

Item Difficulty and Discrimination Indices of Multiple Choice Biology Tests

ADEKUNLE THOMAS OLUTOLA

ORCID No. 0000-0002-5958-793X

aolutola@fudutsinma.edu.ng

Department of Educational Foundations

Faculty of Education, Federal University

Dutsin-Ma, Katsina State, Nigeria.

ABSTRACT

This study empirically analyzed the item difficulty and discrimination indices of Senior School Certificate Examination (SSCE) multiple choice biology tests used by West African Examinations Council and National Examinations Council (NECO) in Nigeria. The researcher employed survey research design for the study. The sample for the study consisted of 1450 Senior Secondary Three students drawn from 20 randomly selected secondary schools. The instruments used for the study were 2008 the NECO and WAEC multiple choice Biology test papers. Item by item analysis was used for obtaining difficulty and discrimination indices. The classical test theory methods involving frequency count and percentages were used for obtaining the difficulty index and discrimination power. Findings from the study showed that 2008 SSCE Biology multiple choice test had mean difficulty index of 0.42 and slightly higher than NECO Biology multiple choice test with mean difficulty index of 0.40 and 2008 SSCE in Biology had a discriminating power of 0.43 and higher than NECO with a mean discriminating power of 0.39. It was recommended that four option items in multiple-choice Biology tests should be encouraged but if five options items should be used more attention should be given to psychometric properties of tests.

Keywords: Difficulty Indices, Discrimination Indices, Multiple Choice Biology Tests.

INTRODUCTION

Evaluation plays an important role in the educational process and development. It is crucial for teachers to make use of the best evaluation practices to help the students to have better results in internal and external examinations. Evaluation can be described as systematic processes of determining the extent to which instructional objectives are achieved by students (Gronlund, 1981). Therefore, students' achievement can be used to determine to a large extent the degree of success or failure of educational practice. Teachers' carry out a routine evaluation of school learning to achieve various objectives, but this is essentially internal.

These internal evaluations go by such names as teacher-made tests, Continuous Assessment, School Based Assessment and local tests. For the conduct of external examinations, However, there are recognized bodies that carry this assignment out for the whole country (Nigeria) and award certificates to candidates at different levels. The National Examinations Council (NECO) and the West African Examinations Council (WAEC) and National Business and Technical Examination Board (NABTEB), are the bodies authorized by the Nigerian law to conduct the Senior School Certificate Examinations (SSCE), General Certificate Examinations (GCE) and other exams. NECO, NABTEB and WAEC carry out the summative evaluation of the Criterion-Referenced Tests. Summative Evaluation is the type of evaluation, which typically comes at the end of a course of instruction. It is used primarily for assigning course grades of the intended learning outcomes. The purpose of the summative evaluation is to assess the overall effectiveness of a program (Susan, 2003; Nuhfer, 1996).

Another form of evaluation according to Tessmer (1993) and Scriven (1991) is the formative type. Formative test refers to structured testing procedure that is executed when teaching and learning are on-going to bring improvements (Nuhfer, 1996 and Susan, 2003). Tests used in the formative evaluation are teacher made tests and thus internal to the school system (Alonge, 2003). The school system adopts some other forms of evaluation in a complementary manner with formative and summative evaluation such as placement, diagnostic evaluation and so on.

The common form of test used for both formative, summative evaluation and other forms of evaluation by teachers for internally conducted assessments and statutory examining bodies for external assessment are objective, essay, and practical variants. Objective tests are not only popular in internal and external examinations; they also play a crucial role in assessment processes in the school system. The multiple choice test type of objective test is regarded as the most applicable, flexible and useful type of objective test items. Multiple choice tests are widely acclaimed as most reliable because

of consistency in scoring the test as well as its fairness to all students (Osunde, 2009). Multiple choice tests discourage the learner's tendency to anticipate likely questions but encourage them to cover the whole contents taught in their preparations. They are also useful in assessing learners' mastery of specific facts, concepts, terms, laws and principles (Lawal, 2001 and Kolawole, 2005).

According to Kolawole (2005), multiple choice tests require students to select the answer from a number of some possible alternatives. Multiple choice items give the fairest opportunity to students to prove their competence and testers to prove their integrity. The objectivity of multiple choice test is based on its development and scoring as items cover wider curriculum contents and objectives of instruction. It is adjudged as having good validity since it has the tendency to cover all aspects of learning content (Alonge, 2003 and Lawal, 2001).

