Ebonyi Journal of Science Education

(EJSE)

VOL 2, NUMBER 1, JULY 2007

PROFILE OF HUMAN AND ICT RESOURCES IN MATHEMATICS

By
Adetunji Abiola OLAOYE (Ph.D)

Abstract
The study was carried-out to outline the human and Information, Communication and Technology (ICT) resources in Mathematics as against context of the Colleges of Education in Nigeria with a view to ascertain their impact on genders' learning outcome in Mathematics. As an expost-facto research design which made use of the one hundred and sixty-five NCE III students of mathematics and thirty mathematics lecturers that were chosen via purposive sampling techniques in the six colleges of education that can ran 10-Mathematics education subject combination out of the approved 20-Mathematics education subject combination in Nigeria. Five research questions and one hypothesis were generated for the study at 0.05 significant levels. Three instruments were developed and used for the study, and these include Lecturer's questionnaire (r=0.75), Inventory of Mathematics resources (r=0.66) and achievement test in mathematics (r=0.86). Data collected were analyzed through percentages, simple descriptive statistics like mean and standard deviation and t-test at 0.05 levels of significant. Study revealed that male students performed better than their female counterparts in the achievement test on mathematics ($t=2.18, df; p<0.05$) though there was general dismal performance of students in mathematics. Moreso, it was discovered that there was variant in the observed qualification of human resources as against the recommended of standard minimum guides, though not very significant. Furthermore, it discovered the qualities of ICT resources for the mathematics education programme was not in line with the qualities stipulated by the standard minimum guides, which invariably affected the teaching and learning of Mathematics. However, conclusion and recommendations were proffered as contained in the write-up.

Introduction

The National policy on Education (1998) section 1 (4) describes education as an instrument for national development. According to Ballantye (2004) education is the key social activity by which society reproduces the traditions and forms of life it considers desirable, and produces new traditions and forms of life it considers preferable to realize its aspiration for humanity. Hence, the advancement in technology and improvement in socio-economic aspects of people's life are made possible through education and this why countries of the world are classified as developed and developing on the basis of their development as dictated by the form of education a country embraces. Functional science education enables its recipients to transfer the skill acquire from the school not only to the industries but also to spheres of life. According to Mkpa (2001) effective science education equips the learners with the potentials and capabilities for self-actualization. But science-education is possible if the qualities and quantities of mathematics resources are adequate to complement the focus of science education.

Mathematics resources include both human and non-human resources for the effective teaching of mathematics. According to Harbinson (1994) the wealth of a country is dependent upon more than its natural resources, and material capital, it is determined in significant degree by the knowledge, skills and motivation of its people. This assertion epitomizes the Japanese's stand on mineral resources of her own but well developed human resources and as such ranked second largest industrial country after the U.S.A. The Nigeria government recognizes the importance of human resources especially the teachers and that was why the establishment of various colleges of education since 1989 by decree 3 section 5 (d) and (c) to saddle with the production of qualitative teachers in all various field of human endeavors. No wonder the government of Federal Republic of Nigeria through education policy provision embraced the quota admission ratio of 60:40 in favour of science to humanities in the nation universities. It is however important to observe that various universities and polytechnics were established to perform many functions in the nation education system the colleges of education was primarily established for mono-function of preparing and producing qualitative teachers for the primary and junior secondary schools in all fields among which is mathematics, with specified guides as contained in the minimum standard guide (1990, 1994, 1996, 1998).

Nature of Training in Colleges of Education

Colleges of education occupy unique position in the training of non-graduate professional teachers in all fields of human endeavous: science, social-sciences and arts. In practice the trainees are expected to put into immediate use the knowledge and skills acquired during training. These non-professional graduate teachers are directly involved in raising the standard of the nation's education as they serve as inputs into the existing primary and junior secondary schools, thereby raising the standard of living of the populace. Hence their training must therefore, be relevant to the immediate needs of the country. In doing so, the objective of the Nigeria Certificate in Education programme of Mathematics have been classified unto six broad areas for the products to attain after the completion of their programme. These include:

