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The effective management of mathematics workbook: Sure remedy to students' performance in mathematics

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Abstract

This study sought to find out the effect of the effective management of Mathematics Workbook on students' performance in Senior Secondary School, using Government Senior Secondary Schools Bwari Area Council as case study. Survey and Experimental research designs were used for this Study. The instruments used for data collection were Likert Scale Questionnaire and Mathematics Achievement Test (MAT). A simple random sampling technique was employed to select 200 students each from Government Day Secondary School Dutse and Government Girls Secondary School Dutse for the survey research design. A 12 items Likert Scale Questionnaire was administered to 400 students of Government Day Secondary School Dutse and Government Girls Secondary School Dutse to obtain responses on the Effect of Mathematics Workbook on Students' Performance in Senior Secondary School. For the Experimental research, the sampled population was grouped into experimental and control groups. The experimental group was taught with the use of Mathematics Workbook while the control group was taught using the traditional method. At the space of two weeks, the Mathematics Achievement Test (MAT) was administered to twenty five students selected for each group. Descriptive statistical analysis was used to interpret the data of Likert Scale Questionnaire while inferential statistical analysis was used to interpret the data of MAT. This study revealed the benefit of Workbook to the understanding of the basic concept in Mathematics and performance of students. The result of the findings of the experiment showed significant difference between mean score of students taught using Mathematics workbook and the students taught using the traditional method. This study recommended that Mathematics workbook should be used in schools: especially in the secondary schools; education policy makers to include Mathematics workbook as a recommended book to be used in secondary schools; school administrators to embrace the use of Mathematics workbook for their students by including it in the list of books to be purchased by them and teachers should embrace the use of Mathematics workbook in the teaching/learning activities of their classrooms as a necessary aid to class evaluation, assessment and assignment exercise for their students which would make them to have spare time to attend to other extra-curricular activities .

Keywords

Management,
Mathematics,
Workbook,
Students,
Performance .

Introduction

Management involves identifying the mission, objectives, procedures, rules and the manipulation of the

human capital of an enterprise to contribute to the success of the enterprise, while managing of school

activities require all the necessary input needed to achieve the goal of its establishment (Dunod, 1966). This implies effective communication: in the school environment, teacher/student motivation and academic performance, in the same way is the effective management of Mathematics workbook could bring the needed academic performance expected from the students.

Owing to the perpetual failure of students in Mathematics as affirmed by Ruqayyatu (2012) who said that the government of Nigeria would not accept the lack of interest in the study of Mathematics and science related courses by students as a result of poor performance. Though many measures have been taken to improve the performance of students in mathematics, effective management of Mathematics workbook could bring the needed desire, since it is the appropriate application of Mathematics workbook to teach mathematics.

As a result of his managerial expertise, Carlson (2011) revealed the lapses of active learning approach by criticizing Pfaff and Weinberg's (2009) work without the use of a workbook. Carlson (2011) opined that Pfaff and Weinberg's (2009) activities may have been ineffective because they did not take into plan the underlying concept of the statistics. Carlson (2011) suspected that the key components of successful active learning approaches are using activities to explain concepts which require students to demonstrate that they understand these concepts by having them answer very specific rather than general questions.

Base on this assertion, Carlson (2011) carried out a research on Evaluating an active learning approach to teaching introductory statistics: A classroom workbook approach, used workbook as a tool to encourage students to think about the underlying statistical concepts. The findings showed the importance of workbook to teaching/learning as it affected the overall performance of the learners. Based on these findings, the researcher of the present research study intends to find out the outcome of effective management of Mathematics workbook on students' performance in Senior Secondary Schools.

