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LOCATION AND AVERAGE CLASS SIZE AS FACTORS IN ACHIEVEMENT IN JSC MATHEMATICS EXAMINATION

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ABSTRACT

The purpose of this study was to find out if there was an association between achievement in JSC Mathematics Examination and class size on one hand and the level of noise around the school on the other hand. The Mathematics results of a sample of 7,276 students who took JSCE in 2003/2004, 2004/2005 and 2005/2006 in Onitsha North Local Government Area of Anambra State were obtained after the schools in that Local Government Area had been stratified according to level of noise around the school and then according to average class size. The result of the study established a negative association between academic achievement and average class size on one hand, and level of noise on the other. From the results one concludes that a student is more likely to perform better in JSC Mathematics Examination, if he is in a school with small average class size, or one in a less noisy area, than if he is in a school with large average class size or one in a highly noisy area.

Introduction

The goal of teaching is to ensure that students learn, and if possible acquire hundred percent of the body of knowledge exposed to them. The attainment of this goal is usually inhibited by a number of factors that impinge on the learners. Psychologists and educationists are often interested in knowing those factors, as this knowledge will place them in a better position to control or improve learning, thereby enhancing the performances of the learners in examinations. As part of efforts to find out why students perform poorly in School Certificate Mathematics, it is important to keep exploring what factors negatively affect performance in the subject.

Some of these factors are inherent in the child while some of them depend on the environment. While the factors inherent in the child are difficult to control, those arising from the environment can be controlled to the advantage of the learner. One of such factors identified by Essien (2002) and Nwachukwu (2002) is the family background. Idowu (2002), while recognizing factors such as family background as affecting academic achievement, identified school environment as a more predictive factor. According to him, if the school environment is good, other factors may have marginal effects. On the other hand, if the school environment is poor, even the socially advantaged child may not enjoy academic excellence. In looking at school environment, a number of factors affect achievement such as school facilities, student -teacher interaction, quality of teachers, method of teaching, location of school among others. Studies concerned with effect of school location on academic achievement, as cited by Bulus (2002), have often centred on urban and rural areas. Apart from comparing achievement scores of urban and rural students as index of location, it may be necessary to consider other indexes such as the level of noise around the school. Evans and Maxwell (1997) and Dunne (2000) have suggested a link between noise and academic achievement. Hopkins (1997), reporting the views of the US Cornell University researchers, observed that children in schools bombarded by noise do not learn to read as well as children in quiet schools do.

Onitsha, being a major commercial city in South Eastern Zone of Nigeria, has some of its areas that are infested by various types of noise like traffick noise as well as noise arising from some other commercial activities. There are however some of the areas that are not exposed to much noise. It may therefore be necessary to compare the achievement scores of students whose schools are located in those very noisy areas with those students from less noisy areas.

Another factor that needs to be considered vis-a-vis academic achievement is the average class size. This factor is important in Onitsha because, being a major commercial city, there is always a tendency to have influx of people into the city thereby giving rise to over-population in some schools within it. According to Deighton (1971), class size refers to the number of students assigned to and enrolled in a specific class under the direction of a specific teacher.

The average class size for a grade level is therefore obtained by dividing the total number of students at that level by the number of arms in the level. Though some people use average class size\ and pupil-teacher ratio interchangeably, the two do not mean the same thing. The pupil-teacher ratio is obtained by dividing the total number of students in an educational unit by the total number of full-time teachers in that unit (Lewit & Baker, 1997; Murphy & Rosenberg, 1998). Pupil-teacher ratio is therefore usually lower than the average class size.

A number of studies on the effect of class size on achievement have been reported by Murphy and Rosenberg (1998). One of such studies is the Student-Teacher Achievement Ratio (STAR) which was a large scale controlled study conducted in the State of Tenesse from 1985 to 1989. Another one is the Student Achievement Guarantee in Education (SAGE) programme conducted by the Centre for Urban Initiatives and Research, University of Wisconsin. Each of these studies established a superiority of small class over large class in mathematics achievement score.

As regards what may constitute a small or large class, there are differences in opinions. In the 1979 US nationwide Teacher Opinion Poll, teachers favoured class reduction to the maximum number of 22 per class for elementary level and 25 at secondary level. Here in Nigeria, the National Policy on Education (Federal Republic of Nigeria, 2004) recommended a teacher-pupil ratio of 1:40 at the secondary school level. It is true that this figure refers to teacher-pupil ratio, and not class size, but it can serve as a criterion for judging the smallness or largeness of a class. An average class size less than 40 is therefore considered as small while any one more than that is considered a large class.

The purpose of this study therefore is to compare the distributions of scores in Junior School Certificate (JSC) Mathematics Examinations of students from schools:

1. Located in highly noisy areas and those in less noisy areas.
2. With large average class size and those with small average class size.