(i.) Discuss with confidence the historical development of mathematics as a discipline,
(ii.) Solve abstract problems using mathematical functions and formulae,
(iii.) Motivate pupils' interest in mathematics by the use of approximate strategies, particularly at the primary and junior secondary schools,
(iv.) Analyze relationships in quantitative terms,
(v.) Apply the computer to data processing, and
(vi.) Demonstrate convincing enthusiasm and intellectual ability for further studies in mathematics (NCCE, 1990)

In order to perform the above mentioned objectives, the human and non-human resources in mathematics at the colleges of education were spelt-out in qualities. For the human resources the standard minimum guide required that there should be five-man personnel of mathematics education background with the minimum qualification of the second class upper division in mathematics

education or lower in mathematics with an additional post graduate diploma in education. Furthermore the workloads of the lecturers were specified to be at maximum of ten hours in a week, so as to ensure qualitative delivery of lecturers. On the non-human resources which included different information, communication and technological media, quite a number to be produced for the running of the mathematics education were stipulated. For instance, the textbook on mathematics were stipulated to cover areas of mathematics such that quantities required should be ratio of one student to ten books since the recommended staff students ratio was pegged at 1:25 in the classroom. With all the human and non-human resources standard minimum guide posited that qualitative teachers of mathematics should be produced for the primary and junior secondary levels of education, and as a measure to uphold the nation self-reliance due to the pivotal role of mathematics. Going by various years of WAEC examiners' reports on the dismal performance of students in secondary school subjects especially science and mathematics in particular, it is sad to observe that perennial dismal performance was largely due to teacher's factors. Since colleges of education was primarily established for the production of non-graduate professional in all fields, mathematics inclusive, and based on the accreditation of these colleges to have possessed the mandated resources the study was carried out to assess the extent of resources in the colleges of education for the mathematics education programme.

Statement of the Problem

The study was carried-out to assess the human and Information, Communication and Technology (ICT) resources in mathematics as against context of the Colleges of Education in Nigeria with a view to ascertain their impact on learning outcome of students in Mathematics. Specifically, the study sought answers to the following research questions:

(i.) What is the general performance of students in mathematics?

(ii.) Do quantities of human resources on ground satisfy the condition of:

(a) Standard minimum guide? (b) Number of students?

(iii.) What are the qualifications of the available human resources?

(iv.) Do colleges maintain the maximum 10 hours workload per week among the human resources available?

(v.) Do qualities of ICT resources in the colleges meet the stated number in the standard minimum guide?

Meanwhile, one hypothesis was raised in the study as

Ho_1: There is no significant gender difference in the academic performance of students in the achievement test.

Methodology

Design

The research design employed for the study was on expost-facto survey where the independent variable such as lecturers' qualifications, workload, etc of human and the ICT resources at the colleges of education could not be manipulated but they were only observed on their effect on the dependent variable which was learning out-come of students in mathematics.

Population

Study's population consisted of all colleges of education that run mathematics education programme in Nigeria and that have been accredited by the National Commission for Colleges of Education. These comprised of sixty-three colleges of Education in Nigeria.

Sample and Sampling Technique

There were sixty-three colleges of education in Nigeria with twenty mathematics education programme but colleges of education that ran ten mathematics education programme were selected into the sample due to the logistic and convenient purpose.

One hundred and sixty-five students at 300 levels and 30 mathematics lecturers in the six colleges of education were used for the sample in the study. Rationale for the 165 students of mathematics was not un-connected with the minimal course attrition rate and exposure to over 90% mathematics course contents as at second semester of 300% levels, when the study was conduced. Hence, purposive sampling technique was adopted.

Instrument

Three different instruments were developed and used for the study. These included lecturer's questionnaire, inventory of resources questionnaire and achievement test on mathematics. Lecturer's questionnaire was divided into three parts A, B, C. part A was the demographic data of lecturer, part B consist the list of recommended text-materials on Mathematics, Mini-computer and Mathematics Laboratory studios are expected to be in the colleges and part C consists of the extent of use of these materials by the stakeholders. Inventory of resources in the colleges made up of those materials stipulated to be on ground by the standard minimum guide in order to ensure accreditation and qualitative production of mathematics teachers. The achievement test on mathematics contains 30 multiple choice questions n mathematics at the NCE levels.

