

Effects of Training and Workload of Teachers' on Achievement of Students' in Mathematics in Senior Schools in Jos Metropolis, Plateau State, Nigeria

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Abstract. The attainment of excellent achievement of students in Mathematics hinged on the training and workload of teachers in schools. Excellent achievement of students does not occur by chance unless some factors are looked into. Much task in terms of teaching units and assignment to Mathematics teachers, can make or mar the achievement of students in the schools. The interplay was a rallying point of this study which tried to ascertain the effect of training and workload of teachers' on achievement of teachers' in Jos metropolis Plateau State, Nigeria. Theoretically, the present study was on Skinner's theory of Operant Conditioning. As a descriptive study which made use of descriptive research survey type of research design, it consisted of two research questions and two null hypotheses tested at 5% level of significance with 10 teachers and 450 students. The Mock results of teachers' from Jos metropolis of Plateau State were used. Two sets of questionnaire were generated as basic instruments for data collection which comprised of effect of teachers' training on students' achievement and effect of teachers' workload on students' achievement in mathematics. Findings revealed that there was significant relationship between teachers' training and students' achievement ($r=0.824$, $P\text{-value}=0.009$). It was also revealed that there was significant relationship between teachers' workload and

students' achievement ($r=0.777$; $P\text{-value}=0.008$). Finally, the senior schools Mathematics teachers' workload and training have effects on students' achievement and therefore government should employ well trained teachers with adequate workload in teaching mathematics. The Mathematics teachers should be allowed to attend seminars and workshops as this will contribute to teachers' understanding of the changes in education system in Nigeria and the globe.

Keywords: Teachers' Training, Workload and Students' Achievement

1. Introduction

The importance of education in the development of manpower for a nation's economy cannot be over emphasized. Education helps individuals to function very well in their environment among many other important values. According to Boit, Njoki and Chang'ach (2012), the purpose of education is to empower the citizenry to reshape their society and eliminate social inequality. In particular, secondary school education is an important sector for national and individual development. It plays a vital role in creating a country's human resource at a higher level than primary education (Achoka, Odebero, Maiyo & Mualuko, 2007). The vital role played by secondary education explains the Nigeria

government decision by making Mathematics a core and compulsory subject at both junior and senior secondary school levels (Federal Republic of Nigeria, 2014)

Provision of quality secondary education is therefore important in generating the opportunities and benefits of social and economic development (Onsumu, Muthaka, Ngware & Kosembei, 2006). One of the indicators of quality education being provided is cognitive achievement of learners (United Nations Educational, Scientific and Cultural Organization, [UNESCO], 2005). According to Adediwura and Tayo (2007), academic achievement is designated by test and examination scores or marks assigned by the subject teachers. It could also be said to be any expression used to represent students' scholastic standing. Levin, Wasanga and Somerset (2011) reported that the academic achievement of students at the secondary school level is not only a pointer of the effectiveness of schools but also a major determinant of the well-being of youths in particular and the nation in general. Yusuf and Adigun (2010) and Lydiah and Nasongo (2009) noted that the performance of students in any academic task has always been of special interest to the government, educators, parents and society at large.

The important role of the teachers in the learning is unquestionable. The mathematics teachers have a lot of influences on their students' achievement. Teachers should have and apply specific abilities without which their influence may not be positively reflected in students' performance in the subject. In order that students make connection between what is taught in school and its application in real life problem-solving, the teacher must be effective in his teaching. Therefore, Mathematics teachers are supposed to possess good qualities such as being firm but friendly and congenial with students; good personality; dress sensibly well, smell good, and deeply competent and knowledgeable (Attah, 2009). Further a teacher must be a very good speaker; have the characteristic of being an even better listener; have the quality and characteristic of having a good sense of humor; being gentle, kind, chivalrous, and benevolent

person. However, they play a crucial role in educational attainment because the teacher is ultimately responsible for translating policy into action and principles based on practice during interaction with the students (Afe, 2001). In their study, Wright, Horn and Sanders (1997) concluded that the most important factor influencing students' learning is the teacher.