To address these issues, the following null hypotheses were formulated and tested at 05 alpha levels.

1. There is no significant difference between the distributions of grades in JSC Mathematics Examinations, of students from schools with high average class size and those with small average class size.
2. There is no significant difference between the distributions of grades in JSC Mathematics Examinations, of students from schools located in highly noisy areas and those located in less noisy areas.

Method

Design

The researchers adopted the ex-post-facto research design because the data used for the study were already available before the commencement of the study. They therefore merely collected existing Junior School Certificate Examination results in the subject of interest.

Population

The population was made up of all Junior Secondary School Year Three students who took the Junior School Certificate Mathematics Examinations in the schools in Onitsha North Local Government Area of Anambra State in 2003/2004, 2004/2005 and 2005/2006 academic sessions.

Sample and Sampling Techniques

The study adopted a combination of stratified random, and cluster, sampling techniques. First the 17 secondary schools in the Local Government Area, were stratified into two - those in highly noisy and those in less noisy areas. In each of these strata, using information earlier obtained from the Zonal Education Commission on school populations, the schools were again stratified into two- those with high average class size and those with low average class size. Considering the populations of schools in the Local Government Area, forty five was used as the criterion for classification according to class size. Thus, any school with an average class size of forty five or more was classified as being high while a school with an average class size less than forty five was classified as having low average class size.

Following the second stratification, four groups of schools were obtained viz:

1. Schools that were in highly noisy area and had high average class size;
2. schools that were in highly noisy area and had low average class size;
3. schools that were in less noisy area and had high average class size; and
4. schools that were in less noisy area and had low average class size.

Two schools were obtained, through simple random sampling from each of the four groups. This gave rise to eight schools. In each of the eight schools, the grades of all the students who took mathematics in the Junior School Certificate Examinations in 2003/2004, 2004/2005 and 2005/2006 were obtained. The sample size finally turned out to be 7,276 made up of 2,878 from highly noisy area 4,398 from less noisy area; 4,322 from high average class size schools and 2,954 from low average class size schools.

Instrument

There was no instrument used for the study since the data used were obtained from compiled result sheets in the Statistics Office of Anambra State Post Primary School Services Commission, Onitsha Zone.

Method of data analysis

The chi-square statistical technique was used in testing the hypotheses. This statistical technique was considered appropriate because the information obtained involved frequency count. Whenever a statistically significant difference was observed, a further analysis, as specified by Minium (1978: p. 442) was made to find out the direction of the significant difference.

Results

The results of the tests of hypotheses are presented in the sections that follow. Each of the hypotheses was tested for each of the sessions (2003/2004 - 2005/2006).

The first hypothesis is concerned with ascertaining if there is a significant difference in the distributions of grades of students from high average class size (HACS) and low average class size (LACS) schools. The results of the chi-square tests are shown in table 1.

Table 1: Chi-square Tests of Distributions of Grades in JSC Mathematics Examinations for HACS and LACS (2003 – 2006)

	2003/2004						
Average Class Size	**Grades**					**Critical Value**	**Calculated Value**
	A	**C**	**P**	**F**	**Total**		
HACS	1	108	335	555	999	7.81	189.29
LACS	25	212	239	193	669		
Total	26	320	574	748	1668		

2004/2005

Average Class Size	Grades A	C	P	F	Total	Critical Value	Calculated Value
HACS	10	394	1135	21	1560	7.81	8.48
LACS	16	271	794	6	1087		
Total	26	665	1929	27	1668		

2005/2006

Average Class Size	Grades A	C	P	F	Total	Critical Value	Calculated Value
HACS	5	411	1324	15	1755	7.81	121.48
LACS	11	465	620	6	1102		
Total	16	876	1944	21	2857		

From the results in table 1, the calculated chi-square value for each of the three sessions (189.29, 8.48 and 121.48) is greater than the critical value (7.81) at .05 alpha level and 3 degrees of freedom. The hypothesis of no significant difference in the distributions of grades for the students in high average class size and low average class size schools is therefore rejected. Having established a difference in the distributions, it becomes necessary to look at the table of proportions in respect of the above data, so as to determine where the difference comes from. This is presented in table 2.

Table 2: Table for Proportions in Mathematics for Average Class Size

2003/2004

	A	C	P	F
HACS	0.00	0.11	0.34	0.56
LACS	0.04	0.32	0.36	0.45
Expected Proportion	0.02	0.19	0.34	0.45

2004/2005

	A	C	P	F
HACS	0.01	0.25	0.73	0.01
LACS	0.01	0.25	0.73	0.01
Expected Proportion	0.01	0.25	0.73	0.01

2005/2006	A	C	P	F
HACS	0.00	0.23	0.74	0.01
LACS	0.01	0.42	0.56	0.01
Expected Proportion	0.01	0.31	0.68	0.01

From the table of proportions, it would be clearly noticed that in the 2003/2004 and 2005/2006 sessions, the proportions of LACS under A and C exceeded the expected proportions while those of HACS under P and F exceeded the expected proportions. It needs also to be noted that the difference in the distributions of the proportions was not distinct in 2004/2005 session.

