TEACHING ANXIETY, EPISTEMOLOGICAL BELIEF, SUCCESS EXPECTANCY, TEACHING APTITUDE, AND EMOTIONAL INTELLIGENCE AS PREDICTORS OF PRE-SERVICE TEACHERS' ACHIEVEMENT IN AND ATTITUDE TO MATHEMATICS

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A THESIS IN THE DEPARTMENT OF TEACHER EDUCATION, SUBMITTED TO THE FACULTY OF EDUCATION, IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE DEGREE OF DOCTOR OF PHILOSOPHY (PhD.) OF THE UNIVERSITY OF IBADAN

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ABSTRACT

Mathematics is the bedrock of scientific and technological development; hence, adequate measure must be taken to improve students' achievement in and attitude towards the subject at all levels of education especially at Colleges of Education because mathematics teachers plays an important role in its development. Reports from Colleges of Education revealed that pre-service teachers' achievement in and attitude to Mathematics are poor. Previous studies focused on effective strategies of teaching Mathematics to pre-service Mathematics teachers without considering the extent to which psychological variables could predict their achievement in and attitude towards the subject. This study, therefore, investigated Mathematics Teaching Anxiety (MTA), Epistemological Belief (EB), Success Expectancy (SE), Teaching Aptitude (TA) and Emotional Intelligence (EI) as predictors of pre-service teachers' achievement in and attitude to Mathematics in the South-west, Nigeria.

Psychoanalytic theory provided the framework. The survey design of correlational type was adopted while multi-stage sampling technique was used to select the pre-service Mathematics teachers'. At the first stage, a total enumeration sampling technique was used to select 11 Colleges of Education (four federal and seven state) in the South-west, Nigeria. At the second stage, purposive sampling technique was used to select 1450 (300 Level) pre-service mathematics teachers (656 male and 794 female) and their age range between 20 to 28 years. Seven research instruments [MTA (r=.77), EB(r=.83), SE(r=.75), EI (r=.81) and Attitude towards Mathematics (r=.83) scales, TA (r=.84) and Mathematics Achievement (r=.89) tests] were used to collect data. Data were analysed using descriptive statistics, Pearson product moment correlation and Multiple regression at 0.05 level of significance.

Mathematics Teaching Anxiety (r=.10), Success Expectancy (r=.05) and Teaching Aptitude (r=.42) positively correlated with pre-service teachers' achievement in Mathematics. Mathematics Teaching Anxiety (r=.29), Epistemological Belief (r=.34), Success Expectancy (r=.48), Emotional Intelligence (r=.29) positively correlated with Pre-service teachers' attitude towards Mathematics. Psychological variables had significant composite contribution to both pre-service teachers' achievement ($F_{(5.1446)}$=60.97,Adj.R^2=.171) in and attitude towards Mathematics ($F_{(5.1446)}$=130.21, Adj R^2 0.308). This implies that 17.1% of the variance in the achievement in Mathematics and 30.8% of the variance in the attitude towards Mathematics were accounted for by the five predictor variables taken together. Only Teaching Aptitude had a significant relative contribution to achievement in Mathematics (β=.41; t=16.91) while Emotional Intelligence (β =.15;t=8.49),Mathematics Teaching Anxiety (β =.11; t=5.68) and Epistemological Belief (B=0.01; t=5.90) had significant relative contributions to pre-service Mathematics teachers' attitude to Mathematics.

High Teaching Aptitude had a positive influence on achievement in Mathematics among the pre-service teachers while high Emotional Intelligence, low Mathematics Teaching Anxiety and Epistemological Belief were strong determinants of pre-service teachers' attitude to Mathematics. Educational policy makers and school administrators should, therefore, factor the variables into Mathematics teachers' preparation programmes for improved learning outcomes.

Keywords: Mathematics Teaching Anxiety, Epistemological Belief, Teaching Aptitude, Emotional Intelligence and Achievement in and Attitude towards Mathematics

Words counts: 443

CERTIFICATION

I certify that this work was carried, out under my supervision, by TEMITOPE OLADOKUN **AJANI, Matric** No: 124660 in the Science and Mathematics unit of the Department of Teacher Education, University of Ibadan, Ibadan.