In spite of the position occupied by Mathematics at the secondary level of education, there has not been a remarkable improvement in students' performance as stated by Odubunmi (2006). This abysmal performance by students in Mathematics is attributable to teachers' workload as attested to by Kurumeh (2008) that Mathematics teachers' heavy workload has contributed to poor students' achievement in Mathematics. The influence of teacher's training on the learning outcome of students as measured by students' achievement in the subject has been an issue of national discourse in the schools time (Adediwura & Tayo, 2007).

Underlying the process of inclusion is the assumption that the general classroom teacher has certain knowledge and understanding about the needs of different learners, teaching techniques and curriculum strategies. Florian and Rouse (2009) stated that the task of teacher education is to prepare people to enter a profession which accepts individual and collective responsibility for improving the learning and participation of all children. Similarly, Savolainen (2009) noted that teachers play an important role in quality education and hinted that McKinsey opined that the quality of an education system cannot exceed the quality of her teachers. Studies indicated that the quality of the teacher contributes more to learners' achievement than any other factor, including class size, class composition, or background (Sanders & Horn, 1998; Bailleul, 2008). The need for high quality teachers equipped to meet the needs of all learners becomes evident to provide not only equal opportunities for all, but also education for an inclusive society. Reynolds (2009) said that it is the knowledge, beliefs and values of the teacher that are brought to bear in creating an effective learning environment for students, making the teacher a critical influence

in education for inclusion and the development of the inclusive school. Cardona (2009) noted that concentration on initial teacher education would seem to provide the best means to create a new generation of teachers who will ensure the successful implementation of inclusive policies and practices.

Teachers' training leads to effective teaching which is a significant predictor of students' academic achievement. Therefore, effective teachers should produce students of higher academic achievement. The reason that some teachers leave the profession for greener pasture could be their inability to manage the heavy workload. Little has been done about the nature of workload and its effect on Mathematics teachers especially considering the large population of students who take the subject. In most cases, they outnumber all other subjects combined since it is a compulsory subject for students.

Teaching mathematics can be considered a high-stress occupation due to workload attached or as a result of shortage Mathematics teachers in secondary schools (Attah & Kotso, 2010). The teaching of Mathematics has all the elements associated with stress such as continuous evaluation of its processes and outcomes, overcrowded classrooms and increasingly intensive interpersonal interactions with students, parents, colleagues, principals and the community. Hence, teachers' workload can affect teachers' behaviour at work and their involvement in the job and relationship with other staff. Its outcome can hamper an effective teacher-student cordial relationship (Dinham & Scott, 2000). In addition, an increasingly negative public opinion on Mathematics has contributed to an embittered teacher force throughout the world (Goswami, 2013). In addition, the population growth and technology development resulted into many children joining secondary education in order to enhance their social mobility. This caused over enrolment and increased the teachers' workload in secondary schools. As such the country has begun to experience challenges which include shortage of teachers, inadequate teaching and learning materials, over enrolment, teaching many periods than what is stipulated per week, lack of

Mathematics laboratories and class rooms among others which can affect students' achievement in Mathematics. Hence, the need for this to be seriously addressed by education specialists and policy makers.

The quality of education primarily depends on teachers and their capacity to improve the teaching-learning process. It is recognized that the quality of teachers and teaching lie at the heart of the school system intending to improve students' academic performance (Lassa, 1999 & Mosha, 2004). The teaching force is the foundation to improve students' academic performance at all levels of education. The importance of teachers and the roles they play in education process are central to the improvement of students' achievement in mathematics. Precisely, in any education level, it is largely the work of teachers that determines the degree of success or failure in the whole processes of teaching and learning.

Despite the importance of mathematics to human, it appears students' achievement in the subject at the secondary school level is becoming worrisome than in the other science subjects. Ibe and Maduabum (2001) argued that candidates performance at the senior school certificate examinations (SSCE) conducted by West African Examination Council (WAEC) have consistently remain poor, with mathematics having the highest enrolments and the poorest results over the recent years. The importance of mathematics to the national development and yet considering the state of poor achievement in this subject at the secondary school level which incidentally serves as the foundation for advance learning and professional courses in fields such as accounting, statistics, engineering and other calculated courses, then the poor achievement observable in the mathematics should be a thing of serious concern to any citizen of Nigeria.