The usefulness of multiple choice tests (MCT) for achieving objectives of testing depends on its quality and properties. The importance of difficulty indices and discrimination power in multiple choice items cannot be overemphasized. According to Schumacker (2005), Classical Test Theory (CTT) utilizes traditional item and sample dependent statistics i.e. item difficulty and item discrimination. In classical theory, the two statistics that form the cornerstone are item difficulty and item discrimination.

Adewuyi and Oluotun (2001) described Difficulty index of an item as the extent to which an item has been answered correctly by the students. That is the percentages of the students that select the right option (Alonge, 2003). Going by this definition of item difficulty, the closer to one (1) the value of the difficulty index is, the simpler the item and the closer the value to zero, the more difficult the item is.

Difficulty index tells us how easy the item was for the students in that particular group. The higher the difficulty index, the easier the question and the lower the difficulty index is, the difficult the question. The difficulty index, in fact, equals to "Easiness index" (Zafar, 2008). Abiri (2006) also indicated that multiple choice tests with fewer numbers of options have better difficulty indices than those with the larger number of options.

Discrimination power of multiple choice items on the other hand, is the ability to discriminate between the brilliant students and poor students (Alonge, 2003). On the other hand, Oyejide (1991) described discrimination power as the strength of each item to distinguish the higher achievers (those who are more competent) from, the lower achievers (those who are less competent). Discrimination power of a test ranges from zero to one (0-1). The closer this value is to one (1) the better the item is (Oyededeji, 1991 and Kelly, 1989). The index of discrimination is also the extent to

which a test is correctly responded to by those examinees possessing more of the traits being measured (Ebel, 1979 and Alonge, 2003).

The role of assessment or test is very vital in evaluating students in the school setting. West African Examinations Council (WAEC) and National Examinations Council (NECO) organize the Senior Secondary Certificate Examination (SSCE) in Nigeria, and they are essentially used for certification. In Nigeria, MCT is being used by examining bodies like National Examinations Council (NECO) and West African Examinations Council (WAEC) and other public examination bodies.

National Examinations Council (NECO) was created by a decree in April 1999. It has its headquarters in Minna, Niger State. NECO took off on 26th April 1999. The National Examinations Council established in April 1999 has the sole responsibility of conducting the Senior School Certificate Examination (SSCE), which is also being conducted by West African Examinations Council (WAEC) (WAEC, 2004 and 2007). The National Examination Council (NECO) conducted its maiden June/July SSCE in the year 2000 and had since continued to conduct Senior School Certificate Examination (SSCE) twice in a year (June/July and November/December) alongside with the West African Examinations Council (NECO, 2007).

West African Examinations Council as one of the examining bodies in Nigeria was established in 1952 following the acceptance of the Jeffery's Report by the then colonial Governments established by five West African Governments namely Ghana, Liberia, Gambia, Nigeria and Sierra Leone. Jeffery's Report passed appropriate ordinances in their Legislative Assemblies in 1951 in collaboration with and in succession to, the Cambridge School Certificate Syndicate. It has his headquarters in Accra, Ghana while the Nigeria headquarters is in Yaba, Lagos (WAEC, 2007). It has the sole responsibility of organizing and conducting secondary schools and public examinations in West African countries such as the Gambia, Ghana, Liberia, Nigeria and Sierra Leone.

One of the emphases of the Nigerian educational policy is that citizens must acquire scientific and technological education. Biology is one of the science subjects and has links with other science subjects. It is the general field of knowledge concerned with the study of all aspects of living organisms. According to Parker (1992), Biology embraces those principles of widest application to the origin, growth, and development, structure, function, evolution and distribution of plants and animals. It is also the bedrock upon which some science subjects derive their origin. Biology as the science of life enables the individuals to understand themselves, as well as the parts and functions of our bodies. Biology has different branches such as Botany, Zoology, Physiology, Genetics, Morphology, Anatomy, and Biochemistry and so on. It is the fact that no student intending to study these disciplines can do without Biology.

The students' poor performance in Biology has drawn the attention of researchers and curriculum planners towards Biology as a subject in the school curriculum (Kareem, 2003). Despite of the importance and popularity of Biology among Nigerian students, performance at senior secondary school level had been poor (Ahmed, 2008). The desire to know the causes of the poor performance in Biology has been the focus of researchers for some time now. The Chief Examiners' reports indicate that students have similar weaknesses in Biology papers which lead to students' poor performance in West African Senior School Certificate Examination (WASSCE) in Biology papers.

