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Effect of Class Size and Students' Attitude on Academic Performance in Chemistry at Demonstration Secondary School, Ahmadu Bello University Zaria, Nigeria.

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Abstract: *The study examines the effect of class size and student attitude on academic performance in chemistry among demonstration secondary school students of Ahmadu Bello University, Zaria. It was guided by three research questions and three hypotheses. The sample of the study was made up of 50 students and 5 teachers. The research instrument was structured questionnaire for both the students and teachers. The teacher's questionnaire consists of 10 questions designed to determine the effect of class size in teaching chemistry. While the student's questionnaire consists of 20 questions designed to determine student's attitude toward chemistry. The data collected were analyzed using Percentages, Mean, standard deviation and t-test statistics was used to analyze the hypotheses at 0.05 level of significance. The study revealed the following findings; there was significant difference in student's attitude to chemistry on their academic performance (t-cal=0.65034 > t-crit = 0.5885 at p<0.05). There was a significant difference in class size on student's academic performance in chemistry (t-cal = 2.02516 > t-crit = 0.1128; tcal = 8.48528 > t-crit = 0.0011 at p<0.05). There was significant difference between male and female students academic performance in chemistry (t-cal = 0.75665 > t-crit = 0.5043 at p<0.05). As a result, the boys performed better than the girls. Boys had a stronger affinity and interest towards Chemistry. Recommendations based on the findings were made among which include; Parents as well as chemistry teachers should encourage the students to develop positive attitude towards chemistry. Also, parents should provide learning opportunities to their girls and should not discourage the girls from studying chemistry.*

Keywords: *Academic performance, attitude, class size, chemistry*

I. Introduction

Chemistry occupies a unique position among various science subjects offered at the senior secondary school level. The study of Chemistry involves pursuit of truth, a process that instills diligence, patience and objectivity in learners [1]. Chemistry learning develops the scientific habits in students, which are transferable to other areas of life. Such habits involve non-reliance on superstition, use of critical thinking and respect for other people's opinion [2]. Chemistry as a science is a fundamental requirement for most core science based courses[3]. There is therefore the need to adopt efficient teaching and learning strategies that will enhance better achievement and retention of the subject matter by students [4].

Class size according to Ronald [5] refers to the actual number of pupils taught by a teacher at a particular time. Michael [6] defined class size as the number of students for whom a teacher is primarily responsible for during a school year. The class size could be large or small. However, Sparks [7] noted that class can be said to be large when the student number is more than 25. Studies have shown that class size is an important factor that affects student's performance in chemistry [8].

Attitude towards chemistry denotes interest or feeling towards the study of chemistry. It is the students disposition towards "like" or "dislike" of chemistry. While attitude in science means scientific approach assumed by an individual for solving, assessing ideas and making decisions. Attitudes, like academic achievement, are important outcomes of science education in secondary schools [8a]. The development of student's positive attitudes regarding science as a school subject is one of the major responsibilities of every science teacher.

The relationship between class size and academic performance has been a perplexing one for educators. Discussing factors affecting students' academic performance will require us to look the concept of poor performance. According to Aremu [9] , poor performance is a performance that is adjudged by the examinees and some significant as falling below an expected standard. The interpretation of this expected or desired standard is better appreciated from the perpetual cognitive ability of the evaluator of the performance. While, Bakare (1994), as cited in Abdullahi [10] described poor academic performance as any performance that falls below a desired standard.

Essentially, several factors have been shown to be responsible for students' academic performance. These factors include: lack of funds [11], lack of curriculum innovation [12] school structure and organization, teacher quality, curriculum, and teaching philosophies [13].

There is a close association between student's attitude and their achievements. Once the attitudes of students are known, suitable instructional methods can be devised to meet the interest of the student.

Despite the awareness of the importance of chemistry, in our daily lives, it is however sad to note that performance of students in secondary schools and students attitude towards these subjects leaves much to be desired. The poor performance of secondary school students in NECO, WAEC and JAMB calls for proper investigation. Although, several scholars have proposed various factors responsible for the poor performance of students, such as economic background of the learner [14], poor attitude to chemical concepts [15] and lately increase in class size. Studies have shown that Positive attitude towards a subject can lead to higher achievement [16]. The way a student perceives chemistry influence his or her attitude towards it, and this attitude to chemistry determines his or her performance.