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DEDICATION

This work is dedicated to the Immortal, Invisible, the only wise God, the King of Kings, the Lord of Lords, the Alpha and Omega, the beginning and the end of all things, the author of Life and giver of every good and perfect gift…and, to my Treasure, my life, my love ABIOLA OLUWAYEMISI OLUWAYOMBO AJANI and my lovely children.

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TABLE OF CONTENTS

LIST OF ABBREVIATION

MA	-	Mathematics Anxiety
MATA	-	Mathematics Teaching Anxiety
MATAS	-	Mathematics Teaching Anxiety Scale
EB	-	Epistemological Belief
EBS	-	Epistemological Belief Scale
TA	-	Teaching Aptitude
TAT	-	Teaching Aptitude Test
SE	-	Success Expectancy
SES	-	Success Expectancy Scale
EI	-	Emotional Intelligence
EIS	-	Emotional Intelligence Scale
MAT	-	Mathematics Achievement Test
ATMS	-	Attitude towards Mathematics Scale
MTEBI	-	Mathematics Teaching Efficacy Belief Instrument
R-MANS	-	Revised-Mathematics Anxiety survey
NCATE	-	National Council for Accreditation of Teacher Education
PTAQ	-	Parent Teacher Attitude Questionnaire
GPA	–	Grade point Average
INTASC	-	Interstate New Teacher Assessment and Support Consortium
NGO	-	Non-Governmental Organisation

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

CHAPTER ONE
INTRODUCTION

1.1 Background to the Problem

Mathematics is an essential school subject which is relevant in all spheres of life. Evolving from elementary practices of counting, measuring and describing the shapes of objects, Mathematics is also scientific in structure, order and relation. It is a creation of the human mind, concerned primarily with ideas, processing and reasoning. Thus, Mathematics is much more than arithmetic—the science of numbers and computation. It is more than algebra—the language of symbols and relation—and geometry—the study of shape, size and space. Oyeniran (2000) describes Mathematics as a way of thinking and a way of organizing a logical proof. It can be used to determine whether or not an idea is true or probably true. As a way of thinking, it is used to solve all kinds of problems in the sciences, government, and industry. As a way of reasoning, it gives insight into the power of the human mind and provokes intellectual thoughts.

Mathematics is an important subject in the development of science and technology, and its mastery requires dedicated efforts.Obe (1996) conceptualises Mathematics as the core pillarof most disciplines, a source of enlightenment and understanding of the universe. He further opines that without Mathematics, the understanding of national problems would be superficial. Graeber and Weisman (1995) agree that Mathematics helps the individual to understand his/her environment and to give accurate account of the physical phenomena around him/her. Setidisho (2001) submits that no other subject forms a strong binding force among various branches of science as Mathematics does, and without it, knowledge of the sciences often remains superficial. The importance of Mathematics permeates all aspects of human endeavour. Increasingly, application for the best employment opportunities would need a good grasp of Mathematics and computer technology (Adewale and Amoo, 2004).

Nasir (2001) also sees Mathematics as a precise and an indispensable tool used by engineers and scientists, and other professionals in their search for a clear understanding of the physical world. He further stresses that Mathematics is mostly considered as a tool because it provides the skills for problems solving, organising,

simplifying and interpreting data as well as performing calculations that are necessary in fields, such as science, business and industry.

Adedayo (2007) considers Mathematics as the key to a productive and fulfilling life. To her, Mathematics is regarded as the key to performing many diversified functions in life. It is the key to career aspiration, cognitive development, successful daily living, scientific development, modernisation, successful career, productive employment, good citizenship and good living. Also, Kolawole and Olutayo(2005) state that application of Mathematical principles to everyday living cannot be exhausted. According to Ajani,Areelu and Odeyemi(2011), Mathematics has been discovered to be of a great importance to man in hisdaily activities. Akinsola, Okanlawon and Ajani(2014) aver that 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 across all fields where it is used by every member of the society. Ogunbanjo (1998) opines that all over the world, science has been accepted as a vehicle of technology, social and economic development. Mathematics is not only basic to these sectors but is also the language of science. Igbokwe (2003) highlights the connection between Mathematics and Science and Technology. The author, therefore, contends that without Mathematics, there will be no science, and without science there will be no technology, and without technology there will be no modern society.