WASSCE Chief Examiners' Report May/June (2004) shows that the students' performance in Biology paper 1 was slightly poorer than the previous year with a mean score of 20 and a standard deviation of 9.60. In Biology paper, 1 and the mean score for the paper 2 were 20 while the standard deviation was 7.48. WASSCE Chief Examiners' Report Nov/Dec. (2004) Shows that the mean for Biology Paper 2 (Essay) was 22 while the standard deviation was 8.94. Students' performance in this paper was fair compared to those in previous years. However, the performance of the candidates was poorer than the previous year in paper 3 (alternative to practical).

WASSCE Chief Examiners' Report Nov/Dec (2007) indicates that the performance of the students in paper 2 (Essay) was slightly poorer than that of the previous year. In Nov/Dec (2007) a mean score of 17 and a standard deviation of 8.77 were obtained for students' performance compared to a mean of 18 and S.D of 8.94 for Nov/Dec 2006. Also, students' performance in paper 3 (alternative to practical) was slightly poorer in 2007 with a mean score of 24 and a standard deviation of 12.17 compared with a mean of 28 and standard deviation of 7.64 for Nov/Dec 2006 WASSCE(WAEC, 2001-2007). Researchers shifted the blame of students' poor performance in Biology on teacher laxity, students poor study habits, parents poor attitude to their children education and so on without thinking about the properties of tests such as difficulty indices and discrimination power of test items.

There is, therefore, need to analyze the difficulty indices and discrimination power in Senior School Certificate Multiple Choice items in Biology. Both WAEC and NECO make use of multiple choice Biology items in their examinations. The researchers also compared the difficulty indices and discrimination power in Senior Secondary School Certificate Multiple Choice items in Biology.

OBJECTIVES OF THE STUDY

The purpose of the study was to analyze the item difficulty and item discrimination indices of Senior Secondary School Certificate multiple choice Biology tests. Specifically, the study focused on: 1) item difficulty index of each of the NECO and WAEC SSCE multiple choice Biology tests; and 2) item discrimination power of each of the NECO and WAEC SSCE multiple choice Biology test.

METHODOLOGY

This study adopted a descriptive survey research design. The population for this study consists of all senior secondary school students in Ekiti State. Ekiti State is one of the states in the South Western part of Nigeria. The state has a largely agrarian economy and most communities engage in growing cash and food crops. Survey research design was chosen for this study because the researcher collected the data through the tests.

The target population for this study consists of senior secondary school three (SS3) students in Ekiti State. Stratified random sampling technique was adopted for the study. The researcher schools stratified the school along three Senatorial Districts in Ekiti State. In Ekiti Central and Ekiti North Senatorial Districts seven senior secondary schools each was selected while six senior secondary schools were selected in Ekiti South Senatorial Districts. Thus, a total of twenty senior (20) senior secondary schools were selected.

In this study, 576 (40%) respondents were selected from Ekiti Central, followed by Ekiti South, with 466 (32%), while Ekiti North had 408 (28%) respondents. Thus, One thousand four hundred and fifty (1450) students were randomly selected to take part in the study. The researcher adopted the 2008 National Examinations Council (NECO) and West African Examinations Council (WAEC) multiple choice Biology question papers to collect the data. Because multiple choice tests are the strongest predictors of overall students' performance compared with other forms of evaluation.

The 2008 WAEC and NECO SSCE multiple choice Biology items have a total of 120 items including 540 options (420 decoys and 120 correct responses). The whole 120 items were reviewed.

The instruments were standardized tests used by these examination bodies in Nigeria and West Africa. These instruments were considered accurate and reliable by the public examination bodies.

The data collected from this study were analyzed with respect to the two research

questions generated for this study. Item analysis was carried out for research questions one and two i.e. to obtain the difficulty indices and discrimination power of the test items

RESULTS AND DISCUSSION

Students were asked to indicate whether they were male and female. Their responses are summarized in Table 1 below.

Table 1. Distribution of Respondents According to Gender

<i>Gender</i>	<i>Frequency</i>	<i>Percentage</i>
Male	758	52.3
Female	692	47.7
Total	1450	100.00

In Table 1, out of the one thousand four hundred and fifty (1450) students sampled, seven hundred and fifty-eight (52.3%) students were males while six hundred and ninety-two (47.7%) students were females.

