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SUSTAINING THE INTEREST OF STUDENT TEACHERS IN MATHEMATICS EDUCATION

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Abstract

The study was carried out in order to examine the extent to which students of Mathematics Education in the Colleges of Education claimed to be skilled in Mathematics and its pedagogy. It was an expost-facto study that contained two research questions and hypotheses at significant level of 0.05. One hundred and sixty-five final year students of Mathematics and thirty mathematics lecturers were chosen through purposive sampling technique in the six colleges of education, located in the southwestern part of Nigeria. Two instruments were adopted, validated and used for the study. These included Achievement Test in Mathematics (ATM, r=0.76) and the Teaching Practice Grade Scores. Data collected were analyzed through means and standard deviation, simple frequency count and t-test. The findings showed students' mean score of 44% which fell below credit level that could make students judged to be skilled in the subject. Male and Female's mean scores in Mathematics were 13.74(45.8%) and 12.76(42.5%) respectively (t-ca l=2.18 >t-val =1.96, df = 163; P<0.05). Male and Female's means scores in the teaching practice grade were 59.73% and 56.56% respectively (t-cal = 3.18 > t-val = 1.96, df = 163; P<0.05). Study highlighted various shortcomings to the sustaining interest of students' teachers in Science, Technology and Mathematics (STM) professionals in teacher education as followed and discussed.

Introduction

Profession conjures in one's mind an organized group with considerable influence on the society with remuneration/earning capacity, job security, monopoly and exclusiveness of specialized knowledge and skill needed for societal development. This is glaring in some professions like medicine, law, architecture, accountancy, engineering that have strong organizations and exert great influence on the society. Profession also connotes occupation which one professes to be skilled in and to follow, and based on these ideas, the key elements in profession are skill in a particular job like teaching, which is the primary goal. Thus, a professional mathematics teacher is to behave in accordance to the ethics of teaching profession and to be skilled in the content of Mathematics.

There are numerous professional bodies in the world over with varying functions, aims and degrees of strength and prestige. For instance, science and human related disciplines have medical professions such as pharmacists, nurses, midwives, doctors and medical consultants while in science, technology and mathematics education there are engineers of various disciplines, surveyors, architects, and teachers of different disciplines like sciences that included mathematics among others. In a neighbourhood of professionals there exist three basic elements such as (1) exercise of some measure of control of those qualified to become members, and this is done through competitive examination, (2) Admission of members is on equal footing as the case of those students that meet the prescribed examination criteria of West African Examination Certificate and Polytechnics/Colleges of Education examination, and (3) Maintaining high standards of professional practice and ethics.

Essentially in Nigeria, the report of Ashby Commission (1959), according to Fafunwa (1991), is an historical one in the development of the Advanced Teachers' Colleges in the different parts of nation. In a bid to satisfy the need of the existing primary and lower level of secondary education's explosion in term of qualified teachers, the federal and state governments established different colleges named Advanced Teachers Training Colleges from 1961-76(Ichukwu, 1998). The major weakness of the system was that there was high level of discrimination in the admission procedure of some colleges' graduates as a result of their colleges that were not in affiliation to the universities of the graduates' choices. Alternatively, some of these graduates were either given three-year programme or total denial of admission into the university where their colleges were not affiliated to. This practice continued for a period of time until various education stakeholders, government and curriculum planners had a curriculum

conference in 1980 which was a follow up of that of 1969. At the conference it was decided that there should be uniformity of standard for all the products of the Advanced Teachers Training Colleges; and consequently led to the formation National Commission for Colleges of Education (NCCE) in 1989 to monitor and regulate the activities of all Nigeria Certificate in Education (NCE) awarding institutions nationwide. The act that gave these colleges the full autonomy in awarding NCE to their graduates that had satisfied the prescribed examination conditions. Prominent programmes in these colleges included science, arts and social science related courses in which Mathematics stand very significant. The primary goal of NCE Mathematics curriculum include the production of professional mathematics teachers that would be intellectually informed in Mathematics, and at the same time serve as input ,upon graduation, to the existing primary and junior secondary schools in the nation education system. These dual training processes allowed the NCE graduates to have smooth continuation of their programmes in the nation universities, where graduates ended up with the Bachelor of Arts/Sciences/Social Science Education, Mathematics inclusive. The objectives of the NCE Mathematics were clearly stated in the Minimum standard guide for NCE teachers to 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)