Purpose of the study

The purpose of the study was to find out:

- i. The outcome of effective management of mathematics workbook on students' performance

- ii. The outcome of effective management of mathematics workbook on students understanding of basic mathematics concept

Research Hypotheses

H₀1: There is no effective management of mathematics workbook on students' performance

H₀2: There is no significant difference in the mean achievement score of students taught using Mathematics workbook as instructional material and those taught with conventional method

Literature review

For effective management of instructional material Santos (2009) stated the standards used to determine the propriety of its selection: The age of the children who normally could be expected to have access to the material, the educational purpose to be served by the material, with priority being given to the selection of materials that encompass state and district performance standards, the consideration of the racial, ethnic, socioeconomic, and cultural diversity of the district, and the degree to which the material would be supplemented and explained as part of normal classroom instruction. Para (2015) gave the purpose of organizing instructional materials; that it is so that both students and teachers can have access to the correct materials with minimum of disruption.

In educational institutions, success is measured by academic performance, or how well a student meets standards set out by local government and the institution itself. As career competition grows ever fiercer in the working world, the importance of students doing well in school has caught the attention of parents, legislators and government education departments alike (Melissa, 2014). Emphatically stating Adedeji (2007) reported that in our match towards scientific and technological advancement, we need nothing short of good performance in Mathematics at all levels of schooling. Unfortunately performance of students in Mathematics at the end of secondary education has not improved in the past decade (Umoinyang, 1999). Adedeji (2007) stated in his work; the factors contributing to low performance in Mathematics as spelt out by other scholars (More, 1973, Callahan, 1971, Aiken, 1976, Aiken, 1970, Ohuche 1978, Ale, 1989, Oshibodu, 1984, Akpan 1987, Odogwu, 1994, Oshibodu, 1988, Edwards and Knight, 1994, Alele-Williams 1988 and Georgewill, 1990).

Debates about the *state* of Mathematics education tend to focus on students' overall poor understanding of key mathematical concepts and procedures, typically reflected in routine rather than flexible use of mathematical ideas (APEC, 2004; De Corte *et al.*, 1996; Gardner, 1991, Wang, 2005).

According to Paul (2005), the argument made about reframing the relationship between what are termed basic and higher order skills in Mathematics is very similar to the case made by some in science education that basic skills are taught in the context of Investigations. Summarizing twenty years of research in the learning sciences, Gardner in his book *The Unschooled Mind* (1991) drew the attention of educational policy makers, educators and the wider public to the phenomenon whereby many degree holders do not have the capacity to apply their hard earned knowledge appropriately in new contexts. In the context of Mathematics, similar concerns have arisen based on observations of how students in school or after completion of school attempt to solve problems in routine fashion disregarding crucial information especially contextual information (Verschaffel, Greer, and de Corte, 2000; Cooper and Harries, 2002).

Carmel (2011) reported that college students have graduated from high school and have been admitted to college, but do not really know their multiplication tables. Reviewing Mathematics workbook as an instructional material, Momoh (1980) carried out a research on the effects of instructional resources on students' performances in WASC examination in Kwara State. In the same manner, Moronlola (1982) carried out a research in Ilorin local government of Kwara State. She also used questionnaires to tap information on the material resources available for the teaching of ten subjects in ten secondary schools.

In the same vein, Popoola (1990) investigated the effect of instructional resources on the academic achievements of students in Ogun State. Five secondary schools in Abeokuta were used for his study. Questionnaires were designed to elicit responses on instructional materials that were available for the teaching and learning of each of the three school subjects he examined.

Zachariah (2011) stated some of the Mathematics teaching and learning resources in secondary schools to include; chalk boards, Mathematics textbooks, three dimensional figures and charts. In support of how important Mathematics' instructional materials are, Cornelius (1982) opined that concept formation in secondary schools is still linked to concrete

representation (teaching aids), and on the mental activity that takes place as the child experiences and interacts with his or her environment. This is supported by Carlson (2011) when he concluded that the workbook approach holds promise for teaching introductory statistics courses.

Materials and Methods

The study is survey and experimental research. The survey research is used to get opinion of the respondents on how effective Mathematics workbook could be on their understanding of the basic knowledge of Mathematics and on their academic performance in Mathematics. The experimental research is used to get data from scores of students in a test administered to them. The experimental study sampled population for the study was grouped into two; the experimental group and the control group. The experimental group was taught Mathematics concepts with the aid of a prepared workbook while the control group was taught the same concepts with conventional method of teaching. At the end of the teaching, both groups were given the same achievement test and their mean scores were compared. A complementary structured questionnaire for (Survey research) was also used in the study to back up the findings.