Objective 1. To determine the difficulty index of each of the NECO and WAEC SSCE multiple choice Biology tests

The researcher determined the item difficulty index of each NECO and WAEC SSCE multiple choice Biology tests by following the CTT principle of selecting the top and bottom 27% of the students for obtaining this item characteristic. The number of students in the upper and lower groups who got each item right was obtained by frequency count and the proportion getting the items right was calculated. The difficult index obtained was then summarized and presented in grouped frequency distribution tables 2. The researcher used the quality criterion recommended by Tarrant, Ware, and Mohammed (2009) and Theodorsson, Shafil, Wardy, Khan, Mahrezi, and Shafae (2010) to interpret the difficulty index obtained.

Table 2. Item Difficulty of 2008 NECO and WAEC SSCE
Multiple Choice Biology tests Items

Ranges of Difficulty Index	NECO Frequency	%	WAEC Frequency	%	Description
0 – 14%	1	2	1	2	Very Difficult
15% - 29%	16	26	5	8	Difficult
30% - 69%	40	67	53	88	Moderately Difficult
70% - 84%	1	2	-	-	Easy
85% - 100%	2	3	1	2	Very Easy
Total	60	100%	60	100%	-

Table 2 reveals that in the 2008 NECO SSCE multiple choice Biology items, 1 (2%) of the items were very difficult, 16 (26%) of the items were difficult, 40 (67%) of the items were moderately difficult, 1 (2%) of the items was easy and 2 (3%) of the items were very easy. Also, Table 2 reveals that, in the 2008 WAEC SSCE multiple choice Biology items, 1 (2%) of the items was very difficult, 5 (8%) of the items were difficult, 53 (88%) of the items were moderately difficult, and 1 (2%) of the items was very easy.

Table 3 below compares the mean (\bar{x}) of item difficulty indices of NECO and WAEC SSCE multiple choice Biology tests items.

Table 3. Comparison of the Item Difficulty in 2008 NECO and WAEC SSCE
Multiple Choice Biology Tests Items

Variable	N	Mean Difficulty
NECO	60	0.40
WAEC	60	0.42

Table 3 shows the comparison of item difficulty in NECO and WAEC SSCE multiple choice Biology test items. From Table 3 above, it can be observed that WAEC SSCE Biology items had a highest mean difficulty of 0.42 while NECO SSCE Biology items had a mean difficulty of 0.40. Based on these findings, WAEC SSCE multiple choice Biology test items have more difficulty items than NECO SSCE multiple choice Biology test items.

Objective 2. To determine the discrimination power of each of the NECO and WAEC SSCE multiple choice Biology tests

Item discrimination power of each of the NECO and WAEC SSCE multiple choice Biology test items were determined by subtracting the number of the students in the lower group who got the item right from the number of those in the upper group who also got it right. The researcher then, divided this difference by half of the total number of the students in the two groups combined. The discrimination index obtained was then summarized and presented in grouped frequency distribution tables 4. The researcher used the quality criterion recommended by Tarrant, Ware and Mohammed, (2009) and Theodorsson, Shafil, Wardy, Khan, Mahrezi and Shafae, (2010) to interpret the discrimination power obtained.

Table 4. Discrimination Power of 2008 NECO & WAEC MCT Items in Biology

Ranges of Discrimination Index	NECO frequency	Percentage	WAEC Frequency	Percentage	Description
-0.00 – 0.18	14	23.3	6	10	Poor
0.19 – 0.29	8	13.3	10	17	Moderate
0.30 – 0.39	9	15	4	7	Good
0.40 – 1.00	29	48.3	40	66	Very Good
Total	60	100%	60	100%	-

Table 4 reveals that 14 (23.3%) of the items were poor, 8 (13.3%) were moderate, 9 (15%) were good, and 29 (48.3%) were very good in NECO SSCE Multiple Choice Biology Items. Also, Table 4 shows that 6 (10%) of the items were poor, 10 (17%) were moderate, 4 (7%) were good, and 40 (66%) were very good in WAEC SSCE Multiple Choice Biology Items.

Table 5 below compares the mean (\bar{x}) of item discriminations in NECO and WAEC SSCE multiple choice Biology test items.