Mathematics is the foundation of science and technology without which a nation can never become prosperous and economically independent. In order to train the required highly skilled personnel needed for science, technology and the industry, mathematical competence is essential. It is the central discipline of any modern society. Mathematics forms the basis of all engineering science, whether basic or technical. Modern technology, as evident in the provision of social amenities, comfortable and quick means of transport and the advancement in industries, has been made possible through competence in, and application of, Mathematical principles.

The revised National Mathematics Curriculum for Basic Education in Nigeria focused on giving children the opportunity to:

- acquire mathematical literacy necessary to function in information age;
- cultivate the understanding and application of Mathematics skills and concepts necessary to thrive in the ever- changing technological world;

- develop the essential elements of problem solving, communication, reasoning and connection within their study of Mathematics; and
- understand the major ideas of Mathematics, bearing in mind that the world has changed and is changing since the first national Mathematics curriculum was developed in 1977(NERDC, 2007).

According to NERDC (2007), these objectives gave rise to the need to make the curriculum more responsive to the survival and developmental needs of the Nigeria child. Unlike the previous curriculum, the revision placed emphasis on affective domain and quantitative reasoning.. This emphasis on affective domain and quantitative reasoning is based on the belief that a love for, and positive attitude towards, Mathematics will boost pupils' achievement in cognitive and psychomotor capabilities. Encarta (2008) defines 'affective' as an external expression of emotion associated with an idea. Affective, therefore, underscores some pre-existing ideas informing emotional expression. In particular, it is expected that mathematical ideas should influence students' emotion and action.

Despite the importance of Mathematics to societal development, it is a subject that many students fear, fail and possibly dislike (Areelu, 2014).Mathematics has always been perceived as the most difficult subject in the school curriculum (Poopola and Ajani, 2011). This has resulted in learners having a negative attitude towards the subject and this attitude seems to have existed from one generation to another. Learners, including adults, who have failed Mathematics at one time or the other, preserve this image of failure and justify their failure by devaluing the importance of the subject – an attitude that influences the efforts that educator put into the teachingof the subject (Ajani and Konku, 2012).

The foregoing reasons are why the Nigerian government believed that the subject should be taken seriously in our school system since it is vital to technological development. The Government has not only made Mathematics a compulsory subject at all levels of the Nigerian educational system, but it has also made the subject a prerequisite to the study of science related courses in colleges, polytechnics and universities (JAMB Brochure, 1992-2014; Federal Republic of Nigeria, 2013).

Efforts to enhance students' performance in, and attitude to, Mathematics have led scholars to come up with various student/learner-centred strategies, such as Activity-Based method (Salami, 2014), and Computer Assisted Instruction (Kara,

2011).. Despite the fruitful insights provided by these studies to the teaching and learning of Mathematics, the trend of poor performance in Mathematics still persists. The implication here is that there is more to the problem of poor learning outcomes in Mathematics than improving the teaching strategies. Majority of the efforts are being targeted at teachers because it is believed that when there are good teachers there will be effective teaching of the subject and learner's performance will be improved.

Several experimental studies have been carried out on the preparation of pre-service teachers in Mathematics (Salami,2014; Olosunde,2009; Olaleye,2004 and Akinsola,2004) in the search forthe best way to prepare mathematics teachers, so that they can teach the subject effectively. However, teachers are still using direct instruction and students' performances have not improved. To make matters worse, the pre-service mathematics teachers that are being prepared are not performing up to expectation, even with the experimental studies as well as the efforts of NGOs and other organisations with series of intervention programmes. The performanceof pre-service mathematics teachers is not encouraging. Thus, in recognition of this fact,Psychologists, Mathematics educators and researchers in the field of education have advocatedthe shift of research attention from pedagogical to psychological variables that influencestudents' achievement in Mathematics and attitude their towards Mathematics (Adegoke,2006 ;Adeleke,2007; Aguele and Usman, 2007 ; Akinsola,2009 and Oduwaiye and Onabanjo,2010).The analyses of pre-service Mathematics teachers' results in some colleges of education in Nigeria are presented in Tables1.1 – 1.3

Table 1.1: Final year results of Pre-service Mathematicsteachers' between 2007/2008 – 2011/2012 in federal college of education, Osiele, Abeokuta.

