibres or holograms in the document which can make it hard and expensive to forge hence, ensuring the security of the document.

b) Real-Time Third-party Authentication and Verification of Any UTME Result

As has been analysed previously, QR code contents that match the candidate's name and aggregate score alone are not enough evidence or proof of the validity or authenticity of a UTME

c8Yz4zIHWcAdoTDsJqHtDcLEQzO96qiINT3cj+La+CsGxlt1M2khuISejN9XVXQj
mmb/UJnIDCWivlunlYtCGWiud1gvJt+1ga6OUxD5wTRlhYhP7AVn1ncvYYV1yaV
FFLplb0NyHq9NdaDlcJ/gBb2k5Zy9ylt6ztSn8n8pFE6uqFHXQt559dYiPzGhcMSe
zQ3mZe/p6GjJf7OJbZMhnb690skSXhHzhq8VvO39qc=

Figure 3. Output of Scanning the QR Code on Figure 2a

result. This is because the content of the QR code can be easily generated to reflect values that match the mutilated result as seen in Figure 1 above.

However, an online reference can be composed into the QR code to give a real-time authentication and verification of the result via a web link, USSD or SMS interface.

A web link to a verification endpoint on JAMB's portal can be composed using the following scheme:

https://caps.jamb.org.ng/verify-result?reg_number=202330639047FF&year=2023

The problem with this solution is that anyone can raise a request to this endpoint at almost no cost to the accessor of the result and this can overwhelm server resources. As a fix, some access tokens can be requested at a fee on the portal.

Alternatively, a USSD scheme (Figure 4) can be employed to verify UTME results by third parties when they scan the QR code. In this scheme, the QR code contains a USSD shortcode string in the format presented below:

To verify this UTME result using USSD dial:

*66019*1*2023306390470606*2023# or
*55019*1*2023306390470606*2023#

The above shortcode strings consist of the JAMB UTME shortcodes **66019** or **55019** followed by a number, say 1, representing the result checker service, then the candidate's registration number, **202330639047FF** for instance. Since every JAMB registration number ends with two (2) letters that cannot be typed on a phone's number keyboard, a conversion scheme is proposed to convert these letters into their number equivalents. For this purpose, each letter is represented by a two (2) digit number where A is represented by 01, B by 02 and Z by 26 see Table 1. In this case, F would become 06. Hence, the value 202330639047FF becomes 202330639047**0606**. The registration number is followed by the year of interest (when the exam was written).

When such QR codes are scanned by third parties, they reveal the shortcode strings they are required to dial on their phones to verify the authenticity of the results. As the request reaches the JAMB server, the USSD parameters are parsed retrieving the registration number and year of examination and consequently converting the registration number back to the original JAMB format using Table 1. The phone number raising this request is billed from their airtime credit balance, the registration number is verified and if validated result is returned to the requesting phone number as SMS in the following format:

Reg. No: 202330639047FF

Year: 2023

Name: Ejikeme Joy Mmesoma

Phone: +23480XXXXXXX

Aggregate: 249



Table 1. Proposed USSD Letter to Number Conversion Table

LETTER	VALUE	LETTER	VALUE	LETTER	VALUE	LETTER	VALUE
A	01	I	09	Q	17	Y	25
B	02	J	10	R	18	Z	26
C	03	K	11	S	19		
D	04	L	12	T	20		
E	05	M	13	U	21		
F	06	N	14	V	22		
G	07	O	15	W	23		
H	08	P	16	X	24		

Eng: 64, Phy:54, Bio: 74, Che: 57

For the avoidance of doubt and possible contentions, the response SMS is proposed to contain the candidate's registration number, year of examination, name, phone number, aggregate score, and breakdown of scores in each subject taken. The advantage of the USSD scheme is that server requests from anonymous users can be throttled by charging an access fee to the phone number that raised the request.

Similarly, an SMS implementation can be adopted to complement the USSD scheme. The QR code string can be formatted to read:

To verify this result via SMS send:
UTME Result 202330639047FF 2023
to:
66019 or 55019

Billing of the requesting phone number, verification of the registration number and response format remain the same as described for the USSD scheme. It is also possible to implement all three (3) options detailed above. In this case, the QR code would consist of a string that provides these three (3) alternatives in the following format:

To verify this UTME result you can visit:
<https://caps.jamb.org.ng/verify-result?registration-number=202330639047FF&year=2023>
or dial the following USSD code:
*66019*1*2023306390470606*2023# or
*55019*1*2023306390470606*2023# or send as SMS:
UTME Result 202330639047FF 2023
to:
66019 or 55019

c) Real-Time Third-party Accessibility to List of Top Scorers
Members of the public who are keen to reward top performers in the UTME examinations can easily obtain a verified list of associated candidates from JAMB using similar schemes (web link to an endpoint, USSD or SMS interface) proposed above

with little tweaks.