Table 5. Comparison of the Discrimination Power of 2008 NECO and WAEC SSCE Multiple Choice Biology Test Items

Variable	N	Mean Discrimination
NECO	60	0.39
WAEC	60	0.43

Table 5 shows the comparative analysis of NECO and WAEC SSCE multiple choice Biology test items according to the level of item discrimination indices. From Table 5, it can be observed that WAEC SSCE Biology items had the highest mean discrimination of 0.43 while NECO SSCE Biology items had mean discrimination of 0.39. Therefore, WAEC SSCE multiple choice Biology test items have more discriminating items than NECO SSCE multiple choice Biology test items.

Discussion of Findings

The researcher discovered that WAEC SSCE multiple-choice Biology test has more difficult items than NECO SSCE multiple choice Biology test. WAEC SSCE multiple choice Biology test has a mean difficulty of 0.42 while NECO SSCE multiple choice Biology test has a mean difficulty of 0.40. It reveals that WAEC SSCE multiple choice Biology test has more difficulty items than NECO SSCE multiple choice Biology test. The findings disagree with the studies of Thorndike and Hagen (1978) and Ramons and Stern (1993) which say that the five (5) option formats have better difficulty indices. The study supports the findings of Abiri, (2006) which say difficulty indices of multiple choice test with a fewer number of options say four (4) is better than anyone with a larger number of options.

The higher mean difficulty index discovered in WAEC may be caused by the number of options in WAEC SSCE multiple choice Biology test. Four option formats in WAEC have a higher difficulty than five option formats in NECO. The findings of this study contradicted the findings of Kolawole (2007) which says that there is no significant difference between the difficult levels of WAEC and NECO multiple choice items in mathematics. Therefore, both WAEC and NECO multiple choice tests in mathematics have the same difficulty levels.

The researcher found that WAEC 2008 SSCE multiple choice Biology test has more discriminating items than NECO 2008 SSCE multiple choice Biology test. WAEC SSCE multiple choice Biology test has a mean discrimination of 0.43 while NECO SSCE Biology test has a mean discrimination of 0.39. This shows that WAEC SSCE multiple choice Biology test has more discriminating items than NECO SSCE multiple choice Biology test. This finding supported by the finding of Olatunji (2007) that four option formats of WAEC SSCE multiple choice tests have better discriminating - indices than NECO SSCE multiple choice test in Economics.

CONCLUSIONS

The 2008 WAEC SSCE multiple choice Biology test has more moderate difficult items than NECO SSCE multiple choice Biology test. Fewer options (4 options) are better written for multiple choice Biology test than larger numbers of options say five (5) options. The 2008 WAEC multiple choice Biology test (with four options) discriminated better than 2008 NECO multiple choice test (with five options). The result of this study is an indication to the teachers, item writers, subject officers, psychometricians and examinations bodies that students' performance can be enhanced positively by adopting the use of fewer options (say four options) for multiple choice Biology tests. The findings of this study will help provide a leeway for solving the problem of the mass failure of the candidates faced by the various examination bodies.

RECOMMENDATIONS

Based on the findings and conclusions drawn in this study, the following recommendations are made to relevant educational authorities and examination bodies and other stakeholders in education.

1. Four option items especially in multiple choice Biology tests, should be encouraged but if five options items should be used the examiner should give more attention to psychometric properties of tests;
2. Teachers should pay particular attention to principles of test construction and item writing to reduce the problems of item difficulty indices and discrimination power, of multiple choice Biology tests;
3. Governments should periodically organize in-service training program for teachers on regular basis to broaden their knowledge in test construction, test administration, and interpretation to improve students' performance in Biology; and
4. The two examining bodies should meet and agree on a number of decoys of the test items for multiple choice biology items to avoid unnecessary standard comparability.

LITERATURE CITED

Abiri, J. O. O.

2006 Elements of Evaluation Measurement and Statistical Techniques in Education. Ilorin: Library and Publication Committee, University of Ilorin, Nigeria.

Adewuyi, J. O. & Oluokun, O.

2001 Introduction to Test and Measurement in Education. Oyo: Odumatt Press Publishers.

Ahmed, M.A.

2008 Influence of Personality Factors on Biology Lecturers Assessment of Difficulty Levels of Genetics in Nigerian Colleges of Education. Unpublished Ph.D. Thesis, University of Ilorin, Ilorin.

Alonge, M.F.

2003 Assessment and Examination: The Pathways to Educational Development. Inaugural Lecture. University of Ado-Ekiti.

Ebel, R.L.

1979 Essential of Educational Measurement. New Jersey: Prentice Hall.

Gronlund, N.E.

