A survey of the Anchor Bias in Mathematics Objective Tests in West African Examination Council (WAEC)

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Abstract
This paper investigated the extent to which test option keys exhibit middle and edge bias in four-option type of multiple choice items. This was with a view to improving the quality of objective test items. The paper used scoring keys of WAEC for five consecutive years. The data for the study was analyzed through descriptive and inferential statistics. The results revealed that correct answers were placed in the middle positions more than edge position in four-option type of multiple choice tests. The study concluded that the test developers tend to exhibit middle bias in placing correct keys in four-option MC format and item keys positioned in the middle hand a tendency to weaken the quality of multiple choice tests.

Keywords: primacy, recency, anchor, mathematics, multiple-choice, middle-bias and edge-bias.

BACKGROUND
Mathematics is defined as the mother of all science subjects; it is also one of the core subjects of the curriculum in the 9-3-4 educational system of Nigeria. Moreover, mathematics is one of the major building blocks on which the much expected national technological advancement is hung. Alutu et al (2004) quoted Inbar (2006) as saying “Mathematics remains the pivot in which any true science can rest on and no true science can succeed without going through mathematics. It is a cognitive subject which needs cognitive assessment through test. However, the test can be defined according to Kolawole (2004) as the device or instrument used to measure a sample of behavior. In general, a test is composed of series of question items designed to measure behaviors such as skill, knowledge, intelligence, aptitude and so on. The mathematics tests are construct or writing by well equipped mathematics teachers.

However, test can be grouped into many dimensions depending on the purpose for testing and what the test or tests intended to find out. The achievement test is a type of test which requires the level of attainment of knowledge acquired by the students (test-takers). It is sub-divided into two namely; essay and objective tests. The objective test can be defined as a type of test that has fixed response while essay test is a free response test [Oladunni (1996)]. The objective test is commonly used in various examining bodies for easier marking, also it is a way of assessing a large number of students and its scores are independence of scorers’ influence. There are various types of objective test but the most common one is multiple-choice item which is being used in certificate classes, entrance, job qualifying examinations and school based examination. Pauk (1994).

In constructing or writing multiple choice questions, the writers usually look for where to hide or place the option keys known as ANCHOR, in an attempt of doing this, they may consciously or unconsciously place the key repeatedly in a particular position in which the test writers is not aware of this tendency [Attali & Bar-Hillel (2004)]. The Banks of multiple choice questions are not free from exhibiting a bias of answers in the middle position. If the writers failed to go through the keys once or twice in order to re arrange the keys, it may lead to edge bias (primacy and recency). In order to control this bias, the number of correct choices used as anchor (keys) should be randomly scattered equally among the positional options of the types of multiple choice items. Arising from the above, this study examined the extent to which test option keys exhibit middle and edge (primacy and recency) bias in four-option type of multiple choice which is the West African Examinations Council (WAEC) style or method of setting or constructing mathematics objective test.

The objective of the study therefore is to determine the extent to which test option keys exhibit middle and edge bias in four-option type of multiple choice used by WAEC. In this study one question was raised which says; to what extent will option keys demonstrate middle and edge bias in four-option type of multiple choice test. Also, one hypothesis was formulated; there is no significant difference between the middle bias and edge bias in the pattern of test option keys by WAEC for the period of five years i.e. 2004 to 2008.

METHODOLOGY
This study was a descriptive survey type using the pattern of option keys for the period of five
consecutive years from 2004 to 2008 by West African Examinations Council (WAEC).

**Sample and Sampling Technique**
The sample for this study is West African Examinations Council as one of the external examination bodies, and the sampling technique used was purposive sampling method.

**Research Instrument**
The instrument used was the pattern of test option keys prepared by WAEC for the period of five consecutive years between 2004 and 2008.

**Procedure for data collection**
The researcher visited the statistics department of WAEC’s office at Osogbo branch for the collection of the prepared pattern of test option keys for the period of five years consecutively. He explained his mission to the officer in charge before the information was released to him.

