

# ITEM BANKING AND TEST ADMINISTRATION: EXAMINING EFFECTIVENESS IN THE UTME AND NABTEB

By

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## **Abstract**

*The importance of item banking to public examinations cannot be over-emphasized giving its contribution to examination security. It potentially allows for the creation and depositing of several calibrated test items which can also be grouped into parallel forms from which tests can be withdrawn and deployed to a group of candidates. The use of item banking became imperative in test administration with the adoption of the Computer Based Test (CBT) as a testing mode in 2013 by the Joint Admissions and Matriculation Board (JAMB). Thus, from the 2013 UTME, the Board began the assembling of a pool of over 1000 test items each of the twenty-three subjects tested in the UTME from which it can withdraw items for use. In a similar fashion, NABTEB, as an examination body uses standardized test in measuring scholastic achievements. The use of item banking has, thus, spanned a number of years in NABTEB. JAMB and NABTEB item banks are repositories of extensive information*

*regarding test development and psychometric characteristics of each item using the fastest software. The purpose of this paper is to highlight the advantages of this technology to test administrations of the Unified Tertiary Matriculation Examination (UTME) and the NABTEB examination. Advantages such as its cost-effectiveness, contribution to examination security and ability to help establish curriculum goals and objectives allows testing bodies to identify the relative difficulty of particular items. The paper concluded by reiterating the need for testing bodies to be more aware of technologies that could help maintain the sanctity of the examinations they conduct. The paper recommended the adoption by testing bodies of a robust item banking system that provides the automation, standardization, and scalability essential to developing and maintaining effective tests for a more efficient test administration in Nigeria and Africa, in general.*

**Keywords: Item Bank, Test, UTME, Technology, Examination Security.**

Public Examination bodies across the globe are faced with the challenge of ensuring that the examinations they conduct are free from errors whether human or systemic. Thus, they proactively come up with workable strategies to confront these challenges headlong. In Nigeria, the Joint Admissions and Matriculation Board (JAMB) and the National Business and Technical Examinations Board (NABTEB) constantly come up with strategies to ensure their examinations are conducted in line with international best practices.

Over the years, assessments have been an integral component of Nigeria's education system particularly in the tertiary education system where the number of aspirants far outweighs the number of available spaces. Whereas in Nigeria, the Joint Admissions and Matriculation Board (JAMB) and the National Business and Technical Examinations Board (NABTEB), Public examination bodies through the conduct of their different examinations, select and place suitably qualified candidates into tertiary institutions by whatever name they are called, the West African Examination Council (WAEC) and National Examination Council (NECO) certify graduates of secondary schools for these tertiary institutions. The UTME is a high-stake examination in Nigeria as over a million candidates scramble for the available spaces in the tertiary institutions. The UTME is a summative assessment that assists the Board to make judgments about candidates' achievements at the point of the end of secondary school education in Nigeria. The test is also used to formally measure

the level of achievement of learning outcomes of these candidates at the secondary school level.

In the same breath, NABTEB as an examination body uses standardized test as a way to measure scholastic achievement. Test with the same frequency are revised to avoid administering the same test year after year. Creating new tests can be a very time consuming endeavour, hence using item banks, NABTEB can escape this process. This presupposes that in order to avoid duplications of test items, a data base system is established by the data processing staff in the Information and Communications Technology Department. Each accepted item is coded properly for filing or identification purposes in the item bank. All items are coded according to subjects and relate to the objectives and theme or topic. The code system permits easy retrieval of items when needed. Though coding system may differ from one subject to another, a code may include the following fields:

**Field I:** A number to denote the subject/area for instance, in General Mathematics can read thus:

- 1.0 Number and Numeration
- 2.0 Algebraic Processes;
- 3.0 Geometry and Mensuration;
- 4.0 Statistics

**Field II:** A roman number denoting a content topic/module in the item/subject area the question deals with in the Syllabus.