Validation of Instruments

The lecturer's questionnaire was administered to mathematics lecturers outside the scope of the study to effect ambiguities of the contents of the instruments. The inventory of resources questionnaire was given to two experts in the Faculty of Education to see to its content adequacy relative to the standard minimum guide requirement. The same method which was used for the lecturer's questionnaire was adopted for the achievement test in mathematics though for the set of 20 students outside the scope of the study.

Reliability of Instruments

After the validation procedures an interval administration of two weeks were executed on the specific number of people and their responses on each questionnaire were correlated via Cronbach-alpha which gave correlation coefficients of 0.75, 0.66 & 0.86 for the lecturer's questionnaires, inventory of resources and achievement test on mathematics respectively.

Procedures

With the permission of the Head of departments of mathematics in the six colleges of education used lecturer's questionnaire was personally administered to the selected 30 mathematics lecturers in their offices wile these lecturers assisted the research to conduct the achievement test for the students and these were collected on the same day of administration in each college though days were at variant from

one college to others. Researcher used the inventory of the resources by himself to assess the quantities of the information, communication and technology resources in the colleges as mandated to be provide in the colleges to enhance teaching of mathematics by the standard minimum guides. Meanwhile the correct and wrong answers of the mathematics achievement test was scored one marks and zero marks respectively, while the available and non-available ICT resources were scored one and zero marks respectively. The lecturer's questionnaire was scored descriptively based on the information supplied by the respondents. Hence, data collected were scored through descriptive statistics of mean and standard deviation and T-test for one hypothesis rose in the study.

Findings

Table 1: Mean and Standard Deviation of Achievement Scores of Students

Variables	Count	Mean	Standard Deviation
All students	165	44.4%	2.90
Male	94	45.8%	2.87
Female	71	42.5%	2.87

Table 1 showed that there was general poor performance of students in the achievement test on mathematics with mean score and standard deviation of 44.4% and 2.90 respectively. The score that represent lower pass in the criterion referenced scored by the NCCE.

Table 2: Average Number of Students per NCE Levels

Level of students	NCE I students	NCE II Students	NCE III Students
Average Numbers	45	31	27.5=28

From table 2, study revealed that the quantities of human resources on ground were adequate in line with the standard minimum guides of 30 lecturers to man to programme for the six colleges. In some colleges the average number of 5 man personnel was more than 5 purposely to boast human resources on ground but some of them were on part-line basis. However, these resources did not conform with the staff-students ratio of 1:25 as the students' population was greater considerable to the staff strength.

The implication of the findings was that the recommended teaching strategies of demonstration cum discovery by the standard minimum guides could not be followed sequentially as this forced the lecturers to adopt lecture method throughout their lectures.

Table 3: Lecturer's Qualifications

Qualification	B.SC	M.SC	B.SC/Ed. &PGDE	M.ED & Ph.D	Tota l
Numbers	5	6	17	2	30
Percentage	16.6	20.0	56.7	6.7	100

Table 3 shows the qualification of mathematics lecturers in the selected colleges with eleven staff representing 36.6% to have academically qualified to teach in the colleges while 19 staffs representing 63.4% to have academically and professionally qualified to teach in the colleges. On investigation about the academic qualified staff it was gathered that quite a number of them have commenced their post graduate diploma in education course. However, the danger of these academicals qualified staff lies in the pedagogy of teaching the students to embrace mathematics fully.