1981 Measurement and Evaluation in Teaching, 4th Edition. New York: Mac Millan Publishing Co. Inc.

Kareem, O. L.

2003 Strategies for Teaching Biology Concepts: An Educational Technologists Perspectives. Journal of Postgraduate Students Association. (POGSASS). (4), 25-39.

Kareem, O. L.

2003 Effects of Autographic Self – Instructional Packages on Senior Secondary School Students' Performance in Biology in Ilorin, Nigeria. Unpublished Ph.D. Thesis, University of Ilorin, Ilorin.

Kelly, T.L.

- 1989 The Selection of Upper and Lower Groups for the Validation of Test Items. *Journal of Educational Psychology*, 30.

Kolawole, E. B.

- 2005 Test and Measurement. Lagos: Bolabay Publications.

Kolawole, E.B.

- 2007 A Comparative Analysis of Psychometric Properties of Two Nigerian Examining Bodies for Senior Secondary Schools Mathematics. *Research Journal of Applied Sciences*, 2(8): 913-915.

Lawal, A.

- 2001 Evaluation of Students' Learning Outcomes 1: Types and Uses of Tests. In I.O. Abimbola (Ed.). *Fundamental Principles and Practice of Instruction*. Ilorin: Belodan (Nig) Enterprises & Tunde Babs Printers.

National Examinations Council

- 2004 Focus about NECO. Minna: Regent Ltd.

National Examinations Council (NECO)

- 2007 National Examination Council, Retrieved 20/05/2011 at info@neconigeria.com; service@neconigeria.org.

Nuhfer, F.B.

- 1996 The Place of Formative Evaluations in Assessment and Ways to Reaps their Benefits. Denver: University of Colorado.

Olatunji, D.S.

- 2007 Effects of Number of Options on Psychometric Properties of Multiple Choice Tests in Economics. Unpublished M.Ed Thesis, University of Ilorin, Ilorin.

Osunde, A.

- 2009 Essay and Multiple Choice Tests: Bridging the Gap. Workshop Papers on Multiple Choice Test Item Writing Procedures for Academic Staff, University of Ilorin, Ilorin, on Monday 4th Monday, 2009. pp. 14-24.

Oyejide, A. P.

1991 Effects of Confidence Scoring Procedures on the Psychometric Properties of Three Multiple Choice Test Formats.

Parker, S.P.

1992 Concise Encyclopedia of Science and Technology (Sixth Edition). New York; Mc Graw-Hill, Companies P 252.

Ramons, R.L. & Stern, J.

1993 Item Behaviour Associated with Changes in the Number of Alternatives in Multiple Choice. *Item Journal of Educational Measurement*, 10.

Schumacker, R.E.

2005 Class Test Analysis. London, Applied Measurement Associates.

Scriven, M.

1991 The Methodology of Evaluation. Chicago: R and Mc Nally.

Susan, A.N.

2003 Formative Evaluation Tools for Campus Conflict Resolution and Mediation Programmes: Overview. Denver: University of Colorado.

Tarrant, M; Ware, J & Mohammed, A. M

2009 An Assessment of Functioning and Non Functioning Distractors in Multiple Choice Questions. A Descriptive Analysis, Department of Nursing Studies, Faculty of Medicine, Hong Kong, China.

Tessmer, M.

1993 Planning and Conduct of Formative Evaluations. Philadelphia; Kogan.

Theodorsson, T., Shafil, K. E., Wardy, N. A., Khan, A., Mahrezi, A. A. & Shafae, M.A.

2010 Assessments of Family Doctors in Oman. Getting the Questions Right Preliminary Findings of a Performance Analysis of Multiple Choice Questions. *Internet Journal of Medical Education*, 1 (1).

Thorndike, R.L. & Hagan, E.R.

1978 Measurement and Evaluation in Psychology and Evaluation. 4th Edition.
New York: John Willey and Sons.

WAEC Diary

2004 Brief History of the Council. Lagos: Academy Press PLC.

WAEC

2007 The West African Senior School Certificate Examination. The Chief Examiners' Reports for Nigeria.

West African Examinations Council (WAEC)

2007 History of WAEC. Retrieved 20/05/2011 at [http:// www: waecnigeria.org.historyt.htm](http://www.waecnigeria.org/historyt.htm)

Zafar, M.

2008 Item Analysis Assumptions (Difficulty & Discrimination Indexes). Assessment Unit
Dept. of Medical Education Ext. 47142.