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Critical Evaluation of Learning Duration and Students' Performance in Secondary School Mathematics

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ARTICLE

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Abstract

This study examined the impact of learning duration on the students' performance in secondary school mathematics within Offa community. A survey research approach was adopted. Sixty students were chosen from six secondary schools in Offa using purposive sampling. Mathematics students' test score and questionnaire on the amounts of time spent on different learning activities in mathematics formed the basis of data generation for the study. The data collected were analyzed using descriptive statistics, correlation, as well as regression analysis. R statistical package was employed to carry out the analyses. The results showed that the contribution of time spent to the student's test score is positive. It was concluded that increasing time spent on learning mathematics will partially lead to an increase in students' test score. It was then recommended that student, teacher, and school should increase learning duration in mathematics.

Keywords: Learning duration, Students' performance, Secondary school mathematics, Descriptive statistics

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1. Introduction

In education, approaches to time are many and different. One approach is to officially allocate time to the task. Another approach is to identify the engaged time or time on task, and an approach is to identify the proportion of the engaged time student used on working on tasks at a level of difficulty for them. Anderson (1983) enumerated these different approaches as officially allocated time which includes school time, classroom time, and instructional time. According to this author, school time is the quantity of time used in school. Classroom time is the quantity of time utilized in the classroom. While the volume of the part of classroom time spent in teaching a particular school subject is the instructional time. In the actual sense, if time is not allocated to learning in schools learning may not take place. The quantity of time students used in learning and understanding varies from one student to another.

In schooling institutions, time is usually assigned for a purpose. For instance, teachings are organized and time duration allocated to it for effectiveness. This is in addition to managing the scarce and limited teaching aids. School time is the periods in which school is opened for school activities. School time includes dead time. Deadtime includes break time, transition time, and holiday time. These are periods students are not expected to be engaged.

School learning time varies from country to country and school to school. In Nigeria, this is also not different. States in the northern part of the country sometimes set their school learning time to suit their climate, culture and religion. Variations in the duration of school learning time in Nigeria is so glaring with the advent of Boko Haram terrorists, Arm Bandits, and Kidnappers which are more prominent in the northern part than the southern part of

Nigeria. The coming of the COVID 19 pandemic is also a factor in the variations of school time in the country now. Different states fix different school learning time depending on the political terrain in operation. School time is crucial to teachers, students, school administrators, and policymakers. According to Mistra (2000), the amount of time spent is believed to aid productivity and helps the student to complete tasks on schedule. Every student in a school share an equal amount of school time resource, the difference lies in the way each school, teacher, student, and school administrator managed it. In Nigeria, few secondary schools are boarder schools where students are forced to make effective use of a fixed and equal amount of school learning time. Other schools are day schools where students contend with the challenges of how to manage both school and domestic workload time. Thus, there are variations in the time used by students on different tasks.

In the report of Lavy (2010), it was discovered that there is disparity across nations of the world in instructional time in schooling institutions. The report shows similar differences in the number of classroom lesson time used per week in different subjects. In addition, it was established that the volume of weekly hours of instructions in mathematics, language, and science is not the same with other subjects. Odeyemi and Udokang (2020) asserted that a slight positive correlation exists between school academic time and students' performance in Mathematics and the English language in Offa, Nigeria.

The question in mind then is that, can all these be responsible for the differences in students' performance in mathematics? What are the consequences of changing time spent in learning mathematics by students on test score in secondary schools? Other bordering questions include: what is the learning duration of mathematics' student in the junior and senior secondary schools? what impact is increasing learning duration on students' performance in mathematics in secondary schools? As a result of this, the assumptions and claims to be verified in this study then remain that the impact of increasing learning duration in mathematics is not significant on students' performance in mathematics in the selected secondary schools in Offa and that the effect of learning time spent on other subjects and activities do not depend on learning duration in mathematics in the selected secondary schools in Offa. The study aims to examine the impact of learning duration on students' performance. The objectives are to determine the average learning duration of different categories of students in different secondary schools. Also, to determine whether there is a correlation between learning duration and students' performance in the selected secondary schools.

