LEARNER, LECTURER AND SCHOOL FACTORS AS PREDICTORS OF ACHIEVEMENT IN MATHEMATICS IN COLLEGES OF EDUCATION IN SOUTHWESTERN NIGERIA

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CERTIFICATION

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DEDICATION

This work is dedicated to the Almighty God through His son, our Lord and Saviour, JESUS CHRIST, the Alpha and Omega, the Beginning and the End, the Omniscience, the Omnipresence and the Omnipotence.

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ABSTRACT

Mathematics is a core subject in schools and a bedrock for scientific and technological development. To this end, qualified teachers must be produced at colleges of education (CoEs) in Southwestern Nigeria to teach the subject at basic education level. In recent times, the performance of learners of Mathematics in the CoEs in Southwestern Nigeria has not been encouraging. Most studies focused on instructional strategies for teaching Mathematics to the neglect of influencing factors. This study, therefore, investigated learners' attitude towards Mathematics, peer influence, self-efficacy in Mathematics, attitude to Mathematics teaching, perception to teaching, teaching experience, availability of infrastructure, textual materials and instructional materials as predictors of learners' achievement in Mathematics in CoEs in Southwestern Nigeria.

The study adopted the survey design of the correlational type while Vygotsky's social learning and environmental learning theories provided the framework. Five CoEs from Southwestern Nigeria: three owned by states (Ikere Ekiti, Ijanikin and Ila-Orangun) and two owned by the Federal government (Ondo and Oyo) were purposively selected based on the high number of Mathematics lecturers. Total enumeration was used to draw 511 final year pre-service Mathematics teachers made up of 211 males and 300 females whose age falls within the range of 18 and 32 and 51 Mathematics lecturers in the five colleges. The instruments used for data collection were: Mathematics Achievement Test (r = 0.75), Learner's Attitudes to Mathematics (r = 0.74) and Lecturer's Attitude towards Mathematics Teaching (r = 0.79). Others were Learners' Mathematics Self-Efficacy (r = 0.93), Learner's Peer Influence (r = 0.92) scales, Teaching Experience, Availability of Infrastructure, Instructional and Textual Material checklists and Mathematics Lecturers' Perception to Teaching Rating Scale (r = 0.77). Data were analysed using descriptive statistics and Multiple Regression Analysis at 0.05 level of significance.

Learners' average performance in Mathematics achievement test was 19.55%. There was significant joint contribution of lecturer variables on learners' achievement in Mathematics ($F_{(3, 47)} = 3.87$; R = 0.44) accounting for 14.7% of its variance. Teachers' experience (B = 0.39, t = 2.66) and perception to teaching (B = 0.35, t = 2.43) predicted learners' achievement in Mathematics. There was significant joint contribution of the school variables on learners' achievement in Mathematics ($F_{(3, 507)} = 6.66$; R = 0.20) accounting for 3.2% of its variance. Instructional (B = 0.18, t = 3.31) and textual (B = 0.13, t = 2.58) materials predicted pre-service teachers' achievement in Mathematics. None of the learner variables predicted learners' achievement in Mathematics. There was significant joint contribution of the nine variables on achievement in Mathematics ($F_{(9, 501)} = 16.67$; R=0.48). This accounted for 21.7% of the total variance when the nine predictor variables are taken together.

Lecturer's teaching experience, positive perception of teaching, relevant instructional and textual materials were determinants of learner's achievement in Mathematics in colleges of education in Southwestern Nigeria. Education policy makers and management of these colleges should take cognisance of these factors for improved learning outcomes in the subject.

Keywords: Achievement in Mathematics, Colleges of education pre-service teachers, learner factor, school factor, Southwestern Nigeria.

Word count: 486

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LIST OF ABBREVIATIONS

FGN:	Federal Republic of Nigeria
NCE:	Nigeria Certificate in Education
NCCE:	National Council of College of Education
STAN:	Science Teachers Association of Nigeria
MAN:	Mathematical Association of Nigeria
CoE	College of Education
NPE:	National Policy on Education
WAEC:	West African Examinations Council
SAP:	Structural Adjustment Programme
NMC:	National Mathematical Centre
ANOVA:	Analysis of Variance
G.P.A.:	Grade Point Average
S.A.M.:	Sensory Activation Model
PRETMAT:	Pre-Service Teachers' Mathematics Achievement Test
SEQPREMAT:	Self Efficacy Questionnaire for Pre-Service Mathematics Teachers
PIQPREMAT:	Peer Influence Questionnaire for Pre-Service Mathematics Teachers
MALEQ:	Mathematics Lecturer's Questionnaire
LATMAT:	Learners' Attitude towards Mathematics Teaching
MALPETERS:	Mathematics Lecturers' Perception of Teaching Rating Scale
SFAQ:	School Factors Questionnaire
PWCUS:	Predominantly White colleges and Universities
HBCUS:	Historically Black Colleges and Universities

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CHAPTER ONE
INTRODUCTION

1.1 Background to the Study

Mathematics, as a school subject, has over the years attracted the interest of educators and researchers who are concerned about its teaching and learning. It is the only subject that is commonly studied globally. Mathematics is the meeting point of most disciplines. The concern of Mathematics educators and researchers might have been predicated on the fact that teaching Mathematics as a subject or course is a very important tool that could be used for the understanding of other subjects especially in science. It is indispensable to science and technology and essential to studies in humanities. The usefulness of Mathematics in everyday life is obvious in areas such as measuring, shopping, cooking, sewing, woodwork and other areas of human endeavour.

Emphasising the importance of Mathematics, Udousoro (2000) makes it clear that knowledge of the sciences remains superficial without Mathematics. It is important to the extent that it occupies a central position in the school curriculum (Amao and Disu, 2012). It is uniquely essential and has an unparalleled number of learners globally. It also provides solutions to the problems of quantity and quality. It is daily used by all and sundry. Mathematics as a subject is a friend to many but loved by very few. It is constantly applied by all whether intuitively, perceptibly or otherwise, consciously or otherwise. That is why Udousoro (2000) referred to it as the central intellectual discipline of the technological societies.

The contributions that mathematical knowledge and skills have made to economic, industrial and technological growth of modern world are quite obvious. The importance of Mathematics does not only lie in its contributions to scientific and technological development but also in its utility in day-to-day interactions at market places, in transportations, and other various businesses engaged in by both literate and illiterate members of the society. As a result, one cannot escape Mathematics as there is real value in and real-life applications for it. Mathematics has beauty just as it has patterns. It is a tool and it is a language. It has many uses. So, there is need for students to study Mathematics to

be properly prepared and equipped to face the challenges ahead if they are to be effective in this present age.

The most emphasised objective of education in Nigeria is academic achievement as certificate issued at the end of completion of a course is the only evidence tenable to secure employment and to gain admission to a higher institution (Olowo, 2001). Among the higher institutions in which students will gain admission to is College of Education where pre-service teachers are being trained. As far as Mathematics is concerned, it is one of the core subjects expected to be passed at the secondary school level and one of the subjects to qualify a candidate to gain admission to the university. At the higher institution, Mathematics is usually one of the general courses which students are made to offer. As a result, academic achievement in Mathematics has been the focus of researchers over the years.

Complaints and comments by the government and the general public in recent time indicate that there is falling standard in students' performance especially in Mathematics. For example, the national policy makers in the Nigeria educational system have given priority to admission into science (in which Mathematics is one) and technology courses at the tertiary level (FGN, 2004), but the target has not been met due to poor performance of students in Mathematics (Afolabi, 2010). According to Abimbade (1996) the technological breakthrough for which the country is craving, cannot be achieved without a sound foundation in Mathematics education. Uduosoro (2000) affirms that Mathematics is a fundamental science, which is necessary for the understanding of most other fields. The honour accorded Mathematics in Nigeria made it to be a compulsory subject in the curriculum of the primary and secondary levels of our educational system, and as well, a pre-requisite to the study of science courses in polytechnics, monotechnics, colleges and universities (FGN, 2004). In spite of the prominence given to Mathematics as a school subject, students' achievement in it has been very low. The results of students in Mathematics in our tertiary institutions especially colleges of education where pre-service teachers are trained have also not been encouraging. Despite all efforts at making students' performance in it better through organising tutorial classes, giving advice, organising counseling sessions, employing qualified Mathematics lecturers among others, their performance has been at a low level. This is evident in the general performance of pre-

service mathematics teachers in the Nigeria Certificate in Education (NCE) final results in some randomly selected colleges of education in the Southwestern geo political zone of Nigeria for five years which the table below reveals.

Table 1: Nigeria Certificate in Education (NCE) Mathematics Results for Selected Colleges of Education in Southwestern Nigeria.

Session	College	Candidates admitted in the College	Total enrolled for Mathematics	Candidates who scored A, B & C	Candidates who scored D & E	Candidates who scored F
2007/2008	College 1	14,299	365	71 (19.45)	35 (9.59)	259 (70.96)
	College 2	1,300	186	103 (55.38)	64 (34.41)	19 (10.21)
	College 3	3,236	179	47 (26.26)	56 (31.28)	76 (42.46)
	College 4	1,986	48	26 (54.17)	18 (37.50)	4 (8.33)
2008/2009	College 1	16,895	413	133 (32.20)	66 (15.98)	214 (51.82)
	College 2	1,370	221	116 (52.49)	87 (39.37)	18 (8.14)
	College 3	2,640	149	64 (42.95)	35 (23.49)	50 (33.56)
	College 4	2,350	44	27 (61.36)	12 (27.27)	5 (11.37)
2009/2010	College 1	13,963	972	192 (19.75)	87 (8.95)	693 (71.30)
	College 2	1,444	242	117 (48.35)	79 (32.64)	46 (19.01)
	College 3	3,122	126	76 (60.32)	25 (19.84)	25 (19.84)
	College 4	2,100	82	45 (54.88)	25 (40.49)	12 (14.63)
2010/2011	College 1	14,098	480	107 (22.29)	179 37.29)	194 (40.42)
	College 2	1,500	224	124 (55.36)	72 (32.49)	28 (12.50)
	College 3	2,050	98	53 (54.08)	20 (20.41)	25 (25.51)
	College 4	2,005	44	24 (54.55)	16 (36.36)	4 (9.09)
2011/2012	College 1	13,368	214	37 (17.20)	31 (14.49)	146 (68.22)
	College 2	1.200	262	127 (48.47)	100 (38.17)	35 (13.36)
	College 3	2,182	110	71 (64.55)	28 (25.45)	11 (10.00)
	College 4	2,000	52	26 (50.00	20 (38.46)	6 (11.54)

Source: Academic Affairs offices of the various Colleges of Education

Key: A – distinction; B – credit; C – merit ; D & E – pass; F – fail

One should note that a pass in college of education is synonymous to failure. So, considering the result in table 1, when the percentage of passes and failures are added together and compared with percentage of distinctions, credits and merits, the result reflects a poor performance. Poor performance, according to Bakare (1994) is taken as all performances that fall below expectation, while academic failure refers to all performances below the pass mark.

In table 1, out of a total number of 365 students that were admitted for Mathematics in 2007/2008 session in College 1, only 71 students had either distinction, credit or merit representing 19.45%, 35 students representing 9.59% managed to have an ordinary pass while 259 students representing 70.96% failed outrightly. In the same session, 186 students were examined in College 2, 103 students recorded merit and above representing 55.38%, 64 (34.41%) had pass and 19 (10.21%) failed. In College 3, only 47 students representing 26.26% had merit and above out of 179 students that entered for Mathematics in 2007/2008 session. 56 (31.28%) had pass and a total number of 76 students representing 42.46% failed. In the same session, a total number of 48 students were examined in College 4. 26 (54.17%) had merit and above, 18 (37.50%) had pass and only 4 representing 8.33% failed.

In 2008/2009 session, out of 413 students that offered Mathematics in college 1, 133 students representing 32.20% had merit and above, 66 students meaning 15.98% passed, while 214 students representing 51.82% failed. Out of 221 students that wrote the examination in College 2, 116 (52.49%) had merit and above, 87 (39.37%) had pass while 18 (8.14%) failed. 149 students were examined in College 3, 64 (42.95%) had merit and above, 35 (23.49%) had pass while 50 representing 33.56% failed. A total number of 44 students were examined in College 4. Out of these students, 27 (61.36%) had merit and above, 12 (27.27%) had pass while 5 (11.37%) failed.

A total number of 972 students registered for Mathematics in 2009/2010 session in college 1, 192 (19.75%) had merit and above, 87 (8.95%) had ordinary pass and 693 (71.30%) failed. In 2009/2010 session in College 2, a total number of 242 students enrolled for Mathematics. Out of this number, 117 (48.35%) had merit and above, 79 (32.64%) had pass while 46 (19.01%) failed. In College 3, 126 students enrolled for Mathematics in 2009/2010 session, 76 (60.32%) had merit and above, 25 (19.84%) had pass and 25 with 19.84% also failed. Out of 82 students that sat for examination in 2009/2010 session in

College 4, 45 students representing 54.88% got merit and above, 25 (30.49%) had pass while 120 (14.63%) failed.

In college 1, 480 students enrolled for Mathematics in 2010/2011 session, 107 students representing 22.29% had merit and above, 179 students representing 37.29% had ordinary pass while 194 students representing 40.42% failed. In college 2, 224 students enrolled for Mathematics in 2010/2011 session; 124 (55.36%) passed with merit and above, 72 (32.14%) had pass and 28 (12.50%) failed. In 2010/2011 session which has the lowest number of students in College 3, that were given Mathematics during the year under study in the college i.e. 98, 53, (54.08%) had merit and above, 20 (20.41%) had pass while 25 students representing 25.51% failed. College 4 had 44 students that registered for Mathematics in 2010/2011. Out of this, 24 (54.55%) had merit and above, 16 (36.36%) had pass while 4 (9.09%) failed.

Finally, college 1 had a total number of 214 students that registered for Mathematics in 2011/2012. Out of the total number, 37 students with 17.29% had merit and above, 31 (14.49%) had pass while 146 students representing 68.22% failed outrightly. During the 2011/2012 session in College 2, 262 students were examined, 127 (48.47%) had merit and above, 100 (38.17%) had pass while 35 students with 13.36% failed. In college 4 in 2011/2012 session, 110 students were examined. Out of this number, 71 students representing 64.55% had merit and above, 28 (25.45%) had pass while 11 (10.00%) failed. Lastly, college 4 recorded a total number of 52 students that enrolled for Mathematics in 2011/2012 session. 26 (50.00%) got merit and above, 20 (38.46%) had pass while 6 students representing 11.54% failed. From this report, pre-service mathematics teachers' poor performances at NCE level calls for the concern of stakeholders.

The results mentioned in Table 1 are corroborated by the following comments/observations of external moderators on the performances of pre-service mathematics teachers in the various colleges of education sampled, which adduce to poor achievement in Mathematics in the colleges of education are also taken into consideration.

i) Examination scores were low [MAT 322, 16/11/2007].

ii) Students' performance is below average [MAT 322, 3/12/2007].

iii) Examination scores and Continuous Assessment scores do not correlate well [MAT 324, 16/11/2007].

iv) The performances of students were generally fair. However many of the students were at the lower grades [MAT 222, 18/6/2012].

v) The students' performance is fairly okay. Though many students passed but larger percentage at lower grades [MAT 323, 18/6/2012].

vi) Students' performances was not generally encouraging [MAT 225, 18/6/2012].

vii) Students found this course more difficult than other courses done this semester. By estimation, more than 60% of those that passed scored ordinary pass (E) [MAT 322, 18/6/2012].

viii) Like other courses, the PES/MAT students appeared to be worst of all the combinations. Most of them were managed to pass [MAT 323, 18/6/2012].

ix) Performance generally was very weak. Continuous Assessment scores were on the high side [MAT 322, 3/10/2008].

x) Continuous Assessment scores do not correlate well with the examination scores [MAT 324, 3/10/2008].

xi) The performance of the students was very low, hence it was jacked up by 10 marks across board to reduce number of failure [MAT 312, 3/10/2010].

NOTE: Lecturers in charge of the courses in (iii), (ix) and (x) stated above (MAT 324, MAT 322, MAT 324 respectively) added more marks to continuous assessment scores in order to reduce failure rate on the part of the students.

The above comments show that the performances of the pre-service mathematics teachers are not encouraging, hence the need for this study.

In a study conducted by Olowo (2001), a number of factors were identified as determinants of academic achievement. The factors identified included difficulty of the test, students' ability and strictness of the marking. According to him, the most influential factor among the listed determinants is the students' ability. The following variables have also been identified by Olowo (2001) as being responsible for poor academic achievement of students in schools. The factors identified are related to government, West African Examination Council, parents, teachers and students. This researcher believed that the stakeholders of education just mentioned have their proportional share of the blame for woeful performance of students in Mathematics examinations. There are usually two groups of students in an average classroom, they are the high achievers who are often expected by

the assessor to do well and the low achievers who may perform poorly. Fabunmi (1997) identifies the quality of intakes as a factor of students' achievements in examination. Other factors identified by him include enrolment, location of schools, age of schools, adequacy of human and material resources, appropriateness and adequacy of curriculum. Most of these factors could also affect pre-service teachers' academic achievement.

Thirty five studies were carried out by WAEC on performance of candidates which revealed that students performed poorly due to lack of adequate preparation, inadequate teaching aids, shortage of qualified teachers, lack of adequate school environment and infrastructural facilities (WAEC, 1994). The results of the studies carried out by WAEC may also affect pre-service mathematics teachers. The report by WAEC also described teachers as central to the performance of students. Lack of competent and committed teachers in schools were also observed. The reason for this may be due to the fact that teachers do not use the necessary skills/methods required to impact the required knowledge which could ensure that learning takes place. Critical examination of the above factors identified and described by WAEC also showed that they are as well applicable to pre-service teachers and lecturers in the tertiary institutions. Some other factors that were also found to be responsible for poor performance of students in Mathematics by scholars are lack of commitment to the profession (Osafehinti,1985), strategy used for students by teachers (Ogunniyi, 1985; Akinsola, 1999), nature of the subject and nature of examination questions (WAEC, 1994), negative attitude toward Mathematics (Udousoro, 1995), poor problem-solving abilities of the students (Abimbade, 1997), poor method of instruction and poor instructional strategies (Olaleye, 1997; Vinson, 2001and Iossi, 2007), inadequacy of appropriate Mathematics textbooks (Okwilagwe, 1999), abstract nature of and language used in Mathematics lesson (Akinsola, 1999), negative attitudes, emotions and inadequate self-regulatory behaviours (DeBellis and Golding, 2006), learning styles (Sloan, Diane and Giesen, 2002), the nature of the curriculum (Ilori, 2003), gender (Altermatt and Kim, 2004; Malmivuori, 2001), lack of self confidence (Uusimaki and Nason, 2004; Brady and Bowd, 2005), and lack of suitable teaching aids (Afolabi, Adeyanju, Adedapo and Falade, 2006) . Also, the following factors which can be personal, social, environmental or otherwise that contribute to poor performance of students' achievements, according to Amao and Disu (2012) include family values and climate, school environment, teachers' factors, society's

view about Mathematics, peer pressure, and test-taking anxiety. Another key factor according to Amao and Disu (2012) is students' judgment of their capability to accomplish a task or succeed in an activity, or self efficacy.

In an effort to identify the causes for either high or low achievement in Mathematics, some researchers (Attwood, 2001, Brodie, 2004, Malcolm, Kiane, Hoohlo, Kgaka and Ovens, 2000) have suggested that achievement in Mathematics in secondary schools is influenced by a number of variables. The variables suggested below are also applicable to pre-service teachers in the college of education. The variables include learners' abilities, attitudes and perceptions, parent and peer influences, family and socio-economic status, school related variables such as poor learning environment, learning culture, past racial discrimination. Another major contributory factor to poor academic performance is the issue of political instability and incessant strikes in schools and colleges by both the teachers and lecturers, and this is yet to receive serious attention by the government. In recent time, higher institutions in the advanced countries have cast serious doubt on the integrity of Nigeria Certificates because of the frequent strikes by teachers/lecturers occasioned by irregular and non-payment of teachers'/lecturers' salaries. These strikes have led to loss of several contact hours by teacher and students. Since learning is cumulative, effects of lost teaching/ learning hours can have staggering effect on students learning outcomes.