2. Statement of the Problem

Mathematics is one of the core subjects offered at secondary schools as stipulated in the Nigerian National Policy on Education (NPE, 2014). In some schools, there are increased responsibilities on Mathematics teachers as a

result of daily occurrence of the subject on the teachers' teaching all through the week. This leads to early fatigue where the teachers become ineffective. There are schools whose teachers neither undergo Nigerian Certificate Examination (NCE) nor pass through Faculty of Education in University that are teaching Mathematics today due to deployment of those who studied like Physics, Engineering, Chemistry, Economics and Geography and allied courses in Polytechnics. Worrisome too is that Mathematics teachers are not given the needed enough recognition, better remuneration and consequently are not encouraged to desire becoming professional teachers to enjoy the appropriate benefits. To worsen the situation, such teachers and with those that read mathematics Education in Colleges and Universities are working longer hours without significant pay to meet the demands of the expanding job roles in today's classroom (Galton, 2008 & Buchanan, 2009). However, many teachers continually are devoted to work longer hours due to job commitment, passion and risk of being incompetent in their profession (Guay, 2008). These problems can affect performance of both the teachers and students. If these problems are not given attention, teachers will continue to face the burdens of being overwhelmed, overworked and hence be professionally incompetent due to motivation in mathematics classroom. This bad situation will result into poor achievement by students who are taught by these categories of teachers. The worry of this study is that if mathematics teachers are overloaded with work and do not undergo sound teachers' training and retraining, it will have a pervasive effect on their effectiveness and Students' achievement in senior secondary school mathematics in Jos metropolis, Plateau State, Nigeria.

From this backdrop, Mathematics teachers' workload and training is given attention in this study that the findings may benefit relevant education stakeholders for an improved students' achievement in mathematics.

3. Aim and Objectives

The broad purpose of the study is to find out the effects of training and workload of teachers on

achievement of students in Mathematics in senior schools in Jos metropolis, Plateau State, Nigeria.

Specifically, the study is to:

- Determine the effect of teachers' training on students' achievement in Mathematics,
- Find out the extent to which the teachers' workload affect students' achievements in Mathematics in Jos metropolis of Plateau State, Nigeria.

4. Research Questions

The study would be guided by the following research questions:

- To what extent does teachers' training affect students' achievement in Mathematics?
- To what extent does teachers' workload affect students' achievement in Mathematics?

5. Hypotheses

The following hypotheses was formulated for the study and tested at 0.05 level of significance:

- There is no significance relationship between teachers' training and students' achievement in Mathematics in senior schools in Jos metropolis, Nigeria.
- There is no significance relationship between teachers' workload and students' achievement in Mathematics in senior schools in Jos metropolis, Nigeria.

6. Research Design

The study used descriptive research survey. The research design is a method for collecting information or data as reported by different individuals. The descriptive research design is purposely used to find out the effect of training and workload of teachers on the achievement of students in senior school mathematics.

6.1 Population

The population of this study consists of the SS3 students from 22 public secondary schools and all mathematics teachers in Jos metropolis, Plateau State, Nigeria.

6.2 Sample

The sample for this study was 5 schools which constituted about 25%, the total population of the students. Hence, the sample of the students was 450 and the available Mathematics teachers in the selected schools, are carefully selected from selected schools in Jos North. The sample represents the population of students and Mathematics teachers in the sampled senior secondary schools. This sample size according to Ibanga (2002) documented that 10%-20% of a population is ideal for sample especially in a survey study.

Table showing the sample of the students and teachers used for the study

Category	M	F	Total
Teachers	7	3	10
Students	223	232	450

6.3 Instrument for Data Collection

The two instruments used for data collection in this study were developed by the researchers for both the students and Mathematics teachers. One set of the instrument was used to ascertain the Mathematics teachers' training and workload, while the second set for students' achievement.