Lavy (2015 & 2019), claimed that in some countries simple correlations and simple OLS regression relationships between classroom time, instruction time, and student's performance have been established. Such claims have not been significantly established in Nigeria (Ayodele, 2014). One of the widely used statistical techniques for describing the relationship among variables is correlation and regression (Kothari & Garg, 2014). Regression equations have been used in many human endeavours. It is a very useful tool. It is also one of the most misused statistical tools by untrained users (Ayodele, 2014). The main objective of regression is to establish whether a relationship exists among variables, estimate parameters, and make predictions based on mathematical equations. Usually, regression requires that a formula be found which relates the variables whose values one wants to estimate.

Many investigators and reviewers have discovered that there is a positive, partial, weak and insignificant relationship between time and student achievement (Walberg, 1988). On the contrary Hossler, Stage, and Gallagber (1988), submitted that there is a positive strong relationship between time-on-tasks and student achievement. They submitted that the consequences of a time-on-task are based on students' characteristics,

subject matter, and instructional techniques. Academic learning time has a positive relationship to student achievement, they asserted. This implies that not all types of time on task have the same impacts. Brown and Saks (1980) in their write up noted that increasing allocated or engaged time is more beneficial to lower ability students. They opined that the performance of the student is dependent on the volume of time required to learn together with the volume of time made available. As such only those students who require a high volume of time to learn to perform better when additional learning time is made available to them

In this study, measures of central tendency and measures of variations will be used to verify some of these claims. Thus, this study seeks to use descriptive statistics (Regression and correlation) to estimate the contribution of learning duration on students' performance in mathematics within the Offa community.

2. Materials and Methods

The study consists of sixty students from JSS2 and SSS2 classes of six secondary schools, Offa selected using a purposive sampling technique. This is because those included are volunteers who permit a certain level of monitoring. The schools are Ansarul-Deen Islam Secondary School, Goodness Royal College, Folorunsho Memorial College, Federal Polytechnic Secondary School, BUKS International School, and Mustapha Standard College. Test scores used are average examination outcomes of each student in the selected subjects of each school. The drafted questionnaire adapted for the study is part of Stallings Observation System (SOS) on task-on-time of 2014 (Stallings, Knight, Markham, 2014 & Lavy, 2015). This is used to investigate time spent on different activity (both academic and non-academic). Itemized in the questionnaire include teaching time, non-teaching time, domestic activity time, and allocated teaching time. This questionnaire on how spent my time per day was used to gather data for one week from the selected students in the secondary schools. The data gathered through this were tabulated for each school and combined for analysis. There were two categories of variables for the study. Variable X represents time while Y represents test scores. The allocated teaching time per week in the different selected schools was also gathered through the school teaching times table. The collected data were tabulated.

The statistical tool employed in this study is regression. This was used to analyze and summarize the study. R statistical software was employed to run the data.

The general linear regression model is given as

$$Y = X\beta + \varepsilon \quad \text{.....(1)}$$

Where:

Y is an nx1 vector of observations of the response variable Y

X is nxp design matrix

β is px1 vector of regression coefficients

and ε is nx1 vector of random errors.

The equation contains an intercept term, so there are p-1 explanatory variables in the model.

This is adapted in this study. So this model is applied thus:

$$Y_{ij} = \mu + \beta_i X_i + \varepsilon_{ij} \quad \text{.....(2)}$$

Where:

Y_{ij} is the performance of the ith student in jth school within a learning duration in mathematics

X_i is the learning duration of ith student in mathematics in the a school

ε_{ij} is the unobserved error term

μ is the fixed effects of learning duration

For purposes of hypothesis testing, the Analysis of Variance (ANOVA) tool in the regression was also adapted. Under the normality of residuals, the test statistic F_c follows Snedecor's F distribution with 1, n-2 degrees of freedom. The null hypothesis is rejected for the right-tailed test. R square is determined from this table and the coefficient of correlation determined from it.

3. Results

Table1: Allocated Teaching Time (mins) per week, Means, and Standard Deviation of Students' Performance in Secondary Schools

Class	Descriptive Statistic	Officially Allocated Teaching Duration (mins.) in Category Per Week		
		160	200	300
SSS	Mean	50.2	54.93	76.6
	Std. Dv	10.719	6.265	8.884
JSS	Mean	55.45	56.07	65.8
	Std Dv	8.626	11.885	14.207

It is clearly shown that the higher the allocated school teaching duration (Allocated Instructional Time) the higher the test scores.

