

Chi-Square Technique For Effects Of Overpopulation In Mathematics Classroom

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Abstract:

Objective: This research project is aimed at finding out the effect of overpopulation in Mathematics classroom. The population for the study consists of both teachers and students of Mathematics in five (5) selected Public Senior Secondary School in Yola South Local Government Area of Adamawa State, Nigeria. A sample of twenty (20) students and teachers from each of the selected schools were drawn. Questionnaires were the instruments used to obtain information from the students and their teachers.

Statistical Analysis: This paper proposes the Chi-Square (χ^2) techniques as a promising and efficient Mathematical approach at 5% level of significance were used to analyse the data collected as statistical tool.

Findings: The calculated $\chi^2 = 46.8926$ is greater than critical value $\chi^2 = 26.30$. The results of the analyses showed that overpopulation in Mathematics class negatively affects students in teaching and learning Mathematics.

Applications/Improvement: More schools should be established and renovated so as to reduce the overpopulation in Mathematics class; number of students in each class should be limited to 35-40 in order to ensure academic excellence of both teachers and students. Education department and government officials should visit schools to observe the population, number of classrooms as well as teaching and learning activities.

Keywords: Effects, Overpopulation, Mathematics, Classroom

I. INTRODUCTION

According to Federal Ministry of Education Nigeria Education Indicators (2016), the population of Nigerian Government Senior Secondary Schools is three million five hundred and sixty-three thousand seven hundred and forty-eight (3563748) students and one hundred and thirty-six thousand eight hundred and sixty-eight (136868) teachers. Post Primary Schools Management Board (PPSMB) in Adamawa state has seven hundred and fifty-eight (758) Public Senior Secondary Schools, eleven thousand two hundred and fifty (11250) teachers and one hundred and ninety-three thousand nine hundred and sixty-six (193966) students. Yola South Local Government Area has eighteen (18) Public Senior Secondary Schools, thirty-six (36) Mathematics teachers, six

hundred and eight (608) teachers and eight thousand five hundred and ten (8510) students (PPSMB Yola, 2018).

The condition of Government schools all over the country and quality of education being imparted, are going from bad to worse, day by day. Government and the concerned Education Department have no check and balance over quality of education. Government schools are overpopulated because of increased population, due to limitation of the economic resources and budget constraints. Owing to these reasons, it raises the problem of overpopulation in classrooms. With the passage of time it becomes one of the major problems of our education system. The average number of students in most of classrooms ranges from 70 to 120. It creates many problems for both, teachers and students in teaching-learning process. A number of researches have been done in order to know the

effects of overpopulated classes on students' achievement but less attention has been given to identify the problems faced by teachers in over-crowded classes. So the researcher decided to deal this problem in a different way and try to find out the problems faced by teachers (Khan and Iqbal, 2012).

Mathematics is almost compulsory at all level of education, leading to high teacher-student ratio (Igbokwe, 2001). There is a general consensus among the researchers and educators that large populated cities lead to overpopulated classrooms, as there is very little classroom blocks in school to accommodate the large number of students attending school.

According to Dictionary (2013), "class is a group of student put together for the purpose of collective instructions". "All the members of the class have common goals, interests, aptitudes and attainments. In a short way, we can say that class consists of homogeneous group of students, who will work and progress together (Khan and Iqbal, 2012)".

Khan and Iqbal (2012) stated that a classroom is said to be overpopulated when the number of students exceed the optimum level such that it causes hindrance in the teaching-learning process. The classroom is the most important area within a school. The students spend most of their time, hopefully in an environment conducive to learning. The entire design of classroom reflects the priorities, goals, philosophy, personality and teaching style of the student. Student learning behaviour can be enhanced when teachers take time to create a classroom climate in which adolescents feel comfortable with their teachers and peers. But unfortunately, in our country the classrooms are overpopulated. Focusing on the effect of this very serious problem prevailing in our country, one thing is very clear that teaching in such an environment, where the number of students is exceeding the acceptable limit, effective teaching is not possible. Overpopulated classes have been considered as one of the most challenging problems facing schools and teachers as well. A combination of an increasing population and a decrease of funding have caused class size to soar (rise). In an ideal world, class size would be capped (laid) at 15-20 students; especially for Mathematics classes. Unfortunately, many classrooms now regularly exceed thirty students, and it is not uncommon to be more than forty students in a class.