Recognizing the importance of Mathematics and teacher education in general, specialized training institutions have been set up like Faculty of Education and recently in Nigeria, the University of Education in order to produce graduate professional teachers of Mathematics among other disciplines. It can then be said that a professional teacher is one who has passed through the Colleges of Education, Faculty of Education or Institute of Education in various universities to acquire the needed professional skills or the art of teaching. Hence, qualification of membership is another criterion for professionals and it is restricted to those who fulfill the minimum entry qualification. Alternative, admittance is by examination. In some developed nations like USA and Britain only people, who had undergone professional teacher training courses and also

posses' necessary academic qualification, are allowed to teach. Non-professional graduates are not permitted to teach in schools like primary or secondary in Britain unless they posses professional teaching certificate (Olabisi, 1996)

Though modern scientific developments cannot be defined in a framework outside science education, and the sustenance of science education depends on the quality and quantity of science teachers among which is the mathematics teacher. Due to the wide application of mathematics in all fields of human endeavours, the subject still records dismal students' performance as corroborated by different scholars like Bojuwoye (1985), Olowojaiye (2002), Adamolekun (2002) and Olaleye (2004) with various reasons advanced. Some of such reasons advanced for the poor performance of students in the subject included mathematics teachers' qualification (Yee, 1990; Salami, 2000), teaching ineffectiveness (Wharton, Pressley and Hampston, 1998), lack of instructional materials (Akinsola, 1999), gender (Tijani, 1999; Adesoji, 1999) and topics pedagogy (Oyedeji, 1996) among others. It has to be noted that the dismal performance of students in sciences, mathematics inclusive, is a global issue as noted by Obioha (1987) who studied the academic performance of students of the Republic of Germany in Science, and concluded that dismal performance in mathematics was more pronounced than in other science subjects. This situation is also noticeable as supported by the findings of some of the studies earlier mentioned.

In a bid to examine the root cause of this perennial problem, this study was carried out to examine the extent to which teachers in training at the Colleges of Education said to be skilled in Mathematics and how the teaching as profession could be a calling, considering quite a number of courses which these students teachers have to passed, relevant to the immediate needs of the country; and as rooted in the series of mathematics courses for a 3-year programme in table 1 below.

Table 1: Hierarchical organization of NCE Mathematics

Year One	Year Two	Year Three
Algebra, Trigonometry, History of Mathematics, Basic Concepts in Mathematics, Differential Calculus, Coordinate Geometry, Mathematics Methodology and Introduction to Computer Studies.	Number Theory, Problem Solving, Mathematics Laboratory Practical, Statistics and Probability, Integral Calculus and Vector Analysis	Dynamics, Real Analysis I, Static, Linear Algebra, Real Analysis II, Differential Equation and Abstract Algebra.

Source: NCCE Manual (1996)

To bring a considerable solution to the problems being faced, critical examination of the academic performance of students in Mathematics for the period of 1990 to 2000 academic sessions was studied, and as presented in table 2, which showed that, much of the dismal performance of students could be traced back to the training level. This was compared to the prevailing performance with the professional status attainment as set by the National Commission for Colleges of Education (NCCE)

Table2: Average performance of students with credit C level and above, and below in the six Colleges of Education from 1990-2000 academic sessions

Sessions	90/91	91/92	92/93	93/94	94/95	95/96	96/97	97/98	98/99	99/00
Below Grade C	64.8	74.8	60.6	60.9	62.8	71.6	66.4	67.0	69.7	75.6
Grade C & Above	35.2	25.2	39.4	39.1	37.2	28.4	33.6	33.0	30.3	24.4
Total Candidate	301	361	403	322	307	425	357	388	320	242

Source: Academic offices of the colleges of education in the southwestern Nigeria.

Table 3: Criterion referenced scores

Scores (%)	70-100	60-69	50-59	45-49	40-44	0-39
Letter Grade	A	B	C	D	E	F
Grade Point	5.00	4.00	3.00	2.00	1.00	0.00
Point Interval	4.50-5.00	3.50-4.49	2.40-3.49	1.50-2.39	1.00-1.49	0.00-.99
Level of Pass	Distinction	Credit	Merit	Pass	Lower pass	Failure

Source: NCCE, 1998

Problem

The study sought for the skill in terms of performances students claimed to profess in Mathematics as sustaining interest of student teachers of Mathematics Education. Specifically, it provided answers to the questions:

Research Questions

The following research questions guided the study

RQ_1: What are the academic performances of the students' teachers in Mathematics?

RQ_2: What are the academic performances of the students' teachers in the teaching practice?

Hypotheses

Meanwhile, two hypotheses were generated at $\alpha = 0.05$ to guide the study

Ho_1: There is no significant difference between the male and female student teachers' performance in Mathematics

Ho_2: There is no significant difference between the male and female student teachers' performance in the teaching practice

Research Design

The study employed an expost-facto design whereby the teaching procedure was examined in relation to the performance of students in mathematics, as a means of establishing the skill to which students teachers profess to attain via their scores.