YEAR	TOTAL ENTRY OF CANDIDATE IN COLLEGE	ENTRY FOR MATHS		A		B		C		D		E		F	
		NO OF CAND	% OF CAND	NO OF CAND	% OF CAND	NO OF CAND	% OF CAND	NO OF CAND	% OF CAND	OF CAND	% OF CAND	NO OF CAND	% OF CAND	NO OF CAND	% OF CAND
2007/2008	1300	186	14.31	-	-	32	17.20	71	38.17	42	22.58	22	11.83	19	10.22
2008/2009	1370	221	16.13	-	-	43	19.46	73	33.03	63	28.51	24	10.86	18	8.14
2009/2010	1444	242	16.76	02	0.83	44	18.18	71	29.34	51	21.07	28	11.57	29	11.98
2010/2011	1500	214	14.27	05	2.34	45	21.03	74	34.58	45	21.03	27	12.62	28	13.08
2011/2012	1200	262	21.83	03	1.15	39	14.89	85	32.44	67	25.57	33	12.60	35	13.36
TOTAL	6814	1125	16.51	10	0.89	203	18.04	374	33.24	268	23.82	134	11.91	129	11.47

Table 1.2: Final year results of Pre-service Mathematics teachers' between 2007/2008 – 2011/2012 in Emmanuel Alayande College of education, Oyo, Oyo state.

YEAR	TOTAL ENTRY OF CANDIDATE IN COLLEGE	ENTRY FOR MATHS		A		B		C		D		E		F	
		NO OF CAND	% OF CAND	NO OF CAND	% OF CAND	NO OF CAND	% OF CAND	NO OF CAND	% OF CAND	NO OF CAND	% OF CAND	NO OF CAND	% OF CAND	NO OF CAND	% OF CAND
2007/2008	3236	179	5.53	01	0.56	16	8.94	30	16.76	36	20.11	20	11.17	76	42.46
2008/2009	2640	149	5.64	-	-	17	11.41	47	31.54	30	20.13	05	3.36	50	33.56
2009/2010	3122	126	4.04	07	5.56	31	24.60	38	30.16	21	16.67	04	3.17	25	19.84
2010/2011	2050	98	4.78	01	1.02	16	16.33	36	36.73	08	8.16	12	12.24	25	25.51
2011/2012	2182	110	5.04	05	4.55	26	23.64	40	36.36	19	17.27	09	8.18	11	10
TOTAL	13230	583	4.41	14	2.40	106	18.18	191	32.76	114	19.55	50	8.58	187	32.08

Table1.3: Final year results of Pre-service Mathematics teachers' between 2007/2008 – 2011/2012 in federal college of education (Special) Oyo, Oyo state.

YEAR	TOTAL ENTRY OF CANDIDATE IN COLLEGE	ENTRY FOR MATHS		A		B		C		D		E		F	
		NO OF CAND	% OF CAND	NO OF CAND	% OF CAND	NO OF CAND	% OF CAND	NO OF CAND	% OF CAND	NO OF CAND	% OF CAND	NO OF CAND	% OF CAND	NO OF CAND	% OF CAND
2007/2008	1986	48	2.42	-	-	06	12.5	20	41.47	10	20.83	08	16.67	04	8.33
2008/2009	2350	44	1.87	01	2.27	08	18.18	18	40.91	05	11.36	07	15.91	05	11.36
2009/2010	2100	82	3.90	03	3.66	07	8.54	35	42.68	20	24.39	05	6.10	12	14.63
2010/2011	2005	44	2.19	-	-	05	11.36	19	43.18	10	22.73	06	13.64	04	9.09
2011/2012	2000	52	2.60	02	3.85	04	7.69	20	38.46	16	30.77	04	7.69	06	11.54
TOTAL	10441	270	2.59	06	2.22	30	11.11	112	41.48	61	22.59	30	11.11	31	11.48

Tables 1.1, 1.2 and 1.3 above show the enrolment and performance of pre-service teachers' in the three colleges of education and the number of pre-service teachers who studied Mathematics as a course between 2007/2008 and 2011/2012. The benefit of having a positive attitude towards Mathematics cannot be under-estimated, because an individual's attitude influences not only how he/she sees the world around him/her but also how situations, circumstances, and the actions of others are interpreted by such an individual (Fritz,2008). Attitude is important in teaching and learning process (Akinsola,2009). Practising teachers' attitudes are particularly important because teachers' attitudes can influence their teaching methods (Wilkins, 2002) which, in turn could influence students' attitude (Duatepepaksu and Ubuz,2009).Thus, teachers have a critical role to play in the formation of their students' attitude and cognitive achievement (Akinsola,2013).