**Field III:** A letter denoting the intended thinking/taxonomic level of the item for instance in General Mathematics, can be shown thus:

- A = Knowledge/recall;
- B = Comprehension/Understanding
- C = Application
- D = Higher thinking level

Thus, a typical test item will be coded (I, II, A) to mean a test-item on number and numeration, under topic/module II, testing knowledge.

Item banking therefore, is a very helpful tool in the testing world. It helps test developers to make test-taking easier, faster and more efficient. Phrases like item banks and item pools are used interchangeably in the research literatures. Generally, an item bank is identified as a large collection of good test items for which their quality is analysed and known, and which are systematically stored in a computer so that they can be used to assess students for the purpose of measuring their achievement or ability (Choppin, 1976). The use of item banking technology provides much relief for all hassles associated with assessments. It helps to enhance the quality of items and improve assessments quality. It also helps to guarantee the security of test items because of the reduction in human intervention during processing. The effective use of item bank provides solution to the efforts of preparing new items every time there's need for test administration. Item banking thus, allows test items to be placed on a common scale. The scale indicates relative difficulty of the items. Consequently, new tests with predictable characteristics can be developed by drawing items from the bank.

The importance of item banking to public examinations cannot be over-emphasised giving its contribution to examination security. Item bank potentially allows for the creation and depositing of several calibrated test items which can also be grouped into parallel forms from which tests can be withdrawn and deployed to a group of candidates. This helps to provide a substantial savings of time and energy over conventional test development. The use of item banking became imperative in test administration with the adoption of the Computer-Based-Test (CBT) as a testing mode in 2013 by the Joint Admissions and Matriculation Board (JAMB). Thus, from the 2013 UTME, the Board began the assembling of a pool of over 1000 test items in each of the twenty-three subjects tested in the UTME from which it can withdraw items for use. JAMB's item bank is a repository of test of each item, and extensive information regarding test development and psychometric characteristics of each items. Advantages such as its cost-effectiveness, contribution to examination security and ability to help establish curriculum goals and objectives since calibrated items allow testing bodies to identify the relative difficulty of particular items.

Item bank that has developed test items that are calibrated makes testing more flexible and appropriate. This is so because different groups of candidates can take their tests at different flexible time and results comparisons done on the

same scale. It is impossible to imagine the test administration of the UTME and the NABTEB examinations without item banks. A robust repository of test questions and the components that make up these questions is critical to keeping the UTME and the NABTEB examinations contents secure and fresh. A standard UTME and NABTEB item banking systems provide the Boards and subject specialists some sets of tools to facilitate the writing, review, editing and selection of test questions. Another very important role of item banking to the test administration system of the UTME and the NABTEB examinations is that it provides the automation, standardization, and scalability essential to developing and maintaining effective tests. The Boards use the fastEST software for item banking, authoring and test delivery through the computer.

### **Problem and the Context**

Achieving effective test administration in Nigeria is a herculean task especially as it affects the conduct of high-stake examinations like the UTME and the NABTEB examinations. Breaches of examination security must be tackled headlong by testing bodies to have assessments that are comparable to other assessments in the world. The issue of reliability of an assessment must be taken seriously and one way to do this is establishing robust effective item banking system. Thus, this paper answered pertinent questions such as the questions of impact of the use of item banking in test administration in the conduct of the UTME as well as the NABTEB examinations and ultimately ascertain how it affects the security of assessment.

### **Purpose of the Study**

The purpose of this paper is to highlight the advantages of *Computer Based Test* to the test administration of the UTME and the NABTEB examinations with the view to ascertaining its impact(s) on the candidates. This paper explored the extent to which the deployment of the item bank affected examination security. Ultimately, it is hoped that experiences highlighted herein could be referred to by other testing bodies in Africa.

### **What can an Item Bank do?**

There are three major functions that may be served by an item bank. These are: item entry and storage; item retrieval for receiving items, formatting test forms, editing and updating items; and maintenance of item history. Item banking can be a useful way for educational systems to monitor educational

achievements. With online testing now becoming commonplace, it is much easier to distribute tests, mark them and report the results without the burden of paper handling.

