Research Article

Effectiveness of Cover-Up, Compensation and Balance Approaches to Solving Equation among Students in Nigeria.

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ABSTRACT

The main focus of this study was to investigate the effectiveness of three different approaches to equation solving among the junior secondary school students. The influence of cognitive levels of the students on achievement in equation solving using these approaches was also investigated. All students were administered the pre-test. COVA experimental group was instructed on the use of the ‘cover-up’ approaches, COMA experimental group was instructed on the use of the compensation approach to equation solving, the third experimental group WEBA was instructed on the use of Weighing balancing approach. All the groups were administered the post-test. Descriptive statistics ANOVA and Scheffe Post-Hoc Analysis were used to analyze the data collected. The results of the study showed that students in the cover-up approach have the highest mean scores, followed by weighing balance approach and compensation approach came last. To cap it all, the study recommended the use of ‘Cover-up’ approach in teaching equation solving in Junior Secondary Schools.

Keywords: Achievement, Balance, Concepts, Compensation Solving-equation, Schools.

INTRODUCTION

One of the broad aims of the secondary school Education in Nigeria, as contained in the National Policy on Education (1977) revised 1981, is to equip the students to live effectively in a modern age of science and technology. In order to achieve these objectives, mathematics is made a compulsory subject for all students in both primary and secondary schools in Nigeria. Fakuade (1981) identified mathematics as an instrument that could be used for material conquest and social organization. Kolawole and Oginni (2009) affirmed that the neglect of mathematics instruction affects knowledge.

Mathematics is a difficult subject version (Adelodun, 1991). Mathematics is presented by most teachers and textbooks. Often mathematics is reduced to a series of definitions and methods to solve various types of problems. Olanrewaju (1987) observed that mathematics is often artificially organized, which bewilder the beginning students in junior secondary Schools.

Fennema (1978) asserted that one of the outstanding causes of the difficulty experienced by students has been an inadequate mastery of fundamental terminologies, concepts, and skills in mathematics operations. According to Fajemidagba (1986) teachers do not use a variety of approaches to the teaching of mathematics.

One of the most striking characteristics of mathematics is its hierarchical nature (Farrell & Farmer, 1980). To learn a higher order concepts in mathematics, sound knowledge and thorough understanding of the lower pre-requisites are needed.

Despite the fact that equation solving is a necessary pre-requisite to the solution of many mathematics problem, Adi (1978) and Adamolekun (1995) have shown that JSS Students have very low facility index on solutions of simple equations involving fractions. A good knowledge of the solution of such equation can be widely transferred to the solutions of a variety of problems in mathematics, chemistry and other related courses in the SSS and higher levels.
Many views have been raised, concerning different approaches of teaching. Some school of taught says there is no method that better than the other, while for others the reverse is the case. Nworgu (1985) had categorized certain methods as superior to others. Eniayevu (1983) argued that there is no single superior method of teaching but that a combination of various methods result in excellent teaching to enhance students’ understanding.

Ojo, O.A. (2010) suggested that no single instructional treatment is likely to maximize learning for every students and recommended that researchers should design alternative treatment that are tailored to suit students with specific characteristics or aptitudes. Leonard (1992) carried out a comparison of student performance following instruction by interactive video disc approach versus conventional laboratory approach for learning biology concepts and science process skills his result showed no statistically significant difference between the two approaches for student grades on laboratory quizzes, reports and final examination.

Purpose of the Study

The purpose of this study was to investigate the influence of cognitive levels of students on the effectiveness of three different approaches namely ‘Cover up (COVA)’, Balancing (BALA) and compensation approaches (COMA) in term of achievement of Junior Secondary School students on linear equation solving. The study will help to determine the differential effect of approaches on students performance in solving equations/The information acquired will enable the researchers make useful recommendation to the teachers, students and government on the need to design curriculum that will simplifying concepts in mathematics.

Statement of the Problem

The poor achievement of Nigerian students in mathematics at all levels of our educational systems has been a source of concern to the government, examining bodies, parents, and educators. A close study of samples of the JSS 3 and SSS 3 mathematics questions showed that scarcely can a problem be correctly solved without the correct solution of one type of equation or the other and most of such equation involve rationale.