According to Hughes (1999), the most important conclusions from qualitative research on factors related to achievement in schools/colleges are that:

i) teachers are critical resources;
ii) the composition of the student body matters;
iii) schools make a difference, and
iv) physical facilities, curriculum, instructional strategies and other resources influence students' learning indirectly through their effect on the behaviour of teachers and students.

These problems highlighted earlier have made mathematics educators to pay more attention to how to improve the teaching and learning of Mathematics in schools and colleges. They have suggested series of methods which include the use of mastery learning approach (Akinsola, 1994), problem-solving approach (Olaleye, 1997), personalization

approach (Heng-Yuku and Howard, 2000), Computer and text-assisted programmed instruction approach (Udousoro, 2000).

Learners generally have varying reasons why they study Mathematics. Each of them has varying goals for studying Mathematics and varying beliefs about Mathematics and mathematical problem-solving. Students who choose to study college Mathematics differ from those studying secondary school Mathematics in relation to their learning context. Reyna and Brainard (2007) makes it known that college students who study Mathematics as their major or minor subject usually show positive attitude towards Mathematics, although the professional interest a teacher of Mathematics has for the subject has been found to encourage student to learn the subject as well as develop interest in the subject. Malmivuouri (2001) categorically declared that his primary aims in teaching Mathematics are to help students understand important mathematical concepts, to help them improve the ability of analytical thinking and problem solving and to enable them to use the Mathematics they learned to solve practical problems in their field of interest. However, most teachers of Mathematics do not take cognisance of these facts, hence the way they teach the subject most times make the students to be afraid of the subject. The pre-service Mathematics teachers are not left out of this act, thus affecting their academic achievement adversely.

Yara (2008) asserted that students' attitudes could be influenced by teacher's attitude and his teaching method. Bolaji (2005), in a study of the influence of students' attitude towards Mathematics found that the teachers' method of Mathematics teaching and their personality greatly accounted for the students' positive attitude towards Mathematics. The result of the study also showed that without interest and personal effort in learning Mathematics by the students, they could hardly perform well in the subject. To some of the students, Mathematics is a necessary evil that must be accommodated (Yara 2008). It is therefore suggested that teachers should develop positive relationship with students which will involve active teaching-learning process and students' participation. Also teachers should engage students' meaningfully in the subject so that adequate and satisfying result can be achieved.

As both learners and teachers of Mathematics, pre-service teachers of pre-primary, primary and secondary education also have various beliefs about themselves. Thus,

improving the mathematical knowledge of elementary school teachers is key to improving children's mathematical knowledge (Hill, Rowan and Ball, 2005; Rowan, Correnti and Miller, 2002; Conference Board of the Mathematical Science, 2001; Monk, 1994). It is believed that a part of the general self-representation consisted of students' beliefs about themselves and about the teaching of Mathematics. Bandura (1977) defines self-efficacy as one's beliefs about his/her ability to organize and execute tasks to achieve special goals. He suggested four sources of self-efficacy information such as mastery experience, vicarious experience, social persuasion and psychological and emotional arousal. According to him, mastery or enactive experiences are considered the most powerful source of efficacy information. He added that the development of these beliefs is the information that the individual gets about his/her ability. Self-efficacy beliefs according to Amao and Disu (2012) determined how much effort a student will expend and how much stress and anxiety they will experience as they engage on a task. A teacher's perception of how effectively he can affect student learning, that is teacher's efficacy beliefs have also been found to have a great impact on their self-efficacy, and therefore the achievement of their students.

Successful people are always confident, enthusiastic, remain positive and optimistic. Individuals with strong self-efficacy are less likely to give up than those who are paralysed with doubt about their capabilities (Alderman, 1999). It is also evident that unsuccessful people often lack confidence, they are negative and pessimistic, they rarely expect success. Everything that happens to one, everything one becomes and accomplished is determined by the way he thinks and, by the way he uses his mind (Zenzen, 2002). What causes certain behaviours is our self-efficacy and how competent we feel and thus establishes certain goals. Some people like to try new experiences and set more challenging goals while others prefer to stay in their comfort zones and be happy with what they know they can accomplish. However, this is based on our view of our self (Zenzen, 2002).

Learning is maximized when students and teachers have a good rapport, when students are safe, trusted and respected and when students believe in themselves (Zenzen, 2002). When students get the opportunity to learn in a supportive environment like what is credited to Zenzen (2002) earlier, their academic achievements are likely to improve, self-efficacy and confidence are built up. They therefore learn joyfully. Unfortunately, many of

our learning environments are not optimised the way our programmes are planned and this could lead to suffering from poor self-efficacy by the students.

Considering the effect of peers on academic achievement, Johnson (2000) observed that without positive peer groups' interactions, serious social problems may develop. Peer rejection in early childhood and early adolescence, for example, is a good predictor of social and academic problems later (Burhmester, 1990). In the case of positive peer relationship, peer approval leads to a pro-social behaviour in many areas of a child's life, including academics (Wentzel and Caldwell, 1997). This in turn will tend to affect the self-efficacy of the child, which has other social consequences (Guay, Boivin and Hodges, 1999). Generally, peer effects become strongest by early adolescence and peers significantly influence all facets of a child's life, including academic achievement.

Adolescent peer pressure may focus on extracurricular behaviour rather than on classroom behaviour. In other words, as children test their independence, they may focus negative peer pressure on antisocial behaviour outside of school rather than on academic achievement. For example, social experimentation with cigarettes, alcohol, and others that generally begins in junior high schools (Johnson, 2000). And so they continue this in higher institution such as colleges of education. This type of attitude may affect their academic achievement adversely in Mathematics.

Another major factor in the achievement of students is the teacher. In fact, teachers are central to the performance of students. The National Policy on Education (NPE) asserted that no educational system can rise above the quality of its teachers (FGN, 2004). The teacher's quality within the context of this study refers to their attitudes, teaching experiences and their perception of teaching. The attitude of teachers/lecturers towards Mathematics teaching plays a significant role in shaping the attitude of students towards the learning of Mathematics. Yara (2008) reported that teachers' attitudes towards science (in which Mathematics is one) is a significant predictor of pupils' science achievement as well as their attitude towards science. Ogunniyi (1985) found that students' positive attitudes towards science could be enhanced by teachers' enthusiasms, resourcefulness, helpful behaviour and thorough knowledge of the subject matter. Since the above assertions could also be applicable to Mathematics, teachers' attitude is therefore a vital role in determining the attitude, commitment and hence the students' achievement in

Mathematics. According to Ofoegbu (2004), poor academic performance of students in Nigeria has been linked to poor teachers' performance in terms of accomplishing the teaching task, negative attitude to work and poor teaching habits.

Considering the quality of teachers as well as their experience, Hanushek, Kain and Rivkin (2002) asserted that teacher's quality is the most important school factor explaining quality among schools. The quality of teachers cannot be well expressed without considering his experience. That's why people say experience teaches. Hanushek et al. (2002) thus found that the effects of teacher quality on students were much larger than other commonly measured school attributes like class size and instructional materials.

Andrew and Schwab (1995) found stronger and more consistently positive influence of teachers' teaching experience and their effectiveness on the student's academic achievement. Brown (2001) found that teachers/lecturers with many years of teaching experience perform better than their counterparts who have less number of years of teaching experience. Behaviours of teachers/lecturers and practices in form of adjusting their teaching/lecturing to fit the needs of different students and demands of various instructional objectives, topics and methods, structuring materials, using students' ideas, probing students' comments, and asking higher order questions have been found to be of significant influence on students' learning ability (Uche, 2002).

The school factor which could be generalised as school environment factor involves the physical structure of the school like the school building, vegetation, surrounding and every other thing that make up the school such as teacher, students, other non-academic workers, infrastructure like furniture, motor vehicle, generating plant, and other facilities such as library facilities, laboratory facilities and others. According to Fraser (1998), condusive school environment is linked with student's achievement. This means that if teachers have a condusive environment, then, there may be better student achievement. In addition, the quality of school can also influence the behaviour of all the students in the school and especially students' academic achievement. The teachers' working environment which could influence his/her attitude towards the teaching of Mathematics, and adequacy of resource materials (Mathematics laboratory inclusive); constitute the school factors. This link between school factors and student achievement continues to be of interest and is addressed in this study.

School factors play an important role in the achievement of students. School facilities have been observed as a potent factor to quantitative education. Owoeye (2000) said, the dictum that "teaching is inseparable from learning but learning could be separable from teaching" is that teachers do the teaching to make the students learn but the students can learn without the teachers. According to Owoeye (2000), learning can occur through one's interaction with one's environment. In his work that involved university students, Young (2005) indicated that an environment filled with supportive feedback increase students' use of self-regulated strategies. Environments here mean infrastructure or facilities that are available to facilitate students' learning outcomes. This include books, audio-visual, software, educational technology hardware, tables, chairs, chalkboards and shelves on which instruments for practicals are arranged (Ferrant, 1991 and Farounbi, 1998).

Squire (1991) stated that individuals seeking to improve the quality of education believed that availability and adequacy of instructional materials would lead to changes in actual teaching, thus leading to improved academic performance of the students. Research reports have shown that availability of instructional materials in the laboratory and ability of Mathematics teachers using them are vital determinant of teaching methods to be used by the Mathematics teachers thereby leading to Mathematics achievement (Afolabi, 2010). Popoola and Olarewaju (2006) thus make it clear that for solid foundation in tertiary level of education, Mathematics laboratory is necessary in primary and post primary institutions. They add that, what abstract ideas are made concrete, the content becomes clearer. Mathematics laboratory thus reduces abstract nature of the subject. Also, project and other teaching/learning activities of pre-service teachers are carried out in the Mathematics laboratory. So its usefulness in the academic achievement of students cannot be overemphasised.

A textbook is a very important material in teaching-learning process. It has the quality of conveying permanent information like other learning materials which could be transient. A textbook is durable and at the same time portable and can be used independently that is, without depending on any other medium (such as electronics or electricity). It serves as a basic source of knowledge and formal learning. Without textbooks, the library will not function effectively. It also aids students' studies and as a

result serves as one of the important tools for academic achievement. Textbooks provide the major source of information for students as well as the course of student for the subject. "Nothing has ever replaced the printed word as the key element in the educational process and as a result, textbooks are central to schooling at all levels" (Owoeye, 2000). Textbooks serve as an excellent and useful resources to many teachers without taking the place of teacher. It should however be noted that the teacher will serve as the only source of information when textbooks are not available or when the cost is too high for the students to afford and so students' academic achievement could be adversely affected.

Citing a UNESCO publication and corroborating the importance of textbooks to learning, Afolabi (2010) declares as follows:

> *Classroom teaching depends heavily on the textbook. In the institutions in which the teacher is not well qualified, the textbook is a guide and a support to teaching. For the learner, the textbook serves as a basis for systematic learning for reinforcement, review and further study* (p. 130).

Research has also reported inadequate supply of textbooks. Commenting on the availability of textbook, Okwilagwe (1999) said:

> *The serious decline in textbooks availability started in 1982 and this has become a matter of considerable concern not only to parents and teacher, but also to the states and federal education officials* (p. 185).

It has also been observed that conditions that would make for effective teaching such as resources available to teachers, general conditions of infrastructure as well as instructional materials in public secondary schools in Nigeria are poor (Oredein, 2000). The situation is not different from what is obtained in tertiary institutions. In his view, Owoeye (2000) quoting Oni, says that, facilities or infrastructure constitute a strategic factor in organizational functioning because they determine to a very large extent the smooth functioning of any social organization including education. He further states that their availability, adequacy and relevance have great influence and lead to high productivity. Facilities, according to Hallak (1990), contribute immensely to academic achievement in the school system. According to him infrastructural facilities include the

school buildings, classroom, accommodation, libraries, laboratories, furniture, recreational equipments, apparatus and other instructional materials. Hallak also adds that their availability, relevance and adequacy contribute to academic achievement. According to Farounbi (1998), the wealth of a nation or society could determine the quality of education in that land. He emphasises that a society that is wealthy will establish good schools with quality teachers and learning infrastructure and this will bring about students learning with ease resulting in encouraging academic achievement. Throwing more light on school facilities, Fabunmi (1997) asserted that school facilities when provided will aid teaching/learning programme and consequently improve academic achievement of students. Writing on poor performance of students in public examination, London (1993) stated that in the development of many nations certain physical facilities are more existent, and that those instances where amenities are available, they are of substandard quality.

The library as mentioned earlier as one of the school factors is important in the students' academic achievements in that it helps them to concentrate and study actively well. Library can be described as a building or room in which collection of books, tapes, newspapers, periodicals and journals are kept for users to read, study or borrow. A school library is identified further by Owoeye (2000) as an instructional resource which may significantly influence learners' achievements. Library is one of the most important educational services. Owoeye (2000) makes it clear that the major purpose of an institution library is to make available to the learners at its easy convenience, books, journals, periodicals and other reproduced materials which are of interest and value to them but which are not provided or assigned to them as basic or supplementary textbooks at their convenience. A library is supposed to be up to date and at the same time allow older materials. It must be properly supported financially to fund materials and services among others. In his contributions, Ola in Owoeye (2000) says that a well equipped library is a major facility which enhances good learning and achievement of high educational standard. In his word, Farounbi (1998) emphasises that if the books in the library are not current and adequate, then it may not be effective. So, its impact may only be meaningful if it could be opened to the students always for a considerable length of time.

The success of any educational endeavour depends on the availability of physical facilities especially school building. Supporting this view Owoeye (2000) states that school

building with aesthetic conditions, playground and others, according to scholars, usually contribute to students achieving higher educational attainments. The Encyclopaedia of Educational Research in Owoeye (2000) emphasized and recorded as follows:

> *The total environment within a school building should be comfortable, pleasant and psychologically uplifting. It should provide a passive physical setting that is educationally stimulating. It should produce a feeling of well-being among its occupants and it should support the educational process* (p1156).

As a result of this deplorable condition, Obemeata (1995) submitted that only a small proportion of secondary school products are qualified to enter the University in Nigeria. Olowo (2001) found that education institutions from nursery to university require buildings for their effective operations. Classrooms, offices, assembly halls, laboratories and staff quarters are needed. Important items like furniture for staff and students, books, science equipments, games and sport equipment should be adequate and should be in good conditions for schools to function properly. Writing on the deplorable state of public schools in Nigeria, Ogunmoyela (1994) laments that buildings in public schools have no roofs, windows and doors, some walls are cracked, instructional facilities are lacking while teachers are frustrated consequent upon lack of equipment/facilities/infrastructure to meet educational endeavours.

Laboratory teaching and learning also contribute immensely to academic achievement. Laboratory is one of the major infrastructure in schools and colleges. Laboratory has been conceptualized as a room or a building especially built for teaching by demonstration of theoretical phenomenon into practical terms. It is a place where new ideas are discovered. It could be described as a place where theoretical work is practicalised and generally practicals in any learning experience involves students in activities such as experimenting, observing, measuring, counting, recording and carrying out field work. Animasahun (2007) simply put it as a resource centre for the learning of Mathematics. Igbokwe (2003) defines mathematics laboratory as a place where students can learn and explore various mathematical facts and theories using varieties of activities and materials. The establishment of a Mathematics laboratory is one way of stimulating interest in

learning Mathematics. Odili (1990) describes a Mathematics laboratory as a place where things can be stored, kept, counted, ordered, recorded, packed, unpacked, grouped, regrouped, arranged, measured, joined, partitioned among numerous other activities. Mathematics can be made simple if the abstract nature of it is practicalised in the Mathematics laboratory. The usage of Mathematics laboratory helps to integrate theory and practical work in Mathematics teaching and learning.

The inconclusive reports and findings from the above factors need to be further investigated and that is why the researcher saw the need to carry out a study to examine the relationship between learner factors (students' attitudes towards Mathematics, his self efficacy and how he interacts with peers), lecturer factors (lecturers' attitudes towards Mathematics teaching, their perception to teaching and their experience), school factors (adequacy of textual materials, instructional materials and infrastructure) and pre-service teachers' achievement in Mathematics.

1.2 Statement of the problem

It is observed by researchers, and as confirmed by literature that performance of students in Mathematics in the tertiary institutions have not been encouraging. Most students lack the ability to do Mathematics, the attitudes of some students and even teachers towards the subject are bad while most colleges lack adequate instructional materials and infrastructure for teaching Mathematics. Although government is making frantic efforts to employ more lecturers and improve infrastructural facilities in colleges while the National Council of Colleges of Education prepared the curriculum in such a way that some instructional materials needed are stipulated, this is yet to fully arrest the situation of pre-service teacher's poor performance in Mathematics in the colleges. Hence the need for this study. Efforts at addressing the problem have not taken cognizance of the variables in this study. Also those who attempted to study part of the variables did it at the univariate level, but this study considers it at the multivariate level. Thus, this study found out which among learner factors (students' attitudes towards Mathematics, self-efficacy and peer influence), lecturer factors (lecturers' attitudes towards mathematics teaching, perception of teaching and experience) and school factors (availability and adequacy of textual materials,

instructional materials and infrastructure) contributed to and / predicted pre-service teachers' achievement in Mathematics

1.3 Research Questions

This study answered the following questions as a result of the problem stated earlier:

1. What is the composite contribution of learner factors (attitudes, peer influence and self-efficacy) to pre-service teachers' achievement in Mathematics?
2. What are the relative contributions of each of learner factors to pre-service teachers' achievement in Mathematics?
3. What is the composite contribution of lecturer factors (attitudes, perception of teaching and experience) to pre-service teachers' achievement in Mathematics?
4. What are the relative contributions of lecturer factors to pre-service teachers' achievement in Mathematics?
5. What is the composite contribution of school factors (instructional materials, textual materials and infrastructure) to pre-service teachers' achievement in Mathematics?
6. What are the relative contributions of school factors to pre-service teachers' achievement in Mathematics?
7. What is the composite contribution of all the independent variables (Attitudes towards Mathematics, peer influence, self efficacy, attitudes towards Mathematics teaching, perception of teaching, teaching experience, availability and adequacy of instructional materials, textual materials and infrastructure) to pre-service teachers' achievement in Mathematics?
8. Which of the learner factors, lecturer factors and school factors will predict pre-service teachers' achievement in Mathematics?

1.4 Scope of the study

This study covered both the students and lecturers in the Departments of Mathematics in the selected colleges of education in Southwestern part of Nigeria. A particular course at 300 level second semester is considered for this study. The study is also delimited to learner factors (attitude of students towards Mathematics, peer influence and

self-efficacy), lecturer factors (attitudes of lecturers toward mathematics teaching, perception of teaching and experience) and school factors (instructional materials, textual materials and infrastructure).

1.5 Significance of the Study

Mathematics is a subject that is well recognised globally. Its teaching and learning is very vital to every individual's meaningful and productive life. When the students put the outcome of learner's factors, that is, pre-service teachers' attitudes towards Mathematics, and peer influence into use, an encouraging performance on achievement in Mathematics on their part is expected to be realised. Again, when self efficacy is put into use, that is, when they believe in themselves, it would help them to know who they are, and that they are capable to do what they feel they cannot do. As a result, their academic performance in Mathematics will improve. That is, failure rate will be reduced to the bearest minimum. Also, they will be able to learn Mathematics better. The result of the findings of lecturers' factors, that is, their attitudes towards mathematics teaching, perception of teaching and experience when applied appropriately, would be expected to improve their versatility on the job thereby enhancing students' academic achievement. If the government and stakeholders could put the result of the findings of school factors that is, the availability and adequacy of instructional materials, textual materials and infrastructure into action by supplying the needed materials, the learners would be motivated to learn and lecturers will also be motivated to teach. Hence, the problem of mass failure on the part of students will be reduced.

