Students' Interest and Class Size as predictive tools for Academic Achievement in Physics

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Abstract- Students' academic achievement in Physics is generally influenced by many factors among which are system, student and parental factors etc. This study examined the influence of students' interest in Physics and class size on students' academic achievement in Physics. Descriptive survey design with a study sample of 150 S.S.III Physics students were used in this study. Students' previous examination result and questionnaires were used as instruments of data collection. Collected data were analyzed using Pearson correlation and multiple regression analysis at 0.05 level of significance. The results revealed: (i) a significantly positive relationship (r = 0.58) between students' Interest in Physics and their academic achievement; (ii) a significantly positive relationship (r = 0.51) between class size and students' academic achievement in Physics; (iii) a statistically significant positive composite relationship (R = 0.635, $F_{(0.001)}$ = 603.429) between students' interest in Physics and class size (predictors), and students' academic achievement in Physics; (iv) students' interest in Physics and class size jointly contributed and influenced academic achievement to about 40.3 % (R^2 = 0.403); (v) students' interest in Physics and class size contributed about 58.4 % (β = 0.584, Sig. = 0.000) and 51.1 % (β = 0.511, Sig. = 0.000) respectively, to students' academic achievement in Physics. It is recommended that stakeholders should put more effort into improving students' interest in sciences and as well, ensure that the class size is reduced to teacher-students ratio of 1:35.

Keywords: Physics, Students' interest, Class size and Academic achievement

I. Introduction

Physics as a physical science entails both practical and theoretical aspects, as well as mathematical and non-mathematical aspects as in mathematics and engineering [23]. It is a basic science with experimental-based principles and concepts which are applied in other aspects of science like computer, chemistry, biology leading to scientific and technological development. Thus, the quality of our Physics education is important for us to monitor if must progress in the course of our human activities such as political, medicine, building, agriculture, pharmacy, engineering, social, economic among others. In fact, the quality of our Physics education can be used as a measure of our technological development; hence, the generally observed poor achievement of students in school Physics needs to be examined.

Academic achievement can be defined as an academic result or numerical score obtained within an educational exercise of teaching and learning after undergoing a due process of examination or test. Specifically, it is a measure of the extent to which educational objectives has been attained. Academic achievement can also be defined as the observed and measured aspect of a student's mastery of skills and subject contents as measured with valid and reliable test [16], while [26] described academic achievement as the ability of the student to study and remember facts and being able to communicate his knowledge orally or in written form even in an examination condition. It is generally used to determine how well an individual is able to assimilate, retain, recall and communicate his knowledge of what has been learnt.

Students' Interest and Academic Achievement

Interest is an emotional state of a person prompting such person to cognitively engage in learning activities and seriously desiring to know. In another opinion, [9] viewed interest as a condition in which an individual associates the essence of certain things or situation with his needs or wants. Interest is also defined as specific predispositions of individuals which can develop over longer periods of time [19].

Interest is often thought of as a process that contributes to learning and achievement [12]. It has been opined that academic interest can help students of natural sciences deal with learning struggles and achieve high performance [15]. In another study, interest was observed to correlates with and significantly predicted achievement [30] but [25] in their study of interest-educational success link using both cross-section and panel data, observed that there is little support for the idea that prior interest in school has a bearing on future educational success.

Students' interest in learning has been observed to correlate significantly and positively to academic achievement; thus, interest in learning significantly predicts their academic achievement [26]. Further study showed that the higher the levels of interest of individual students in natural science subjects, the higher the achievement in those subjects [17]. Similarly, [5] observed significant relationship between students' academic interest and achievement in Chemistry. Like others, [13] revealed that academic interest has a statistically significant positive impact on students' academic achievement. They also found that the relationship between academic interest and achievement is much stronger in natural sciences than in other disciplines. To buttress it all, students' performance in science subjects was observed to be determined among others, by the students' level of interest toward those science subjects [21] as cited in [17].

Class size and Academic Achievement

Class size can be defined as the number of students in a class at a given specific time undergoing teaching and learning instructions of a teacher. In a similar version, [1] defined class size as the number of students per teacher in a given class. In Nigeria, small class size is very common in private schools while large class size is a peculiar feature in public schools because the government does not usually invest in public school developments. The general consequences based on experience is that teaching and learning in large class sizes is not usually interesting (compared to small class sizes) with teachers unable to teach, explain and evaluate concept effectively to the best of students' understanding, hence the students' academic achievement is affected. However, [8] stated that class size affects the level of understanding of the students since the teacher will not have full attention on every student in the classroom. Their research studies revealed that both large and small class size affects student's performance.

Literatures concerning the effect of class size on students' academic achievement have indicated inconsistent findings. Research studies have shown that class size has insignificant influence or relationship with academic performance of students [2], [22]. In another study, [7] observed that smaller class size was not found to have a consistently positive effect on student achievement, but that the result does not mean that the positive benefits of smaller class size were not present, while [6] observed a relatively moderate inverse correlation between class size and student achievement. Large class sizes have been observed to negatively affects and impacts students' academic performance and learning [24], [28], [31] and are less preferable to small class sizes for better academic achievement of students [31]. It was further emphasized that students' scores in large classes do not translate to actual performance and this could have adverse effect on them in external examinations [28].