Overpopulated classrooms may create an obstacle in the progressive activities of classroom teaching-learning process. In the classroom the primary objective of a teacher is to treat each and every individual student in a proper way in order to regulate his activities and to develop his inner personality, not only that, he has to give him a widest opportunity to develop his skills, abilities and potentialities at the optimum level. Overpopulated classes have some effects. Student teachers undertaking their teaching practice at schools were visited, they were investigated, observed, assessed and it convinced the researcher, that the challenge of overpopulated classrooms and the management thereof is still largely unaddressed in South African schools and teacher training institutions (Marais, 2016). John (2013) "reported that in some schools in the Eastern Cape, learners are sitting three or four to a desk meant for two, thus obstructing traffic flow in the classroom and necessitating extraordinary tactics to move around".

In this paper, the Chi-Square technique that has the capability to predict the effects of overpopulation in

Mathematics Classroom is proposed. The paper is divided into seven sections. The first section introduces the basic concepts contained in the topic. The second section is the methodologies explaining equation governing Chi-Square and application of the Chi-Square technique to overpopulation in Mathematics Classroom problem. Results and discussion are presented in section three. Section four is the conclusion of this paper. Section five is the Recommendation, Acknowledgement is in section six and section seven is the References.

II. METHODOLOGIES

A. RESEARCH DESIGN

The study is descriptive in nature. This research design was considered appropriate because it is one of the best available research design for the purpose of describing conditions as they exist, considering the overpopulation of schools these days. It was an attempt to investigate the problems faced by the teachers and students in overpopulated classes and suggested some measures to settle these problems. Again, it was designed in such a way as to obtain relevant information through the questionnaire.

B. POPULATION OF THE STUDY

The target population for the study was eighteen (18) Public Senior Secondary Schools in Yola South Local Government Area of Adamawa State, Nigeria. Statistics from Post Primary Schools Management Board, Yola showed a total population of six hundred and eight (608) Teachers, thirty-six (36) Mathematics Teachers and eight thousand five hundred and ten (8510) Students. List of Government Senior Secondary Schools in Yola South Local Government Area are:

S/N	NAME OF SCHOOL	MATHS TEACHERS	TEACHERS	STUDENTS
1	AMC (SS), Yola	5	59	2041
2	GDSS (SS), Yola Town	5	46	358
3	GDSS (SS), Wuro-Hausa	3	49	643
4	GDSS (SS), Shagari	2	38	388
5	SAIS (SS), Yola	3	48	1733
6	GDSS (SS), Damare	1	30	192
7	GDSS (SS), Njoboli	1	6	88
8	GDSS(SS), Ngurore	3	23	684
9	GDSS (SS), Yolde Pate	3	35	234
10	GDSS (SS), Mbamba	2	25	169
11	GDSS (SS), Wauru Jabbe	1	37	469
12	GDSS, Nantari	1	22	306
13	GDSS (SS), Hammawa-Toungo	3	25	180
14	GDSS, Njoboli Fulani	1	27	218
15	GDSS, Bole II	-	25	55

16	GDSS, Gongoshi II	-	12	40
17	GGDSS, Sanda	1	56	312
18	GSTC, Yola	1	45	400

Source: 2017/2018 Student/Teachers update (DPRS) Post Primary Schools Management Board, Yola.

Table 1: List of Senior Secondary Schools in Yola South Local Government Area and their Population

C. SAMPLE AND SAMPLING TECHNIQUES

Five (5) Senior Secondary Schools were selected from Yola South Local Government Area. Sample of twenty (20) questionnaire were distributed to five (5) Senior Secondary Schools to Teachers and Student in Yola South Local Government Area. The Schools are:

- ✓ Aliyu Musdafa College (AMC), Yola
- ✓ School for Arabic and Islamic Studies (SAIS), Yola
- ✓ Government Day Senior Secondary School (GDSS), Yola Town
- ✓ Government Day Senior Secondary School (GDSS), Shagari
- ✓ Government Day Senior Secondary School (GDSS), Wuro-Hausa