Population

All the colleges of education that run mathematics education, specifically in the southwestern part of Nigeria constituted the population to the study. Twenty mathematics education subject combinations were run throughout Nigerian Colleges of Education (PCE, 2000) with ten-subject combination of these programmes run by the Colleges of Education in the southwestern parts of Nigeria. Table 4 described mathematics education students in the affected colleges.

Table 4: Population of students in the chosen colleges of education in the southwestern Nigeria

Colleges	NCE I	NCE II	NCE III
Federal College of Education(Special), Oyo	32	24	20
Oyo State College of Education (Former St Andrews college), Oyo	65	44	39
Federal College of Education(Osiele), Abeokuta	29	20	18

Tai Solarin College of Education, Ijagun, Ijebu Ode.	62	42	38
Osun State College of Education, Ilesha,	35	24	22
College of Education, Ila,	47	32	28
Adeniran Ogunsanya College of Education, Otto-Ijanikin, Lagos	51	34	20

Sample and Sampling techniques

One hundred and sixty five final year students of Mathematics were purposively chosen with thirty mathematics lecturers based on the condition of accreditation of the programme as stated by the NCCE in all the six Colleges of Education in the southwestern part of Nigeria. Table 5 described the sample selected in each college based on purposive techniques and the fact that there were minimal course attrition at 300 levels in the programme on one hand, and that those students' teachers had been exposed to over 90% course contents in Mathematics which Achievement Test in Mathematics (ATM)
measured on the other hand

Table 5: Sample of students in the chosen colleges of education in the southwestern Nigeria

Colleges	Candidates
Federal College of Education(Special), Oyo, Oyo State	20
Oyo State College of Education (Former St Andrews college), Oyo, Oyo State	39
Federal College of Education (Osiele), Abeokuta, Ogun State.	18
Tai Solarin College of Education, Ijagun, Ijebu Ode, Ogun State.	38
Osun State College of Education, Ilesha, Osun State.	22
College of Education, Ila, Osun State.	28

Instruments

Two major instruments were adopted, validated and used for the study. These included colleges teaching practice grade scores that were obtained from school of education in each college and the self developed Achievement Test in Mathematics (ATM), which contained thirty multiple choice questions.

Validation and reliability of Instruments

Content validity of the instruments was carried out by experts in Mathematics, test and measurements and guidance psychologists. Different amendments were done with original fifty multiple choice questions reduced to thirty in order to suit the purpose of the study. Moreover, these instruments were tested on some students outside the scope of the main study in an interval of two weeks in order to ensure its reliability. At the end of the exercise Pearson moment correlation formula was applied and the value obtained was 0.76.

Procedures

Before the commencement of the main study all the personnel involved had been briefed of the intention of the researcher. And with their assistance Achievement Test in Mathematics (ATM) was administered by their respective lecturer of Mathematics on behalf of the researcher and the responses collected on the spot, having clarified their ambiguity in the classroom. Each procedural administration of the instrument took a whole one day total six days altogether. The other instruments, teaching practice grades, were collected from the colleges' school of Education. These exercises lasted for one semester in the affected Colleges of Education because of the teaching practice grades that demand the administrative procedure in procurement.

Data collection and scoring

The teaching practice grades of the affected students were collected from the school of education in each college and the scored used as attested to by the external assessor to each college. On the other hand, the correct answer in the Achievement Test in Mathematics (ATM) had one mark and wrong answer had zero mark. Scored over thirty marks but converted to 100% in order to make comparison with the criterion referenced score of NCCE.

Findings

RQ_1: What are the academic performances of the students' teachers in Mathematics?

RQ_2: What are the academic performances of the students' teachers in the teaching practice?

Table 6: Mean scores and standard deviation of dependent variables

Variables	Count (n)	Mean (χ)	Standard Deviation (σ)	Scoring Instruments	
				Minimum	Maximum
Achievement Test in Mathematics	165	44.4%	2.90	0	100
Teaching practice grades/scores		58.4%	5.50	40	

Table 6 showed that students' mean score in the achievement test was 44.4% which fell below the credit level that could be regarded as the skills which they profess in Mathematics. The implication of the above is that much dismal performance in Mathematics among the students could be traced back to the training ground since these products go into the primary and junior secondary schools to teach the subject. This is to say that Mathematics content was lacking among the students' teacher in training.

On the pedagogical process students mean score was 58.4% as an attribute of teaching with criterion reference of merit in the NCCE's grade. With these scores as approved by the external examiners for the colleges there was hope of sustaining and attracting interest of students in Mathematics Education programme, because different supervisor's score were averaged to get each student' s score in the teaching practice exercise. The implication of the above finding revealed that majority of those students saw teaching as calling which is an attribute of profession but not all of them were content wise profession in Mathematics. Immediate implication of this is the multiplier effect on the students handled by these students' teacher after their training.