Attitude of students can be influenced by the attitude of the teacher and his method of teaching. Studies have shown that the teacher's personality and his method

of teaching greatly accounts for his attitude towards the teaching of mathematics.And withoutgenuine interest and personal effort in learning mathematics, students can hardly perform well in the subject. Students' attitudes toward mathematics can be an obstacle to their learning. This is supported by the relevant literature (Hembree, 1990; Sousa, 2001).A prior lack of success in a subject can lead to a student developing a lower self-concept and eventually avoidance of that subject (Sembera and Hovis, 1993). In order to successfully help students with negative or fearful attitude toward mathematics, the effects of their previous failures must be overcome. New positive experience must be facilitated in such a way that the student's self-confidence improves and the brain receives and integrates new information (Sousa, 2001).

The improvement of mathematics education for all students requires effective mathematics teaching in all classrooms. Current studies and reforms on education show the importance of teacher education and the need for improvement of pre-service teacher training (Wingfield and Ramsey, 1999). In addition, while striving to improve the pre-service teacher training in colleges of education, one could consider such factors as Mathematics teaching anxiety(Baloğlu, 2001; Akinsola, 2002; Peker,2009),Epistemological beliefs (Pomeroy, 1993), Teaching aptitude (Harmeet,2014), and Success Expectancy (Eccles and Wingfield, 2002) as well as Emotional Intelligence(Salovey and Mayer, 1990) and their influence on mathematics achievement and attitude.

Mathematics teaching anxiety has become a focus of interest to the education community. This is because individuals find themselves in situations or places requiring that they either use or learn Mathematics or both, (American Institute for the Improvement of Mathematics Learning and Instruction, 2005). An underlying assumption is that Mathematics anxiety is of interest only to those people who had been previously influenced by it, in career choices, for example, and those who are being influenced by it in contexts such as a Mathematics class or job skill. Mathematics anxiety is unimportant to an individual as long as he has no need for the subject, (Phillippe, 2001).

Since the 1960s, researchers have carried out many studies on Mathematics anxiety.Also, there haveevolveddifferent definitions of what constitutes Mathematics anxiety. Richardson and Suinn (1972) view it as feelings of tensions that interfere with the manipulation of numbers and the solving of mathematical problems in a wide variety of ordinary life and academic situations (as cited in Gierl and Bisanz, 1995).

Mathematics anxiety has to do with a sense of discomfort exhibited by a person when he is required to work on mathematical problems (Ma, 2003) and with fear and apprehension to specific math-related situations (D'Ailly and Bergering, 1992). Mathematics anxiety is a multifaceted construct with influencive and cognitive dimensions. Personality, self-concept, self-esteem, learning style, parental attitudes, high expectation of parents, negative attitudes toward Mathematics, avoidance of Mathematics, teachers' attitudes, ineffective teaching styles, negative school experiences and low degree of achievement in Mathematics are among the concepts and constructs that may induce or influenceMathematics anxiety (Bursal and Paznokas, 2006).

There are many other factors such as prior-knowledge, gender, instructional method, self-confidence, motivation, pedagogical content knowledge, and use of technology that mayinfluence students' anxiety and success in Mathematics (Iossi, 2007). For instance, according to Altermatt and Kim (2004), gender is a great factor influencing students' Mathematics anxiety. The authors stated that female students had higher anxiety level in Mathematics than male students do. Likewise, several studies claimed that having negative experiences in Mathematics can produce negative results in the learning and teaching of the subject (Uusimaki and Nason, 2004).Many students who suffer from Mathematics anxiety have little confidence in their ability to study the subject, and tend to take the minimum number of required Mathematics courses. This practice has greatly limited their career choice options (Garry, 2005). Mathematics anxiety is the outcome of low self-esteem and the fear of failure. It causes problems for processing the incoming information as well as the previously learnt information for problem solving. Such students that suffer from Mathematics anxiety tend to avoid the subject whenever or wherever possible (Daane and Tina, 1986).