6.4 Description of Instrument

The instrument on Teachers' Training and Workload Questionnaire (TTWQ) was constructed on the basis of research questions on a four-point likert scale. The second questionnaire was on students' achievement in mathematics questionnaire (SAMQ) for students. The instruments are made up of items on effect of teachers' training, teachers' workload and students' achievement in mathematics. The first instrument for teachers has two parts: Part one provides demographic data of the respondents that contains teachers' training and questionnaire items like teachers' knowledge, training level of teachers' skills, teachers' experience and part two provides workload information on school administration,

students' assessment, workload level of teaching and resources management. The second instrument has to do with students' achievement in mathematics based on teachers' training and workload. The items were structured in form of a four-point likert scale coded: Strongly Agree (4), Agree (3), Disagree (2) and Strongly Disagree (1)

6.5 Procedure for Data Collection

The researchers worked with one research assistant each in a sampled school. The research assistants were recruited from among secondary school teachers in the study area. The researchers had interacted with the research assistant in each school on the objective of the study. This equipped them to explain certain items in the questionnaire to the respondents so that the questionnaire would be properly completed. The questionnaire was administered by the researchers with the aid of research assistants face-to-face to the respondents and thereafter collected on the spot. This method ensured proper completion and high percentage return of completed questionnaire but some copies were returned uncompleted. A total of 450 copies of questionnaire were distributed but 400 copies were filled and returned representing 88.89% return rate which is enough for the analysis.

6.6 Methods of Data Analysis

Quantitative data analysis required the use of Statistical Package for Social Sciences (SPSS). Furthermore, the researchers employed the Pearson moment correlation coefficient (r) for analysis at 0.05 significant level.

7. Results

Research Question One: To what extent does teachers' training affect students' achievement in Mathematics?

Table 1.1: Teachers' Qualification and Students' Performance

Teachers Qualification	No of Teachers	Teachers Qualification	Scores (less than 49)%	Moderate (49-52)%	High (53 & above)%	TOTAL OF STUDENTS
NCE	2	NCE	34 (85.00)	3(7.50)	3(7.50)	40 (100)
DIPLOMA	1	DIPLOMA	23(28.40)	18(22.22)	40(49.38)	81 (100)
B.ED/B.SC.	4	B.ED/B.SC.	78(39.20)	36(18.10)	85(42.71)	199 (100)
PGDE.	1	PGDE.	24(60.00)	10(25.00)	6(15.00)	40 (100)
M.ED/M.SC.	2	M.ED/M.SC.	16(40.00)	6(15.00)	18(45.00)	40 (100)

Source: Field Data 2017

Table 1.1 reveals the teachers training (qualification) and the Grade score (groups) of their students in mathematics. Teachers with NCE training had 34(85.00%) with Low grade score, 3(7.50%) with Moderate grade score and High grade score respectively in Mathematics. Teachers with Diploma training had 23(28.40%) with Low grade score, 18(22.22%) with Moderate grade score and 40(49.38%) with High grade score respectively in Mathematics. Teacher's with B.ED/B.SC. training had 78(39.20%) with Low grade score, 36(18.10%) with Moderate grade score and 85(42.71%) with High grade score respectively in Mathematics. Teacher's with PGDE training had 24(60.00%) with Low grade score, 10(25.00%) with Moderate grade score and 6(15.00%) with High grade score respectively in Mathematics. Teacher's with M.Ed./M.Sc. training had 16(40.00%) with Low grade score, 36(18.10%) with Moderate grade score and 85(42.71%) with High grade score respectively in Mathematics.

Research Question Two: To what extent does teachers' workload affect students' achievement in Mathematics?

Table 1.2: Overall Teachers Workload and Students' Achievement in Mathematics (Grade Score)

Schools	Overall Teachers Workload	Students Achievement Grade Score		
		Low (less than 49)	Moderate (49-52)	High (53 & above)
school A	77	14	14	13
school A	78	15	5	19
school B	77	23	14	3
school B	72	24	10	6
school C	66	34	3	3
school C	56	12	10	18
school D	53	20	4	16
school D	45	16	6	18
school E	34	9	4	27
school E	24	8	3	29

Source: Field Data 2017

Figure2: Teachers Overall Workload and Student Academic Performance

Table 1.2 and figure 2 above reveal the teachers workload and the Grade score (groups) of their students in mathematics. In school A, Teachers with overall workload of 77 had 14 students with Low achievement score, 14 students with Average/Moderate achievement score and 13 students with High achievement score

respectively in Mathematics. When teachers overall workload increase to 78, the teacher had 15 students with low achievement score (increase of 1), 5 students with Average/Moderate achievement score (decrease of 9), and 19 students with High achievement score (increase of 6: from 13 to 19). This shows

that as teachers workload increases, number of students with high grade achievement score increases in School A.