Other studies have found a positive link between student achievement and class size [20] and have indicated that as class sizes increase, student learning and achievement decreases [29], [3], [10], [27] cited in [28]. Again, [14] observed negative relationships between class size and student load with student outcomes. They further revealed that class size and student load primarily influence student outcomes and that reducing class sizes will lead to significant improvements in student outcomes. Studies also confirmed that in smaller classes, time spent on classroom management was decreased which led to improvement in academic achievement [11] cited in [7]. In another pattern, [4] observed a significant difference in the academic performance of secondary school students based on class size, with students in large classes performing better than their counterparts in smaller classes. Similarly, [18] observed that students in larger classes performed the same or better than students in smaller classes.

Statement of Problem

The regular under-achievement of students in science especially physics in both secondary and tertiary schools are a major concern for all stakeholders in education sectors. This has lead to several thought and theories as to why this failure has become so regular, increasing instead of decreasing. This has, however necessitated this study to ascertain whether or not students' interest in Physics and class size can likely minimize the observed failure.

Purpose of the Study

The purpose of this study is to examine the predictive ability of students' interest in physics and

class size on students' academic achievement in physics. It also intend to determine the relationship between students' interest in physics and their academic achievement in physics, as well as the relationship between class size and students' academic achievement in physics. In a similar manner, this study will also investigate the joint and relative contributions of students' interest in physics and class size to students' academic achievement in physics.

Research hypotheses

The following null hypotheses were raised.

Ho_1: There is no significant relationship between students' interest in Physics and their academic achievement in Physics.

Ho_2: There is no significant relationship between class size and academic achievement of students in Physics.

Ho_3: There is no significant composite contribution of students' interest in Physics and class size to academic achievement of students in Physics.

Ho_4: There are no significant relative contributions of students' interest in Physics and class size to academic achievement of students in Physics.

II. METHODOLOGY

This study used ex-post facto descriptive survey design method. The target population consists of all Senior Secondary III (SS III) Physics students in all public senior secondary schools in Odeda Local Government area, Abeokuta, Ogun state, Nigeria. The study samples consist of one hundred and fifty (150) Physics students (made up of 95 boys and 55 girls) drawn from three randomly selected secondary schools in the local government area of study. Fifty (50) students each were picked from each of the three selected secondary schools in the Local Government area. SS III students were used in this study because they are the most experience students with highest level of academic curriculum coverage in the schools.

The instruments used for data collection are SS III First term result sheets and Students' Interest-Class Size Scale (SICSS). The SS III First term result sheets contain the first term examination scores of SS III Physics students and represent their academic achievements. The SICSS is a questionnaire made up of sections A, B and C. Section A contains bio-data information of the sample students, while sections B and C consists of ten (10) items each, designed to obtain information on students' interest in Physics and Physics class size, respectively. The response options to the SICSS items were based on the likert-scale of Strongly Agree (SA = 4 points), Agree (A = 3 points), Disagree (D = 2 points), and Strongly Disagree (SD = 1 point). This leaves sections B and C of the SICSS with a maximum score of 40 points, each. The questionnaire was validated by experts, subjected to Cronbach alpha reliability test and a reliability coefficient of 0.78 was obtained. The questionnaire was administered to the study students and allowed to answer under strict examination conditions to avoid sharing of ideas among one another.

The research hypotheses were analyzed using mean, standard deviation, Pearson product moment correlation, Analysis of variance (ANOVA) and multiple regression analysis at 0.05 level of significance. The SS III First term examination scores (academic achievements) were converted to over 40 (i.e maximum score of 40) to help easy analysis of the questionnaire data with the students' academic achievements.

III. RESULTS AND DISCUSSION

Ho_1: There is no significant relationship between students' interest in Physics and their academic achievement in Physics.

Table 1: Pearson correlation analysis results for Students' Interest - academic achievement relationship

Variable	N	Mean	SD	R	Sig.
Student Interest in Physics	150	25.13	5.99	0.58*	0.001
Academic Achievement	150	21.65	3.14		

* Correlation is significant at 0.05 level (2-tailed)

Table 1 shows the results of correlation analysis conducted for the relationship between students' interest in Physics and their academic achievement in Physics. The result indicated that there is a positive significant relationship (r = 0.58) between students' Interest in Physics and their academic achievement in Physics. Hence, the null hypothesis is rejected. In general situation, Physics being somehow abstract and mathematically requires students' interest otherwise, excelling in it can be really difficult. Experience has shown that majority of students who excelled in Physics had interest in it or basically in sciences. In other words, assessment of students' interest in Physics can be used to predict academic achievement of students in physics.

Ho_2: There is no significant relationship between class size and academic achievement of students in Physics.