In recent years, there have been many studies done on the Mathematicsteaching anxiety with pre-service teachers (Levine, 1996; Peker, 2006, 2008; Peker and Halat, 2008). For example, Peker and Halat (2008) investigated the gender-related differences in pre-service elementary school teachers' teaching anxiety about Mathematics. They found that there were no gender-related differences in Mathematics teaching anxiety between pre-service male and female elementary school teachers. Levine (1996) stated that pre-service elementary school teachers usually experience anxiety for teaching Mathematics and show feelings of

Mathematics anxiety. Furthermore, Peker (2006) found that there were several factors such as content knowledge, attitudes towards Mathematics, attitudes towards Mathematics teaching and self-confidence related to both Mathematics anxiety and Mathematics teaching anxiety.

A number of research outcomes indicate that abstract discussions regarding mathematical concepts increased the teaching anxiety of the pre-service teachers who had high level of anxiety for teaching Mathematics. However, using manipulative materials, getting familiar with developing creative teaching strategies for teaching Mathematics and learning to design lesson plans in mathematical concepts, reduced the teaching anxiety level of the pre-service teachers (Levine, 1996). Likewise, Sloan (2002) reported that using both manipulative materials and hands-on activities inMathematics method courses may reduce anxietyfor the subject. According to Vinsion (2001), pre-service teachers are better off in understanding Mathematics concepts and procedures when these are presented in a concrete way.

The incomplete cognitive level of a prospective teacher with insufficient content knowledge will also cause the development of various negative effective characteristics, one of which is Mathematics teaching anxiety. Levine (1996), on the one hand, states that the anxiety of prospective teachers, with high level of Mathematics teaching anxiety is related to their previous, insufficient knowledge of the subjectand unpleasant experiences they have. He found that prospective teachers, with Mathematics teaching anxiety, were also inadequate in learning how to teach thesubject and in how to produce necessary materials. On the other hand, Peker (2008) states that as the need for the concretization of the subject to be taught increased, so did the Mathematics teaching anxiety of the prospective teachers. However, literature cites some factors that influenceMathematics teaching anxiety. For example, Peker, (2009) and Peker and Halat (2009) observe that the teaching methods used in teacher training programs influence the Mathematics teaching anxiety of prospective teachers. Peker (2009) also states that the Mathematics teaching anxiety of prospective teachers differs according to their learning styles. However, it has also been pointed out that other factors that might be correlated with Mathematics teaching anxiety must also be investigated.

Another factor that influences teachers' behaviour and success in the classroom is 'epistemological belief'. Berman (1977,p.78) define epistemological belief as "the extent to which the teacher believes he or she has the capacity to

influence student performance". Guskey and Passaro (1994) provide another definition as "teachers' belief or conviction that they can influence how well students learn, even those who may be difficult or unmotivated" or teachers' comprehension over efficacy as "their beliefs in their ability to have a positive effect on students' learning".Pre-service teachers and their efficacy beliefs over Mathematics may shape their professional life. However, many argue that those beliefs should be considered as important for society, because the amount of sophistication of our epistemological beliefs is responsible for how we process information and what value we place on that knowledge (Hofer, 2002). Moreover studies indicated that investigating students' scientific epistemologies has had a long tradition in science education research (Solomon, Scott, and Duveen, 1996), and epistemological beliefs become an increasingly important dimension of educational research. Students' science epistemology views have been related to the extent, richness, and precision of their cognitive structure outcomes of science learning (Tsai, 1998) and to the level of performance on learning tasks requiring abstract problem solving (Novak, 1988).

Belief does not have a generally acceptteddefinition as opinions on it meaning differ. According to Beswick (2007) Ajzen and Fischbein (1980)belief is anything that an individual regards as true. Beliefs, whatever their source, are related to one another, forming systems inwhich related beliefs are connected (Ambrose, 2004).According to Opt,Eynde and Verschaffel (2002) as cited by Akinsola (2006), beliefs may be defined as the implicitly or explicitly held conceptions, understanding, premises, proportions and expectations that subjects hold to be true. According to them, beliefs are organised in complex belief systems which are characterised by cluster, structure, quasi-logicalness and psychological centrality. Within the belief systems of individuals, epistemological beliefs are considered to be core beliefs (Brownlee, 2002).