As Rudner (1998) pointed out, item banking has major advantages in terms of test development. It is very time consuming for examination bodies to be creating tests each year. Item banks are files of various suitable test items that are coded by subject areas and pertinent item characteristics (for instance, item difficulty, item discrimination power, susceptibility to guessing and carelessness) (Gronlund, 1998, p 130).

### **Merits of Item Banking in the 21<sup>st</sup> Century Test Delivery**

With the 21st century current realities, it is hard to imagine the successful administration of test without the deployment of technology. One of these impacts on assessment is the deployment of technology to create and bank test items in the item bank for subsequent recall when it is needed. The primary advantage of item banking is in test development where Item Response Theory (IRT) method can play very important role. This is so because items from different modes of test delivery can be placed on a common scale and equated. The scale indicates the relative difficulty of the items.

Since expanding the frontiers of the test delivery to entail the Paper Pencil Test (PPT), Computer Based Test (CBT) and Dual Based Test (DBT) in the UTME, the items to be delivered to the candidates must be equated to ensure that they are of equal psychometric values in order not to give undue advantage to any candidate. For instance, in order to tackle challenges that may occur if items are not harmonised, the items for the three modes in the UTME are equated with the rescaling of the CBT scores to the other forms to make it equivalent in terms of mean, standard deviation and shape of performance curves. Items are thus placed on a common scale. The scale indicates the relative parameters. New tests can be developed by drawing items from the bank.

JAMB and NABTEB ensure that parallel test forms are assembled for each subject in tandem with their corresponding psychometric values or properties. That is, each item would have a  $p(\square)$  value of between 0.3 and 0.7 respectively with an average mean value of  $p(\square) = 0.5$ . Randomisation of test items are done vertically within test forms and horizontal across test forms.

Item bank also has the potential of allowing the additional depositing of items to be withdrawn from time to time as needed. It permits test constructors to deposit additional items to be withdrawn as needed. Since it is a bank, additional items whose psychometric properties and weightings are ascertained can be stored and added to existing ones from time to time.

The use of Item banking provides substantial savings of time and energy over conventional test development. In test development, item characteristics are extremely ‘group and test specific’. With item banking, items are described by their relative difficulty across grade levels. The process of creating a test has transited from a tedious and error-prone process that consumed many people’s hours to a simple process that can be entered into a well- developed item banking system (Weiss, 2011). Test constructors therefore do not need to go through the laborious process of developing large set of items for piloting and evaluating, instead, one just draws from the bank.

Cost-effectiveness is a major advantage of the item bank. The deployment of item banking in the test delivery is cost-effective. In the case of the Joint Admissions and Matriculation Board (JAMB), over 1000 items are developed for the over twenty-three subjects it administers in the Unified Tertiary Matriculation Examination (UTME) and these items are stored in the item bank and are called for candidates’ assessment.

The ability to help establish curriculum goals and objectives is easily achieved using item banking. It allows testing bodies to identify the relative difficulty of particular items and to know the item fit of each item. This helps the testing experts to either withdraw or throw away items that are deemed bad or redeem them for possible use for the students. Item banking thus, helps to establish a platform for designing and reviewing curriculum goals and objectives. Test that are banked describe individual learning tasks for students and their corresponding learning achievement. The use of item bank with items on a calibrated scale allows measurement experts to know the relative difficulty of particular tasks. This provides a way to discuss possible learning hierarchies and ways to better structure curriculum.

Generally, Item banking and the use of Computer Based Test (CBT) contributes to examination security. The problems of the deployment of Multiple Choice Questions (MCQs) on Paper and Pencil format using Optical Mark Reader (OMR) sheets like delay in the release of results, incomplete results, mutilation of the OMR sheets and above all, breaches of examination security necessitated the CBT. Deploying the CBT in the 2013 and 2014 UTME therefore

was a herculean task especially since it was the first time in Nigeria that a public examination body was delving into this unfamiliar territory.

### **Challenges of Item Banking**

In spite of the advantages of the CBT deployment, there are series of challenges that must be addressed if the CBT is to be effective and fair (Bridgeman, 2009). Thus, the Board had to work to overcome a lot of these challenges to be able to record the great success it recorded in the first ever deployment of the computer based examination in Nigeria and one way was through the use of a robust item bank.