In addition to the above, an in-depth knowledge of the factors that motivate pre-service teachers to learn effectively would assist the various tertiary institutions producing these teachers to have an insight into how they could be helped so that their academic aspiration/career could be achieved. The study is also considered significant in that it would provide remedy for poor performance of students in Mathematics in tertiary institutions. Also, it is hoped that the study would acquaint the National Council of Colleges of Education, curriculum designers and other related bodies with the situation in the teaching and learning of Mathematics at the tertiary institutions most especially at the colleges of education which could lead to the solution of the prevailing problems.

1.6 Operational Definition of Terms

Pre-service mathematics teachers: - These are students that are undergoing teacher education training at the college of education.

Pre-service mathematics teachers' achievement: - These are scores obtained by individual students in multiple-choice tests based on a particular course in Year Three covered by the Colleges under study.

Learner's factors: - These are factors that may influence the performances of students in terms of their attitudes towards learning Mathematics, peer groups and self-efficacy.

Teacher: - These are mathematics lecturers teaching pre-service teachers at the college of education.

Lecturer's factors: - These are factors that can either make or mar the way a lecturer carries out his duties in terms of his attitude towards the teaching of Mathematics, perception of teaching and his experience.

School factors: - These are factors that may enhance or mar teaching and learning situation in terms of instructional materials, textual materials and infrastructure which are made available.

Perception of Teaching: - This is the way and manner mathematics lecturers view teaching.

Teaching Experience: - This refers to how long or the number of years a particular lecturer has put up in teaching which would have exposed him/her to the rudiments of the job.

Instructional materials: - This means all forms of teaching aids different from textbooks.

Textual materials: - These are the recommended Mathematics textbooks in use and or materials produced by the teacher in charge of the particular course.

Infrastructure: - This is the totality of every other thing apart from textbooks and other teaching aids that makes the school function effectively. These are college buildings, lecture halls, libraries, laboratories, furniture, recreational equipments, apparatus and accommodation.

CHAPTER TWO
LITERATURE REVIEW

Related literatures for the study are reviewed around major headings and sub headings as follows:

2.1 Theoretical Framework

This study is based on the following theories of learning.

i) Vygotsky social learning theory

ii) Environmental learning theory.

2.1.1 Vygotsky social learning theory

Vygotsky's (1962) social learning theory addressed both the school factor and teacher factor. According to Vygotsky's (1962) theory, he proposed that social interaction influences cognitive development. Driscoll (1994) emphasises that this theory recognizes the fact that biological and cultural developments do not occur in isolation. Thus, social learning theory establishes the fact that personality is as a result of the interaction of the environment (.i.e. the school), behaviour and the individual's psychological processes. The environment, that is the totality of the school and the place where individual children live influence their behaviour, which results in their personality. Crawford (1996) indicated that this theory also focused on the connections between people and the cultural context in which they act and interact. Considering the situation on ground, schools are yet to promote environments in which the students play active role in their own education vis a vis their peers. What Vygotsky's (1962) theory actually requires that both the teacher and the students should work as one as they collaborate with each other (Hausfather, 1996). Vygotsky's (1962) theory also makes provision for chairs, tables, other infrastructure and work space for peer instruction, collaboration, and small group instruction. Considering the school environmental factors, the instructional design of materials to be learnt that is, the planning of the lesson would be structured to promote and encourage student interaction and collaboration. With this, the classroom becomes a community of learning. This is therefore very relevant to this research study in that if a particular environment is conducive for the students, academic achievement will be easy. The style employed by individual teacher, the content taught, the maturity and learning abilities of the students must be accommodated within the classroom space. If all these are considered, the learning process will be enhanced and not be hindered as students would be able to participate actively in the lesson. So, students' achievement in mathematics will be aroused.

2.1.2 Environmental learning theory

Bandura's (1986) theory of environmental learning addressed learner factors. The belief of Bandura is that the environment of the child shapes his learning and behaviour. According to him, human behaviour, development and learning are thought of as reactions to the classroom environment. He added that, the readiness of individuals is the age or stage when they can respond appropriately to the environment of the school and the classroom. Whatever he is given would not be turned upside down, but would be done appropriately, positively and according to specification. Individual child will succeed greatly if he can follow instructions from the teacher. This is therefore relevant to this study in the sense that when the environment of the learners provide for their participation in the subject being taught, their attitudes are likely to change positively towards learning and they could therefore perform better in Mathematics.

2.2 Conceptual Review

2.2.1 Achievement in Mathematics

For a long period of time, literatures have revealed that academic achievement has a number of determinant factors ranging from student's employment status (Wantanabe, 2009), student's interest (Udegbe, 2009), gender continuous assessment (Owolabi and Etuk-Irien, 2009), school entry modalities (Olayemi, 2009; Cameson and Wilson, 2011), teaching methods (Eniayeju, 2010), learning diabiliteis (Shupe and Yager, 2005) to socio-economic status (Ajayi and Muraina, 2011). Numerous researchers have worked in quest for better academic performance of students at all levels of education.

Factors such as previous exposure to Mathematics and lack of adequate resources are usually outside the control of students, hence those factors may influence the growth at which these students master Mathematics skills and concepts (Capraro, Young, Lewis, Yetkiner and Woods, 2009). Jordan, Kaplan, Olah and Locuniak (2006) suggest that achievement trajectories may vary between different subgroups. However, students who were admitted to school with varying degrees of mathematical knowledge may gain mathematics skills differentially than their peers. Certain empirical studies (Aunola,

Leskinen, Lerkkanen and Nurmi, 2004; Bodovski and Farkas, 2007; Rescorla and Rosenthal, 2004) indicate that initial performance predicts positive subsequent academic growth while the opposite was found for some students that entered school with lower initial Mathematics achievement. The suggestion of Fan (2001) that some students are faced with 'double barreled' barriers of low initial performance and lower growth rates than their peers is also noted. Again, some students may enter school with low Mathematics achievement but progress at nearly the same rate as their peers.

Certain scholars such as Ding and Davison (2005) suggested that students can enter school with lower initial achievement and manage to progress at a rate that is not statistically significantly different than their peers, but because of their lower level of initial achievement, the students were unable to reach the same academic levels as their counterparts. However, initial achievement differences do not account for all the subsequent variation in student's academic progress and achievement, but it puts the student at a disadvantage early in the educational pipeline.

The quality of output of any operation is a function of the input that is processed (Adeyemi and Adeyemi, 2014). As a result of this, the quality of output of primary and secondary school certificate holders depends, to a very large extent, on the quality of trained teachers from colleges of education. This is contained in the National Policy on Education (2004: 33). It states that the minimum qualification for entry into the teaching profession shall be the Nigeria Certificate in Education. As a result, these pre-service teachers should be well grounded. In a study conducted by Bassi (2001) on students' under-achievement in schools and colleges, he found that overpopulated classes, institutional materials for teaching and learning and teachers' pedagogy are significantly related to students' academic achievement.

Conducive environment can lift a student up and promote his all round development while an environment that is not conducive can let him down and make him live a miserable life. Supporting this assertion, Mark (2002) reported that clean, safe, quiet, comfortable and healthy environments are regarded as important components of successful teaching and learning. He stressed further that poor indoor air quality makes teachers/lecturers sick, while unhealthy students and teachers/lecturers cannot perform the

same way as the healthy ones. Thus**,** achievement in Mathematics depends on a number of factors that must be carefully looked into.

2.2.2 Importance of Mathematics Education Programmes of the Nigerian Colleges of Education

Adelodun (2014) viewed education as an essential pathway to making a total child. It is meant for all citizens in a country to receive. That is why Yara and Otieno (2010) refer to education as a fundamental human right. On the other hand, Mathematics according to Adelodun (2014) is an important subject for sustainable development which has permeated all facets of human endeavour. Thus, students who are not well grounded in it would have difficulties in employing its concepts, principles and skills in the course of their science education and other courses that requires Mathematics. This is where pre-service mathematics teachers in the colleges of education are important. Since they are the ones to teach the students at the lower levels, they too need to be well grounded in Mathematics. Herbor-Peters (2001) noted that Mathematics remains the pivot on which any true science can rest and no true science can succeed without going through Mathematical demonstration. Its relevance to human living has been acknowledged greatly. Makarfi (2001) affirmed that Mathematics is universal not only in the way it influences the basic sciences, the applied sciences, engineering and technology, but also in the way it has been made relevant to the development of the social sciences and the liberal arts.

It is not an overstatement for one to describe the significance of Mathematics in producing versatile and resourceful graduates both at colleges of education and at the universities. Setidisho in Adelodun (2014) therefore declared that no other subject forms such a strong force among the various branches of science. Also, the Science Teacher Association of Nigeria (2002) described Mathematics as the central intellectual discipline of the technological societies. The importance of Mathematics education programmes have made many organisations such as Nigeria National Petroleum Corporation (NNPC) Mathematics competition, Olympiad Mathematics competition, National Academy of Science Mathematics competition, Cowbell Mathematics competition and a host of others to rise up in support and encourage the teaching and learning of Mathematics. So, if

teachers, especially the ones produced by the colleges of education that usually produce the largest teachers in primary and secondary schools do not have good grasp of the subject matter, then academic achievement of students emanating from these teachers may be jeopardized. Adelodun (2014) therefore suggests that the training of a prospective Mathematics teacher should be expanded to allow for sufficient exposure to subject matter content so that these teachers (that is, pre-service Mathematics teacher) would have more sense of belonging to Mathematics.

2.2.3 Mathematics Teaching and Learning Quality Status in Colleges of Education

A major importance of mathematics education for all citizens of a nation is that it helps them to be interested in, understand the world around them and to be engaged in the discoveries of Mathematics (Bessong, Ubama and Udo, 2013). According to researchers as contained in the National Council of Teachers of Mathematics (2012) that all students can learn Mathematics when they have access to high-quality mathematics teaching and are given sufficient time and support to master a challenging curriculum. When this is done teaching and learning of Mathematics would be interesting.

Ahuja (2006) identifies the key features contributing to Singapore's success as follows:

(i) Students' high educational aspirations and positive attitude towards Mathematics;
(ii) World-class facilities in all schools;
(iii) Gifted education program;
(iv) Alternative mathematics framework and special assistance for slow learners;
(v) Safe school environment;
(vi) Competent and dedicated mathematics teachers; and
(vii) Excellent textbooks.

If the aforementioned features are also present and operational in the Nigerian institutions, most especially at the colleges of education, higher success would be recorded.

Various associations and private companies according to Ahuja (2006) also give several opportunities to students with varying abilities in Singapore. Thus, other features contributing to Singapore's success in mathematics education through Mathematics teachers and educators include:

(i) A lighter workload for new teachers/lecturers;
(ii) The monitoring of new teachers/lecturers by more experienced ones;
(iii) Common teachers' rooms/conducive offices, with appropriate furniture;
(iv) Well-informed and well-structured guides;
(v) Co-operation and sharing among teachers/lecturers within schools, colleges and neighbourhoods;
(vi) The availability of manipulative software and computers;
(vii) Teachers'/lecturers' efforts at attending meetings, workshops and conferences ; and
(viii) Teachers'/lecturers' incorporation of varieties of methods in teaching mathematics such as assigning theme based projects and using models.

Nigerian colleges of education and other institutions of higher learning teaching Mathematics can as well apply the Singapore's ideas for quality teaching of Mathematics.

2.3 Empirical Review

2.3.1 Learners' Factors and Academic Achievement in Mathematics

This study deals with their attitudes, their influences due to peers and self efficacy.

2.3.1.1 Learners' Attitudes and Academic Achievement in Mathematics

Popoola and Ogunrinade (2013) quoting Breckler and Wiggins (1992) defined attitude as "mental and neural representations, organized through experience, exerting a directive or dynamic influence on behaviour." By this definition, it is implied that a person's attitude manifests in his behaviour to situation with which it is concerned. Attitude towards science in which Mathematics is one denotes interest or feeling towards studying it. Student's attitude toward Mathematics can therefore be obtained from his responses to questions that seek for his feelings about Mathematics. However, attitude can be changed through persuasion (Mistretta, 2004). Thus a student will be much more

persuaded to understand Mathematics if he is being taught by someone he knows is a professional in that field than someone who is not a professional. The attitudes students develop and have towards different subject tend to influence their achievement in those subjects positively or negatively. Findings and reports from researchers on relationship between students' attitudes and their achievement have however not been consistent or conclusive.

Fraser in Olaewe (2005) assessed the characteristics of attitude, and summarised as follows:

i) Attitude is developmental in nature.
ii) Attitude is action – tendency.
iii) Attitude could predict success or failure.
iv) Attitude could be favourable (positive) or unfavourable (negative).
v) It could determine the behaviour or responses of an individual.
vi) It could be developed and be changed over time.

Several studies have shown that students' attitudes change with their levels of education. Simpson (1977) explains that positive attitude towards a subject assists the student to achieve better and that students with negative attitudes score lower. Olaewe (2005) quoting Bloom and Hasting, concluded from their study that children are more likely to learn and remember materials for which they have a positive feeling. It is important to remember that attitudes are not innate or inborn but are learnt. Attitude predicts behaviour of individual. In any discussion on education, attitude is usually described either as teacher – oriented, learner (student) – oriented or subject – oriented. Students can be described as energetic, capable, resourceful, articulate, and willing to obey the teacher's instruction in every step of teaching/learning. An obedient learner who humbly shows a good understanding of all teaching/learning situations will always emerge a high grade performer and achiever at all times. Thus, learning ability can be measured by degree of obedience and submission. Kline in Olaewe (2005) was categorical about attitude and contented that there was no special gift or qualities of mind to learn Mathematics. It is stressed that the subject is within the grasp of anyone. The attitude of students who are incapable of performing well in Mathematics can hence be related to their willingness of choice to grasp or not to grasp the subject. Laziness, nonchalant attitude, indifference, abandonment,

unwillingness, disinterest or downright surrender are elements which can be deduced from Kline's principle on studying Mathematics as a subject. Therefore, the students' attitudes towards the teacher may be important in the formation of Mathematics attitude. There is considerable evidence that educational attainment and attitudes toward education are positively related to each other.

According to Mcleod (1992), factors such as attitudes and beliefs play important roles in Mathematics achievement. The attitude of students toward the learning of Mathematics and about the nature of Mathematical knowledge and skills on their own mathematical capability, often determine their level of attendance and learning (Hassi and Laursen, 2009). The general relationship between attitude and achievement is based on the concept that the better the attitude a learner has towards a subject or task, the higher the achievement or performance level in Mathematics. White, Way, Perry and Southwell (2005) affirm that the most favourable a person's attitude is towards a behavior, the more likely the person would intend to perform that behaviour. Thus, according to them, a two-way relationship between attitudes towards Mathematics and achievement exist.

Stuart (2000) argues that teacher, peer and family attitudes toward Mathematics may either positively or negatively influence learners' confidence in Mathematics. Findings revealed that learners who have positive attitudes towards their teachers have high achievement levels. In the same vein, Tsanwani (2009) states that learners like their teacher influence their liking of the subject. This may further be explained that the performances of pre-service teachers in colleges could also be influenced with the way they like their course lecturers. In his study of attitudes of practicing elementary teachers, Wilkins (2002) argued that teachers with positive attitudes might be more able to transfer positive attitudes about Mathematics to their students.

Hurd (1984) reported on the state of pre-college education in Mathematics and Science in the United States of America and described the situation of students' attitudes as worrisome in the sense that they do not particularly like science and the dislike is acquired early in life. In his own contribution, Olatoye (2001) found that the attitude of student towards science have significant direct effect on student's achievement in the subject.

In a comparative study of factors influencing Mathematics achievement, Burstein (1992) found out that there is a direct link between students' attitudes towards Mathematics

and students' achievements. He also found that 25% in England and 26% in Norway accounted for the variation in students' attitudes towards Mathematics that were due to student gender, maternal expectation, expectations of the student's friends, and success attribution (belief about success in Mathematics). Students' beliefs and attitudes have the potential to either facilitate or inhibit learning.

Gibbons, Kimmel and O' Shea (1997) submit that students' attitudes about the value of learning science may be considered as both an input and outcome variable because their attitudes towards the subject can be related to educational achievement in ways that reinforce higher or lower performance. What we can infer from this is that those students who do well in a subject generally have more positive attitudes towards that subject and those who have more positive attitudes towards a subject tend to perform better in that subject. A critical look into the above cited studies indicated that there are conflicting reports concerning the relationship between students' attitudes and academic achievement, it is against this backdrop that the present study will in part establish the relationship, if any, between students' attitude and academic achievement in Mathematics.

2.3.1.2 Peer Influence and Pre-service Teachers' Achievements in Mathematics

Pre-service teachers generally, are affected by peer pressure in Mathematics. The effect of negative peer pressure has been recorded in some articles (Reynolds and Walberg, 1992; Stuart, 2000). Stuart (2000) argued that peer and family attitudes towards Mathematics may either make or mar confidence of learners in the subject. In his review of literature, Tsanwani (2009) found that learners' attitude towards Mathematics have been associated with peer group influence. Accordingly, Reynolds and Walberg (1992) identified peer attitudes as one of the most influential factors on learners' mathematical achievement. According to Harris (1995), learners are ridiculed by their peers for taking challenging Mathematics while others are encouraged to pursue academic excellence in Mathematics. This could make the pre-service teachers have better achievement or otherwise depending on the type of peers they relate with.

Another aspect of peer influence is peer support. Evans, Flower and Holton (2001) define peer support or tutoring as that part of the teaching process that involves learners teaching other learners. Evans , Flower and Holton, (2001) stated that:

> *Peer tutoring is a structured way of involving students in each other's academic and social development. As a learning experience, it allows students to interact and to develop personal skills of exposits while increasing their knowledge of a specific topic (p. 161).*

Tutors may be high-ability learners or learners in higher grades. Tutors may also be low-ability learners who assist other low-ability learners. Abrami, Chambers, D'apollonia and Farrel (1992) report that learners may benefit motivationally from being in Mathematics groups which provide peer encouragement and support. As a result, there can be improvements in their achievement. The view of this researcher is that since peers can encourage one another to view Mathematics positively or negatively, a major task for teachers is to understand the nature of peer relationships so that positive engagement can be geared towards.

2.3.1.3 Self-efficacy and Pre-service Teachers' Achievements in Mathematics

Research on attitudes towards Mathematics has focused on two major dimensions, namely mathematical self-concept or self-esteem or self-efficacy and mathematical anxiety. This study is however limited to self-efficacy. So, reinforcing effort in Mathematics begins with helping learners to develop a positive self-concept (Fiore, 1999). Michell, James, Essig and Shipp, (2003) stated that:

> *Mathematics self-concept refers to a person's perception of their ability to learn new topics in Mathematics and to perform well in Mathematics classes and tests*. (p. 42)

Tsanwani (2009) found that the Mathematics self-concept is correlated with achievement in Mathematics. As a result, most researches have supported the belief that there is a persistent and significant relationship between self-efficacy and academic achievement and that a change in one seems to be associated with a change in the other.

Grade Point Average (G. P. A.), and admission test scores which are traditionally being used as academic measures have been used to make decisions for College's admission. It is however being revealed that these measures may not be as effective in predicting academic success in every students. When considering a selective admission

program such that there are a limited number of student positions available, it will be ideal to identify the variables and student characteristics that are related to success in College. Previous researches have suggested that there is a relationship between academic achievement in secondary and post secondary students. Certain studies have quantified the relationship between self-efficacy and scholastic ability, but few have studied a population of students in a selected admissions college program. Academic self-efficacy and academic achievement are strong predictors of each other. Students with a low academic self-efficacy have shown low commitment to school. Students having a positive feeling of self, both academic and non-academic could have more positive characteristics in the areas of cooperation, persistence leaderships and expectations for further schooling.

