COMPARATIVE ANALYSIS OF STUDENTS PERFORMANCES IN BASIC GENERAL MATHEMATICS AMONG SOME SELECTED ARTS AND SCIENCE STUDENTS OF CAS KANO.

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Abstract

The study, Comparative Analysis of Students Performances in Basic General Mathematics among Some Selected Arts and Science Students of College of Arts Science and Remedial Studies in Kano, investigated and compared some Arts and Science students' performances in basic general mathematics courses in NCE programme. The research design for this research is longitudinal design. The records of the students' examinations results were followed from the second semester first year to the first semester second year. The population for the study consists of three hundred and forty (340) students that sat for the second semester examinations for GSE 122 and first semester examination for the GSE 212. The sample of the study consists of one hundred and eighty (180) students according to the table of determination of sample size by (Krejcie and Morgan 1970). The sample of the study was selected using cluster sampling technique to select from various clusters (Arts and Science). Simple random sampling technique was later used to select the sample of the study. The data required for this research (students' performances) were collected through documentary analysis of students' performances from the examination secretariat of the College. The data (students' performances in GSE 122) collected through documentary analysis serves as the independent variable while that of GSE 212 serves as the dependent variable. The study has three objectives, research questions and hypotheses. The findings from the study showed that GSE 122 (basic general mathematics II) a pre requisite course does not predicts performance in GSE 212 (basic general mathematics III). The study concludes that despite the fact a prerequisite course unit is very vital to the upcoming courses, performance in GSE 212 was not predicted/ facilitated/influenced by the performance in GSE 113 and GSE 122 as prerequisites. The study recommends that general courses be approached squarely to see to the success in the NCE programme. The teachers needs to adopt varying techniques of teaching to ensure the success of their students.

Introduction

Mathematical approaches are applied by all fields of sciences and technology to succeed. The relevance of mathematics to technological advancement made it a strong criterion for admission into institutions of higher learning in the sciences oriented disciplines (Physical, Management, Social, Medicine etc). Dowker (2005), mathematics (frequently divided into four subcomponents, factual knowledge, procedural knowledge, conceptual knowledge and applied mathematics or rather problem solving) tends often to be taught in a hierarchical way (from simple to difficult). This means that if students have missed or failed to learn earlier concepts, they may have difficulty with later lessons based on attempts to build on earlier information. According to Rittle-Johnson and Michael (2015) mathematical competence rests on developing knowledge of concepts and of procedures (i.e. conceptual and procedural knowledge).

Clark & **Robert (2004) state that** the National Policy on Education has prescribed that, as from 1998, the new minimum qualification required for teaching in the primary school will be the **Nigerian Certificate in Education** (NCE). The NCE is also the qualification required for teaching in junior secondary schools and technical colleges and the NCE certificate is awarded by Colleges of education after three years of full-time post secondary study.

Prior knowledge is that knowledge acquired first from some predefined contents. Some course units are said to be prerequisites to other course unit either in the same level of study or at different levels. What students learned (prior knowledge) from say first semester of an academic programme can in one way or the other facilitate students' readiness to what they should take in the second semester or in the next session. The prior knowledge enables students to build on an existing foundation and as well link between previously acquired and new knowledge. As students brought this knowledge along with them to the classrooms, it ought to influence how they grasp and interpret incoming information.

Having an increased prior knowledge, enabled students to understand more rapidly because the prior knowledge is readily referable/accessible and hence the components of the new information are rapidly linked. Prior knowledge is important educational variable in the sense of contribution to the new information. However, if students' prior knowledge has some existing gaps and insufficiencies, it may not adequately support new knowledge let alone predict success. Moreover, if prior knowledge is applied in the wrong context, it may lead students to make faulty application, assumptions or draw inappropriate conclusions. In addition, inaccurate prior knowledge turns out to be surprisingly difficult to correct and can both distort students' understanding and interfere with incoming information

Prerequisite knowledge for learning is the content that should be reviewed, or perhaps even covered for the first time, to properly prepare the students for the material they are about to encounter. Welder (2006) states that research indicates that prior to learning algebra, students must have an understanding of numbers, ratios, proportions, the order of operations, equality, algebraic symbolism (including letter usage), algebraic equations and functions. Green, Stone, Abera, and Thomas (2007) stated that differences in students' performances are, at best, suggestive of the impact of different math prerequisites on student performance because they ignore the effect of other potentially important explanatory factors on student performance. Sumaila (2014) found a strong positive relationship between math 201 (mathematical methods) in the second year and math 101 (set theory and number systems), math 102 (algebra), math 103 (trigonometry and coordinate geometry), math 104 (conic section and application of calculus), math 105 (differential and integral calculus) and math 106 (Vectors and Dynamics) in first year.