The second hypothesis was concerned with finding if there was a significant difference between the distributions of grades in JSC mathematics examination results for students in highly noisy areas (HNA) and those in less noisy areas (LNA). The results of the chi-square tests are shown in table 3. The test was again done for each academic year.

Table 3: Chi-square Tests of Distributions of Grades in JSC Mathematics Examinations for Students from HNA and LNA

2003/2004

Level of Noise	Grades					Critical Value	Calculated Value
	A	C	P	F	Total		
HNA	1	98	280	226	605	7.81	66.99
LNA	25	222	294	522	1063		
Total	26	320	574	748	1668		

2004/2005

Level of Noise	Grades					Critical Value	Calculated Value
	A	C	P	F	Total		
HNA	6	160	798	12	976	7.81	207.56
LNA	20	505	1131	15	1671		
Total	26	665	1929	27	2647		

Level of Noise	2005/2006 Grades					Critical Value	Calculated Value
	A	C	P	F	Total		
HNA	4	286	883	10	1182	7.81	43.46
LNA	12	591	1061	11	1675		
Total	16	876	1944	21	2857		

The results show that the calculated chi-square value is greater than the critical value in each of the academic sessions, at .05 alpha level and 3 degrees of freedom. The null hypothesis of no significant difference in the distributions of grades for students in HNA and LNA was therefore rejected. To determine where the difference lies, the table of proportions was again used. This is presented in table 4.

Table 4: Table of Proportions in Mathematics for Noise Level

2003/2004

Level of Noise	A	C	P	F
HNA	0.00	0.16	0.46	0.37
LNA	0.02	0.21	0.28	0.49
Expected Proportion	0.02	0.19	0.34	0.45

2004/2005

Level of Noise	A	C	P	F
HNA	0.01	0.16	0.82	0.01
LNA	0.01	0.30	0.68	0.01
Expected Proportion	0.01	0.25	0.73	0.01

2005/2006

Level of Noise	A	C	P	F
HNA	0.00	0.24	0.82	0.01
LNA	0.02	0.35	0.68	0.01
Expected Proportion	0.01	0.31	0.68	0.01

From the table, it would be seen that in each academic year, there was a higher proportion of students from LNA, scoring A and C than the proportion from HNA. The reverse was the case for the proportions of students that obtained P and F.

Discussion of Results

The first hypothesis of no significant difference between the distributions of scores for high and low average class size schools was rejected. The implication of this difference in distributions is that there is an association between class size and the distribution of grades in each of the sessions. It is not enough to establish an association; one needs to go further to determine the direction of the association. This was done, by looking at the table of proportions in respect of the chi-square test. From the table of proportions, it was observed that in the 2003/2004 and 2005/2006 sessions, the proportions of students in the Low Average Class Size (LACS) group that scored A or C exceeded the expected proportions, while those students in the High Average Class Size (HACS) group that scored P or F exceeded the expected proportions. This means that a greater proportion of the students in the LACS group were found in the higher grades (A and C) while a greater proportion of the students in the HACS group were found in the low and failing grades. The non-distinct difference in the distributions of the proportions for the 2004/2005 session should not be surprising, if one considers the low value of chi-square that was obtained for that year. The situation in 2004 /2005 notwithstanding, the implication of the general result is that achievement in Junior School Certificate Mathematics examination tilted in favour of students from the low average class size schools. These results agree with those in the STAR and SAGE programmes, as reported by Murphy and Rosenberg (1998)

The second hypothesis, which sought to ascertain if the distribution of grades for students in Highly Noisy Area (HNA) and Less Noisy Area (LNA) was rejected. This again means that there is an association between the grade obtained in the Junior School Certificate Mathematics Examinations and the level of noise around the school area. The table of proportions showed that a higher proportion of the students from LNA second A and C than those from HNA. The implication of this result is that students from less noisy area had better performance than those from highly noisy area. The result of this study agrees with that of Evans and Maxwell (1997), who found a negative effect of noise on children's reading skills leading to poor academic achievement.

Conclusion

The results of this study established an association between academic achievement and class size on one hand and level of noise around the school on the other hand. From the results, one concludes that students are more likely to perform better in JSC mathematics examination if they are in a school with small average class size or one in a less noisy area than if they are in a school with large average class size or one in a high noisy area. This therefore calls for a need to reduce the size of classes in secondary schools.

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