Manger and Eikeland (2006) in their study of the effect of Mathematics self-efficacy on boys' and girls' Mathematics achievement found that Norwegian elementary school boys showed significantly higher Mathematics self-efficacy than girls. Also, boys had significantly higher mathematical achievement score than girls. On an investigation of academic self-efficacy and its relationship to academic achievement in African American College students, Cokley (2000) found that the best predictor of academic self-efficacy for students attending predominantly White Colleges and Universities (PWCUs) was grade point average, whereas the best predictor of academic self-efficacy for students attending historically Black Colleges and Universities (HBCUs) was quality of student-faculty interactions. Further analysis indicated that grade point average is significantly more important for the academic self-efficacy of African American Students attending PWCUs than African American Students attending HBCUs.

Self-efficacy is the most important psychological construct in the explanation of human behaviours (Brinthaupt and Lipka, 1994; Purkey and Novak, 1996). James (1992) analyzed the self in terms of its constituent parts as the sum total of what one considers oneself to possess including one's body, traits, characteristics, abilities, aspirations, family, work, friends and other social affiliations. According to him, the self can be divided into (i) the 'Me' which include the material, social and spiritual self and (ii) the 'I' which is a safe place where the mind collects and compares the different objects that the mind perceives. The concept of the "Me - I" division can be understood in the context of current theories of meta-cognition (Yara, 2008). Meta-Cognitions can be described as the awareness of one's

own cognitive processes. Self-efficacy towards Mathematics is an attitude structure. This consists of the subjective knowledge (that is beliefs, cognition etc.), the emotions, evaluation and intentions of action about oneself related to Mathematics and Mathematics education. Grigutsch (2006), made it clear that the most important elements of self-efficacy in Mathematics are the subjective knowledge and the emotions concerning the interest in Mathematics, the pleasure in Mathematics and the reasons for one's success or failure in Mathematics.

Researches show that self-efficacy beliefs have positive effects on student's motivation and achievement (Pintrich and De Groot, 2000). For example, Pintrich and De Groot (2000) reported that academic self-efficacy positively correlated to various outcomes measures such as grades and seatwork performances, scores on examination and seatwork performances, scores on exams and quizzes, and quality of essay and reports. Researchers have established that self-efficacy is a strong predictor of academic performance (Chemers et al, 2004). They found that self-efficacy was related to both the academic performance and persistence. In the same context, Pajares and Kranzler (2003) study has convincingly demonstrated that the direct effect of Mathematics self-efficacy on Mathematics performance was as strong as was the effect of general mental ability.

In a study of the relationships among academic self-efficacy, academic achievement and persistence with self-attribution, study habits, and perceived school environment, Gordon (1997) found that academic self-efficacy, academic achievement, and persistence were related significantly to academic self-efficacy and academic achievement. A student really needs a good academic self-efficacy in order to be successful academically. To achieve this success, colleges can impact their students' academic self-efficacy by developing an organized, orderly and supportive environment. This would result in the teacher using some teaching strategies that could influence students' persistence and academic self-efficacy which would in turn promote academic achievement. Thus, this study, is interested in finding the relationship between pre-service teachers' self-efficacy in Mathematics and academic achievement.

2.3.2 Teachers' factors and Pre-service Teachers' Achievements in Mathematics

Mathematics teaching is as important as Mathematics itself (Adeniran, 2003). No educational system can rise above the level of its teacher (FGN, 2004). This statement is

categorically made in the National Policy on Education (Revised 2004). One should not forget that anybody that teaches is a teacher. As a result lecturers teaching in the colleges of education and other tertiary institutions including universities are also regarded as teacher, most especially in the context of this study. Also, Akinsola (2002) categorically made it clear that teachers are the vital personnel in the attainment of any educational objectives. It shows the importance attached to teacher in national development. Researchers like Okebukola and Jegede (1986), and Akale (1986) jointly agree with the findings of Science Teachers Association of Nigeria (STAN) that there is a decline performance by students in Science, Technology and Mathematics group of courses. The causes of the decline in performance in addition to teacher related causes are government related causes, examination body related causes and home related causes. Two factors that encourage students in pursuing Mathematics education at tertiary and postgraduate levels are identified to be teacher factor as a major one (Azuka, 2000) and attractive incentives from alternative profession. Teachers' factors such as perception of teaching, experience, attitude, qualification, ability, supply etc. go a long way to affect achievement in Mathematics. However, this study is restricted to the first three factors highlighted.

2.3.2.1 Teachers' Attitude and Pre-service Teachers' Achievements in Mathematics

Attitude is concerned with how an individual thinks, acts and behaves. It has implication for the learner, the teacher, the immediate social group with which the individual learner relates and the entire school system. Teachers are role models whose behaviours are easily copied by students. Those things teachers like or dislike, appreciate and how they feel about their learning or studies could have a significant effect on their students. Most teachers do not realize that how they teach, how they behave and how they interact with students can be more important than what they teach. In a nutshell, the attitudes of teachers directly affect the attitudes of students. The attitudes of teachers towards their students in colleges must be favorable enough to carry students along. When the learner exhibits the expected behaviour or response, the value attached determines very significantly the effectiveness of the learning processes in any aspect of education. Igwe (2002) stipulated that for teaching and learning of science to be interesting and stimulating, there has to be motivation on the part of both the teacher and the learner so as to ensure the

development of positive attitude and subsequently maximum academic achievement. Igwe in Yara (2008) showed that the effect of teachers' attitudes to Mathematics was stronger on the students' mathematical achievement than on their attitudes. Also, Chacko (1981) reported in a study of teacher's and student's characteristics as correlates of learning outcomes in Mathematics that teachers' attitude toward teaching significantly predict students' attitude as well as achievement in Mathematics.

Teachers' attitude towards the teaching of Mathematics plays a significant role in shaping the attitude of students towards the learning of Mathematics. Ogunniyi (1982) found that students' positive attitude towards science could be enhanced by the following teacher-related factors:

i) Teachers' enthusiasm,
ii) Teachers' resourcefulness and helpful behavior,
iii) Teachers' thorough knowledge of the subject matter and their making science quite interesting.

From the points mentioned above, one can say that the role of the teacher as facilitator of learning and the contributions of students' achievement is substantial. The characteristics of the teachers, their experiences and behaviours in the classrooms, contribute to the learning environment of their student and this in turn could have an effect on student performances. It is important to note that most times, the way some teachers carry out their work betray their devotion. This in turn could affect the attitude of students towards learning most especially the learning of Mathematics thus leading to their poor performance in the subject.

Meyer and Koehler (1990) state that one of the most important factors in developing learners' Mathematics ability is the attitude of Mathematics teachers. According to them, learners' thinking is important while teachers' knowledge of Mathematics content and pedagogy is also critical to the culture of the learning environment, which could either motivate or demotivate learning. In fact, Inekwe (2000) affirmed that the teacher's personal attitude toward the subject contribute much to generate in student's positive or negative attitude toward the subject. According to Lubinski (1994), knowledge of the content and pedagogy in conjunction with learners' thinking allows a teacher to design blueprints for worthwhile Mathematics tasks. In this respect, it is expected that teachers will feel

successful when their learners perform well in Mathematics irrespective of whether or not they come from a historically disadvantaged school situation. It should also be expected that teachers would feel frustrated and unsuccessful when the learners perform badly.

In Mathematics research, one area of focus had been on teachers' beliefs and attitudes towards Mathematics. Ernest (1999) observes that the practice of teaching Mathematics depends on a number of key elements which includes the teachers' mental contents and schemes, particularly the system of beliefs concerning Mathematics and its teaching and learning, the social context of the teaching situation, particularly the opportunities and task problems it provides and reflection. Fennema and Romberg (1999) have made similar observations that teachers' beliefs influence the way teachers teach and talk about Mathematics to their learners. They observed that:

> *If teachers believe that Mathematics is useful, it seems reasonable to assume that they will work harder to ensure that their learners learn Mathematics.* (p. 174)

Tsanwani (2009) also asserts that teachers' attitude towards Mathematics have a strong bearing on learners' attitude towards Mathematics. Tsanwani (2009) thus concluded that the attitudes of learners towards mathematics are derived from the attitudes of teachers towards the subject. The achievement of learners is in turn affected through these attitudes. Whatever decision the teacher makes about the learning environment is guided by the beliefs of teachers about the abilities of the learners. He also felt that teachers, who believe that the Mathematics content in their classroom is guided by the textbook, make decisions that differ from those teachers who believe that the interest and ability of learner guide the Mathematics content.

Fennema and Franke (1992) and Thompson (1992) suggest that teachers' belief and teachers' knowledge are related to the instructional decision making process. As a result of this, what teachers believe about the content, methods and materials available to teach Mathematics influences the teachers' instructional decision. Schmidt (1999) also observed that:

> *What teachers teach and how they teach it are affected by their subject matter belief and preferred pedagogical*

approaches, things that are consequences of their training and experience. (p. 81)

Fennema and Franke (1992) further indicate that teachers' beliefs and their conception of subject matter discipline in Mathematics affect the way they teach coupled with beliefs about their learners and by their understanding of appropriate pedagogy. As part of teachers' attitude towards Mathematics, Schmidt (1999) classifies teachers' belief into four categories.

i) **Discipline – Oriented Teachers: -** The features of these teachers are that it was important to remember formulae, Mathematics was essentially abstract, mastering algorithms and basic computation was more important and that they consider success in Mathematics learning a matter of natural talent than other factors.

ii) **Process – Oriented Teachers: -** These features are that: formulae are important to remember, algorithms should be focused upon; computation is emphasised; Mathematics is not abstract and its real world use is important. Creativity and thinking about Mathematics conceptually is highly emphasized.

iii) **Procedure – Oriented Teacher: -** They have more common characteristics with discipline oriented teachers. However, they are more concerned with emphasizing the real – world use of Mathematics. They regard algorithms as modestly important and that subject matter should be present conceptually. They regard mastering Mathematics as a talent.

iv) **Eclectic Teacher: -** This group of teachers emphasises nothing and do not possess a distinctive character. They are both somewhat discipline – oriented and somewhat real – world oriented.

These groups of teachers generally will definitely affect the achievement of students whether positively or negatively. Thus, to stem brain drain, Kuku (2012) has suggested that Nigerian (and African) government should create an enabling working environment for scientists by (i) radically improving teaching and research institutions. (ii) providing special incentives for science teachers and researchers at all levels through good remunerations and favourable service conditions.

One of the most important factors in developing learners' mathematics ability is the attitude of the teacher towards them. It is not only the teachers' beliefs about Mathematics

and its usefulness that are important, but also that the teachers' belief about their learners' ability to do mathematics have an influence on how they teach and subsequently on how learners learn (Fennema and Romberg, 1999). For mathematics learners to effectively learn, teachers need to regard the learners as capable of learning and expose them to quality experiences that enhance learning. Tsanwani (2009) established in his review of literature that teachers positively influenced learning and achievement through high expectations in relation to learners' learning. Cheung (1998), thus found that if a learner believed a teacher had a low opinion of him/her, the performance of such a learner tended to be low as well.

2.3.2.2.1 Teaching as a concept and Mathematics Achievements

Teaching can be viewed as the stimulation, guidance and encouragement of meaningful learning by the teacher so as to enable the learners internalize basic concepts and skills beyond their current level of development and responsibility (Oyekan, 2000). In this regard, teaching is regarded as triadic and dynamic interaction between the teacher, the curriculum (subject matter) and the learner. However, the strategies, procedure and processes needed by the teacher in the classroom to disseminate information to his/her students is called teaching method. It can also be defined as the totality of pedagogical procedure and processes carried out in the classroom by the teacher with the aim of developing cognitive, affective and psychomotor domains of the learner. Ogunbiyi (2004) sees teaching methods as the sum of all the principles of good teaching that are known to have been proved from psychological, biological and educational research. Oyeniran (2003) makes it clear that any teaching method should follow five normative principles. These are proceeding from simple to complex, easy to difficult, concrete to abstract, known to unknown and from particular to general.

2.3.2.2.2 Perception of teaching and Pre-service Teachers' Achievement in Mathematics

According to Popoola and Olarewaju (2006), some teachers have thorough knowledge of their subjects but may however have no exposure to modern teaching methods and find it difficult to impart their knowledge to students and arouse their mathematical consciousness toward learning the subject. This has made some mathematics educators to carry out several researches on how to improve Mathematics teaching and learning. Such educators include Vinson (2001), Akinsola (2002), Sloan, Diane and Giesen (2002), Uusimaki and Nason (2004), Brady and Bowd (2005), Halat (2006), Iossi (2007), Akinsola (2008), Adekoya (2008), Peker (2009) and Afolabi (2010). Despite this, the performances of pre-service mathematics teachers is yet to improve.

Tsanwani (2009) thus points out some factors he perceives influence effectiveness of teachers such as their teaching strategies, beliefs about teaching and the general classroom processes that provide an immediate learning environment for Mathematics. In this regard, Dreckmeyi (1994) defined

> *A teaching strategy as an extensive teaching plan which includes all elements of the instruction learning events, such as form, content, classification, principles and aids*. (p. 67)

2.3.2.2.3 Teaching Methods and Pre-service Teachers' Achievement in Mathematics

Teaching strategies can be classified in two ways; for example, teacher – centred or learner – centred. Teacher – centred strategies are those in which the teachers have direct control while learner – centred strategies are those strategies that allow learners to play a more active role. A teaching method is student – oriented when the entire focus (or emphasis/attention) of both teacher and content are concentrated on or directed at emphasizing the student and discovering. The considerations include his actions, his pleasure, interests, dislikes, conducts, skills, measure of success etc. vis – a – vis his failure. Successful attempts to teach Mathematics effectively have been made and a range of education policies, programmes, school effectiveness and methods for effective instruction have also been identified (Oyedeji, 2000; Adewale and Amao, 2004).

Kurumeh (2013) thus concluded that the teaching of Mathematics in Nigerian tertiary institutions demands that the teacher should be knowledgeable in various methods and strategies for teaching Mathematics topics. Thus, to achieve the required learning outcomes, the Mathematics teacher need to use a particular teaching method. She therefore groups the methods/strategies under three sub-headings, these are:

a) The methods we are used to such as lecture method, demonstration method, discussion method, project method;

b) Effective methods we should use such as problem solving method, games and simulation method and concept mapping; and

c) Innovative teaching methods we should search for such as (i) Constructivist based method, (ii) Focus group discussion method (iii) Analogy approach, (iv) Co – operative learning, (v) Team teaching (vi) Process based method (vii) Heuristic method (viii) Synthetic method (ix) Laboratory method (x) Computer based method (xi) Ethno-mathematics Approach (xii) Inquiry based method (xiii) Experimental learning (xiv) Scaffolding (xv) Thematic approach (xvi) Outcome based learning (xvii) Character based learning etc. Kurumeh (2013) thus added that the lecturers are expected to be very resourceful and creative in their areas, go into research and expose them. She also made it clear that such methods should be learner-centred, practical oriented and applicable.

There are many methods of teaching mathematics topics but not every method is good and adequate for every concept/topic to be taught. Some topics may require the combination of two or more methods to achieve the expected goal. For the teacher to be able to select the appropriate suitable teaching method, the following factors, according to Kurumeh (2013) have to be considered:

i) the learner,
ii) the nature of the topic or concept,
iii) the instructional objectives of the lesson,
iv) the duration of the lesson,
v) size of the class,
vi) the available resource materials,
vii) teacher's competence.

Borich (1996) then gives the following summary of teacher's variables that may be necessary to obtain high achievements gains. They are:

i) Generating a warm and supportive effect by letting learners know that help is available;
ii) Getting a response before moving on to the next bit of new material;
iii) Presenting material in small bits, with a chance to practise before moving on;
iv) Emphasizing knowledge and applications before abstraction, putting the concrete first;
v) Giving immediate help (through use of peers perhaps), and
vi) Generating strong structure and well planned transition.

2.3.2.3 Teaching Experience and Pre-service Teachers' Achievements in Mathematics

The idea that is common to most researchers with respect to the relationship between teachers' experience and pre-service teachers' achievement is that pre-service teachers taught by more experienced teachers achieve at a higher level, because their teachers have mastered the content and acquired classroom skills to problems (Slavin, 1987; Evans 1992; Gibbons et al, 1997). Also, experienced teachers are considered to be more able to concentrate on the most appropriate way to teach particular topics to students who differ in their abilities, prior knowledge and backgrounds (Raudenbush and Williams, 1991). To improve on any aspect of education Ejiogu (1999) was of the view that it will be better to involve a well articulated teacher education programme that will prepare the teacher for the leadership role they are expected to play.

Aladejana and Ilugbusi (2013) quoting Ale and Emmalo summarized as part of the problems associated with Mathematics teaching in any developing country as

i) ineffective teaching method, and
ii) lack of experience teachers.

This shows the importance attached to teachers' experience. Findings from existing literature according to Bamidele (1988), Oloyede (1998), Adeyeye et al (1998), Usman (2003), Usman (2004), Ilugbusi and Kolawole (2006), Olojo (2011) and Ilugbusi (2012) showed that personality characteristics of teachers like their qualification and years of

teaching experience have significant effect in the life of students they teach and hence make major impacts on their students' feelings and academic achievement in Mathematics at all the various strata of Nigeria's educational system. Findings from the research carried out by Kemp and Hall (1992) indicate, among others that student's achievement is linked to teacher's competence, lesson presentation, review, skill practice, teacher questioning techniques, discipline, and effective patterns of instruction. The factors listed above are all components of teacher's experience.

Thus, Ilori (2003) emphatically declares that departments of Mathematics are grossly under staffed in terms of academic staff. He adds that the few available lecturers are spread too thin over our many tertiary institutions such as universities, polytechnics and colleges of education. The situation is described by Igbokwe (2003) as follows: "for more than a decade now, many universities in Nigeria are left with young, inexperienced and insufficiently trained staff, who lack the necessary mentors and role models to guide them." This is very unfortunate. The teacher is therefore the most indispensable factor in the effective administration of any educational system. Then, it can be concluded that no matter the amount of resources we might put into the nation's education system, without properly prepared, motivated and experienced teachers, such system cannot work. Thus, teacher's experience is very important in the academic achievement of pre-service mathematics teachers.

2.3.3 School factors and Pre-service Teachers' Achievements in Mathematics

Effective school characteristics are those things that help to create a fertile school culture that facilitates achievement of learners. Some researchers (Henson and Eller, 1999; Berliner, 1999) have identified such characteristics. Their findings indicate that learners excel when the following factors are present:

i) Strong leadership is provided by a principal who works with staff to communicate the mission for the school; provide reliable support for staff, and meet with teachers and other members of staff frequently to discuss classroom practices. This is also applicable to Provost and other lecturers in our colleges, especially in the area of supporting self.

ii) High learner achievement is the foremost priority of the school and the school is organized around this goal as shown by teachers who demonstrate high expectations, achievement of learners and make learners aware of and understand those expectations.

iii) Parents are aware of, understand and support the basic objective of the school and believe they have an important role to play in their children's education.

iv) Teachers work together to provide an orderly and safe school environment.

v) Schools use evaluation to measure progress of learners and promote learning. If any of those factors is lacking, students may not learn effectively.