Class size also affects the level of understanding of the students since the teacher will not have full attention on every student in the classroom. This unpleasant trend in educational development has in turn affected teaching and learning in schools today. The foregoing differing findings, opinions and observations call for further investigation into the relationship between class size and student's attitude on academic achievement in chemistry, which this present study was out to do.

II. Purpose Of The Study

The main purpose of the study was to investigate the effect of class size and student's attitude on academic performance in chemistry. Specifically, the study sought to:

i. Determine the extent to which class size and student's attitude affect their performance in chemistry.

ii. Determine the extent to which gender affects student's academic performance in chemistry.

III. Research Questions

Three research questions were posed for the study;

i. To what extent do student's attitudes affect their academic performance in chemistry?

ii. To what extent do class size affects student's academic performance vin chemistry?

iii . To what extent does gender affect student's performance in chemistry?

IV. Research Hypotheses

Arising from the research questions, the following research hypotheses were formulated at $P < 0.05$ level of significance.

i. There is no significant difference in student's attitude on their academic performance in chemistry.

ii. There is no significant difference in class size on student's academic performance in chemistry.

iii. There is no significant difference between male and female students academic performance in chemistry.

V. Methodology

5.1 Area and Population of the study

The study was carried out in Demonstration secondary school, Ahmadu Bello University, Zaria Kaduna state. The study population comprises of 250 SSII students with 3 chemistry teachers in the main campus while the annex campus in Kongo consists of 104 SSII chemistry students with 2 chemistry teachers.

5.2 Sample and sampling techniques

The study was conducted using 50 SSII chemistry students with 5 chemistry teachers in the school.

5.3 Instrumentation

The research instrument was questionnaire designed by the researcher for both the students and teachers. The teacher's questionnaire consists of 10 questions designed to determine the effect of class size in teaching chemistry. While the student's questionnaire consists of 20 questions designed to determine student's attitude towards chemistry. The items in the questionnaires were structured on four-point Likert rating scale of Strongly Agree (SA) – 4, Agree (A) – 3, Disagree (D) – 2 and Strongly Disagree (SD) – 1. The respondents were to tick (√) against their opinions.

5.4 Validity of research instrument

Before the questions were administered, they were subjected to content and face validity by scrutiny of specialists in chemistry and curriculum, to determine the appropriateness or otherwise of the questions for the purpose of the research. In this way, an attempt was made to validate the instrument to ensure that it measures what it is suppose to measure.

5.5 Method of data collection

The questionnaires administered to students and teachers of the school and collected after being filled. The actual administrations of the research instruments and data collection were conducted in the third term of the school calendar.

5.6 Method of data analysis

After the completion and collection of the questionnaires, the data were analyzed using percentages, mean, standard deviation and t-test statistics to analyze the hypotheses at 0.05 level of significance using WINKS SDA version 7.0.6.