The sample for the study consists of senior secondary School students in Bwari Area Council. There were eleven Government Senior Secondary Schools in the area with a total population of 10,977 as at the time of this research (SEB, 2014). Random sampling technique was used to select the students for the study. The sample size used for this study was thus calculated using the formula illustrated by Glenn (2013)

$$n = \frac{N}{1+N(e)^2}$$

Where n is the sample size, N is the population size and $e = 5\%$ (0.05) is the level of significance (sampling error that could be accommodated)

From this formula the sample size for this study work was computed to be a total number of four hundred (400) students these students were used for non-experimental study which questionnaire were used. For the Experimental research, the sampled population was grouped into experimental and control groups. Each group has twenty five students each. The twenty five students used were for proper management of the experiment. The two groups were from different schools in order to prevent interference.

Results

Table 1: Respondents' Opinions Regarding the Effective management of Mathematics Workbook and Students Performance

Breakdown of Research Question one	Strongly Agree	Agree	Disagree	Strongly Disagree	Total	Mean Score
Do you agree that most students always fail Mathematics because of not using Mathematics workbook?	200 50%	195 48.7%	5 1.3%	0 0%	400 100%	3.49
The absence of learning aid especially workbook is one of the reasons for failure in Mathematics.	185 46.3%	180 45%	35 8.75%	0 0%	400 100%	3.38
Instructional material like Workbook can help you to perform better in Mathematics.	271 67.5%	129 32.5%	0 0%	0 0%	400 100%	3.68

Grand mean score = 3.52

Table 4.2: Respondents' Opinions Regarding Effective Management of Mathematics workbook and Students understanding of the Basic Concepts in Mathematics

Breakdown of Research Question two	Strongly Agree	Agree	Disagree	Strongly Disagree	Total	Mean Score
Do you agree that most students do not know the basic knowledge of Mathematics like multiplication table and division of numbers as a result of lack of exercise the use of Mathematics workbook could provide?	176 44%	155 38.67%	55 13.67%	15 3.66%	400 100%	3.23
The basic knowledge of Mathematics with the use Mathematics workbook would improve the performance of students in Mathematics.	275 68.7%	125 31.3%	0 0%	0 0%	400 100%	3.69
Mathematics workbook would help students to know the basic knowledge in Mathematics	220 55%	180 45%	0 0%	0 0%	400 100%	3.55

Grand mean score = 3.49

Table 3: Performance of students on the Experiment

S/N	X(20mks)	X ²	Y(20mks)	Y ²	S/N	X(20mks)	X ²	Y(20mks)	Y ²
(1)	14	196	10	100	(15)	20	400	8	64
(2)	16	256	8	64	(16)	14	196	10	100
(3)	14	196	10	100	(17)	16	256	4	16
(4)	20	400	6	36	(18)	18	324	10	100
(5)	14	196	8	64	(19)	16	256	6	36
(6)	14	196	10	100	(20)	18	324	4	16
(7)	14	196	10	100	(21)	18	324	10	100
(8)	14	196	8	64	(22)	20	400	8	64
(9)	18	324	6	36	(23)	16	256	6	36
(10)	16	256	10	100	(24)	18	324	10	100
(11)	18	324	10	100	(25)	16	256	10	100
(12)	16	256	6	36	Total	410	6828	200	1704
(13)	14	196	6	36	Source: Field Survey, 2015				
(14)	14	196	6	36	$M_x = \frac{410}{25} = 16.4, \quad M_y = \frac{200}{25} = 8$				

From the above, X is the scores of students in the experimental group (Group taught with the aid of Mathematics workbook and Y is the scores of the

students in the control group (Group taught using the convectional teaching)

Table 4: Summary of the Experiment

Variable	Number of Student	Total score	Mean	Df	t-test calculated	t- critical	Remarks
Experiment Group	25	410	16.4	48	2.211	1.676	NS
Control Group	25	200	8				