The Approaches

Question: Solve the Following equation, stating clearly your method of solution.

\[ 8 + \frac{72}{x - 3} = 16 \]

“Cover up” Approach (COVA): In this approach, whatsoever item covered in the equation stand for the word “what”

Solution:

\[ 8 + \frac{72}{x - 3} = 16 \]

8 plus what equals 16? (8)

i.e. \[ \frac{72}{x - 3} = 8 \]

72 divided by what equals 8 (9)

i.e. \( x - 3 = 9 \)

what – 3 = 9 (12)

\( x = 12 \)
Compensation Approach (COMA):

Solution: \[ 8 + \frac{72}{x-3} = 16 \]

Divide both sides of the equation by 8

i.e. \[ 2 = \frac{9}{x-3} + 1 \]

Subtract 1 from both sides of the equation

i.e. \[ 1 = \frac{9}{x-3} \]

Multiply both sides of the equation by \( x - 3 \)

i.e. \( x - 3 = 9 \)

Add 3 to both sides of the equation

\( x = 12 \)

Weighing Balance Approach (WEBA):

The left hand side of the weighing balance contains the unknown; subtract 8 from both sides to leave \( \frac{72}{x-3} \) on LHS and 8 on RHS i.e
Divide both sides by 72 to leave \( \frac{1}{x-3} \) on L.H.S and \( \frac{1}{9} \) on R.H.S i.e.

\[
\begin{align*}
\frac{1}{x-3} &= \frac{1}{9} \\
\therefore x &= 12
\end{align*}
\]

Invert both side to leave \( x - 3 \) on L.H.S and 9 on R.H.S. i.e.

\[
\begin{align*}
\frac{x - 3}{9} &= 1 \\
\therefore x &= 12
\end{align*}
\]

Add 3 to both side to leave \( x \) on L.H.S and 12 on R.H.S. i.e

\[
\begin{align*}
x &= 12
\end{align*}
\]

Research Questions

i. Is there any significant difference in the performances of students taught the use of the COVA, COMA and WEBA before treatment?

ii. Is there any significant difference in the performances of students taught the use of the COVA, COMA and WEBA after treatment?

iii. Is there any significant difference between the performances of students taught the use of the COVA, COMA and WEBA in the retention-test?
Research Hypotheses: The following hypotheses were postulated

i. There is no significant difference between the performances of students taught the use of the COVA, COMA and WEBA before treatment.

ii. There is no significant difference between the performances of students taught the use of the COVA, COMA and WEBA after treatment.

iii. There is no significant difference between the performances of students taught the use of the COVA, COMA and WEBA in the retention test.

Population and Sampling Procedure

The target population for this study consisted of all JSS II students in Ekiti-State Government school year 2009/2010 academic session. Simple random sampling technique was used to select 200 students that were assigned randomly to the three treatments. The Government Colleges were used because they are somewhat comparable in academic standards.

Sample I: Consisted of 90 junior students of two intact classes representing the experimental group I (COVA), while the others are control

Sample II: Consisted of 75 junior students representing the experimental group II (COMA), while the others are control

Sample III: Represented the experimental group III (WEBA) was 35 junior students, while the others are control

Research Instrument

Two main categories of 10 items of research test were constructed by the researcher on equation solving for the students. The content validity of the test items was established by giving the items to two experts in mathematics education and two JSS mathematics teachers for their comments on whether the test item measured what it was expected to measure relative to the objectives. Their comments assisted the researcher to determine the appropriateness and adequacy of the items in terms of content coverage, lucidity of rubrics, and language level. The three groups were subjected to pretest on the selected items for the purpose of homogeneity. After 2 weeks extensive teaching was given to three groups on their own approach, the posttests were administered on them. About 6 weeks after the pretests, the same questions on posttests were administered to measure the retention level of the three groups.

Data Analysis

The hypotheses generated were tested, using Analysis of variance (ANOVA) of mean performance scores. Data were further analyzed by Scheffe post-hoc pair wise contrasts.

Results and Discussions:

Pretests and posttests and retentive test were analyzed using ANOVA and scheffe Post-hoc pair wise contrasts—at critical level of $p = 0.05$ as presented in the tables below.