VI. Results

Table 1: Percentage responses of student's attitude towards chemistry

		RESPONSES									
S/N	STATEMENTS	SA	A	Total of SA&A	% of SA&A	N	% of N	D	SD	Total of SD&D	% of SD&D
1.	Chemistry is fascinating and fun	05	11	16	32.00	04	8.00	23	07	30	60.00
2.	I really like chemistry	03	16	19	38.00	-	-	18	13	31	62.00
3.	Chemistry is very interesting	-	18	18	36.00	06	12.00	20	06	26	52.00
4.	I feel at ease in chemistry class	03	15	18	36.00	02	4.00	25	05	30	60.00
5.	I like chemistry than any other subject	07	30	37	74.00	01	2.00	10	02	12	24.00
6.	I feel good when I solve chemistry questions	04	16	20	40.00	-	-	29	01	30	60.00
7.	I am willing to spend more time reading chemistry books.	02	17	19	38.00	01	2.00	28	02	30	60.00
8.	Chemistry makes me feel secure and at the same time its stimulating	02	20	22	44.00	05	10.00	20	03	23	46.00
9.	Chemistry is a subject in school that I enjoy studying	02	18	20	40.00	-	-	23	07	30	60.00
10.	Chemistry is useful for solving everyday problems.	02	07	09	18.00	14	28.00	22	05	27	54.00
11.	I feel a definite positive reaction towards chemistry.	-	19	19	38.00	09	18.00	22	-	22	44.00
12.	I dislike chemistry	11	16	27	54.00	-	-	21	02	23	46.00
13.	I do not like chemistry and it scares me to have to take it	07	23	30	60.00	-	-	16	04	20	40.00
14.	My mind goes blind and am unable to think clearly when working chemistry	04	26	30	60.00	-	-	19	01	20	40.00
15.	I feel a sense of insecurity when attempting chemistry	04	20	24	48.00	06	12.00	19	01	20	40.00
16.	I am always under a terrible strum in a chemistry class	10	19	29	58.00	08	16.00	11	02	13	26.00
17.	Chemistry is a better subject for boys to study than girls	02	06	08	16.00	14	28.00	20	08	28	56.00
18.	Chemistry makes me feel uncomfortable and impatient	04	24	28	56.00	-	-	19	03	22	44.00
19.	Chemistry is boring	11	16	27	54.00	-	-	20	03	23	46.00
20.	Chemistry makes me feel as though I am in a jungle of formulae or equations and can't find my way	01	28	29	58.00	02	4.00	17	02	19	38.00

Table 2: t-test analysis on effect of student's attitude to chemistry

Attitude	N	Mean	S.D	df	t_{cal}	$P_{0.05}$
Positive	11	22.45	7.2727	19	0.65034	0.5885
Negative	10	23.95	5.65197			

Table 3: t-test analysis of large class size effect on student's academic performance

Large class size	N	Mean	S.D	df	t_{cal}	$P_{0.05}$
Positive	4	3.2	3.83406	4	2.02516	0.1128
Negative	2	10.4	4.3359			

Table 4: t-test analysis of small class size effect on student academic performance

Small class size	N	Mean	S.D	df	t_{cal}	$P_{0.05}$
Positive	4	13.2	1.48324	4	8.48528	0.0011
Negative	2	1.2	1.78885			

Table 5: t-test analysis of academic performance of male and female students in chemistry.

Group (By sex)	N	Mean	S.D	df	t_{cal}	$P_{0.05}$
Male	3	7.5	1.73205	3	0.75665	0.5043
Female	2	6.25	1.70783			

VII. Discussion

Form the results on the effect of students attitude on academic performance, t-calculated (0.65034) was greater than t-critical (0.5885) at 19 degree of freedom and 0.05 level of significance. Thus, the null hypothesis was rejected implying that there is a significant difference in student's attitude on their academic performance in chemistry. However it could be deduced from the findings that student's attitude to chemistry affects their academic performance. This finding corroborates the earlier findings of Ali [17] and Gbore [18] who found that student's attitude was a major predictor of academic performance. Adodo [19] and Yara [16] also claimed that student's attitude toward learning goes a long way to record their achievement in science. The finding oppose those of Salta and Tzougraki [20], who surveyed 576 high school students in Greece using an attitude scale with four subscales: the difficulty of chemistry course, the interest of chemistry course, the usefulness of chemistry course for students' future career and the importance of chemistry for students' life. They found no differences in student attitudes regarding interest, usefulness, and importance of chemistry.

On the effect of large class size on academic performance, it was observed that t-calculated (2.02516) was greater than t-critical (0.1128) at 4 degree of freedom and 0.05 level of significance. Hence, the null hypothesis was rejected which implies that there is a significant difference in class size on student's academic performance in chemistry. The finding revealed that large class size affects student's academic performance in chemistry. This finding is in agreement with those of Adeyela [21] who found in her study that large class size is not conducive for serious academic work and Yara [22] in his study on class size and academic achievement of students in mathematics in Southwestern Nigeria, found out that the performance of students in large classes was very low (23%) compared to those students in smaller classes (64%). However, it contradicts the findings of Pong and Pallas [23] who found that students do better in large classes. They hypothesized that this could be because more experienced teachers are given larger classes or low achievers are placed in smaller classes. Borland et al.,[24] further stated that in a relatively larger class there was an implied increase in associated skills from which an associated student may benefit and peer effects on student achievement were expected to be positive. Furthermore, if students competed with one another, there would be an additional positive effect with increased class size. Meanwhile, Afolabi [25] found no significant relationship between class size and students' learning outcomes.