Epistemological beliefs, as conceived by educational psychologists, are beliefs about the nature of knowledge. Depending upon the theory, these may include beliefs about the certainty, source, justification, acquisition and structure of knowledge (Duell and Schommer-Aikins, 2001). Deryakulu (2004), however, defines epistemological beliefs in the widest sense as the subjective belief of individuals on what knowledge is, and how"knowing" and "learning" are realized. Most research regard epistemological beliefs as valid for all domains. However, Hofer (2000) suggest that epistemological beliefs are domain-specific (cited in: Banks, 2005).

Studies in different disciplines, especially those in the domains of Mathematics and science, show that epistemological beliefs can change from one domain to the other (Banks, 2005). One of the domains where the effects of epistemological beliefs on the behaviour of individuals can clearly be observed is Mathematics. Mathematical beliefs are considered as personal philosophies or conceptions about the nature of Mathematics as well as about the teaching and learning of the subject (Thompson, 1992).

The beliefs of prospective teachers on the nature of Mathematics, as a part of the belief system, are a part of the domain-specific beliefs, and may be considered the epistemological side of belief. When the beliefs of pre-service teachers, in the teaching ofMathematics, are studied, literature suggests that they see the subject as an authoritarian discipline, and that they believe that doing Mathematics means applying memorized formulas and procedures (Szydlik, 2003). The selection of the activities to be carried out in class is largely dependent, not only on the knowledge of the teacher, but also on his/her epistemological conceptions of Mathematics and Mathematics education (Steinberg, 1998). Studies on beliefs and the practice of teaching (Cross, 2009; Son and Crespo, 2009) show that there is a correlation between teachers' beliefs and teaching practices. This phenomenon clearly emphasises the fact that the teaching of Mathematics should not be entrusted to teachers who nurture the belief that Mathematics is a bunch of meaningless rules.

Colleges of Education often require courses designed to enhance the mathematical knowledge of prospective teachers by encouraging them to make sense of Mathematics and understand the principles that underlie the arithmetic they memorized as children. Often, efforts to change prospective teachers' beliefs are initiated in methods and courses to inculcate beliefs that will help the teachers in developing a deep understanding of fundamental Mathematics (Ambrose, 2004). When the level of epistemological beliefs about the nature of knowledge is considered, it is clear to what extent a prospective teacher who, as mentioned before, sees Mathematics as a totality of rules to be memorized, will endeavour to learn mathematical subjects in Colleges of Education, together with preliminary learning.

Furthermore, as a result of a lack of meaningful effort, learning of Mathematics will also be insufficient. The incomplete cognitive level of a prospective teacher with insufficient content knowledge will also cause the development of various negative characteristics.At present, there is little knowledge about what values

teachers are teaching in Mathematics classes, about teachers'awareness of their own value positions, about how these influence their teaching, and about how they are teaching, which may influence how they develops certain values in their students. Values are rarely considered in any discussions about Mathematics teaching, and a casual question to teachers about the values they are teaching in Mathematics lessons often produces an answer to the effect that they do not believe they are teaching any values. It is a widespread belief that Mathematics is the most value-free of all school subjects, not just among teachers, but also among parents, university mathematicians and employers.

Every profession has its norms, moral responsibilities and personal values. When we talk about the teaching profession, we talk about teacher's moral responsibilities, personal values, expertise in using teaching skills and knowledge of the subject matter. Teachers have multiple roles to play, including teaching, research, consultancy, extension work, development of instructional resources, and management of classrooms. Therefore, it is necessary to know their ability which can indicate their success in the teaching profession.

Aptitude is a component of competence in performing a given task at a certain level. This can also be considered as "talent". Aptitudes may be physical or mental. Aptitude is not knowledge, understanding, learned or acquired abilities skills or attitude. The innate nature of aptitude is in contrast to achievement, which represents knowledge or ability that is gained. Aptitude refers to 'a natural or acquired capacity or ability especially a tendency, capacity or inclination to learn or understand' (Webster's Medical Dictionary, 2002). It refers to part of a person's mental equipment which gives him a special fitness for any kind of endeavour. Such an aptitude may be the result of either an innate endowment or of special training or both. The mental and physical qualities giving rise to differences in aptitude are difficult to distinguish.