Hypothesis I ($H_0^1$):
There is no significant difference in the mean performance of students taught with cover-up (COVA), compensation (COMA) and weighing balance (WEBA) approach in the pre-test.

Table 1: Comparison of Pre-test, Post-test and Retentive-test Mean and Standard Deviation Scores of students.

<table>
<thead>
<tr>
<th>Group</th>
<th>Variable Name</th>
<th>Students N</th>
<th>Pretest Mean</th>
<th>SD</th>
<th>Posttest Mean</th>
<th>SD</th>
<th>Retentive-test Mean</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>COVA</td>
<td>$X_1$</td>
<td>90</td>
<td>14.42</td>
<td>4.28</td>
<td>44.41</td>
<td>11.15</td>
<td>45.68</td>
<td>11.95</td>
</tr>
<tr>
<td>COMA</td>
<td>$X_2$</td>
<td>75</td>
<td>14.61</td>
<td>4.55</td>
<td>35.29</td>
<td>8.30</td>
<td>30.95</td>
<td>8.17</td>
</tr>
<tr>
<td>WEBA</td>
<td>$X_3$</td>
<td>35</td>
<td>14.57</td>
<td>4.12</td>
<td>39.24</td>
<td>8.55</td>
<td>33.75</td>
<td>8.05</td>
</tr>
</tbody>
</table>
The achievement of students exposed to Cover-up (COVA), Compensation (COMA) and Weighing Balance (WEBA) approaches in Equation solving in mathematics are shown in Table 1. The results show that students exposed to COVA, COMA and WEBA had pretest achievement mean scores of 14.42, 14.61 and 14.57 respectively. While their standard deviations were 4.28, 4.55 and 4.12 respectively. Hence, the result of \( F_{\text{max}} \) calculated 1.220 < \( F_{\text{tab}} \) of 2.60. Thus shows that there is no significant difference in their performance which is an indication that the groups are homogenous group.

### Table 2: ANOVA Summary of Pretest on Students’ Achievement in Equation Solving

<table>
<thead>
<tr>
<th>Source of Variation</th>
<th>SS</th>
<th>df</th>
<th>MS</th>
<th>( F_{\text{cal}} )</th>
<th>( F_{\text{tab}} )</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between Sample</td>
<td>19.48</td>
<td>2</td>
<td>9.74</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Within Sample</td>
<td>897.53</td>
<td>197</td>
<td>4.56</td>
<td>2.14</td>
<td>2.99</td>
<td>NS</td>
</tr>
<tr>
<td>Total</td>
<td>917.01</td>
<td>199</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The ANOVA summary of pretests in Table 2 also showed that the three groups were not significant in their achievement before the treatment was given to them.

**Hypothesis II (H\(_2\)):** There is no significant difference in the mean performance of student taught with Cover-up (COVA), Compensation (COMA) and Weighing Balance (WEBA) Approaches in their Post-test.

### Table 3: ANOVA Summary of Posttest on Students’ Achievement in Equation Solving

<table>
<thead>
<tr>
<th>Source of Variation</th>
<th>SS</th>
<th>df</th>
<th>MS</th>
<th>( F_{\text{cal}} )</th>
<th>( F_{\text{tab}} )</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between Sample</td>
<td>9323.86</td>
<td>2</td>
<td>4661.93</td>
<td></td>
<td></td>
<td>S</td>
</tr>
<tr>
<td>Within Sample</td>
<td>49697.19</td>
<td>197</td>
<td>252.27</td>
<td>18.4</td>
<td>2.99</td>
<td>S</td>
</tr>
<tr>
<td>Total</td>
<td>59021.05</td>
<td>199</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table III presented the post-test achievement of students exposed to COVA, COMA and WEBA approaches. The result here showed significant difference in the mean performance of the groups. Hence, the hypothesis H\(_2\) is rejected and alternative to it is upheld which indicated that there was a statistical significant difference in their mean performances.