D. CHI-SQUARE GOVERNING EQUATION

Chi-Square is a non-parametric (distribution free) tool designed to analyse group differences when the dependent variable is measured at a nominal level. It is a quantitative measure used to determine whether a relationship exists between two categorical variables. It can provide information not only on the significance of any observed differences but also provides detailed information on exactly which categories account for any differences found. It is used to determine whether observed frequencies were significantly different from the expected frequencies. The formula is:

$$\chi^2 = \sum_{i=1}^r \sum_{j=1}^c \frac{(O_{ij} - e_{ij})^2}{e_{ij}}$$

where; O_{ij} = Observed Value in i, j cell, e_{ij} = Expected or Theoretical Value in i, j cell.

$$\sum_{i=1}^r \sum_{j=1}^c = \text{The sum of rows and columns}$$

The associated degree of freedom (d.f) in a contingency table is given by: d.f = (r-1) (c-1).

where; r = Number of rows, c = Number of columns.

E. APPLICATION OF THE CHI-SQUARE TECHNIQUE TO OVERPOPULATION IN MATHEMATICS CLASSROOM PROBLEM

In this study, structured questionnaire was used as the research instrument for data collection. The questionnaire titled “Effects of Overpopulation in Mathematics Classroom in Public Senior Secondary Schools, Yola”. The questionnaire has section A and B. Section A is the personal data of the respondents such as name of schools, sex, age, marital status

and so on. While section B is the study of research questions using questionnaire in order to gather information from the respondents.

The instrument was 20-item questionnaire each for the students and the teachers. The questionnaires was developed by the researcher, validated by experts in educational research and then used to collect data for this study. The questionnaire was developed based on the research questions. Again, a close format questionnaire with five point likert type rating scale of Strongly Agreed (SA), Agreed (A), Strongly Disagreed (SD), Disagreed (D) and Undecided (U) type of questionnaire.

The researcher personally administered at least twenty (20) questionnaire to each of the five (5) selected Public Senior Secondary Schools Yola South Local Government Area to both teachers and students by visiting all selected schools. One hundred and twenty (110) was administered but one hundred (100) was retrieved. The personally administered instrument helped the researchers to further explain the purpose of the research and to answer questions that might be raised by some respondents. The questionnaires administered were duly and adequately completed and retrieved from the respondents. Their response then form part of the data used for the analysis.

III. RESULT AND DISCUSSION

The analysis was performed on the basis of effects of overpopulation in Mathematics classroom as indicated in the hypothesis. The questionnaire results of each of the five (5) selected Public Senior Secondary Schools were recorded items by items.

HYPOTHESIS

There is no significant relationship between problem of overpopulation and the effects of overpopulation in Mathematics class using Chi-Square.

Observed value versus expected in bracket.

S/N	HYPOTHESIS	SA	A	SD	D	U	TOTAL
1	Classroom management is a challenging task in overpopulated classroom.	46 (32.4)	46 (45.6)	02 (8.0)	02 (11.2)	04 (2.8)	100
2	There is inadequate teacher-student interaction in teaching and learning Mathematics.	20 (32.4)	50 (45.6)	13 (8.0)	14 (11.2)	03 (2.8)	100
3	Too much of work on teachers reduce efficiency.	39 (32.4)	44 (45.6)	06 (8.0)	11 (11.2)	00 (2.8)	100
4	The total number of teachers is limited, compare to the increasing population of students in	38 (32.4)	40 (45.6)	06 (8.0)	14 (11.2)	02 (2.8)	100

	government schools.						
5	Teacher-centred method lead to poor performance in Mathematics class.	19 (32.4)	48 (45.6)	13 (8.0)	15 (11.2)	02 (2.8)	100
		162	228	40	56	14	GT=500