2.3.3.1 Textual Materials and Pre-service Teachers' Achievements in Mathematics

Textual presentation in which the learners are caused to make use of Sensory Activation Model (S.A.M.) strategy (Douville, 2004) and to comprehend, interpret and remember are better than those in which the learners are made to receive instruction only in a visual imagery. The importance of the findings above are enormous because researchers and educators within the field of reading have long recognised the importance of assisting students to step into the text world in order to actively construct meaning during the reading process (Ruddell and Unrau, 2004). Equal percentage of the student's population that experience reading problems also experience problem in Mathematics (Sousa, 2001). Considering the issue of Mathematics achievement and the need for student to develop their own repertoire of problem solving strategies is even more compelling when one examines the type of text students are required to process in Mathematics classes. Mathematics, characterized by multiple abstractions, specialized symbolism and technical vocabulary made Mathematics text to be most difficult content area material to read, even for students who do not experience reading problems in other area of the curriculum (Schell, 1982).

There is also the complexity of the tasks necessary for successful construction of solution to problems. Two mental subsystems must be passed through first. According to Douville and Pugalee (2003), we have verbal subsystem and non-verbal (imagery) subsystem. These researchers also suggested three steps to accurate solution of Mathematics problems based on the need for appropriate and simplified presentation of textual materials as follows: (i) Students must be able to process the related verbal

information (i.e word and symbolic language). (ii) Students must construct the solution to the problem. As a result of the reasons stated above, textual materials recommended for student/course use must have clearly stated behavioural objectives, relevant and clear examples followed by exercises at graded levels, simplified language free from any ambiguity, relevant and adequate etc.

Instructional manipulations of various degrees may have effects on different aspects of cognitive processing in learners differently. To be specific, considering assimilation theory, that is, the idea that learning involves integrating new information with existing knowledge (Meyer, 1989) suggested three primary functions of cognitive processes as follows: to guide selective in the text, to foster the building of internal connections among ideas from the text, and to foster the building of external connections between ideas in the text and the learners existing knowledge (Okedara, 1997). To enhance these cognitive processes, the materials to be learnt must be potentially meaningful (Mannes, 1994). That is, it must be possible to construct a coherent mental model from the materials (Newton and Marrel, 1994). Meyer (1989) observes that if the material was not potentially meaningful, then any attempt to help students to understand it will be with failure. Good mental models or representations enhances reasoning, understanding and ability to solve problems (Low and Over, 1992).

On this issue of textual materials, Ayoola (2011) detected that primary and secondary school books in Nigeria were written and published locally, thus reducing cost, however, most tertiary Mathematics texts are imported, and so are unaffordable by students, teachers and sometimes libraries. Ilori (2003) declares that university libraries do not stock current books and journals anymore because of lack of funds. This is also applicable to colleges of education and polytechnics' libraries. He adds that imported Mathematics textbooks have, since the introduction of the Structural Adjustment Programme (SAP) in Nigeria, been out of the reach of most Nigerian students, because of our weak currency. There is therefore the challenge for Nigerian authors to produce Mathematics textbooks for use by our students. In his own research, Kuku (2012) says that imported textbooks at tertiary level are so expensive that neither students, teachers, nor even libraries can afford to buy many of them. Yet, there are relatively few quality textbooks written by African scientists. He therefore suggests that NEPAD/AU should provide funds to encourage

African scientists to write books at tertiary levels and publish them in Africa so that the books could be sold at affordable prices. He adds that such financial support from NEPAD could be channeled through the professional organizations in the continent. In conclusion, examination of the appropriateness and adequacy of textbook is therefore, of paramount importance in order to enhance performance in Mathematics.

2.3.3.2 Infrastructure and Pre-service Teachers' Achievements in Mathematics

Infrastructure play a very important role in the academic achievement of the pre-service teachers. Tsanwani (2009) stated that what teachers actually do, depends not only on their competence, but also on the conditions under which they provide instruction, they noted that a fully competent teacher might perform below expectation in the classroom, if he or she is working or teaching in a disorganised and unsupported environment. On the other hand, teachers with only minimal competence can perform quite adequately, given supportive and favorable working conditions. That is why Adewale (2004), Amao and Rahman (2004) and Amao and Onasanya (2010) have concluded that teachers vary in their perception of effectiveness culture as well as classroom practices. This, then suggests that where adequate infrastructure are provided within the school environment, teachers are likely to perform well, and if otherwise, reverse may the case.

That is why Kuku (2012) affirms that teaching and research facilities should be radically improved. He adds that the facilities that were too expensive to provide for individual institutions should be jointly used by groups of institutions. Also, for every science & technology discipline, there should be at least one place where library and research facilities are of international standard so that such place could serve other less equipped institutions. For Mathematics, it used to be the case that the National Mathematical Centre, Abuja was well equipped to serve the needs of Nigerian universities, polytechnics and colleges of education (library, facilities, books and journals) but the centre is no longer able to play this role because of paucity of government funding.

Henson and Eller (1999) gave some characteristics of effective teacher working with learners in an ideal environment with adequate infrastructure. Although the focus is not specifically on Mathematics, the researcher's opinion is that the characteristics they

identified are applicable to teachers in all subject areas, and at all levels of education. The said characteristics are that, they

i) set high goals and communicate these goals to learners;
ii) are flexible in their thinking and willing to admit mistakes or change their positions or opinions when evidence warrant this;
iii) appreciate creativity and enjoy the unpredictability of working with divergent thinkers;
iv) are well organized and flourished in classrooms where there were multiple activities running concurrently, and
v) are willing to be flexible in terms of time of the task during the school day, and they devote extra time after school to working with their learners.

Apart from the last characteristic highlighted, others are adequately applicable to teachers in the tertiary institutions. Such teachers are expected to motivate students in the domain to learn, thereby enhancing achievement in the subject, especially in Mathematics.

2.3.3.3 Instructional materials and Pre-service Teachers' Achievements in Mathematics

Instructional materials are aids to teaching and learning which could help raise learning from verbalization to practical. Egwu (2008) defines instructional materials as audio visual materials or innovations in teaching and learning which involve the use of human effort, appropriate choice design and utilization of objects to ensure effectiveness. It can also be described as an instructional device or techniques used to facilitate sharing of experience, knowledge, skills and value. Instructional materials, according to Emezie (2010), include those materials and services used in learning situations to supplement the written or spoken words in the transmission of knowledge, attitude and ideas. The common denominator to their submission is that they are materials that facilitate teaching and learning activities and consequently leading to the attainment of lesson objectives.

Ewudo (2009) states that skills are developed with the help of instructional materials and students learning procedure is also improved. He declares that instructional materials stimulate students' desire to learn. He adds that, it generally assists the students learning process by making assimilation and memorization of materials easy and help to hold

attention as well as longer retention of information. It enhances learning, improves the competence of learners and makes learning more meaningful to students. It also provides both the teachers and the students with relevant and meaningful source of information. Student's desire to learn is stimulated through instructional materials. It assists learning process by making assimilation and memorisation of materials easy. Also, it helps to hold attention, include greater acquisition as well as objectives which may be inaccessible to many students. Thus, the students capture the true picture of what is taught by the lecturers.

Instructional materials according to Ani (2006), help the teacher to present the subject matter effectively to the students. He also notes that instructional materials help teachers in improving their skills and widening their knowledge. Adewale (2011) makes it clear that instructional materials help the teacher to hold students' attention in the class. He also submits that instructional materials help the lecturer to control the pace of learning. Thus, the lecturer uses such resources in presenting his lessons so that the learners can easily understand what is being taught. According to him, instructional materials are means of making teaching and learning process more meaningful, effective, productive and understandable. He also declares that most teachers do not teach with instructional resources on the excuses that they are not available.

A professionally qualified mathematics lecturer, no matter how well trained, would be unable to put his ideas into practice if the college lacks the material necessary for him to translate his competence into reality. Omosewo (2008) and Akinsola (2000) consider the human factor as the teacher professional commitment, creativity ,mechanical skills, initiative and resourcefulness. They found that many of Nigeria science teachers were aware of possibility of improvisation but many exhibited poor attitude towards improvisation. They also note that very few teachers practice improvisation while majority depends on imported equipments and claim that improvisation is time-consuming and fund depleting. The situation is not different with mathematics lecturers as well as mathematics students in the colleges of education where they possess little or no interest in improvisation of instructional materials.

Today, advances in technology have made it possible to produce materials and devices that could be used to minimise the teacher talking and at the same time, make the message clearer, more interesting and easier for the learners to assimilate (Onasanya,

Adegbija, Olumorin, and Daramola, 2008). Instructional materials could be in various forms, part of which is graphics. According to Soetan, Iwokwagh, Shehu, and Onasanya (2010), graphics include charts, posters, sketches, cartoons, graphs and drawings. The instructional value of graphical illustrations lies generally in their capacity to attract attention and convey certain types of information in condensed form (Onasanya and Adegbija, 2007).

2.4 Appraisal of Literature

Going by the various literature reviewed, there were different opinions and findings on the attitudes of student towards Mathematics and their academic achievements. Many studies at the lower level showed that students' attitudes change with their levels of education but there is agreement that students' positive attitude towards a subject makes them achieve better and that students with negative attitudes score lower but not many studies have been carried out on this at the tertiary level. Mathematics performance is also not different. Several studies were also carried out regarding the effect of peer influence on the academic achievements of students. It was reported that peer effects can either make or mar confidence and achievement of learners in Mathematics depending on the type of peers they relate with. Also peer support was seen as a process that involves learners teaching other learners and literature found that it was a right thing in the right direction. Most researchers, according to the literature reviewed, supported the belief that there is a persistent and significant relationship between self efficacy and academic achievement and that a change in one seems to be associated with a change in the other. According to them, students with a low academic self-efficacy have shown low commitment to school. Others claimed it was not so. As a result, it calls for further investigation.

Review of relevant literature reviewed revealed the importance of teachers to the academic achievement of students to the extent of stating that an educational system cannot rise above the level of its teachers. Some literature were of the opinion that the attitudes of mathematics teachers could lead to the development of learners' mathematics ability. Very few studies even concluded that the attitudes of learners towards Mathematics were derived from the attitudes of teachers towards the subject, thus extensive investigation is highly needed.

Teachers are even classified according to their belief as discipline-oriented, process oriented, procedure-oriented and eclectic teachers. Thus, teacher's disposition to work might likely affect pre-service teachers' attitudes and subsequently their academic achievements which calls for more clarifications. Perception to teaching and teaching methods as they relate to Mathematics achievement and pre-service teachers' achievement were also reviewed. Any teaching method according to the literature reviewed should be followed by five normative principles which include: proceeding from simple to complex, easy to difficult, concrete to abstract, known to unknown and from particular to general. The literature reviewed also made it clear that teaching strategies can be classified as teacher-centred or learner-centred. Several methods were identified according to the literature reviewed and were grouped into only three. These are (i) effective methods we are used to, (ii) effective methods we should use and (iii) innovative teaching methods. The literature reviewed revealed seven factors to be considered in selecting appropriate suitable teaching method. Researchers are inconclusive on the fact that students taught by more experienced teacher achieve at a higher level and that experienced teachers are considered to be more able to concentrate on the most appropriate way to teach particular topics to students who differ in their abilities, prior knowledge and backgrounds. It was also revealed by very few literature that personality characteristics of teachers like their qualifications and years of teaching experience have significant effect on the lives of the students they teach and hence make major impacts on their students' feelings and academic achievement in Mathematics while others differ from these findings. So the researcher made further attempts for clarification.

The opinions of researchers on school factors that it plays important role in the academic achievement of pre-service teachers were not the same. Certain characteristics which the school is expected to possess before giving the best to the learners were identified by some researchers. On the issue of textbooks, the reviewed literature argued that textual materials recommended for students' use or for any course must have clearly stated behavioural objectives, relevant and clear examples followed by exercises at graded levels, simplified language free from any ambiguity, relevant and adequate etc. Certain literature reviewed added that if the material is not potentially meaningful, then any attempt to help students to understand it will be with failure. On the roles infrastructure plays, few

of the reviewed literature affirm that teacher's competence is not enough but also the conditions under which they provide instruction. Buttressing this, they note that a fully competent teacher might perform below expectation in the classroom if he/she is working in a disorganized and unsupported environment for teaching and learning and vice versa. Also, certain literature reviewed gave some characteristics of effective teacher working with learners in an ideal environment with adequate infrastructure. Since those findings were inconclusive, reinforcing them would be highly necessary.

CHAPTER THREE

METHODOLOGY

This chapter deals with research design, variables in the study, population, sample and sampling technique , research instruments, validity of the instruments, procedure for data collection and method of data analysis.

3.1 Research Design

This study is a survey research design of the correlational type. It establishes the degree of relationship between the independent (predictor) variables and the dependent (criterion) variable.

3.2 Variables in the Study

The variables in this study are:

(A) The independent variables which are:

Learner Factor:

1. Attitude towards Mathematics
2. Self efficacy in Mathematics
3. Peer influence

Lecturer Factor:

1. Attitude towards Mathematics teaching
2. Perception of teaching
3. Teaching experience

School Factor:

1. Availability of infrastructure
2. Availability of textual materials
3. Availability of instructional materials

(B) **The dependent variable.** There is only one dependent variable, that is pre-service teachers' achievement in Mathematics.

3.3 Population

The population for this study is all the students and lecturers in colleges of education in Southwestern Nigeria. All the states in southwestern Nigeria were involved in the study except for the state that was used for validation of research instruments.

3.4 Sample and Sampling Technique

Purposive sampling technique was used to select colleges. A total number of five colleges of education were selected for this study. The selection of the colleges were based on the following criteria:

i) The colleges chosen were considered eligible if they are government-owned tertiary institutions.

ii) The said colleges have also been graduating students for more than five years.

iii) Such a college must have a sizeable number of lecturers in the Mathematics.

iv) The College that has the highest number of mathematics lecturers in the department was chosen from the state that has more than one college of education.

v) Such college must have demonstrated willingness to participate in the study.

Also, the only 300 level compulsory second semester course which all students must offer was selected for the study. All the mathematics students at 300 level were used because the population was not too large to be sampled. In all, a total number of five hundred and eleven students comprising 211 males and 300 females participated in the study. Also, all the fifty one available mathematics lecturers in these colleges were used for the study.

Table 3.1: NUMBER OF LECTURERS PER COLLEGE OF EDUCATION USED FOR THE STUDY

S/N	Name of College	Number available in the college	Number available for the study
1	College of Education, Ikere Ekiti.	14	13
2	Adeniran Ogunsanya College of Education, Ijanikin.	8	7
3	Adeyemi College of Education, Ondo.	14	13
4	Osun State College of Education, Ila Orangun.	8	8
5	Federal College of Education (Special), Oyo.	11	10
	Total	**55**	**51**

3.5 Instrumentation

The following instruments were used to elicit information for the study.

a) Pre-service Teachers Mathematics Achievement Test (PRETMAT)

b) Pre-service Teachers' Attitude towards Mathematics (PRETATOM)

c) Self Efficacy Questionnaire for Pre-service Mathematics Teachers (SEQPREMAT)

d) Peer Influence Questionnaire for Pre-service Mathematics Teachers (PIQPREMAT)

e) i) Mathematics Lecturers' Questionnaire (MALEQ)

ii) Lecturers' Attitudes towards Mathematics Teaching (LATMAT)

f) Mathematics Lecturers' Perception to Teaching Rating Scale (MALPETERS)

g) School Factors Questionnaire (SFAQ)

3.5.1 Pre-service Teachers Mathematics Achievement Test (PRETMAT)

This is a 40-item multiple choice test with four options A, B, C and D developed by the researcher in order to assess the level of ability of the pre-service teachers. It covered the course content of MAT 322 titled 'Linear Algebra'. To ensure that the test is both valid and reliable, the systematic procedure for test construction was followed in the planning and compilation of the test. A total number of 60 items were initially prepared. Copies were given to two Mathematics lecturers at the college of education, and two lecturers each from the Department of Teacher Education, Mathematics Unit and the Department of Mathematics, Faculty of Science respectively. After validation, 10 items were dropped. The remaining 50 items were administered on 20 pre-service Mathematics teachers to determine the liability index using Kuder-Richard formula 20. The difficulty index were computed. The result was used to pick 40 items that were neither too difficult nor too easy. The analysis yielded difficulty indices of between 0.38 and 0.68. Thus, the discriminating index of 0.4 and up was considered for the inclusion of the items with a reliability index of 0.75. A blue print was drawn in a table of specification for PRETMAT and is shown in Table 3.2.

Table 3.2: TABLE OF SPECIFICATION FOR PRETMAT

S/No	Content	Objectives			Total No. of items
		Knowledge	Application	Evaluation	
1.	Matrices	(1, 3, 4) 3	(10, 13, 37) 3	(2, 12, 14) 3	9
2.	Determinants	(5) 1	(6, 7, 11) 3	(26, 28) 2	6
3.	Inverses	0	0	(8) 1	1
4.	Systems of Linear equations	(15) 1	(9)1	(25) 1	3
5.	Eigen values and eigen vectors	0	(16, 27) 2	(16) 1	3
6.	Characteristics polynomials, equations and roots	(18) 1	(20) 1	0	2
7.	Equivalent matrices	(21) 1	(22) 1	0	2
8.	Consistent equation	(19) 1	(24) 1	(23) 1	3
9.	Vector space and linear transformations	(30, 31, 2, 36) 4	(29, 33, 40) 3	(34, 35, 38, 39) 4	11
TOTAL		14	13	13	40

3.5.2.1 Pre-service Teachers Attitudes Towards Mathematics (PRETATOM)

The generation of this instrument is in two folds – some questions were adapted while others were constructed by the researcher. The ones adapted were from the Modified Fennema-Shaman Mathematics Attitude Scale. The questionnaire was designed to elicit information from the pre-service mathematics teachers on their attitudes towards Mathematics learning. It consists of two sections. Section A which is referred to as Pre-service Teacher's Biodata deals with the candidate's name, level, college, state, sex and age. Section B consists of 39 items which is made up of both positive and negative worded items. It is a four-point rating scale of Strongly Agree, Agree, Disagree, Strongly Disagree and scored as 4, 3, 2, 1 respectively. The 13 negatively worded questions in the instrument were reversed.

For face, construct and content validities, colleagues' scrutiny and experts' review were executed. The experts were drawn from the Department of Teacher Education, Mathematics unit. The Cronbach alpha coefficient obtained when computed to determine its reliability was 0.74.

3.5.2.2 Self Efficacy Questionnaire for Pre-service Mathematics Teachers (SEQPREMAT)

The items here are adapted version of May (2009). It consists of 14 items and deals with what pre-service Mathematics teachers feel/think/perceive about Mathematics, how they react to Mathematics, and what they feel can make them do well in Mathematics. These are made up of only positive worded items. It is a 4-point rating scale ranging from Never (1), Sometimes (2), Often (3) and Usually (4).

The SEQPREMAT were given to two lecturers at the College of Education and then to two lecturers in the Department of Teacher Education for their expert review and ascertaining the face, construct and content validities of the instrument. Their inputs were reflected in the copy of the one that was presented to my supervisor. The final copy of the instrument was administered to 20 pre-service Mathematics teachers comprising both male and female. These pre-service teachers were chosen from another college different from the colleges that participated in the actual study. The Cronbach alpha obtained when computed was 0.93.

3.5.2.3 Peer Influence Questionnaire for Pre-service Mathematics Teachers (PIQPREMAT)

These items are adapted from Animasahun (2007) with minor modifications by the researcher. It consists of only ten items and has the options Strongly Agree, Agree, Disagree and Strongly Disagree. The responses were scored as 4, 3, 2 and 1 respectively.

For face, construct and content validities, copies of PIQPREMAT were given to experts in the Department of Teacher Education for their expert review. The reliability coefficient obtained when computed using Cronbach alpha was 0.92.