Nigeria Certificate in Education is a programme aimed at producing well trained teachers for the basic education. Amongst the goals of the programme is to ensure that the novice teachers are well trained in education as well as the teaching subjects. Within the curriculum framework of the programme, there are the general studies in English language, Information and communication technology and the basic general mathematics. Federal Republic of Nigeria (2012) stated that basic general mathematics is an integral part of the general education curriculum aimed at enabling students to appreciate the inter relationship between disciplines in an integrated world which is fast becoming one big village. Other goals of the course unit .include developing critical thinking and imagination to apply basic mathematics in solving problems of everyday life. Prerequisite Knowledge for learning is the prerequisite content that should be reviewed, or perhaps even covered for the first time, to properly prepare these students for the material they are about to encounter.

Kano State College of Arts Science and Remedial Studies offers courses viz: - IJMB in humanities, Social and Management Sciences and the Sciences; Diploma in English Education affiliated to Bayero University, Kano; Diploma in Mathematics Education, Physics Education and Integrated Science Education in Affiliation with Institute of Education,

Ahmadu Bello University, Zaria and remedial Programmes in SSCE. The College also offers some Diploma courses under the consultancy services unit in Affiliation with Kaduna Polytechnic.

The course units basic general mathematics are registered by all students in five semesters as contained in table 1.

Table 1: Basic General Mathematics Course Units across the Three Sessions of the Programme

SN	COURSE CODE	COURSE TITLE	YEAR	SEMESTER	CONTENT	STATUS
1	GSE 113	Basic General Mathematics I	1	First	Number and Numeration	C
2	GSE 122	Basic General Mathematics II		Second	Simple Algebra	C
3	GSE 212	Basic General Mathematics III	2	First	Units of Measurement and Geometry	C
4	GSE 222	Basic General Mathematics IV		Second	Algebra and introductory Statistics	C
5	GSE 322	Basic General Mathematics V	3	Second	Descriptive Statistics and probability	C

GSE 113 is a prerequisite to GSE 122; as such success in GSE 122 ought to be preceded by success in GSE 113 and also that success in GSE 212 should be preceded by successes in GSE 113 and 122. The content of GSE 122 includes expansion and factorization of simple algebraic expressions, simple algebraic equations and methods of solution, simple word problems, ratios, percentages, simple and compound interests and direct and inverse variations. The contents of GSE 212 include change of subject of formulae, units of measurement for time, money length, mass weight, area and volumes of some 2 and 3 dimensional shapes.

Statement of the Problem

Sequel to the commencement of the NCE programme and coupled with the need to track the progress or otherwise of the students in all the courses of the study in the College, this paper intends to follow the progress of the students particularly the basic general mathematics being a core course for all the students. The choice of GSE 122 and GSE 212 was a deliberate one, as GSE 113 was offered by the students in the first semester first year and serves as a prerequisite to the GSE 122. Both GSE 113 and GSE 122 are prerequisite to GSE 212. The idea behind the research on basic general mathematics was born out of the fact that mathematics was made to be a compulsory criteria for admissions in the institutions of higher learning.

Objective of the study

The main objective of this study was to investigate and compare Arts and Science NCE students' performance in basic general mathematics (GSE 122 and GSE 212) of the second semester first year and first semester second year of the programme respectively.

Specifically, the study aims at finding the relationship/difference between:-

1 Arts students' performance in GSE 122 and GSE 212
2 Sciences students' performance in GSE 122 and GSE 212
3 Arts and Science students' performance in GSE 122 and GSE 212

Research questions

The following research questions were formulated to guide the study:

1 What is the relationship if any between Arts students' performance in GSE 122 and GSE 212?

2 What is the relationship if any between Sciences students' performance in GSE 122 and 212?

3 What is the difference if any between Arts and Sciences students' performance in GSE 122 and GSE 212?

Research Hypotheses

In line with the research questions, the followings corresponding research hypotheses were formulated and tested at 0.05 level of significance.

H_o1: There is no significant relationship between Arts students' performance in GSE 122 and GSE 212.

H_o2: There is no significant relationship between Science students' performance in GSE 122 and GSE 212.

H_o3: There is no significant difference between Arts and Science students' performance in GSE 122 and GSE 212.

Scope of the study

This study was limited to the students' performance in GSE 122 in second semester NCE I and students' performance in GSE 212 first semester NCE II examinations of CAS Kano for the session 205/2016.