Hypothesis (Ho_1): There is no significant difference between the male and female student teachers performance in Mathematics.

Hypothesis (Ho_2): There is no significant difference between the male and female student teachers performance in teaching practice.

Table 7: T-test for mathematics students on Achievement Test and Teaching Practice Grades

Dependent Variables	Sex	Count	Mean	Std Dev	t-cal	df	t-table	Significance
Achievement in Mathematics	Male	94	13.74	2.87	2.18	163	1.96	0.031*
	Female	71	12.76	2.87				
Teaching practice	Male	94	59.73	4.35	3.18			0.000*
	Female	71	56.56	6.33				

(*) Significance at P<0.05

Table 7 showed that male students performed better than females with the males' mean score of 13.74(45.8%) and females' mean score of 12.76(42.5%) (t-cal = 2.18 > t-val=1.96, df = 163; P<0.05) and it was significant. As a result the null hypothesis one is hereby rejected, and it confirmed that male students tend to perform better in science related course, Mathematics inclusive. This was corroborated in the study of Obioha (1987) on the academic performance of students in Mathematics for the Republic of Germany. The implication is that more interest could be sustained in males as reflected in the skill they profess to have in Mathematics compared to their female counterparts. This might have sustained influence on the male students, greater number of them, to pursue more science-oriented courses, Mathematics inclusive, than their female counterparts. Secondly, the hypothesis two was rejected on the premise that males' mean score was 59.73 and greater than females' mean score of 56.56(t-cal = 3.18> t-val =1.96, df = 163; P<0.05) and it was significant. The implication of this finding lies in the fact that male students tend to have sustained better interest in the teaching of Mathematics than their female counterparts. The result is in line with the study of Aghenta (1983) though in contrast with that of Yee (1990). The implication of this finding was that students actually took Mathematics as career of their studies but unsustainable interest in the career might not be unconnected with what transpire in the process of teaching and learning.

Conclusion

One would expect that knowledge of the subject matter is an important variable of professionals especially when taking cognizance of national aspirations under 6-3-3-4 system. The ability to assess learners' performance structure and motivational drives, on the basis of observation and theory-based interpretations should be a prerequisite to teacher education professionals. Knowledge of how to present ideas to suite students' existing state of cognitive

development and subject matter readiness should be relevant to mathematics professionals. The effect of mathematics professionals on learning is complex due to some of professionals' motivation of learners while others cannot. Apart from these mathematics professionals' interest could be attracted and sustained whenever the trainers' professionals are dedicated, having good attitude towards the job, committed and with sense of responsibility in the discharge of duty, willingness to learn from others. The mathematics professionals' vis-à-vis learners go beyond original instructional tenets but include functions as parent surrogate, friend and confidant, counselor, adviser, representative of adult culture, transmitter of approved cultural, knowledge value and facilitator of personality development.

Recommendation

Problems such as untrained self-acclaimed professionals, poor condition of service, inadequate facilities to work with, different service condition and lack of discipline among professionals constituted some of the unattractive and hindrance to the interest in mathematics professionals in spite of the indispensable role of Mathematics among school subject in the society. To make Mathematics attractive and sustained interest among students the above mentioned odds have to be rectified. Apart from this professional training programme currently undertaking by the National Commission for Colleges of Education should be sound in design and modes of delivery. Kennedy (1986) as documented in Dye (1990) observed that most of the teacher education programmes have skewed towards teaching of academic subject matter at the detriment of academic qualities. The colleges should ensure that those to be taken for the programme should be of sound mind via examination as against dropout of other courses being taken. In the word of Shulman (1987) as reflected in Dye (1990), Science, Technology and Mathematics (STM) professionals need to provide comprehension among students vis-à-vis content knowledge, pedagogical knowledge, knowledge of learners and characteristics, knowledge of educational contexts and ends, purposes and values. This is to safeguard fire-brigade method of certification via examination-teaching orientation. More so it is documented according to Hill (1990) that one bad teacher is more dangerous than one bad surgeon because a surgeon can only hurt a person at a time while bad teacher would hurt human generation. In other words the condition of programme accreditation as spelt-out by the NCCE should be strictly followed and monitored in the colleges so as to ensure that good and commendable interest is sustained among the professionals be it in the service and the training. To attain these funds

need to be channeled into the appropriate use in order to sustain interest among the professionals like that of American Federation of Teachers States in the blue-print of benefits befitting Science, Technology and Mathematics professional teachers.

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