On the effect of small class size as shown in table 4, t-calculated (8.48528) was also greater than t-critical (0.0011) at 4 degree of freedom and 0.05 level of significance. The null hypothesis was rejected and the results revealed that small class size do affect student's performance in chemistry. This finding agrees with those of earlier investigators[26,27,28] who from their studies concluded that small classes do not improve student achievement. Another stream of recent evidence based on natural experiments found that smaller classes do not help at improving student performance [29]. But this finding is contrary to those of Krueger and Whitmore [30] and Resnick [31], who suggested that smaller classes enhances student's achievement.

The researchers are of the view that the poor performance in large class size may be due to the more restricted range of teaching and learning activities accorded to students in a large class as well as the reduced interaction. Furthermore, class size has preference to particular topics in chemistry as practical chemistry is unfavourable in a large class, theoretical chemistry could be taught in a large class.

As to gender effect, the result showed that t-calculated (0.75665) was greater than t-critical (0.5043) at 3 degree of freedom and 0.05 level of significance. Therefore, the null hypothesis was rejected implying that there is a significant difference between male and female students academic performance in chemistry. Thus the finding revealed that male students perform better in chemistry than their female counterparts. This report is in line with the analysis made by Onaen and Obiora [32] in the enrolment and achievement of boys and girls in chemistry WAEC examination between 1994-1998 in Anambra state,Nigeria. It showed that out of 4,163 girls and boys that registered within the period, only 1,352 girls registered and only 9.30% of the girls had credit and above. It also complies with the work of Okereke and Onwukwe [33] which revealed that the male students achieved better than the female students. Yet the findings contradicts those of Udousoro [34], who stated that there is no significant difference in the academic achievement of male and female students in chemistry and Jegede [35] who found that the female students show higher anxiety towards the learning of chemistry in secondary schools than male students. These show that the issue of gender in chemistry achievement is yet to be resolved.

Perhaps the most important implication of the results from the present study is that chemistry educators need to consider different components of the chemistry curriculum in order to improve male and female students' attitudes toward chemistry lessons. The key to make chemistry lessons more male-friendly is probably the regular use of inquiry-based laboratory work at each grade level, while the use of the humanistic approach to designing the chemistry curriculum may be a good strategy for making chemistry lessons more female-friendly.

VIII. Conclusion

The findings suggest that students attitude to chemistry affect their academic performance. Secondly, there was a significant difference in class size on academic performance in chemistry. That is, both large and small class size affects student's performance in chemistry and finally we found a significant difference in academic performance in chemistry between male and female students where the male students performed better than their female counterparts. This implies that academic performance is gender bias. In summarizing our findings, we conclude that these results apply to only Demonstration Secondary School Ahmadu Bello University, Zaria. We cannot say whether these relationships apply to other institutions of secondary education. Our results certainly suggest avenues for further research and it would be desirable to examine these relationships using data from more than one institution. Nonetheless, we have found students attitude, class size and gender a significant factor influencing their academic performance in chemistry.

IX. Recommendation

In view of the findings from the present study, the following recommendations are proffered:

1. More instructional materials should be provided to include public address system so that the students in a large class could be instructed as appropriate.
2. Chemistry teachers should direct more attention particularly to female students to make them improve on their academic achievement.
3. Parents as well as chemistry teachers should encourage the students to develop positive attitude towards chemistry. Also, parents should provide equal learning opportunities to their children and should not discourage the girls from studying chemistry.
4. The ministry of Education, chemistry authors as well as chemistry teachers should design chemistry textbooks devoid of any gender – typical behavior or gender bias.
5. The study on student's attitude, class size and gender should be applied to other discipline in science so as to compare findings.

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