Methodology

The research design for this research is longitudinal design. The records of the students' examinations results were followed from the second semester first year to the first semester second year. The population for the study consists of three hundred and forty (340) students that sat for the second semester examinations for GSE 122 and first semester examination for the GSE 212. The sample of the study consists of one hundred and eighty (180) students according to the table of determination of sample size by (Krejcie and Morgan 1970). The sample of the study was selected using cluster sampling technique to select from various clusters (Arts and Science). Simple random sampling technique was later used to select the sample of the study. The data required for this research (students' performances) were collected through documentary analysis of students' performances from the Directorate of Examination of the College. The data (students' performances in GSE 122) collected through documentary analysis serves as the independent variable while that of GSE 212 serves as the dependent variable.

Table 2: Sample of the study

N	Combination	No. of students
	IRS/ARABIC	29
2	SOS DM	49
3	ISC/BIO	57
4	MATH/BIO	21

Data Analysis

The data were analysed using descriptive statistics to answer the research questions and inferential statistics Pearson's Product Moment Correlation and Analysis of Variance (ANOVA). The analyses and discussions were contained in the respective tables.

Research Question One: What is the relationship if any between Arts students' performance in GSE 122 and GSE 212?

Table 3: Means and Standard Deviations of Arts students' performance in GSE 122 and GSE 212

Variables	N	Mean	Mean Difference	Std. Deviation
GSE 122 Arts	78	30.1154	1.9872	22.30542
GSE 212 Arts	78	28.1282		19.68872

Table 3 presented the means and standard deviations of the Arts students' performances in GSE 122 and GSE 212. From table 3, the mean 30.1154 (SD=22.39542) of the GSE 122 NCE I students is greater than the mean 28.1282 (SD=19.68872). The mean difference is 1.9872 which indicates existence of difference in performance.

Hypothesis One: There is no significant relationship between Arts students' performance in GSE 122 and GSE 212

Table 4: Pearson's Product Moment Correlation of Arts Students' Performance in GSE 122 and GSE 212

Variables	N	Pearson's r	Sig
GSE 122 ARTS	78	-0.217	0.056
GSE 212 ARTS	78		

Table 4 presented the Pearson's Product Moment Correlation of Arts students' performance in GSE 122 and GSE 212. From table 4, r = -0.217 (P=0.056) indicates a significant negative relationship in performance in GSE 122 and GSE 212. This explains that performance in GSE 212 is not in any way influenced by the performance in GSE 122. Conclusively, the hypothesis that stated that there is no significant relationship among Arts students performance in GSE 122 and GSE 212 fails to be rejected.

Research Question Two: What is the relationship if any between Science Students performance in GSE 122 and GSE 212?

Table 5: Mean and Standard Deviation of Science Students' Performance in GSE 122 and GSE 212.

	N	Mean	Mean Difference	Std. Deviation
GSE 122 SCIENCES	78	32.4103	-5.1666	25.18732
GSE 212 SCIENCES	78	37.5769		28.57186

Table 5, presented the means and standard deviations of science students performance in GSE 122 and GSE 212. From table 5, the mean 32.4103(SD= 25.18732) for GSE 122 is less than the mean 37.5769 (SD=28.57186) for GSE 212. The mean difference is -5.1666 which indicate a wide negative gap in the means of the two groups (NCE I and NCE II).

Hypothesis Two: There is no significant relationship in science students performance in GSE 122 and GSE 212.

Table 6: Pearson's Product Moment Correlation of Science Students' Performance in GSE 122 and GSE 212

Variable	N	Pearson's correlation	Sig.
GSE 122 SCIENCES	78		
		-0.097	0.399
GSE 212 SCIENCES	78		

Table 6, presented the Pearson's correlation for science students performance in GSE 122 and GSE 212. From table 6, r = -0.097 (P= 0.399) indicates an insignificant negative relationship in performance in GSE 122 and GSE 212. This explains that performance in GSE 122 has little or no influence over GSE 212. Conclusively, the hypothesis that stated that there is no significant relationship among Sciences students performance in GSE 122 and GSE 212 fails to be rejected.

Research Question Three: What is the difference if any between Arts and Sciences students' performance in GSE 122 and GSE 212?

Table 7: Mean and Standard Deviation of Arts and Sciences Students Performance in GSE 122

Variables	N	Mean	Mean Difference	Std. Deviation	Minimum	Maximum
GSE 122 ARTS	78	30.1154	-2.2949	22.30542	3.00	83.00
GSE 122 SCIENCES	78	32.4103		25.18732	1.00	87.00

Table 7 presented the means and standard deviations of the students' performances in GSE 122 Arts and Sciences. From Table 7, the mean 30.1154 (SD= 22.30542) for GSE 122 Arts is less than the mean 32.4103(SD= 25.18732) for GSE 122 sciences, and the mean difference is -2.2949 in favour of the science students. The gap between the students' performances in GSE 122 for Arts and Sciences indicated a significant difference.