3.5.3.1 Mathematics Lecturer's Questionnaire (MALEQ)

This is a questionnaire which has two sections. The first section, that is, the demographic variables of the lecturers was developed by the researcher and deals with the name of college, state, sex, qualification and years of experience which has the options 1 – 4 years, 5-8 years, 9-12 years, 13-16 years and 17 years^{+}. The second section, that is, Lecturers' Attitudes towards Mathematics Teaching (LATMAT) was adapted by the researcher from the Third International Mathematics and Science Study (TIMSS) with modification by the researcher consists of fourteen items and deals with the attitude of lecturers towards the teaching of Mathematics. It focused on the multi various and multi-dimensional behavioural disposition of mathematics lecturers towards the teaching of Mathematics. The instrument is a Modified Likert type with the descriptions Strongly Agree which was scored 4 marks, Agree – 3 marks, Disagree – 2 marks and Strongly Disagree – 1 mark.

To ensure that MALEQ is valid and reliable, copies were given to four mathematics lecturers at the college of education and two lecturers in the Department of Teacher Education for scrutinisation. The revised version was administered to lecturers at the College of Education different from the Colleges chosen for the study. The Cronbach alpha coefficient obtained was 0.79.

3.5.3.2 Mathematics Lecturers' Perception to Teaching Rating Scale (MALPETERS)

This instrument consists of two sections. Section A is developed by the researcher and consists of ten questions while Section B is adapted from the Third International Mathematics and Science Study questionnaire and consists of only seven questions. Section A is a two-point rating scale of Yes and No and scored as 2 and 1 respectively. Section B was outlined on a four-point Modified Likert Scale of Never or Almost Never, Some lessons, Most Lessons and Every Lesson. For example, a stem in the item reads thus: In your Mathematics lesson, how often do you usually ask students to represent and analyse relationship using tables, charts, or graphs? The responses were scored as 1, 2, 3 and 4 respectively.

These instruments were subjected to face and content validity through researchers, experts and mathematics educators. The Cronbach alpha was used to determine the reliability coefficient. The value obtained after computation was 0.77.

3.5.4 School Factors Questionnaire (SFAQ)

This instrument was designed by the researcher to elicit information on the availability, adequacy and utilization or otherwise of infrastructure, instructional materials and textual materials in the Colleges chosen for the study. In section A, the pre-service mathematics teachers were expected to supply information on the name and type of college they attend together with their sex. Section B of the first part which is based on infrastructure and instructional materials consists of 17 items while the second part consists of 9 items which are basically on textual materials. Section B of the first part is a two-point rating scale of true and false type and were scored as 2 and 1 respectively. The second part is a three-point rating scale. These are True, Almost True and False. The responses were scored as 3, 2 and 1 respectively.

The SFAQ was given to four lecturers in the Department of Mathematics at the College of Education. Their comments and corrections were collected and reflected in the copies that were given to two lecturers in the Department of Teacher Education in the University, for their expert contributions and advise. Their corrections were subsequently reflected in the copy that was presented to my supervisor. The final copy of the instrument which reflected my supervisor's comments/corrections were administered to all the pre-service mathematics teachers in the colleges considered for the actual study.

3.6 Administration of Instruments and Procedure for Data Collection

The researcher obtained a letter of introduction from the Department of Teacher Education, University of Ibadan and was presented to the Head of Mathematics Departments of the Colleges of Education used for the study. He also discussed the importance with them. The researcher trained two research assistants who were involved in the data administration and collection. He briefed them about the study and how both the questionnaire and the achievement tests were to be administered in order to facilitate the success of the exercise. Support and cooperation of the Heads of Mathematics Department and other lecturers in the departments were sought in administering the questionnaire to the students in all the colleges of education used for the study. The pre-service teachers, that is the year three students were also briefed about the importance and why they needed to

participate actively in the study. Thus, the Pre-service Teachers' Attitude towards Mathematics (PRETATOM), Self-Efficacy Questionnaire for Pre-service Mathematics Teachers (SEQPREMAT), Peer Influence Questionnaire for Pre-service Mathematics Teachers (PIQPREMAT) and School Factors Questionnaire (SFAQ) were given to them to respond to and were collected thereafter accordingly. The same was done in all the colleges of education under study. The researcher, through the Mathematics lecturers in the various colleges of education used for the study, informed the pre-service Mathematics teachers to prepare for the Pre-service Teachers Mathematics Achievement Test (PRETMAT) the following week. This was then done accordingly, the following week. The researcher, the research assistants and the lecturers in the Mathematics Department of the Colleges under study were involved in carrying out the administration and collection of the questionnaire as discussed earlier. The Mathematics Lecturers' Questionnaire (MALEQ), which also include Lecturers' Attitudes towards Mathematics Teaching (LATMAT) and Mathematics Lecturers' Perception to Teaching Rating Scale (MALPETERS) were given to all lecturers in the Mathematics Departments of all the Colleges used for the study and were collected the following week. The administration of the instrument described earlier lasted for ten weeks.

3.7 Methods of Data Analysis

Data were analysed using descriptive statistics (mean and standard deviation) and multiple regression. The results of multiple regression were used to provide information on the composite and relative contributions of the nine variables to the prediction of achievement of pre-service teachers in Mathematics.

CHAPTER FOUR

RESULTS AND DISCUSSION

4.1 Results

This study dealt with the contribution and prediction of pre-service teachers' achievement in Mathematics on the basis of the nine independent variables selected. To be precise answers are provided to the eight research questions raised earlier in chapter one. The results and discussions are presented in this chapter.

RESEARCH QUESTION 1: What is the composite contribution of learner factors (attitudes, peer-influence and self efficacy) to pre-service teachers' achievement in Mathematics?

Table 4.1: Multiple regression analysis showing the composite contribution of the learner factors (pre-service teachers' attitude, self efficacy and peer influence) on pre-service teachers' achievement in Mathematics.

R		R Square		Adjusted R Square		Std. Error of the Estimate
.047		.002		-.004		1.2502
ANOVA						
Model	Sum of Squares	Df	Mean Square	F	Sig.	Remark
Regression	1.769	3	.590	.377	.769	Not sig
Residual	792.419	507	1.563			
Total	794.188	510				

Table 4.1 reveals that there is a relationship between the independent variables (pre-service teachers' attitude, self efficacy and peer influence) and the dependent variable (pre-service teachers' achievement in Mathematics) [R = 0.47]. This led to the fact that the independent variables accounted for 0.4% of the total variance in the dependent variable (Adjt.R^2 = 0.004). This composite contribution is shown not to be significant {$F_{(3, 507)}$ = 0.38; $p > 0.05$).

RESEARCH QUESTION 2: What are the relative contributions of each of learner factors to pre-service teachers' achievement in Mathematics?

Table 4.2: Multiple regression analysis showing the relative contribution of the learner factors (pre-service teachers' attitude, self efficacy and peer influence) on pre-service teachers' achievement in Mathematics

Model	Unstandardized Coefficient		Stand. Coefficient	t	Sig.	Remark
	B	Std. Error	Beta contribution			
(Constant)	19.413	.567		34.216	.000	Sig.
Pre-service teachers' attitude	-0.004972	.005	-.047	-.910	.363	n.s
Self efficacy	-0.001561	.007	-.010	-.210	.833	n.s
Peer influence	0.004417	.012	.018	.368	.713	n.s

Table 4.2 reveals that there is no significant relative contribution of the three independent variables to the dependent variable. The pre-service teachers' attitude (β=-0.047, p>0.05), self efficacy(β=-0.010, p>0.05) and peer influence (β = 0.018, p>0.05) have no significant relative contribution.

RESEARCH QUESTION 3: What is the composite contribution of lecturer factors (attitude, perception of teaching and experience) to pre-service teachers' achievement in Mathematics?

Table 4.3: Multiple regression analysis showing the composite contribution of the lecturer factors (lecturers' attitudes, perception of teaching and teaching experience) on pre-service teachers' achievement in Mathematics

R	R Square	Adjusted R Square	Std. Error of the Estimate
.445	.198	.147	2.4900

ANOVA

Model	Sum of Squares	df	Mean Square	F	Sig.	Remark
Regression	71.920	3	23.973	3.866	0.015	Sig
Residual	291.413	47	6.200			
Total	363.333	50				

Table 4.3 shows the composite contribution of the three independent variables to the prediction of the dependent variable, that is pre-service teachers' achievement in Mathematics. It could be observed that there is positive multiple correlation (R=0.445) among the three independent variables. This connotes that the factors are very relevant towards the determination of the dependent measure. Also an adjusted R square of 0.147 means that 14.7% in the dependent variable is accounted for by the three predictor variables when taken together. The remaining 85.3% could be the contributions of other variables not considered in this study. The analysis of variance showed that the F-ratio of the regression analysis is significant ($F_{(3, 47)} = 3.866$; $p<0.05$). This implies that the joint contribution of the independent variables to the dependent variable was significant.

RESEARCH QUESTION 4: What are the relative contributions of lecturer factors to pre-service teachers' achievement in Mathematics?

Table 4.4: Multiple regression analysis showing the relative contribution of the lecturer factors (lecturers' attitude, perception of teaching and teaching experience) on pre-service teachers' achievement in Mathematics

Model	Unstandardized Coefficient		Stand. Coefficient	t	Sig.	Remark
	B	Std. Error	Beta contribution			
(Constant)	29.309	6.097		4.807	.000	Sig.
Lecturers' attitude	0.0325	.030	.146	1.082	.285	n.s
Perception of teaching	-0.748	.308	-.349	-2.430	.019	sig
Teaching experience	0.633	.238	.392	2.664	.011	sig

Table 4.4 reveals the relative contributions of the three independent variables to the dependent variable. It reveals that two out of the three independent variables significantly and independently predict pre-service teachers' achievement in Mathematics. Teaching experience ($\beta = 0.392$, $p < 0.05$) had the greatest contribution to achievement in Mathematics, followed by perception of teaching ($\beta = -0.349$, $P < 0.05$) while lecturers' attitude ($\beta = 0.146$, $p > 0.05$) made the least contribution to pre-service teachers' achievement in Mathematics.

RESEARCH QUESTION 5: What is the composite contribution of school factors (instructional materials, textual materials, and infrastructure) to pre-service teachers' achievement in Mathematics?

Table 4.5: Multiple regression analysis showing the composite contribution of the school factors (instructional materials, textual materials and infrastructure) on pre-service teachers' achievement in Mathematics.

R	R Square	Adjusted R Square	Std. Error of the Estimate
.195	.038	.032	1.2276

ANOVA

Model	Sum of Squares	df	Mean Square	F	Sig.	Remark
Regression	30.090	3	10.030	6.655	.000	Sig
Residual	764.098	507	1.507			
Total	794.188	510				

Table 4.5 shows the composite contribution of the three independent variables to the prediction of the dependent variable, that is pre-service teachers' achievement in Mathematics. The table also shows a coefficient of multiple correlation (R=.195) and an adjusted R^2 value of 0.032. This means that 3.2% of the variance is accounted for by the three predictor variables when taken together. The remaining 96.8% could be the contribution of other variables not considered in this study. Table 4.8 also shows that the analysis of variance for the regression yielded F-ratio of 6.655. This implies that the composite contribution of the independent variables to the dependent variable was significant.

RESEARCH QUESTION 6: What are the relative contributions of school factors to pre-service teachers' achievement in Mathematics?

Table 4.6: Multiple regression analysis showing the relative contribution of the school factors (instructional materials, textual materials and infrastructure) on pre-service teachers' achievement in Mathematics

Model	Unstandardized Coefficient		Stand. Coefficient	t	Sig.	Remark
	B	Std. Error	Beta contribution			
(Constant)	17.476	.615		28.407	.000	Sig
Instructional materials	.100	.030	.182	3.307	.001	Sig
Textual materials	-0.06204	.024	-.127	-2.575	.010	Sig
Infrastructure	0.0559	.052	.053	1.071	.285	n.s

Table 4.6 reveals the relative contribution of the three independent variables to the dependent variable, expressed as beta weights, viz: Instructional materials (β=0.182, $p<0.05$), Textual materials (β=-0.127, $p<0.05$) and Infrastructure (β=0.053, $p>0.05$). One should note that instructional materials made the greatest contribution to pre-service teachers' achievement in Mathematics (β=0.182), followed by textual materials (β=-0.127) while infrastructure (β=0.053) is the least.

RESEARCH QUESTION 7: What is the composite contribution of all the independent variables (pre-service teachers' attitudes, self efficacy in Mathematics, peer influence, lecturers' attitudes, perception of teaching, teaching experience, instructional materials, textual materials and infrastructure) to pre-service teachers' achievement in Mathematics?

Table 4.7: Multiple regression analysis showing the composite contribution of the independent variables (pre-service teachers' attitudes, self-efficacy, peer influence, lecturers' attitudes, perception of teaching, teaching experience, instructional materials, textual materials and infrastructure) on pre-service teachers' achievement in Mathematics

R	R Square	Adjusted R Square	Std. Error of the Estimate
.480	.230	.217	1.1045

ANOVA

Model	Sum of Squares	Df	Mean Square	F	Sig.	Remark
Regression	183.040	9	20.338	16.672	.000	Sig
Residual	611.147	501	1.220			
Total	794.188	510				

Table 4.7 shows the composite contribution of the nine independent variables to the dependent variable, that is pre-service teachers' achievement in Mathematics. The table also shows a positive multiple correlation (R=0.480) among the nine independent variables and the dependent variable. Also, an adjusted R square value of 0.217 means that 21.7% of the variance is accounted for by the nine predictor variables when taken together. The remaining 78.3% could be the contributions of other variables that are not considered in this study. It showed that the F-ratio of the regression analysis is significant ($F_{(9,501)}$ = 16.672; $p<0.05$). This implies that the composite contribution of the independent variables to the dependent variable was significant.

RESEARCH QUESTION 8: Which of the learner, lecturer and school factors will predict pre-service teachers' achievement in Mathematics?

Table 4.8: Multiple regression analysis showing the relative contribution of the (pre-service teachers' attitudes, self-efficacy, peer influence, lecturers' attitudes, perception of teaching, teaching experience, instructional materials, textual materials and infrastructure) on pre-service teachers' achievement in Mathematics

Model	Unstandardized Coefficient		Stand. Coefficient	t	Sig.	Remark
	B	Std. Error	Beta contribution			
(Constant)	17.942	.826		21.724	.000	Sig
Pre-service teachers' attitude	-0.001474	.005	-.014	-.291	.771	n.s
Self-efficacy	0.0008766	.008	.006	.115	.909	n.s
Peer influence	0.002341	.011	-.009	-.218	.828	n.s
Lecturers' attitude	0.003867	.004	.037	.885	.376	n.s.
Perception of teaching	-0.06303	.023	-.140	-2.723	.007	sig
Infrastructure	0.08189	.047	.077	1.728	.085	n.s
Instructional materials	0.06772	.027	.123	2.465	.014	sig
Textual materials	-0.06050	.023	-.124	-2.677	.008	sig
Teaching experience	.317	.031	.420	10.253	.000	sig

Table 4.8 reveals the relative contribution of the nine independent variables to the dependent variable, expressed as beta weight, viz: pre-service teachers' attitude (β=-0.014, p>0.05), self efficacy (β=0.006, p>0.05), peer influence (β=-0.009, p>0.05), lecturers' attitude (β=.037, p>.05), perception of teaching (β=-0.140, p<.05), infrastructure (β=0.077, p>0.05), instructional materials (β=0.123, p<0.05), textual materials (β=-0.124, p<.05) and teaching experience (β=0.420, p<0.05) respectively. The result in table 4.8 above also reveals that out of the nine factors, teaching experience made the greatest contribution (β =0.420) to the variance in the dependent variable, followed by perception of teaching (β =-

0.140) then textual materials (β =-0.124) and the 4th in rank is instructional materials (β =0.123). The 5th, 6th, 7th, 8th and 9th contributions to the variance in the dependent variable in order of decreasing magnitude are infrastructure (β =0.077), lecturers' attitude (β =0.037), pre-service teachers' attitude (β =-0.014), peer influence (β =-0.009) and self efficacy (β =0.006) respectively.

Hence, while perception of teaching, instructional materials, textual materials and teaching experience significantly and independently predicted pre-service teachers' achievement in Mathematics, pre-service teachers' attitude, self-efficacy, peer influence, lecturers' attitude and infrastructure were not significant.

4.2 Discussion of Results

The finding of this study reveals that teaching experience has the highest contribution to pre-service teachers' achievement in Mathematics. This finding is in consonance with the findings of Brown (2001), and Hanushek, Kain and Rivkin (2002) that teachers with many years of teaching experience perform better than their counterparts who have less number of years of teaching experience, and this subsequently have a direct link with the performances of their students in Mathematics. Also, the findings of Bamidele (1988), Oloyede (1998), Adeyeye et al (1988), Usman (2003), Usman (2004), Ilugbusi and Kolawole (2006), Olojo (2011) and Ilugbusi (2012) that years of teaching expereicne have significant effect in the life of students they teach and hence make major impacts on their students' feelings and academic achievement in Mathematics at all the various strata of Nigeria's educational system corroborates the findings of this study. The implication of this is that government should allow lecturers to spend more years in service before they are asked to retire. As a result of this, the newly recruited lecturers would have learnt and gain more experience before the senior ones actually retire. Thus, this will enhance pre-service teachers' achievement in Mathematics.

Perception of teaching also contributes in no small measure to the prediction of pre-service teachers' achievement in Mathematics. The implication of this result is in accordance with the conclusion of Kurumeh (2013) that teaching of Mathematics in Nigerian tertiary institutions demands that the teacher view teaching as a laudable job that has glorious future. She adds that teachers should be knowledgeable in various methods and strategies for teaching Mathematics topics. Supporting this claim, Ofoegbu (2004)

concluded that poor academic performance of students in Nigeria has been linked to poor teachers' performance in terms of accomplishing the teaching task, negative attitude to work and poor teaching habits.

From the findings, textual materials are also very significant in predicting pre-sercie teachers' achievement in Mathematics. The findings corroborates that of Sousa (2001), Schnotz (2002), Ilori (2003) and Douville and Pugale (2005). The implication of this result is that mathematics textbooks should not be written abstractly. They should be written using simple language which could also involve graphs, diagrams and pictures for simplification. Also, since textbooks provide the major source of information for pre-service teachers, they should not be too costly so that students will be able to afford them. This is in line with Ayoola (2011) and Kuku (2012) who declared that most tertiary mathematics texts are imported, and so are unaffordable by students, teachers and even libraries. Again, course materials written by the existing teachers in the colleges of education should be keenly prepared that will be free of errors and should not be too expensive so that students will be able to afford them.

Instructional material is another variable that contributes to pre-service teachers' achievement in Mathematics in this study. This finding is in agreement with the findings of squire (1991), Popoola and Olarewaju (2006) and Afolabi (2010). The implication of this result is that using instructional materials will lead to the changes in the teaching of the pre-service teachers which may lead to improvement on academic achievement of the pre-service teachers. There can also be a positive change in the attitude of lecturers if there is a well-equipped mathematics laboratory in these colleges. The assertion of Ani (2006) also corroborates this statement that instructional materials help the teacher/lecturer to present the subject matter effectively to the students. He adds that instructional materials help teachers/lecturers in improving their skills and widening their knowledge. With instructional materials in place, the subject will be made meaningful, very interesting and exciting to the pre-service teachers. Mathematical exploration, manipulation and usage by the pre-service teachers will thus be encouraged. The availability of equipped library and other models will also aid the teaching of Mathematics and as well keep the students alive and more application of Mathematics to situations and life generally easy.