Table 2: Means and Standard Deviations of School Academic Learning Time (ALT) spent by the Student in the six Schools

Mean Value	Standard Deviation	The proportion of Students by the amount of weekly hours spent
8.44	5.066	5.42

The proportion of students by the amount of learning duration (instructional + extra lesson + self-study + assignment + tutorial time) is 5.

Table 3: Average Hours of School Academic Learning Time Spent and Examination test scores in the Six Secondary Schools

School	Hours	Scores
MSC	8.0	59.2
BIS	7.35	56.5
FPSS	8.69	54
FMC	9.09	69.3
GRC	9.32	62.4
AUDSS	8.19	52.4

The table above shows the average hours spent by the students in the respective schools in instruction time, self-study, assignment, and tutorials per week and their average corresponding tests scores.

Table 4: Regression of Students' Scores on School Time

Source of variation	coefficients	standard error	t-value	pr (>|t|)
Mean effects	42.4412	5.2210	8.128	2.72e-11
Learning duration	0.8046	0.2731	2.946	0.00463

Residuals standard error is 10.62 on 58 degrees of freedom. The regression standard error is 0.2731.

Table 5: ANOVA Table of Regression of scores on Time

Source of variation	Degrees of freedom	Sum of squares	Mean sum of squares	F-ratio	Pr (>|F|)
Learning duration	1	979.5	979.5	8.6803	0.004625
Residuals	58	6544.7	112.84		

R squared is 0.13 so that |r| is 0.36.

4. Discussion

Table 1 of the results clearly shows different levels of time used in teaching mathematics per week in the various schools. From the table, we can see the changes in the average test scores. Of the students in both SSS and JSS classes, average scores progress as allocated teaching time progresses. An increase is noticed in the senior classes so also is the case of the junior classes. Scores increased steadily with time in both. Time spent in learning mathematics here affects students' scores. But a study of the standard deviations depicts that allocated teaching time of 200 minutes has the least standard deviation and allocated teaching time of 160 in JSS classes has the least standard deviation. The implication of this is that for younger student increasing learning duration might not produce much increase in test score while for the older students it might contribute much more. Table 2 tells us the average time an hour a student spent on mathematics per week. Of 24hours in a day and a week of seven days (24x7=168 hours), 8.44 hours of it was expended learning mathematics on the average by each student per week. The proportion of students by the amount of learning time is 5.42. Similarly, table 3 depicts the average learning duration per student in each school in a week as well as the average scores per student per week in the school. The average scores range from 52.4% to 69.3% and the average learning duration ranges from 7.35 to 9.32 hours spent per student in a week in each school.

The results of the regression of students' performance on learning duration are shown in table 4. The coefficients estimates are 42.4412 for intercept and 0.8046 for slope. And standard errors are 5.2210 and 0.2731 for intercept and slope respectively. The model is then Students' performance = 42.4412 + 0.8046 Learning Duration. This means that students' performance has a positive relationship with learning duration. To test the assumption and claim that the impact of learning duration on students' performance is not significant, the ANOVA table 5 shows a P-value of 0.004625 which is less than 0.05, and F calculated of 8.68 on 1 and 58 degrees of freedom is greater than F critical value. This implies that the null hypothesis of no impact on test scores is rejected. Thus, learning duration has a significant impact on student performance. From the same table, 5 R squared is calculated to be 0.13 and r is 0.36. This indicates that there exists a correlation between learning duration and students' performance. This regression model with a small standard error of 0.2731 might be considered good. This is not to say that the model is adequate.

5. Conclusion

In conclusion, it is observed that for a certain reason or the other, there are different levels of time for learning mathematics in the secondary schools in Offa. These levels of learning time have different effects on students' performance. Based on the findings above, the average time spent in learning mathematics per week in these schools is 8.44 hours and the average scores are 58.97. The regression equation indicates that time has positive effects on students' performance. Thus, we can conclude students' performance partially depends on learning duration. An increase in time spent is linked to an increase in students' performance. Therefore, based on the conclusion, student, teacher, and secondary school should moderate learning hours of mathematics.

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