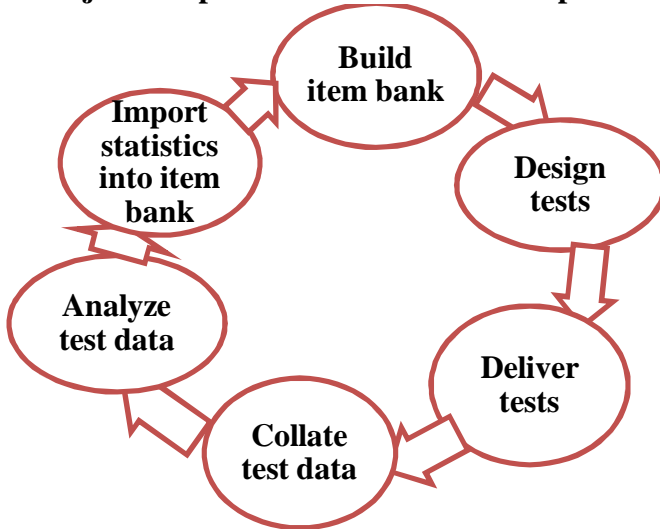
### **Planning for an Item Bank for the UTME**

In the Board, the most crucial step in developing an item bank is planning. A lot of preparation is carried out before the actual setting up of item bank. This involves the preparation of the test experts, the identification of what they have to start an item bank, and the identification of what they hope to accomplish with an item bank. The start-up activities would mostly involve administrative activities and the data processing staff. Each test item is calibrated and equated to the parallel form a data based system is developed by the data processing staff.

Other activities include: familiarity with IRT and various logistic models, training and retraining of staff, use of computer staff capable of modifying computer programmes, establishing a data base system and running packaged programmes. The use of evaluators who are personnel capable of critically evaluating test items for technical quality, curriculum match, uni-dimensionality and potential bias is also very critical to planning an item bank. Last but not the least, is the calibration of items. In order to accurately calibrate test items and establish scales, items need to be presented to examinees with wide range of ability.



**Figure 1: Major Components of the Test Development Cycle**



**Source: Adapted from Weiss (2011).**

Three basic options for establishing an Item Bank are:

1. Purchase of a bank of items alongside the software to operate it.
2. Purchase or leasing of item banking software with local development of items.
3. Local development of software programs and items.

### **JAMB Item banking software**

Item banks are essentially in simple [database](#) and hence can be stored in database software or even a spreadsheet such as [Microsoft Excel](#). Items are presented as they would appear to the examinee, and item response theory parameters can be translated into item response functions or information functions. In the case of the UTME, the FasTEST 2.0, an item banking software and test assembly system is what is used in creating tests.

### **Running the Item Bank**

The item bank will allow one to withdraw items as needed to develop new or even special tests and subtests. There are basically two activities involved in running an item bank - making deposits and withdrawing items to develop a test.

After an item review of the items, small deposits of items would be made by calibrating and equating a few of them at a time. One very efficient approach

to collecting the requisite data is to append subtests of new items to original groups. The items within the original group would serve as anchor items for the new subtest(s) of items. In this manner, you can be constantly adding to your item bank.

In the conduct of the Computer Based Test by JAMB, the role of item banking comes to the fore. After the items generated have passed through all the processes of moderation, selection, item analysis and calibration, trial testing, etc. the Test Development Department thereafter sends those adjudged fit to populate the JAMB central server. These items are subsequently sent to the central servers at the various e-testing centres for onward deployment to the candidates desktops during the CBT. Items sent to these servers are encrypted and in zipped files to avoid sharp practices. These items are only de-encrypted by the registration log in details of individual candidates on each day of their tests.