Again, from the result, infrastructure, though not significant, made some contribution to the prediction of pre-service teachers' achievement in Mathematics. The implication of this result made one to realise the inadequacy of what is currently on ground in the lecturers' offices and lecture halls where teaching and learning actually takes place in the colleges. This is in line with Tsanwani (2009) who states that what teachers actually do, depends not only on their competence, but also on the conditions under which they provide instruction. He adds that a fully competent teacher/lecturer might perform below expectation in the classroom, if he/she is working in a disorganied and unsupported environment. Most offices have no furniture, fans and two or three lecturers may be managing a room that is not even enough or conducive for a person. As a result they may not even stay in the offices and the implication is that there may be no room for special consultations for the students. The same is also true of the students. The halls they manage for lectures are not well furnitured. There are no enough chairs and tables with which they can sit. At times, some students stand throughout when lectures are taking place. Another thing is the issue of staff quarters which are not available for the lecturers. Many of them come from neighbouring towns and cities to have their lectures, continuity of this can hamper pre-service teachers' achievements in Mathematics.

Considering the results and findings from this study, pre-service teachers' achievement in Mathematics is jointly and significantly influenced by lecturer factors – teaching experience and perception of teaching, and school factors - textual materials and instructional materials.

CHAPTER FIVE

SUMMARY, CONCLUSION AND RECOMMENDATIONS

5.1 Summary of Findings

The findings of this study are summarised as follows:

- There is a significant composite contribution of the lecturer factor to the dependent variable
- Two out of the three lecturer factors (perception to teaching and teaching experience) have significant relative contribution to the prediction of pre-service teachers' achievement in Mathematics.
- There is a significant composite contribution of the school factor to the dependent variable.
- Two out of the three school factors (instructional material and textual materials) have significant relative contribution to the prediction of pre-service teachers' achievement in Mathematics.
- There is a significant composite contribution of the independent variables to the dependent variable when taken together.
- Four out of the nine independent variables (perception to teaching, teaching experience, instructional materials and textual materials) have significant relative contribution to the prediction of the pre –service teachers' achievement in Mathematics.
- None of the three learner independent variables significantly predict pre-service teacher's achievement in Mathematics.

5.2 Conclusion

The result arrived at in this study has established that certain lecturer factors and school factors are good predictors of pre-service teachers' achievement in Mathematics. The result of the findings has showed that teaching experience, perception to teaching, textual materials and instructional materials are variables that can predict pre-service teachers' achievement in Mathematics. The essence of these variables to the prediction of pre-service teachers achievement in Mathematics identified the areas that government, both

federal and state, and the National Council of Colleges of Education (NCCE) need to pay more attention to in addressing the issue of failure in Mathematics at the college of education level.

5.3 Recommendations

1. To a certain extent, instructional materials determine which method a teacher/lecturer will use in disseminating his/her lesson to his/her students, so the government and philanthropist should see to its availability by funding the colleges adequately.
2. Since the improvisation of instructional materials is being taught as a course at NCE level, it could be given to students in the form of project. However, the number of students that will form a group should not be small so that the amount to be contributed by each student towards its provision would be minimised.
3. Mathematics lecturers especially at the college of education, have a great task in that they are the ones producing teachers that would teach both the primary and the secondary school students, the government therefore needs to help/motivate these lecturers in the discharge of their duties by equipping mathematics laboratory.
4. It is imperative for lecturers to attend workshops, conferences and seminars where they will be retrained on the use of instructional materials.
5. Newly recruited/appointed staff should work closely with experienced staff. They should humble themselves in such a way as to work under the guidance of the experienced ones so as to maintain the norms especially in terms of teaching and marking appropriately.
6. Approved foreign textbooks should be made to sell at a regulated cost while recommended locally published textbooks should not be scarce.
7. Each college of education should also set up price regulatory committee where course materials prepared by the lecturers teaching the pre-service teachers will be moderated.
8. Mathematics lecturers should see their work not just as a profession but also as a calling and put in their maximum efforts so that the students they teach could achieve maximally.

9. There is need to replicate this study using all the colleges of education in the Southwestern part of Nigeria and also to conduct this in other geo-political zones of the country.

5.4 Limitation of the Study

The major constraint encountered in the process of carrying out this study which may limit the result of this study to be generalised are that

i) not all the colleges of education in the southwestern part of Nigeria was considered, and

ii) only one course at the final year was considered.

(iii) not all the lecturers returned the questionnaire given to them as a result of their tight schedule.

5.5 Contribution of the study to Knowledge

This study has further established that teaching experience and perception of teaching are very important in predicting pre-service teachers' achievement in Mathematics. Thus, this study has shown that experience really counts in the learners' achievement. Thus, teachers who have been on the job for years are better than the newly recruited ones. The study also established that experience teachers having appropriate perception to teaching and using appropriate teaching methods will aid the pre-service teachers' achievement in Mathematics.

Further, this study has made it known how important textual materials and instructional materials are in the achievement of pre-service teachers. When textbooks are up to date and instructional materials are appropriately used, pre-service Mathematics teachers' achievement will be better.

Many people do emphasise that students' attitude and teachers' attitude are very important in the prediction of students' achievement especially in Mathematics. However, as far as this study is concerned, it has proved to the public that they are not very important.

5.6 Suggestions for further Research

The following suggestions are made for further studies:

i) Studies should be conducted using the significant variables in all the colleges of education in the Southwestern part of the country so that a more valid generalisation could be made.

ii) Studies could also be conducted using the significant variables and the non-significant ones in other geo-political zones of the country.

iii) Some other variables that were not considered in this study like motivation, pre-service teachers' study habit, gender, socio economic background of the pre-service teachers, influence of parents on pre-service teachers, etc. could be explored/used.

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APPENDIX I

UNIVERSITY OF IBADAN

DEPARTMENT OF TEACHER EDUCATION

PRE-SERVICE TEACHERS MATHEMATICS ACHIEVEMENT TEST (PRETMAT)

Each question is followed by four options lettered A to D. Find out the correct option for each question. Mark with pencil the answer that bears the same letter as the option you have chosen. Give only ONE answer to each question.

Attempt ALL questions.

Do not write anything on the question paper

TIME: 2HOURS

1. A matrix is defined as a
   (A) set which has rows and columns
   (B) rectangular array of numbers from a field
   (C) linear transformation that has at least one characteristic vector
   (D) triangular array of numbers from a field.
2. $A = \begin{bmatrix} 2 & 1 \\ 1 & -3 \end{bmatrix}$, $B = \begin{bmatrix} 1 & 4 \\ 0 & 2 \end{bmatrix}$ and $C = \begin{bmatrix} 3 & 4 \\ 2 & 3 \end{bmatrix}$, find $2A - C$
   (A) $\begin{bmatrix} 4 & 2 \\ 2 & -6 \end{bmatrix}$ (B) $\begin{bmatrix} -1 & -3 \\ -1 & -6 \end{bmatrix}$ (C) $\begin{bmatrix} 1 & 0 \\ 0 & -9 \end{bmatrix}$ (D) $\begin{bmatrix} 1 & -2 \\ 0 & -9 \end{bmatrix}$
3. A square matrix is a matrix which has
   (A) exactly one row and one column
   (B) two rows and two columns
   (C) equal number of rows and columns
   (D) four rows and four columns
4. A scalar matrix is defined as a
   (A) square matrix that has all its entries outside the leading diagonal being zero
   (B) matrix of coefficients where all the non zero elements are on or above the leading diagonal
   (C) matrix where each non zero element are on or below the leading diagonal

(D) diagonal matrix whose diagonal elements are equal.

5. The determinant of a matrix having two identical rows equal (A) 4(B) 2 (C) 1 (D) 0
6. What happens to the new determinant if two rows of a determinant are interchanged?

   (A) The sign changes.

   (B) The result is doubled.

   (C) The result is halved.

   (D) The result is trebled.
7. Given the matrix A = $\begin{pmatrix} 1 & -6 \\ -3 & 15 \end{pmatrix}$, find it's determinant (A) 2 (B) 3 (C) -3 (D) -2
8. Using the matrix given in No. 7 above, find its inverse.

   (A) $\begin{pmatrix} -2 & -5 \\ \frac{1}{3} & -1 \end{pmatrix}$ (B) $\begin{pmatrix} -5 & -2 \\ -1 & -\frac{1}{3} \end{pmatrix}$ (C) $\begin{pmatrix} \frac{1}{2} & -3 \\ -\frac{3}{2} & \frac{15}{2} \end{pmatrix}$ (D) $\begin{pmatrix} \frac{1}{3} & -2 \\ -1 & 5 \end{pmatrix}$
9. Use Crammer's rule to solve the following system of equations over the field of real numbers

   $3x + 2y + z = 0$

   $5x + 2y + z = -2$

   $7x + 5y + 2z = 1$

   (A) (-1, -2, -3) (B) (1, 2, 3) (C) (-1, 2, -1) (D) (2, 1, -3)
10. If A = $\begin{pmatrix} 1 & 2 \\ 3 & 4 \end{pmatrix}$ and B = $\begin{pmatrix} 2 \\ 1 \end{pmatrix}$, find $B^T A^T$. (A) (4 10) (B) (6 8) (C) (3 4) (D) (10 6)
11. If $\begin{vmatrix} 3 & 4 & 5 \\ 1 & x & -1 \\ 1 & o & 1 \end{vmatrix}$ = 0, find the value of x (A) 2 (B) -4 (C) -1 (D) 3
12. If A = $\begin{pmatrix} 1 & 1 & 1 \\ 1 & -2 & 3 \\ 1 & 3 & -4 \end{pmatrix}$ and B = $\begin{pmatrix} 1 & -7 & -5 \\ -7 & 5 & 2 \\ -5 & 2 & 3 \end{pmatrix}$, find AB.

    (A) $\begin{pmatrix} -11 & 5 & 0 \\ 10 & 0 & -11 \\ 6 & 8 & 3 \end{pmatrix}$ (B) $\begin{pmatrix} 12 & -11 & 10 \\ 0 & -11 & 0 \\ 6 & -11 & 0 \end{pmatrix}$

    (C) $\begin{pmatrix} 0 & 0 & -11 \\ 0 & -11 & 0 \\ -11 & 0 & 0 \end{pmatrix}$ (D) $\begin{pmatrix} -11 & 0 & 0 \\ 0 & -11 & 0 \\ 0 & 0 & -11 \end{pmatrix}$

13. If $\begin{vmatrix} 3 & 5 & 1 \\ 0 & 4 & x \\ x & -1 & 6 \end{vmatrix}$ = 90, find the value of x . (A) (2 and 0)(B) (5/9 and 2)

(C) (-9/5 and 2) (D) (0 and -9/5)

14. Evaluate $\begin{vmatrix} 1 & 1 & 1 \\ 4 & 2 & 1 \\ 9 & -3 & 1 \end{vmatrix}$ (A) 10 (B) -20 (C) 30 (D)20

15. The process of adding to one equation a multiple of another equation in order to produce a more convenient set of equations with the same solution set is called (A) Elementary operations (B) Crammer's rule (C) Equivalent matrix (D) Systematic elimination

16. Find the eigen values of the matrix $\begin{pmatrix} 4 & 2 \\ 1 & 3 \end{pmatrix}$ (A) (4,3) (B) (2,1) (C) (3,2) (D) (2,5)

17. Find the corresponding eigen vectors of the matrix $\begin{pmatrix} 4 & 2 \\ 1 & 3 \end{pmatrix}$ as given in No. 16 above (A) $\begin{pmatrix} -3 \\ 1 \end{pmatrix}$ and $\begin{pmatrix} -2 \\ 1 \end{pmatrix}$ (B) $\begin{pmatrix} -1 \\ 1 \end{pmatrix}$ and $\begin{pmatrix} 2 \\ 1 \end{pmatrix}$ (C) $\begin{pmatrix} 1 \\ 4 \end{pmatrix}$ and $\begin{pmatrix} 3 \\ 2 \end{pmatrix}$ (D) $\begin{pmatrix} 1 \\ 2 \end{pmatrix}$ and $\begin{pmatrix} 3 \\ 4 \end{pmatrix}$

18. Cayley Hamilton's theorem states that (A)Equivalent matrices have the same rank (B) The (row) rank of a matrix always equals its column rank (C) Similar matrices have the same characteristic polynomial (D) Every square matrix satisfies its characteristic equation,

19. Let $A \in M_{m,n}(F)$, then a non homogeneous system of linear equations Ax = Y is consistent if and only if the coefficient matrix A and the augmented matrix (A,Y) have the same (A) eigen value (B) eigen vector (C) characteristics (D) rank

20. Find the characteristic polynomial for the matrix over $\Re$ given that

$A = \begin{pmatrix} 2 & 1 & 1 \\ 1 & 2 & 1 \\ 1 & 1 & 2 \end{pmatrix}$ (A) $\lambda^3 + 4\lambda^2 - 8\lambda + 12$ (B) $-\lambda^3 + 6\lambda^2 - 9\lambda + 4$

(C) $\lambda^3 + 6\lambda^2 + 9\lambda + 4$ (D) $-\lambda^3 - 4\lambda^2 + 8\lambda - 6$

21. A matrix A is said to be equivalent to another matrix B if B can be obtained from A by (A) Crammer's rule (B) Equivalent matrix (C) Elementary operation (D) Systematic elimination

22. The following except one are true of matrix A to be a row-reduced echelon matrix or in row-reduced echelon form if

(A) the leading entry in any non-zero row is 1

(B) Ci is a column containing a leading entry 1, then the entries in Ci below 1 are zeroes. Also each zero row in A is below all the non-zero rows of A

(C) there are r non-zero rows and the leading entry in row i appears in column l_i for i = 1, 2, 3, … r.

(D) there are no row that will not contain element 1.

If one of the value of λ for which the system of linear equations

$(2 - \lambda)x + 2y + 3 = 0$

$2x + (4 - \lambda)y + 7 = 0$

$2x + 5y + 6 - \lambda = 0$

are consistent is 1. Use this information to answer questions 23 and 24

23. Find the rank of augmented matrix (A) 1 (B) 2 (C) 3 (D) 4

24. Find the values of x and y (A) x = 1, y = 1 (B) x = -5, y = 3 (C) x = -5, y = 1 (D)x = -1, y = 3

25. Solve the equations:

$p + q + r = 4$

$4p + 2q + r = 12$

$9p - 3q + r = 32$

(A) (-1, -2, -7) (B) (2,1,-7) (C) (-7,-1,2) (D) (7,1,-2)

26. Given that $A = \begin{pmatrix} x+3 & -1 & 1 \\ 7 & x-5 & 1 \\ 6 & -6 & x+2 \end{pmatrix}$, evaluate |A|. (A) $x^3 + 2x^2 - x - 8$

(B) $x^3 - 12x + 6$ (C) $x^3 - 2x^2 + 12x - 16$ (D) $x^3 - 12x - 16$.

27. Find the eigen values of the matrix $\begin{pmatrix} 1 & 4 \\ 2 & 3 \end{pmatrix}$. (A) -2 and 5 (B) 3 and 4 (C) 5 and -1 (D) 2 and 3

28. Evaluate $\begin{bmatrix} q+r & p & p \\ q & p+r & q \\ r & r & p+q \end{bmatrix}$ (A) $pq + q^2 - qr$ (B) $p^2q + pq^2 + p^2r - pr^2$ (C) 4pqr (D) 0

29. The vectors x = (1,2,1), y = (0,0,3), z = (2,4,0) form a linearly dependent set in R^3 for example with (A) 5x – 7y + 2z (B) 6x – 2y – 3z (C) 4x + 3y + 5z (D)2x + 8y – 6z

30. The number of elements in any basis of a finite-dimensional vector space V is called the (A) subspace of V (B) rank of V (C) vector space of V (D) dimension of V

31. The kernel and the image of a linear transformation T are (A) Linear transformation (B) Vector subspaces (C) Scalars (D) Equivalent matrices.

32. The dimension of the image of a transformation i.e. the range $T\{V_n(F)\}$ is called the (A) basis of T (B) subspace of T (C) rank of T (D) kernel of T

Use the given matrix to answer questions 33 to 36

$$A = \begin{pmatrix} 1 & 0 & -1 & 2 \\ 1 & 3 & 1 & 6 \\ 1 & 5 & -1 & 16 \\ 4 & 1 & 0 & 2 \end{pmatrix}$$

33. Reduce matrix A to the row-reduced echelon form

A $\begin{pmatrix} 1 & 0 & -1 & 2 \\ 0 & 1 & -26/3 & 23/3 \\ 0 & 0 & 1 & 5 \\ 0 & 0 & 0 & 1 \end{pmatrix}$ B $\begin{pmatrix} 1 & 0 & -1 & 2 \\ 0 & 1 & 6 & 5 \\ 0 & 0 & 1 & 4/3 \\ 0 & 0 & 0 & 0 \end{pmatrix}$

C $\begin{pmatrix} 1 & 0 & -1 & 2 \\ 0 & 1 & \frac{2}{3} & \frac{4}{3} \\ 0 & 0 & 1 & \frac{-11}{5} \\ 0 & 0 & 0 & 0 \end{pmatrix}$ D $\begin{pmatrix} 1 & 0 & -1 & 2 \\ 0 & 1 & 3 & 7 \\ 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 \end{pmatrix}$

34. Find the rank of matrix A . (A) 4 (B) 3 (C) 2 (D) 1

35. Find the dimension of matrix A. (A) 4 (B) 3 (C) 2 (D) 1

36. What is the status of matrix A from the row reduced echelon form (A) linearly spaced (B) linearly ranked (C) linearly independent (D) linearly dependent

37. Given that I is (2x2) unit matrix and A = $\begin{pmatrix} 1 & 2 \\ -1 & 3 \end{pmatrix}$. Determine the constants k and m such that $A^2 = kA + mI$ (A) k = 1, m= -2 (B) k = 3, m =4 (C) k = 4, m = -5 (D) k = 2, m= -3

Let A be the subspace of $\Re^4$ generated by (0,0,1,1), (2,2,-1,-1) and (1,1,0,0). Use this information to answer questions 38 and 39

38. Find its dimension (A) 0 (B) 1 (C) 2 (D) 3

39. Find its bases (A) [(1,1,0,0), (0,0,1,1)] (B) [(0,0,1,1)(2,2,1,1)] (C)[(1,1,0,0)(0,0,-1,1)] (D) [(0,0,1,1)(-2,-2,1,1)]

40. Given that

A = $\begin{pmatrix} 3 & 0 & 2 & 2 \\ -6 & 42 & 24 & 54 \\ 21 & -21 & 0 & -15 \end{pmatrix}$

Find the rank of A. (A) 3 (B) 2 (C) 1 (D) 0

APPENDIX II

Answer to PRETMAT

1.	B	21.	C
2.	D	22.	D
3.	C	23.	B
4.	D	24.	C
5.	D	25.	C
6.	A	26.	D
7.	C	27.	C
8.	B	28.	C
9.	C	29.	B
10.	A	30.	D
11.	B	31.	B
12.	D	32.	C
13.	C	33.	C
14.	B	34.	B
15.	D	35.	B
16.	D	36.	D
17.	B	37.	D
18.	D	38.	C
19.	D	39.	A
20.	B	40.	B

APPENDIX III

UNIVERSITY OF IBADAN

DEPARTMENT OF TEACHER EDUCATION

PRE-SERVICE TEACHERS' ATTITUDES TOWARDS MATHEMATICS

(PRETATOM)

SECTION A – PRE-SERVICE TEACHER'S BIODATA

Please, provide the required information about yourself.

Name:_____

Level:_____

College:_____

State:_____

Gender: M [ ] F [ ]

Age: _____

INSTRUCTIONS

SECTION B

You are required to respond by putting (√) in any of the columns to each of the items on a four-point scale: Strongly Agree (SA); Agree (A); Disagree (D); Strongly Disagree (SD). You are simply asked of your personal opinion hence there is no right or wrong answer. Mark only one of the four options to each statement.