### Table IV: Scheffe Post-Hoc Analysis of students’ achievement of post-test in Equation Solving ability.

| Contrasts   | \(|X_1 - X_2|\) | S.E  | \(S_{\text{cal}}\) | \(S_{\text{tab}}\) | Result |
|-------------|-------------|------|-------------------|-------------------|--------|
| \(X_1 - X_2\) 9.120 | 2.483       | 3.673| 2.445             | 2.445             | S      |
| \(X_2 - X_3\) 8.390 | 3.164       | 2.652| 2.445             | 2.445             | S      |
| \(X_3 - X_2\) 3.950 | 3.251       | 1.215| 2.445             | 2.445             | NS     |

Table I and IV, revealed that Cover-up (\(X_1\)) is the variable that made the compares significant. Hence, it is a prefer method to either compensation of Weighing balance approaches. We could also observed that there is no significant difference in the performances of students using compensation and weighing balance approach.

**Hypothesis III (H\(_3\)):** There is no significant difference in the mean of student target with cover-up approach (COVA), compensation approach (COMA) and Weighing Balance approach in students’ retentive ability.

### Table V: The ANOVA summary of retentive-test on students’ achievement in Equation Solving

<table>
<thead>
<tr>
<th>Source of Variation</th>
<th>SS</th>
<th>df</th>
<th>MS</th>
<th>( F_{\text{cal}} )</th>
<th>( F_{\text{tab}} )</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between Sample</td>
<td>11269</td>
<td>75</td>
<td>5634.88</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Within Sample</td>
<td>52238.49</td>
<td>197</td>
<td>265.17</td>
<td>21.25</td>
<td>2.99</td>
<td>S</td>
</tr>
<tr>
<td>Total</td>
<td>63598.24</td>
<td>199</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Table IV revealed that $F_{cal} (21.25)$ is less than $F_{tab} (2.99)$ which led to the rejection of null hypothesis and thus indicated that there was a significant difference between the mean performances of the groups’ retentive ability.

Table VI: Scheffe Post-Hoc analysis of students’ achievement in Equation Solving retentive ability.

| Contrasts | $|X_A - X_B|$ | S.E  | $S_{cal}$ | $S_{tab}$ | Result |
|-----------|--------------|------|----------|----------|--------|
| $X_1 - X_2$ | 14.730       | 2.540 | 5.799    | 2.445    | S      |
| $X_2 - X_3$ | 14.630       | 3.244 | 4.510    | 2.445    | S      |
| $X_3 - X_2$ | 2.800        | 3.333 | 0.840    | 2.445    | NS     |

Table I and VI, revealed that Cover-up approach ($X_1$) is the variable that make it significant. This means that cover-up is the best approach followed by weighing balance approach ($X_3$) and Compensational approach ($X_2$) came last as shown in the mean of their retentive ability.

Conclusion

The values of means (44.41, 35.29, 39.24) and standard deviations of (11.15, 8.30, 8.55) in the Post-test showed that there was a statistically significant difference in the mean of Cover-up, Compensation and weighing balance approaches. Through the ANOVA in table III and VI and scheffe Post-Hoc in table IV and VI, Cover-up approach is preferred to other approaches. This is in support of the finding of Nworgu (1985) who categorized certain method as superior to others.

Findings further showed that there is no significant difference between the achievement of students when exposed to compensation and weighing balance approach (See Post-test, Retentive-test and Scheffe Post-Hoc in table IV and VI). This was also in support of Eniayeju (1983) view of no single superior method of teaching but that a combination of various methods result in excellent teaching to enhance student understanding.

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Consequently, teacher of mathematics should imbibe the use of various approaches in passing instruction to their students. Also, practical approach should be emphasized in the primary and lower secondary school in our nation.

Recommendations

Based on the findings for this study, it was recommended that

I. Teachers in the JSS should be encouraged to adopt different approaches to the teaching of this type of topic among the JSS to cater for the developmental levels of the students.

II. It was recommended that “Cover-up” approach be used to teach equation solving as an alternative to other approaches to students at JSS level.

III. Mathematics textbooks, curricula, scheme of work and notes of lesson at the JSS should be written, using different approaches to teach the same mathematics topic. Thus helping students at different cognitive levels to find approaches appropriate to their developmental level and effectively acquire desired knowledge and skills.

REFERENCES


Kolawole E.B & Oginni O.I (2009) Effectiveness of Laboratory Method of Teaching on Students'Performance in Senior Secondary School Mathematics. ABACUC The Journal of Mathematics Association of Nigeria. 34(1);120-125