Table 2: Results of Pearson correlation analysis for class size - students' academic achievement relationship

Variable	N	Mean	SD	r	Sig.
Class Size	150	31.57	5.60	0.51*	0.004
Academic Achievement	150	21.65	3.14		

* Correlation is significant at 0.05 level (2-tailed)

Table 2 indicates the results of correlation analysis conducted for the relationship between class size and students' academic achievement in Physics. Just like in table 1, this result showed a positive significant relationship (r = 0.51) between class size and students' academic achievement in Physics. Hence, the null hypothesis is also rejected. This may have implied that an increase in class size leads to an increase in students' performance, or vice versa. Based on this result, one can opined that thorough assessments of class size in Physics learning can be used to predict academic achievement of students.

Ho_3: There is no significant composite contribution of students' interest in Physics and class size to academic achievement of students in Physics.

Table 3a: Model summary results of relationship in Multiple Regression Analysis

Model Summary

Model	R	R^2	Adjusted R^2	Std. Error of Estimate
1	0.635	0.403	0.401	1.041

Predictors: (Constant), Class Size, Students' Interest in Physics

Table 3a shows the results of the multiple regression analysis conducted to determine the combined contribution of students' interest in Physics and class size to academic achievement of students in Physics. As indicated by the table, the regression coefficient, R = 0.635 indicates that a significantly positive composite relationship exist between the students' interest in Physics and class size (predictors) and academic achievement of students in Physics. Likewise, the regression's coefficient of determination, R^2 = 0.403 indicates that both students' interest in Physics and class size jointly contributed and influenced academic achievement to about 40.3 %, while the remaining 59.7 % may be due to other factors not included in this study.

Table 3b: ANOVA results for level of significance in Multiple Regression Analysis

Model	Sum of Square	Df	Mean Square	F	Sig.
Regression	1306.657	2	653.329	603.429	0.001
Residual	159.156	147	1.083		
Total	1465.813	149			

Dependent Variable: Achievement, Predictors: (Constant), Class Size, and Students' Interest in Physics

Table 3b shows the results of the ANOVA analysis conducted to determine the significancy of the relationship and contribution of both students' interest in Physics and class size (predictors) to academic achievement of students in Physics. The table shows an $F_{(0.001)}$ value = 603.429 at 0.05 significant level. This result indicates a statistically significant relationship between students' interest in Physics and class size (predictors) and the academic achievement of students in Physics. Similarly, the F-value (603.429) indicates that the composite contribution of students' interest in Physics and class size (predictors) to academic achievement of students in Physics is significant. In essence, both students' interest in Physics and class size (predictors) can reasonably be used estimate students' academic achievement in Physics.

Ho_4: There are no significant relative contributions of students' interest in Physics and class size to academic achievement of students in Physics.

Table 4: Coefficients results in the Multiple Regression Analysis

Model	Unstandard. Coefficients		Standard Coeff.	T	Sig.
	B	Std. Error	Beta		
Constant	5.642	0.492		11.471	0.000
Students' interest	0.278	0.019	0.584	14.949	0.000
Class size	0.286	0.020	0.511	14.410	0.000

Dependent Variable: Achievement

Table 4 shows the resultant coefficients in the multiple regression analysis conducted to determine the relative contribution of students' interest in Physics and class size to academic achievement of students in Physics. As indicated by the table, students' interest in Physics (β = 0.584, t = 14.949, Sig. = 0.000) and class size (β = 0.511, t = 14.410, Sig. = 0.000) have statistically significant positive effects on students' academic achievement in Physics. In other words, students' interest in Physics and class size contributed about 58.4 % and 51.1 % respectively, to students'

academic achievement in Physics. However, based on this result students' interest in Physics contributed more to students' academic achievement in Physics than class size.

IV. CONCLUSION

Results from this study revealed that both students' interest in physics and class size separately exhibited a significantly positive relationship (Students' interest–academic achievement, r = 0.58; Class size–academic achievement, r = 0.51 at 0.05 significant level) with academic achievement in physics. The study also showed a statistically significant composite relationship (R = 0.635) between students' interest in Physics and class size (predictors) and academic achievement of students in Physics. The study further showed that both students' interest in Physics and class size jointly influenced academic achievement in Physics by 40.3 %, while the remaining 59.7 % may be due to other factors not included in this study. Likewise, students' interest in Physics and class size contributed about 58.4 % and 51.1 % respectively to students' academic achievement in Physics, indicating that students' interest in Physics contributed more than class size to students' academic achievement in Physics. In essence, both students' interest in Physics and class size can reasonably predict academic achievement of students in Physics.

V. RECOMMENDATION

Based on the observations of this study, the following recommendations are made:

1. School authorities, Parents and teachers should put in great effort in ensuring that students develop quality interest in sciences through several motivational means.
2. Educational authorities should work on implementing teacher-students ratio of 1:35.
3. More schools, classrooms and lecture rooms should be built to accommodate rising population of students and enhance teaching-learning activities.
4. Government and Educational authorities should organize workshops for teachers on importance students' interest and class size for optimum students' achievement.

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