S/N		SA	A	D	SD
1.	I like solving Mathematics problems				
2.	Knowing Mathematics will help me earn a living				
3.	Mathematics is a very difficult subject				
4.	There are too many facts to learn in Mathematics				
5.	Mathematics helps me to develop good reasoning ability				
6.	I feel happy when I solve Mathematics problems				
7.	I like to help others with Mathematics problems				
8.	I feel challenged when I am given a difficult Mathematics problem				

9.	I enjoy solving mathematical puzzles and quizzes				
10.	Working Mathematics with others makes me happy				
11.	Mathematics is harder for me than most people				
12.	No matter how hard I try I still don't perform well in Mathematics				
13.	I will work for a long time in order to understand a new idea in Mathematics				
14.	I usually feel calm when doing Mathematics				
15.	I take Mathematics to be fun				
16.	When a problem is difficult for me to solve, I feel as though I am lost.				
17.	If I had my choice I would not learn Mathematics any more				
18.	There are many different ways of solving Mathematics problems				
19.	Learning Mathematics involves mostly memorizing				
20.	Trial and error can often be used to solve Mathematics problems				
21.	There is always a rule to follow in solving a Mathematics problem				
22.	Mathematics helps one to think logically				
23.	Mathematics lecturers shows us different ways of solving the same problem				
24.	Mathematics learning requires more thinking about the methods of solving problems than memorizing rules and formulae				
25.	Too much emphasis is placed by my Mathematics lecturers on the answer to problems than the steps towards the answers.				
26.	When working assignments, my Mathematics				

	lecturers expect us to follow the rules and procedures taught for solving problems even though there are other ways of solving it				
27.	Credit should be given to correct procedures for solving problems if the answers are incorrect				
28.	I make frequent consultation with library materials in solving Mathematics problems.				
29.	I always represent my school in external Mathematics competition.				
30.	Mathematics is an interesting subject.				
31.	I enjoy Mathematics.				
32.	Mathematics is important to everyone's life.				
33.	I prefer learning Mathematics to other subjects.				
34.	The feeling I have towards Mathematics is a good one				
35.	I gained nothing in studying Mathematics				
36.	Mathematics does not terrify me.				
37.	The mood/feeling of my lecturers does not affect my state of learning Mathematics concept.				
38	It is easy learning Mathematics.				
39.	Learning Mathematics does waste a lot of time than necessary.				

APPENDIX IV

SELF EFFICACY QUESTIONNAIRE FOR PRE-SERVICE MATHEMATICS TEACHERS *(SEQPREMAT)*

S/N		Never	Sometimes	Often	Usually
1.	I feel confident enough to ask questions in my Mathematics class.				
2.	I believe I can do well on a Mathematics test.				
3.	I believe I can complete all of the assignments in a math course.				
4.	I believe I am a kind of person who is good at Mathematics.				
5.	I believe I will be able to use math in my future career when needed.				
6.	I believe I can understand the content in a Mathematics course.				
7.	I believe I can get an “A” when I am in a Mathematics course.				
8.	I believe I can learn well in a Mathematics course.				
9.	I feel confident when taking a Mathematics test.				
10.	I believe I am the type of person who can do Mathematics.				
11.	I feel that I will be able to do well in future Mathematics courses.				
12.	I believe I can do the Mathematics in a Mathematics course.				
13.	I believe I can think like a Mathematician.				
14.	I feel confident when using Mathematics				

	outside of school.				

APPENDIX V

PEER INFLUENCE QUESTIONNAIRE FOR PRE-SERVICE MATHEMATICS TEACHERS *(PIQPREMAT)*

S/N		SA	A	DA	SD
1.	I have friends that teach me Mathematics				
2.	Most of what my parents cannot teach me in Mathematics I learn from my peers				
3.	I cherish being in the company of my friends who talk about Mathematics than any other thing				
4.	My friends and I engaged in youthful exuberance but still give time for learning Mathematics				
5.	I have some notorious friends but they are good at Mathematics				
6.	My drinking habit is influenced by my peers who teach me Mathematics				
7.	My friends who teach me Mathematics connect me with friends of shady character				
8.	I learnt bad habits from my friends who teach me Mathematics				
9.	My friends who teach me Mathematics often take me out for enjoyment				
10.	My friends who teach me Mathematics often teach me how to secure freedom from the lecturers				

APPENDIX VI

UNIVERSITY OF IBADAN

DEPARTMENT OF TEACHER EDUCATION

MATHEMATICS LECTURER'S QUESTONNAIRE *(MALEQ)*

SECTION A

This questionnaire is meant for teachers of Mathematics in Colleges of Education. Your responses are very important in helping to describe Mathematics classes in Nigerian Colleges of Education. There is no 'right' or 'wrong' answer to any of these items. Your cooperation in completing this questionnaire will be greatly appreciated. It is primarily designed to improve our mathematical teaching for better achievement of our students. Thanks for the time, effort and thought in completing this questionnaire.

Name of College_____

Sex: M [ ] F [ ]

Qualification: B.Sc/B.Sc(Ed) M.Ed/M.Sc Ph.D

Teaching Experience: 1-4 years 5-8 years 9-12 years

13-16 years 17 years^{+}

You are required to respond by ticking (√) in any of the columns to each of the items on a four-point scale indicated below:

Strongly Agree (4)

Agree (3)

Disagree (2)

Strongly Disagree (1)

SECTION B

LECTURER'S ATTITUDE TOWARDS MATHEMATICS TEACHING *(LATMAT)*

S/N		SA	A	D	SD
1.	Mathematics is primarily an abstract subject.				
2.	Mathematics is a formal way of representing the real world				
3.	Mathematics is primarily a practical structured guide for addressing real situations.				
4.	If students are having difficulty, an effect approach is for the teacher to give them more practice during the class.				
5.	Some students have natural talents for Mathematics and others do not.				
6.	More than one representation (picture, concrete material, symbol set etc) should be used in teaching any Mathematics topic.				
7.	Mathematics should be learned as a set of algorithms or rules that cover all possibilities.				
8.	A liking for and understanding of Mathematics by students are essential for teaching Mathematics.				
9.	Mathematics is a very difficult subject to teach.				
10.	I am compelled to teach Mathematics.				
11.	I teach Mathematics because I have no option				
12.	I am not competent to teach some topics in Mathematics effectively.				
13.	Shortage of equipments does not give room for effective teaching of Mathematics.				
14.	Mathematics teachers should be given special stipend to motivate them to teach Mathematics.				

APPENDIX VII

MATHEMATICS LECTURERS' PERCEPTION TO TEACHING RATING SCALE *(MALPETERS)*

There are statements to be considered in the context of the college in which you work and your actual working environment. Think about how well the statements describe your school environment. Indicate your answer by ticking **Yes** or **No**. If you change your mind about a response, cross out the old answer and tick the new choice. Thank you very much for your cooperation.

SECTION A

S/N		Yes	No
1.	I discuss teaching methods and strategies with each other.		
2.	There is much experimentation with different teaching approaches.		
3.	I display facility with strategic questioning tactics.		
4.	My questions are relevant and answerable.		
5.	My questions are evenly distributed.		
6.	The extent to which I use specific techniques to develop enthusiasm for learning should be encouraged.		
7.	I satisfactorily handle students' problems		
8.	Students and I review answers to questions.		
9.	I use simple methods to support the use of mental imagery.		
10.	I provide initial background knowledge to anchor the new one with aids of the imagery.		

SECTION B

In your mathematics lesson, how often do you usually ask students to:

S / N		Never or almost never	Some lessons	Most lessons	Every lessons
1	Explain the reasoning behind an idea ……..				
2	Represent and analyze relationship using tables, charts, or graphs ……				
3	Work on problems for which there is no immediately obvious method of solution …….				
4	Use computers to solve exercises or problems..				
5	Write equations to represent relationships……				
6	Practice computational skills…….				
7	Use graphing calculators to solve exercises or problems……				

APPENDIX VIII

UNIVERSITY OF IBADAN

DEPARTMENT OF TEACHER EDUCATION

SCHOOL FACTORS QUESTIONNAIRE (SFAQ)

QUESTIONNAIRE ON INFRASTRUCTURE AND INSTRUCTIONAL MATERIALS

These are statements to be considered in the context of the College where you are schooling. The questionnaire seeks for information on infrastructural and instructional materials available for lecturer's use in the College for the teaching of Mathematics. Think about how well the statements describe your school environment. Indicate your answer by ticking either True or False.

Thanks very much for your cooperation.

SECTION A

NAME OF COLLEGE:_____

TYPE OF SCHOOL: PRIVATE [ ] PUBLIC [ ]

GENDER: FEMALE [ ] MALE [ ]

SECTION B

S/N		True	False
1.	The school library includes an adequate selection of books and periodicals.		
2.	The supply of equipments and resources is inadequate.		
3.	Adequate copying facilities and services are available to lecturers.		
4.	Mathematical instruments are available when needed.		
5.	Facilities are inadequate for catering for a variety of classroom activities and learning groups of different sizes.		
6.	There is mathematics laboratory in your school		
7.	Your laboratory is well equipped.		
8.	Your school is beautiful.		
9.	Your school is renovated at regular interval.		

10.	Your school is beautifully laid out.		
11.	Your school is always kept clean.		
12.	Your school depicts a calm atmosphere.		
13.	Your school have medical facility for the students.		
14.	Your library is well equipped.		
15.	There is graph board in your school.		
16.	There are geometric models and shapes		
17.	The instructional materials are adequately and appropriately used.		

QUESTIONNAIRE ON TEXTUAL MATERIALS

This questionnaire is expected to be filled by pre-service mathematics teachers in each of the colleges considered for this study. Kindly indicate your choice.

S/N		True	Almost True	False
1.	Using additional textbook as supplement to course material will be too expensive for students to afford.			
2.	Other textbooks are readily available than our course materials.			
3.	Other textbooks are cheaper and better than our course materials.			
4.	Other text materials support self-learning (i.e personal studying) than course materials.			
5.	I prefer to use more other books alongside with course materials.			
6	I enjoy Mathematics better with another textbook.			
7.	I want us to change to using textbooks only.			
8.	Important resource books are available when needed.			
9.	I am very interested in reading Mathematics textbook.			

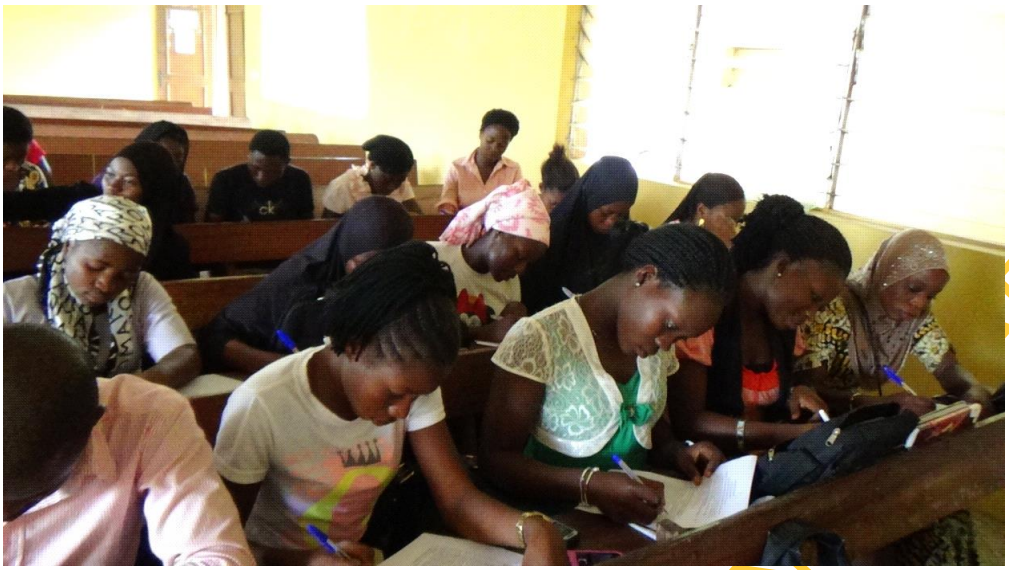

Plate 1: Pre-service teachers solving achievement test in one of the colleges.

Plate 2: Pre-service teachers solving achievement test in one of the colleges.

Plate 3: Pre-sesrvice teachers solving achievement test while a research assistant supervises.

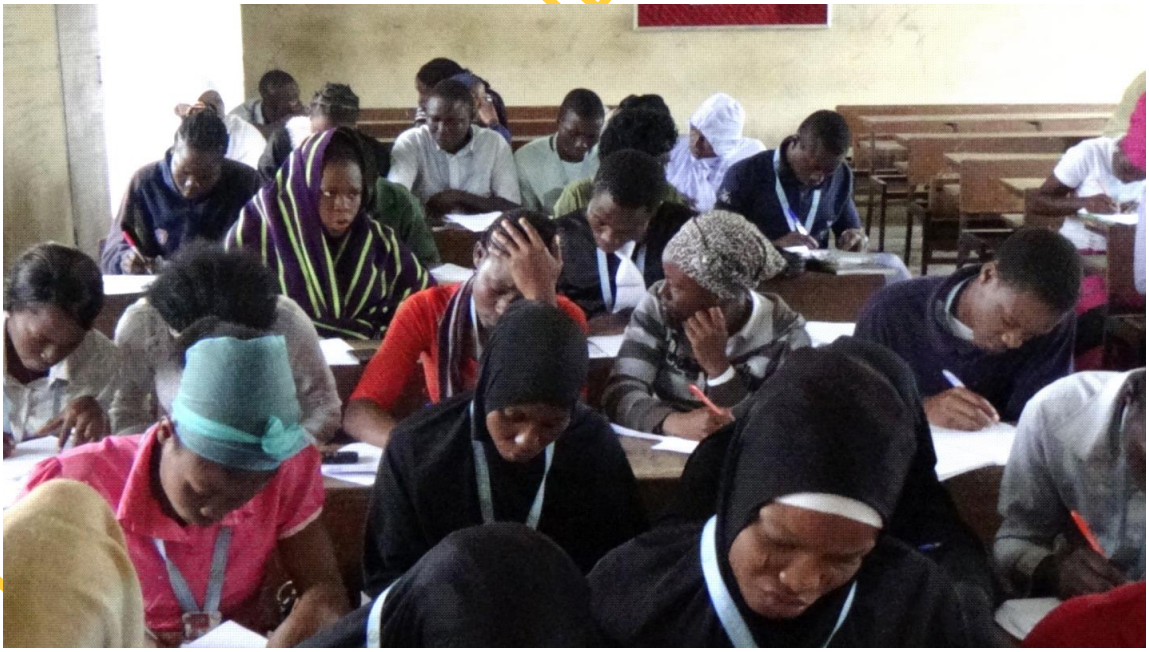

Plate 4: Pre-service teachers completing questionnaires in one of the colleges

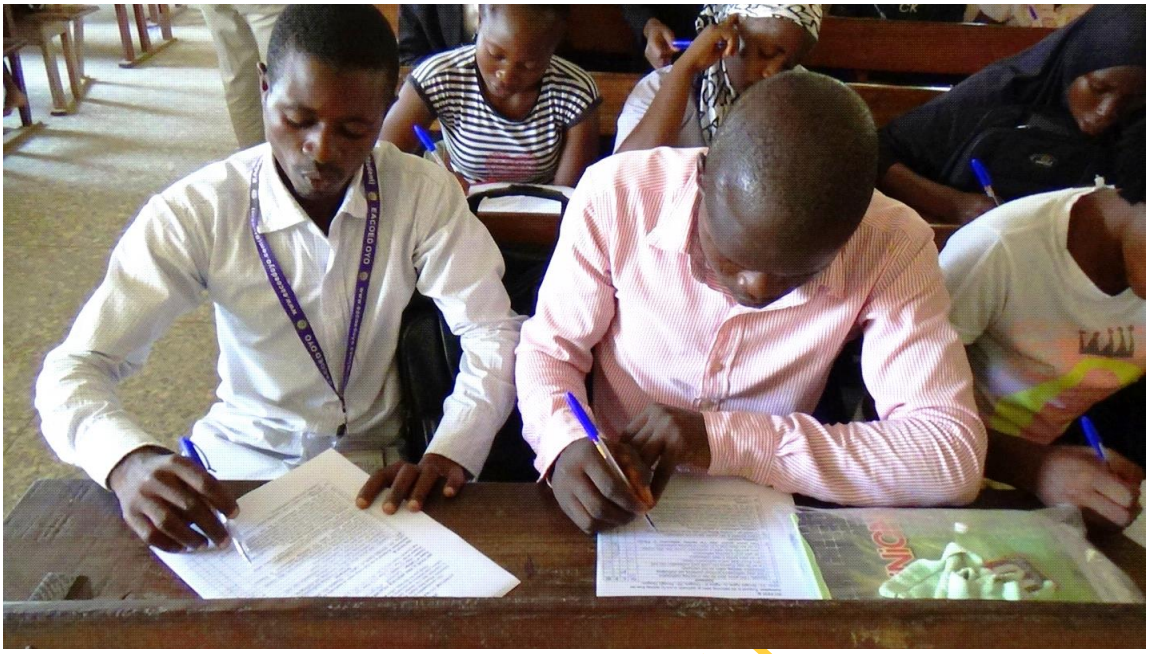

Plate 5: Pre-service teachers solving achievement test in one of the Colleges

Plate 6: Pre-service teachers solving achievement test in one of the Colleges used

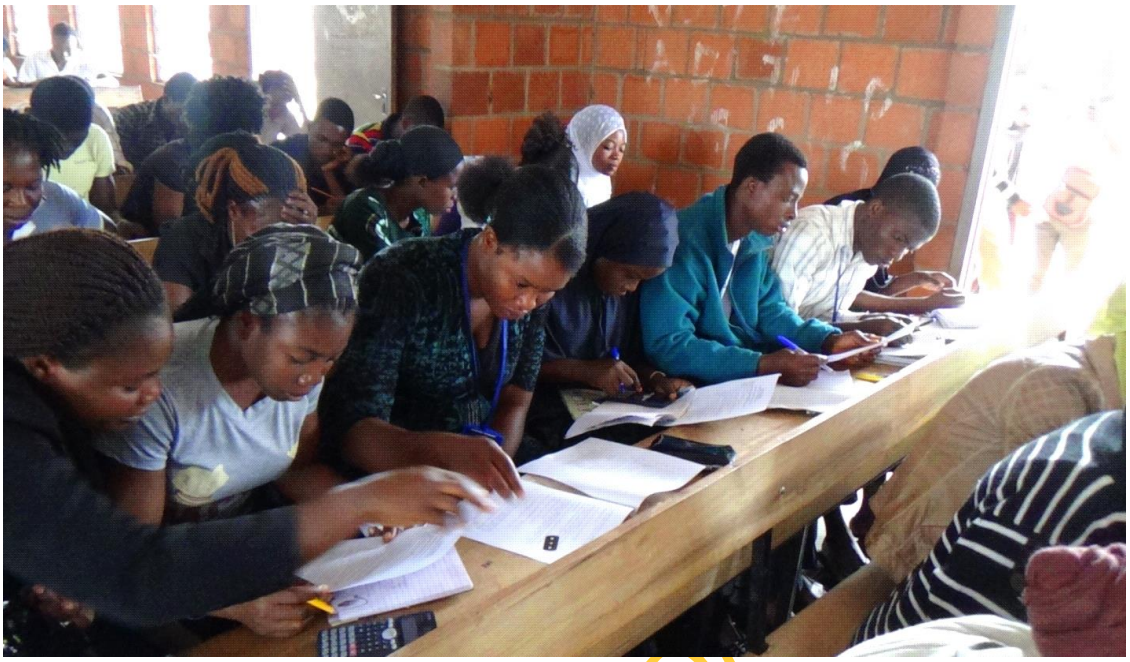

Plate 7: Pre-service teachers completing questionnaires in one of the colleges

Plate 8: Pre-service teachers solving the achievement test in one of the colleges