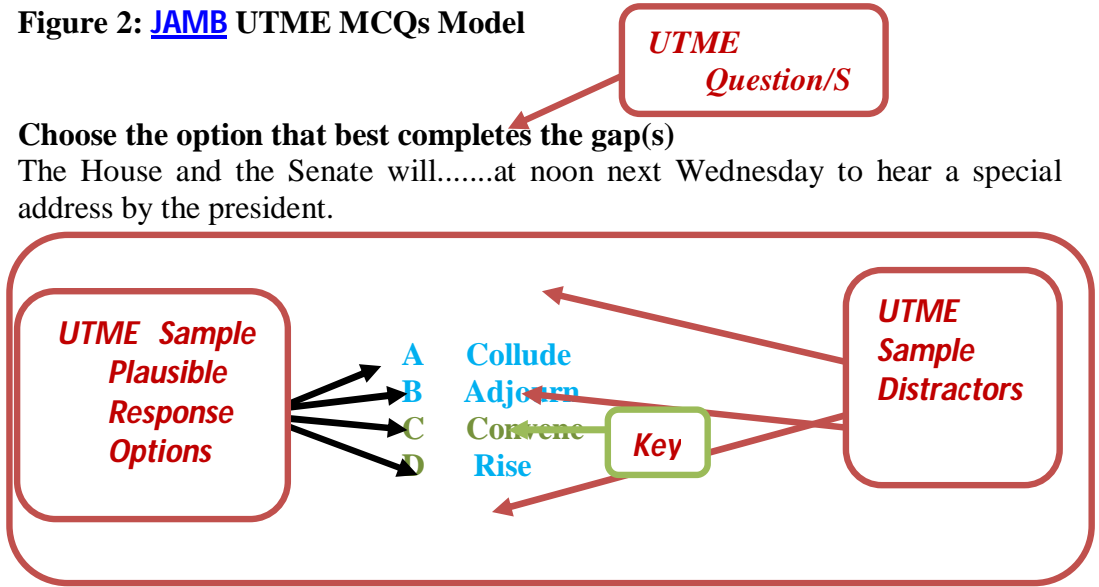
### **JAMB Innovative Item Types**

The UTME makes use of innovative item types in its deployment of multi-choice questions for the three modes of test delivery, that is, across the Paper-Pencil Test (PPT), Dual Based Test (DBT) and Computer-based test (CBT) respectively. The UTME uses letters usually to differentiate the various item types. For example, in the 2013 and 2014 UTME, types such as *S, E, L, F* were used. Juggling of questions for these various types are computer generated. In the 2014 UTME for example, all questions irrespective of type were same across board but options were juggled. The Board also makes use of interactive multimedia in deploying test items.

### **JAMB UTME Multiple-Choice Questions (MCQs)**

The Unified Tertiary Matriculation Examination (UTME) conducted by JAMB is a multi-choice high stake examination. The UTME consists of a question/*stem*, which may also be in the form of a statement. This stem is accompanied by a set of usually four response options from which the candidates are expected to choose the correct options. One of the options is the correct answer, or key. The remaining incorrect response options are called distractors.

Figure 2: **JAMB** UTME MCQs Model



Source: Source: 2014 **JAMB** UTME Use of English (UOE); JAMB MCQs Model adapted from <http://www.proftesting.com/test/steps>

From the figure above, it can be seen that the item bank has stored the stem which is the question and the options. Of these options therefore, there is a right key and three other remaining randomised options known as distractors.

### Conclusion

The possession of a robust item bank is a revolutionary step in ensuring examination security by examination bodies. Thus, this paper reiterates the need for testing bodies to be more aware of technologies that could help maintain the sanctity of the examinations they conduct. This is so because item banking provides the automation, standardization, and scalability essential to developing and maintaining effective tests for a more efficient test administration in Nigeria and Africa, in general.

## **Recommendations**

### **Establishment of Item Bank**

Other examination bodies and educational institutions are encouraged to establish item bank for effective deployment of items.

### **Increase Government Support for Education**

Local Governments have revenues from three sources, namely statutory allocations from the Federation Account, proceeds from the centrally collected Value Added Tax (VAT) and Education Tax Fund (ETF) and, internally generated revenue.

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