In school B, Teachers with overall workload of 77 had 23 students with Low achievement score, 14 students with Average/Moderate achievement score and 3 students with High achievement score respectively in Mathematics. When teachers overall workload decreases to 72, the teacher had 24 students with low achievement score (increase of 1), 10 students with Average/Moderate achievement score (decrease of 4), and 6 students with High achievement grade score (increase of 3: from 3 to 6). This shows that as teachers workload decreases, number of students with high grade achievement score increases in School B.

In school C, Teachers with overall workload of 66 had 34 students with Low achievement score, 3 students with Average/Moderate achievement score and 3 students with High achievement score respectively in Mathematics. When teachers overall workload decreases to 56, the teacher had 12 students with low achievement score (decrease of 22), 10 students with Average/Moderate achievement score (increase of 7), and 18 students with High achievement grade score (increase of 15: from 3 to 18). This shows that as teachers workload decreases, number of students with high grade achievement score increases in School C.

In school D, Teachers with overall workload of 53 had 20 students with Low achievement score, 4 students with Average/Moderate achievement score and 16 students with High achievement score respectively in Mathematics. When teachers overall workload decreases to 45, the teacher had 16 students with low achievement score (decrease of 4), 6 students with

Average/Moderate achievement score (increase of 2), and 18 students with High achievement grade score (increase of 2: from 16 to 18). This shows that as teachers workload decreases, number of students with high grade achievement grade score increases in School D.

In school E, Teachers with overall workload of 34 had 9 students with Low achievement score, 4 students with Average/Moderate achievement score and 27 students with High achievement score respectively in Mathematics. When teachers overall workload decreases to 24, the teacher had 8 students with low achievement score (decrease of 1), 3 students with Average/Moderate achievement score (decrease of 1), and 29 students with High achievement grade score (increase of 2: from 27 to 29). This shows that as teachers workload decreases, number of students with high grade achievement grade score increases in School E.

The overall results shows that in schools only in School A is when teachers' workload increases that the number of students with high grade achievement score increases. While in School B, C, D and E shows that as teachers workload decreases, the number of students with high grade achievement score increases.

8. Hypotheses Testing

Hypothesis One

H₀: There is no significant relationship between teachers' training and students' achievement in Mathematic in senior schools in Jos metropolis, Plateau State, Nigeria.

H₁: There is a significant relationship between teachers' training and students' achievement in Mathematic in senior schools in Jos metropolis, Plateau State, Nigeria.

Contingency Table 1.3: Pearson Correlation of Teachers Qualification and Students Mathematics Grade Score

Teachers Qualifications	No of Stds	$\bar{X}$	SD	t_{cal}	P-value
NCE	40	45.53	8.49	0.824	0.009
DIPLOMA	81	54.59	11.92		
B.ED/B.SC	199	51.77	10.42		
PGDE	40	46.50	5.37		
M.ED/M.SC	40	52.38	9.46		
Total	400	51.25	10.44		

P<0.05

Table 1.3 reveals the mean score of students with NCE teachers is 45.53 ± 8.49 , Diploma Teachers is 54.59 ± 11.92 , B.Ed./B.Sc. Teachers is 51.77 ± 10.42 , PGDE Teachers is 46.50 ± 5.37 and M.Ed./M.Sc. Teachers is 52.38 ± 9.46 .

Hypothesis Two

H_0 : There is no significant relationship between teachers' workload and students' achievement in Mathematic in senior schools in Jos metropolis, Plateau State, Nigeria.

H_1 : There is a significant relationship between teachers' workload and students' achievement in Mathematic in senior schools in Jos metropolis, Plateau State, Nigeria.

The researcher uses table 1.2 of teachers' workload affects students' achievement in Mathematics to generate data for this hypothesis.

The parameters have the following frequency distributions.