Table 4: Lecturer's Workload in a Week

Workload	Below 10hours	10 hours	Above 10 hours
Numbers	7	14	9
Percentage	23.3	46.7	30.0

Table 4 shows the lecturer's workload in line with the standard minimum guide. Study showed that 14 (46.7%) had an average of 10 hours maximum per week but these figure fell below the 50% of the total personnel on full-time basis and on ground. 7 (23.3%) staff had workload less than 10 hours maximum in a week while 9 (30%) staff had more than 10 hours in a week. On investigation of unequal distribution of workload as mandated by the guides it was revealed that those who had 10 hours maximum in a week were mostly the senior colleagues who were saddled with different administrative jobs within the system, and for those having more than 10 hours maximum in a week was on internal arrangement to allow those on PGDE complete their programme. The implication of this findings lies in non-coverage of mathematics content very well to the students as most of those lecturers who had been saddled with more than 10 hours in a week would likely to concentrate on those topics to be set in the examination at the detriment of the philosophical foundation of NCE mathematics which was to produce non-graduate professional teachers of mathematics. Apart from these, the issue of thorough marking might be another serious concern due to student's population as well as the overloaded of courses in mathematics, in some cases, and the maximum workload of 10 hours not strictly followed.

On the quantities of the ICT resources in the colleges that ranged from the recommended textbooks on mathematics to the micro-computers and mathematics laboratory studios, there was gross inadequate of these resources in some colleges while some colleges did not possess of these materials.

YRI	Materials	MAT111	MAT112	MAT113	MAT114	MAT121	MAT122	MAT123	Mat124
	Quantities	35	10	05	02	15	17	02	04
YRII	Materials	MAT211	MAT212	MAT213	MAT214	MAT221	MAT222	-	-
	Quantities	04	01	0	18	05	09	-	-
YRII	Materials	MAT311	MAT312	MAT321	MAT322	MAT323	MAT324	MAT325	-
	Quantities	01	07	02	11	04	10	10	-

Table 5 (a) shows the inventories of mathematics textbooks in all the chosen colleges with their corresponding quantities on ground. While there were considerable quantities in some areas of mathematics others did not have the required numbers and some did not exist at all. For instance it was only textbooks on MAT111 that had considerable quantities though not up to the required number relatively to the students' population and the quantities specified by the standard minimum guide. Other areas of mathematics that were grossly short of recommended text-materials were shown in the table but those that were not available at all was that of MAT213 (Mathematics Laboratory Studios).

This implication of this findings lies in the fact that much of the needed knowledge of mathematics in these areas will be drastically reduced if at all exist because the alternative source of knowledge in those acute textbooks would be from what the lecturers taught in that areas. The situation could be worsening when the available lecturers did not cover the content areas as a result of the workload. Furthermore, there would be likely multiplier effect of loss of knowledge required from those text-materials that were not available to the lower level of educational strata since one cannot pretend to now what ones does not know. As a result these inadequate textbooks of materials might be one of the contributing factors to the dismal performance of students in the achievement test on mathematics as shown in table one.

Table 5 (b): Quantities of ICT Resources Available for Mathematics Education Programme

Materials	Flannel Board	Probability Instruments	Overhead Projectors	Flywheel Machines
Quantities	08	12	01	03
Materials	Inclined planes	Measuring Tapes	Double Protractors	Spherical Globe
Quantities	07	24	09	05
Materials	Assorted Games	Tracks & Trolley	Abacus	Meter Rule
Quantities	05	03	20	04
Materials	2by3 Geo. Instru.	Instructor. Comp. & Protac	Views Instruments	Mini-Computers
Quantities	09	11	07	03
Materials	Raybometer	Scientific Calculator	Graphical Board	Wall Chart
Quantities	03	-	06	08
Materials	Geometric Board	Mathematical Tables	Mathematics Laboratory Studios	
Quantities	05	06	03	

Table 5 (b) reveals various Mathematical instruments provided in the colleges with their corresponding quantities. While some of these materials were available relatively to the students' population others were not found except those on personal basis as in the case of scientific calculators. Apart from this not all the colleges had the mini-computer which students were expected to be familiarized-with in order to attain one of the objectives of Mathematics education programme. Furthermore, it is disheartened that the room for keeping the mathematics materials in some of the colleges were not in-existence though the few ones found on ground were not adequately equipped. The expected outcome of these gross inadequate materials is a pointer to abstract learning of Mathematics with has the multiplier effect of teaching at the primary and junior secondary schools where students found mathematics difficult to comprehend. To this end, this has made the students to believe that Mathematics has no relevance to the society's problems when in actual sense it is a tool towards modern technology.