**RESULTS**
In this study, efforts were made to find the percentages; graphical representation, frequency counts, and t-test were used in the analysis of data in this study. The research question was answered through descriptive statistics and the only hypothesis was also analyzed through the inferential statistics.

**Research Question 1:** It states that, what extent will item option keys demonstrate middle and edge bias in four-option type of multiple choice test? To answer this question, the positioning of correct keys by WAEC in multiple choice test option keys for mathematics in five consecutive years were collected from WAEC’s office at Osogbo for the investigation.

<table>
<thead>
<tr>
<th>YEARS</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>TOTAL</th>
<th>B+C (MIDDLE BIAS)</th>
<th>A+D (EDGE BIAS)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>F</td>
<td>%</td>
<td>F</td>
<td>%</td>
<td>F</td>
<td>%</td>
<td>F</td>
</tr>
<tr>
<td>2004</td>
<td>9</td>
<td>18</td>
<td>11</td>
<td>22</td>
<td>19</td>
<td>38</td>
<td>50</td>
</tr>
<tr>
<td>2005</td>
<td>6</td>
<td>12</td>
<td>16</td>
<td>32</td>
<td>16</td>
<td>32</td>
<td>50</td>
</tr>
<tr>
<td>2006</td>
<td>9</td>
<td>18</td>
<td>14</td>
<td>28</td>
<td>17</td>
<td>34</td>
<td>50</td>
</tr>
<tr>
<td>2007</td>
<td>12</td>
<td>24</td>
<td>17</td>
<td>34</td>
<td>10</td>
<td>20</td>
<td>50</td>
</tr>
<tr>
<td>2008</td>
<td>8</td>
<td>16</td>
<td>17</td>
<td>34</td>
<td>13</td>
<td>26</td>
<td>50</td>
</tr>
</tbody>
</table>

F = Frequency, % = percentage

In 2004, through the frequency counts and percentages it was detected that edge bias effect is greater than middle bias. In 2005, the distribution of option keys showed the middle bias is not equal to edge bias, because the percentage of middle bias is greater than edge bias. In 2006, 2007 and 2008, the examiners were middle bias examiners. The data collected were analyzed using t-test statistics.

The hypothesis states that there is no significant difference between middle bias and edge biases for the period of five consecutive years.

**Table II: Comparative of positional bias of five consecutive years**

<table>
<thead>
<tr>
<th>BIAS</th>
<th>N</th>
<th>X</th>
<th>S.D</th>
<th>df</th>
<th>t</th>
<th>t_cal</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Middle</td>
<td>5</td>
<td>28.4</td>
<td>13.4</td>
<td>8</td>
<td>1.860</td>
<td>1.332</td>
<td>≤ 0.05</td>
</tr>
<tr>
<td>Edge</td>
<td>5</td>
<td>21.6</td>
<td>13.4</td>
<td>8</td>
<td>2.160</td>
<td>0.05</td>
<td></td>
</tr>
</tbody>
</table>

The t-calculated is less than t-table which means that the null hypothesis is upheld which says that there is no significant difference between middle bias and edge bias for the period of 2004 to 2008 pattern of option keys by WAEC for mathematics multiple-choice tests and the frequency of edge bias is greater than middle bias in the remaining three years i.e. 2005 to 2008.

**CONCLUSION**
This paper was undertaken to find out the extent to which test option keys exhibit in middle and edge bias. It was found that there is no difference between the edge and middle biases, that is, the test-writers favoured both edge and middle bias, and they were not justifiable. It also affected the strength of M.C items.

**SUGGESTION FOR FURTHER STUDIES**
It is suggested that further studies should be conducted for other external examination bodies such as NECO, NABTEB, UTME and all subjects in the WAEC syllabus.

**RECOMMENDATION**
It is also recommended that the WAEC body should organize seminars, workshop quarterly for their examiners and their tests experts to aid them in constructing meaningful multiple choice tests for the candidates.

**REFERENCES**