A top scorers' list endpoint can be accessed by passing the choice examination year and the number of the first top scorers using a URL scheme in the format below:

<https://caps.jamb.org.ng/utme-top-scorers?first=10&year=2023>

Also, a USSD scheme containing the number of first top scorers and the year of choice in the format shown below can be adopted:

*66019*2*10*2023# or
*55019*2*10*2023#

The first part of the USSD scheme above is **66019** or **55019** representing the JAMB shortcode for UTME results, the next is 2 representing the top scorers' list service on the portal, followed by 10 representing the number of the first top scorers and then **2023** the year of choice.

An SMS scheme can also be adopted for this same purpose by sending for instance **UTME First 10 2023** to **66019** or **55019**. As in the case of result verification a fee can be charged to throttle access to the server.

4.3. Impact Of Security Measures

The security measures proposed in this research would have the following impacts:

4.3.1. Reduced administrative bottlenecks in third-party verification of JAMB scores.

4.3.2. The additional layer of verification beyond the QR code implies more difficulty in defrauding individuals with mutilated UTME result slips.

4.3.3. Increased public trust in the integrity of JAMB.

4.3.4. An additional source of passive revenue for JAMB.

4.4. Recommendations

The literature reviewed shows that an increased emphasis on paper certification has led to students getting involved in one form of examination malpractice or the other. Also, increasing public emphasis on the list of top scorers in public examinations has led some candidates to mutilate or forge their results to



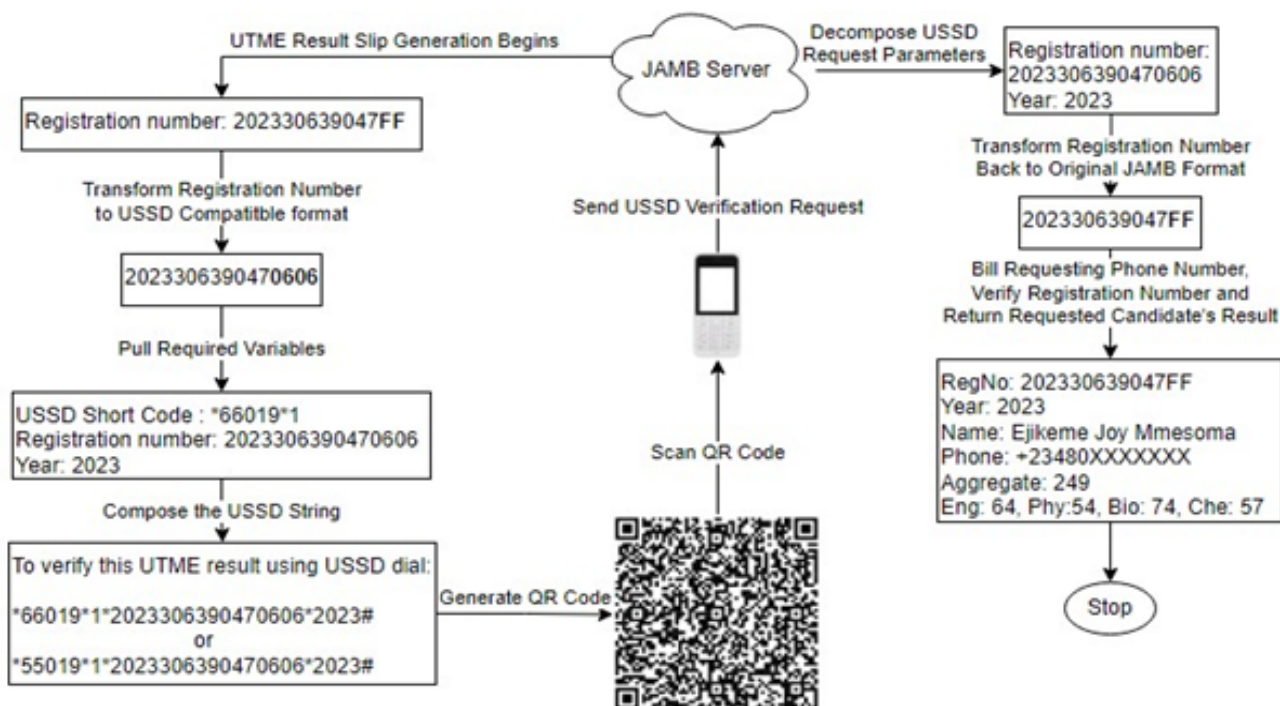


Figure 4: Proposed USSD Scheme for UTME Results Verification

claim a score among the highest scorers. This in itself can raise diverse opinions and feelings among members of the public that can lead to potential tensions. As a recommendation, JAMB could adopt a mix of the various verification options here detailed to enable the public or third-parties verify UTME results and obtain the list of top best scorers.

5. CONCLUSION

Securing UTME results is not a one-off act but a work-in-progress. With candidates and the general public getting to know the various security features on the printed UTME results fraudulent individuals would continue to attempt to compromise them, thus requiring a concerted effort by JAMB to ensure sustained security.

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