Table 1.4: Pearson Correlation of Teachers Workload and Student Achievement Grade Score in Mathematics

grade score	no of stds	$\bar{X}$	sd	r_{cal}	p-value
low	10	17.50	7.92	.553	.097
moderate	10	7.30	4.35	.620	.056
high	10	15.20	9.11	-.777**	.008

The calculated Pearson correlation coefficient r_{cal} value of 0.55 is a relationship between Teachers workload and students with Low grade score in mathematics, this implies that as teachers workload increases there is an increase of students with Low grade score in mathematics

While the calculated Pearson correlation coefficient r_{cal} value of 0.62 is a relationship between Teachers workload and students with Average grade score in mathematics, this implies that as teachers workload increases there is an increase of students with moderate grade score in mathematics. The calculated Pearson correlation coefficient r_{cal} value of -0.777, show a negative relationship between Teachers workload and students with High grade score in mathematics, this implies that as teachers workload decrease there is an increase of students with high grade score in mathematics. In addition, the p-value of 0.008, the researcher therefore accepts the alternative hypothesis and rejects the null hypothesis. This means there is a significant relationship between teachers' workload and students' achievement in Mathematic in senior schools in Jos metropolis.

9. Discussion of Results

Hypothesis one shows that there was statistically significant relationship between teachers' training and students' achievement in Mathematics, the mean score of students with NCE teachers is 45.53 ± 8.49 , Diploma Teachers is 54.59 ± 11.92 , B.Ed./B.Sc. Teachers is 51.77 ± 10.42 , PGDE Teachers is 46.50 ± 5.37 and M.Ed./M.Sc. Teachers is 52.38 ± 9.46 . With an overall students mathematics mean and standard deviation of 51.25 ± 10.44 . NCE teachers had students with the most low score in Mathematics while Diploma Teachers had the highest student mathematics mean score and followed by B.Ed./B.Sc. Teachers. The calculated Pearson correlation coefficient r value of 0.824 with p-value of 0.009 which is less than 0.05 level of significant. The researcher therefore accepts the alternative hypothesis and rejects the null hypothesis. This means there is a significant relationship between teachers' training and students' achievement in Mathematic in senior schools in Jos North Local Government Area. And results of the analysis summarized in 4.1 show that the students that teacher with high

qualification taught perform better than students taught by NCE and Diploma qualifications.

Hypothesis two result of calculated Pearson correlation coefficient r_{cal} value of 0.55 signifies that there is a relationship between Teachers workload and students with Low grade score in mathematics which implies that as teachers' workload increases there is an increase of students with Low grade score in mathematics. While table 4.2 shows that that students of the teachers have less or moderate workload perform more better that students of the teachers that have much workload.

10. Conclusion

The study concluded that teachers training and workload have a significant role played in the students' achievement in Mathematics in Jos metropolis, Plateau State, Nigeria. The teachers' training and workload have significant relationship with students' achievement in Mathematics. The teachers' training and workload were significant predictors of students' achievement in mathematics. The analysis revealed that teachers' workload had positive predictor of students' achievement more than the teachers' training. The implication is that a competent trained teacher was in overloaded can affect his quality of teaching and students' achievement in mathematics.

It is therefore evident that effort needs to be made to ensure that schools are staffed with trained teachers. Extra effort needs to be made by schools to supplement the teachers' devotion prepare students for national examinations through reduced teachers' workload and in order to guarantee efficiency on the part of teachers. In other word, the more the overburden the teacher becomes, inefficiency will set in to affect students' achievement in Mathematics.

11. Recommendations

Based upon the findings of the study, the researchers recommend that the government, through the Ministry of Education should consider the teachers' workload in order to ease

teachers' weekly workload for adequate content coverage in mathematics. All levels of administration (Department of Education, district office, and schools) should be considerate assigning duties to members of their teaching staff for effective Mathematics teaching. Effort should be made by school authority to protect teachers' teaching time and not to disrupt teaching. Mathematics teachers should attend seminars, workshops and retraining in Mathematics to enhance their performance so that they can use the robust experience in achievement of students in the subjects.

Finally, the government should ensure that schools are adequately staffed with Mathematics teachers to manage workload to provide quality teaching to students in secondary schools.

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