Source: Field Work, 2018

Table 2: Table of Observed Value versus Expected in Bracket for Hypothesis

$$E = \frac{RT \times CT}{GT}$$

where: E = Expected value, RT = Row Total, CT = Column Total and GT = Grand Total

$$X^2 = \sum_{i=1}^r \sum_{j=1}^c \frac{(o_{ij} - e_{ij})^2}{e_{ij}}$$

O	E	O - E	(O - E) ²	$\frac{(O - E)^2}{E}$	$\sum_{i=1}^r \sum_{j=1}^c \frac{(o_{ij} - e_{ij})^2}{e_{ij}}$
46	32.4	13.6	184.96	5.7086	
46	45.6	0.4	0.16	0.0035	
02	08.0	-6.0	36.0	4.5000	
02	11.2	-9.2	84.64	7.5571	
04	02.8	1.2	1.44	0.5143	
20	32.4	-12.4	153.76	4.7457	
50	45.6	4.4	19.36	0.4246	
13	08.0	5.0	25.0	3.1250	
14	11.2	2.8	7.84	0.7000	
03	02.8	0.2	0.04	0.0143	
39	32.4	6.6	43.56	1.3444	
44	45.6	-1.6	2.56	0.0561	
06	08.0	-2.0	4.0	0.5000	
11	11.2	-0.2	0.04	0.0036	
00	02.8	-2.8	7.84	2.8000	
38	32.4	5.6	31.36	0.9679	
40	45.6	-5.6	31.36	0.6877	
06	08.0	-2.0	4.0	0.5000	
14	11.2	2.8	7.84	0.7000	
02	02.8	-0.8	0.64	0.2286	
19	32.4	-13.4	179.56	5.5410	
48	45.6	2.4	5.76	0.1263	
13	08.0	5.0	25.0	3.1250	
15	11.2	3.8	14.44	1.2893	
05	02.8	2.2	4.84	1.7286	46.8926

Source: Chi-Square analysis of responses to questions

Table 3: Table of Calculated Chi-Square for Hypothesis From Equ. (2)

Calculated $X^2 = 46.8926$

d.f (degree of freedom) = (r-1)(c-1), where r = 5 and c = 5
= (5 - 1)(5 - 1)
= 4 × 4 = 16

$$\chi^2_{(r-1)(c-1)}(0.05) = \chi^2_{16}(0.05) = 26.30$$

Decision Rule: Reject Ho if $X^2 \geq \chi^2_{16}(0.05)$

The calculated $X^2 = 46.8926$ is greater than critical value $\chi^2 = 26.30$

The calculated $X^2 = 46.8926$ is greater than critical value $\chi^2 = 26.30$. The null hypothesis which says that there is no significant relationship between problem of overpopulation and the effects of overpopulation in

Mathematics class using Chi-Square, is hereby rejected. It means that there is a significant relationship between problem of overpopulation and effects of overpopulation in Mathematics class using Chi-Square.

This reveals that a lot of problems are caused in overpopulated Mathematics class, which shows that overpopulation in Mathematics classroom have effects.

IV. CONCLUSION

This paper presents the Chi-Square technique as an efficient Mathematical approach to the investigation of the effects of overpopulation in Mathematics Classroom. The Chi-Square governing equation was applied to the overpopulation in Mathematics Classroom problem. The deduction of the Chi-Square application was used to analyse overpopulation in Mathematics Classroom situation. Results based on the findings using the hypothesis show that overpopulation has an effect in Mathematics class.

V. RECOMMENDATIONS

Based on the findings of the research work achieved, certain recommendations were highlighted below:

- ✓ More schools should be established and renovated so as to reduce the overpopulation in Mathematics class.
- ✓ The ministry of education should give quota on the Mathematics students' enrolment in Public Senior Secondary Schools.
- ✓ Number of students in each class should be limited to 35-40 in order to ensure academic excellence of both teachers and students.
- ✓ Trained and qualified Mathematics teachers should be recruited and posted to the needed schools.
- ✓ Government should plan strict rules and policies regarding optimum population in classrooms such as establishment of maximum number of schools and criteria for enrolment of students and employment of teachers as per population requirements and provide sufficient budget to education department for providing better facilities in schools.
- ✓ Appropriate planning is needed in order to control population because over population in our country is also the main factor leading to excess classroom.
- ✓ Suitable training and retraining programmes such as workshop, seminar, in-service and other related orientation activities should be arranged for the teachers in order to educate them how to handle the congested classrooms.
- ✓ Education department and government officials should visit schools to observe the population, number of classrooms as well as teaching and learning activities

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