Table 8: Mean and Standard Deviation of Arts and Sciences Students Performance in GSE 212

Variables	N	Mean	Mean Difference	Std. Deviation	Minimum	Maximum
GSE 212 ARTS	78	28.1282	-9.4487	19.68872	3.00	83.00
GSE 212 SCIENCES	78	37.5769		28.57186	1.00	89.00

Table 8 presented the means and standard deviations of the students' performances in GSE 212 Arts and Sciences. From Table 8, the mean 28.1282 (SD= 19.68872) for GSE 212 Arts is less than the mean 37.5769(SD= 28.57186) for GSE 212 sciences, and the mean

difference is -9.4487in favour of the science students. The gap between the students' performances in GSE 212 for Arts and Sciences indicated a significant difference.

Hypothesis Three: There is no significant difference between Arts and science students' performance in GSE 122 and GSE 212.

Table 9: Analysis of Variance of Arts and Science Students' Performance in GSE 122

Source of Variation	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	16633.190	38	437.716	.788	.768
Within Groups	21676.771	39	555.815		
Total	38309.962	77			

Table 9 presented the analysis of variance of Arts and sciences students' performance in GSE 122. From Table 9, the ratio F = 0.788 (P=0.768) indicates a variation in performance (0.768>0.05).

Table 10: Analysis of Variance of Arts and Science Students' Performance in GSE 212

Source of Variation	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	15333.951	36	425.943	1.203	.282
Within Groups	14514.767	41	354.019		
Total	29848.718	77			

Table 10 presented the analysis of variance of Arts and sciences students' performance in GSE 212. From Table 10, the ratio F = 1.203 (P=0.282) indicates a variation in performance (0.282>0.05). The fact that (0.768>0.05) for GSE 122 and (0.282>0.05 for GSE 212 leads to the rejection of the null hypothesis which states that there is no significant difference between Arts and sciences students performance in GSE 122 and GSE 212.

Discussion

From table 3 through table 10, it was observed that all the three hypotheses failed to be rejected as no relationship existed between Arts and Science students' performances in both the GSE 122 and GSE 212. The findings of this study are in disharmony with that of Sumaila (2014) who found strong positive correlations between the prerequisite course units. The findings support Green et-al (2007) who stated that differences in students' performances are, at best, suggestive of the impact of different math prerequisites on student performance because they ignore the effect of other potentially important explanatory factors on student performance.

Conclusion

The findings of this research study showed that there were no relationship between both the Arts and science students in both the GSE 122 for second semester first year and the performance in the GSE 212 for the first semester second year. The performances in GSE 212 were expected to be influenced by the performance in the GSE 122 as a prerequisite course unit. The study concludes that despite the fact a prerequisite course unit is very vital to the upcoming courses, performance in GSE 212 was not in any way facilitated/influenced by the performance in GSE 113 and GSE 122 as prerequisites.

Recommendation

The study recommends amongst others that similar study be conducted to ascertain the extent of the relationship between the prerequisite course (GSE 113 and GSE 122) as year one course and GSE 212 and GSE 222) as year two courses. It is also recommended that year one courses be studied separately and year two courses also separately.

Referrences

Clark, N. & **Robert, S. (2004)** Education in Nigeria Practical Information. **Volume 17, Issue 5**

Dowker, A. (2005). *Individual Differences in Arithmetic*. Hove: Psychology Press.

Federal Republic of Nigeria (2012) National Commission for Colleges of Education, Nigeria Certificate of Education, Minimum Standard for General Education Second Edition

Green, J. J., Stone, C. C. Abera, Z., and Thomas, A. C. (2007) Changes in Math Prerequisites and Student Performance in Business Statistics: Do Math Prerequisites Really Matter? *Journal Of Economics And Finance Education* • 6(2)27

Kano State College of Arts, Science and Remedial Studies, P.M.B. 3145, Students Handbook 2014.

Rittle-Johnson, B and Michael S. (2015) *Oxford handbook of numerical cognition*. Oxford University Press

Sumaila, M. U. (2014) Prerequisite Courses in Mathematics as Determinants of Students' Academic Performance in Diploma in Mathematics Education in College of Arts and Science, Kano State, Nigeria. Being a Seminar Paper Presented at the Department of Science Education, Faculty of Education, Ahmadu Bello University, Zaria Course Code: EDSE 805 (Seminar)

Welder, R. M. (2006) Prerequisite Knowledge for the Learning of Algebra Hawaii International Conference on Statistics, Mathematics and Related Fields.