Table 6: t-test of Achievement Scores of Students

Variables	Count	Mean	Standard Deviation	T-table	T-cal	Significant level	Degree of Freedom
All students	165	44.4%	2.90	2.18	7.31	P<0.05*	163
Male	94	45.8	2.87				
Female	71	42.5%	2.87				

*Significant on the hypothesis raised, study found that male students perform better than their female counterparts in the achievement test. (t=2.18, d=163; P<0.05) and it was significant. This in line with the study of Ohioha (1987) of the students' performance in science subjects of the Republic of Germany where male students performed better than their female counterparts.

Discussion and Conclusion

This height attained by any country in science and technology towards meaningful development is a reflection of the quality of science, technology and Mathematics at different levels of the nation's educational system. In acknowledging the all-important role of Science, Technology and Mathematics in the nation's development findings have shown that profile of the human and ICT resources in the Colleges of Education are not adequate to produce the much needed non-professional graduate teachers of Mathematics as stipulated in the minimum standard guide; and this is in collaboration with the study of Mulemwa (2002) that any nation devoid of sound science, technology and Mathematics based risk being isolated from the global village of development. Moreso, the minimum of 10 hours workload was not strictly followed as some staff was overloaded at the detriment of the others due to shortfall in the personnel relatively to the students'

population. For the nation like Nigeria to move forward much attention and resources have to be committed in that direction since the nature of the human and ICT resources in the development of education determine the greatest height to which the country education attains. In general the academic performance of students was low, and this is due to inadequate ICT resources to complement learning and aid teaching in Mathematics. To improve students' learning according to Darling-Hammond (2005) one would have to invest heavily on teachers' learning in both content and practical aspects of teacher training. This is feasible in an atmosphere of adequate provision of human and ICT resources to enhance teaching and learning. Furthermore, it was found that male students performed better than their female counterparts notwithstanding of inadequate resources, but not impressive. According to Akale (1990) the development of science and technology culture in any nation begins in the classroom and submitted that the teacher is the key factor. As a result strict condition of running the Mathematics education programme in terms of qualitative and quantitative human and ICT resources should be upheld otherwise the nation's education philosophy of self-reliance will be a dream.

References

Ballantyne, J. (2004) Current Trends in Teacher Education: Some Implication Online

Harbinson, F.H. (1994) Human Resources as wealth of Nations. Oxford University Press.

Mulemwa, J. (2002) The challenges of providing quality Science in Africa. Proceeding of 43rd Annual Conference of STAN August, 18-24.

Mkpa, M.A (2001) Promoting Functional Education in the millennium. A keynote address presented at the millennium faculty week on 13th –17th August in the Faculty of Education, ESCT.

Federal Republic of Nigeria (1998) National Policy on Education Lagos NERDC Press

Akale, M.A.G. (1990) Teacher and student factors in the implementation of science, technology and mathematics education curricular of the 90s. in J.O.E. Otuka (Edition), Proceedings of the 31st STAN Annual Conference.

(P 107-112) Ibadan: Samedex Printing Works Ltd.

Darling-Hammond, L. (2005) Teacher Preparation. http:www.glrf.org/php/interview.php. Id = Art-832 & key =039.

Obioha, N.E. (1987) Declining trends in students' choice of Science and Technology. 28th STAN Annual Conference proceeding p. 16-24.

National Commission for Colleges of Education (1990) Standard Minimum Guides for the NCE teachers (Science). First Edition Kaduna

National Commission for Colleges of Edition (1994) Standard

Minimum Guides for the NCE teachers (Science). Revised Edition Kaduna

National Commission for Colleges of Education (1996) Standard Minimum Guides for the NCE teachers (Science). Revised Kaduna.

National Commission for Colleges of Education (1998) Standard Minimum Guides for the NCE teachers (Science). Revised Kaduna.