Discussion

From Table1, the assumption of the researcher was supported by the respondents’ opinion. This is seen in the grand mean score of the table 1 (GMS = 3.52) which is greater than the 2.5

From Table 2, the assumption of the researcher was supported by the respondents’ opinion. This is seen in the grand mean score of the table 2 (GMS = 3.49) which is greater than the 2.5

In Table 3, the degree of freedom is $n_x + n_y - 2 = 25 + 25 - 2 = 48$. The null hypothesis at 5% level of significance at 48 degrees of freedom gave table t critical value of 1.676 which is below the calculated t value of 2.211 which makes the null hypothesis it to be rejected. The rejected null hypothesis stated that: there is no significant difference in the mean achievement score of students taught using Mathematics workbook instructional material and those taught with conventional method.

The findings showed that the absence of learning aid especially workbook is one of the reasons for failure in Mathematics as supported by Momoh (1980), Moronfolo (1982) and Popoola (1990). Momoh (1980), Moronfolo (1982) and Popoola (1990) carried out researches on the effect of material resources on the students’ academic performance and the results showed how important learning aids are. In addition to this Cornelius (1982) opined that concept formation in secondary schools is still linked to concrete representation (teaching aids). The study revealed the importance of effective management of Mathematics workbook as an instructional material that could help students to perform better in Mathematics. As Para (2015) put it; organizing instructional materials is so that both students and teachers can have access to the correct materials with a minimum of disruption which shows that management of the workbook is also important. Additional support for the use of Mathematics workbook came from Carlson (2011).

Carlson (2011) revealed that an active learning workbook approach yielded more positive attitudes toward statistics.

The study showed that most students do not know basic knowledge of Mathematics like multiplication table and division of numbers which Mathematics could have provided. In support of this, Carmel (2011) reported that many college students do not know their multiplication tables. He said it is not an idle question because of alarming frequency College professors who have noted with shock and dismay how ill prepared their incoming students are. In agreement to this findings Carmel (2011) opined that focus should not be on how much Mathematics is taught before graduation, but rather how solid the foundations of Mathematics are. The finding of the study also reveals that the basic knowledge of mathematics would improve the performance of students in Mathematics. Stock (2009) agreed with this when he said that successful arithmetic abilities in elementary school are built upon early experiences with number sense as well as mastering essential counting principles. The study also revealed that workbook would help students to know the basic knowledge in Mathematics. Carlson (2011) had this opinion when he suspected that the key components of successful active learning approaches would be using activities to explain concepts and requiring students to demonstrate that they understand these concepts by having them answer very specific rather than general questions.

The null hypothesis at 5% level of significance at 48 degrees of freedom gave table t critical value of 1.676 which is below the calculated t value of 2.211 which makes the null hypothesis to be rejected. The rejected null hypothesis stated that: there is no significant difference in the mean achievement score of students taught using Mathematics workbook instructional material and those taught with conventional method.

Conclusion

The study therefore concludes that if the result of the findings could show the benefits of workbook on students' academic performance in Bwari Area Council, then Mathematics workbook is highly needed in our secondary schools as a tool for improving students academic achievement. Failure in Mathematics has a vivid link to lack of instructional materials or its inadequacy and management. Workbook is a complementary material which is

needed in the classroom teaching and learning activities and it ensures active involvement of students in learning. The lack of the basic knowledge of Mathematics is a factor in the poor academic performance of students, most especially in Mathematics. Workbook could help students to acquire the basic knowledge required and this could be presented in a simple comprehensible way.

Recommendations

Adequate attention should be given to Mathematics (like a state of emergency) to tackle the rampant failure in Mathematics. Facilitation and provision of needed instructional materials (Workbook) in schools should be highly considered. The inclusion of Mathematics workbook as a recommended book to be used in schools should be enforced. The enforcement of the basic knowledge requirement of Mathematics as a policy should be implemented in schools.

The use of Mathematics workbook by the students should be encouraged by the school's administrators. Mathematics workbook should be included in the list of books to be purchased by their students. Emphasis should be placed on the understanding of basic knowledge on the concept of Mathematics. Teachers should be monitored to ensure the regular usage of the workbook and its proper management.

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