Warren's Dictionary(1987, p.44) says, "Aptitude is a condition or a set of characteristics regarded as symptomatic of an individual's ability to acquire with some training, some knowledge, skills or set of responses such as ability to speak a language". When we refer to a person's aptitude for Mathematics or Music, we are referring to his future too. His aptitude, however, is a present condition having something to do with the future.According to Bingham (1999),aptitudeis a condition symptomatic of a child's readiness to acquire proficiency his potential ability and another is his readiness to develop an interest in exercising his ability".Harmeet(2014)

defines teaching aptitude as ‘a specific capacity or special ability, distinct from the general intellectual ability of individual, indicative of his probable success in a particular field after receiving appropriate opportunity for learning or training’.

The expectations teachers have for their students and the assumptions they make about their potential have a tangible effect on the students’ achievement. Research findingsclearly establishe that teacher’s expectations do play a significant role in determining how well and how much students learn (Bamburg, 1994). Students tend to internalize the beliefs teachers have about their ability. Generally, they "rise or fall to the level of expectation of their teachers.... When teachers believe in students, students believe in themselves. When those you respect think you can, you think you can" (Raffini, 1993, p105).Culture of high expectations for all students’ accounts for school effectiveness is one of the most consistent findings in educational research (cf. Newmann and Wehlage, 1995). Research also shows that the influence of teacher expectations on students’ achievement is substantial and that, overall, teachers have lower expectations for students in Mathematics (Miller,1995).

Atkinson (1957), who had originally defined success expectancy as individuals’ anticipations that their performance will be followed by either success or failure, defines value as the relative attractiveness of succeeding or failing on a task. According to Jacquelynne (1980), “success expectancy refers to how confident an individual is in his or her ability to succeed in a task. It is the specific belief individuals have regarding their success on certain tasks they will carry out in the short-term future or long-term future”. The expectancies of individuals shape their behaviours as well as the choices they make.

Within this field, one particular construct of interest relevant to this study is also that of Emotional Intelligence (EI) – a set of competence, which directs and controls one’s feelings towards work and performance at work (Caruso, 2000).The set of competence is the ability of the individual to control and manage his or her mood and impulses, which contribute to the best of situational outcomes. Understanding one’s own moods and impulses of others in any situation helps one to respond and behave in accordance with expectations. In a work situation, a worker’s effective use of skill and knowledge in time depends on the effective regulation of emotions at work and his/her readiness to contribute the best in their target accomplishment. In a learning situation, since it involves a group of people with different ideas,

suggestions, and opinions, effective conglomeration of all these determines the best outcomes in students' academic success.

Emotional intelligence, often measured as Emotional Intelligence Quotient (EQ), is a term that describes the ability, capacity, skills or a self-perceived ability, to identify, assess, and manage the emotions of oneself, of others and of groups. To be successful, it requires the effective awareness, control and management of one's own emotions and those of other people. Emotional intelligence embraces two aspects of intelligence which are understanding yourself, your goals, intentions, responses, and behaviour, and understanding others and their feelings.

Theories of cognitive and neuropsychological and emotional intelligence provide additional scientific rationale for why students should improve stress and morale in the school to achieve maximum performance.Salovey and Mayer (1990) define Emotional Intelligence (EI) as 'the ability to monitor one's own and other's feelings and emotions, to discriminate among them and to use this information to guide one's thinking and actions'. Research on emotional intelligence and work life show mixed results: a positive relation has been found in some of the studies.

This led researchers like Cote and Miners (2006) to offer a compensatory model between Emotional Intelligence (EI) and Intelligence Quotient (IQ)—a model that posits that the association between Emotional Intelligence and Mathematics anxiety becomes more positive as cognitive intelligence decreases. This idea was first proposed in the context of academic performance (Petrides, Frederickson and Furnham, 2004). Establishing the relationship among all these factors (Mathematics Teaching Anxiety, Epistemological Belief, Success Expectancy, Teaching Aptitude and Emotional Intelligence) and their influences on learners' achievement in Mathematics and attitude to Mathematics teaching is the aim of this study.

1.2 Statement of the Problem

Mathematics is a core subject and pre-requisitefor studying courses in Sciences, Engineering and Medicine in tertiary institutions in Nigeria. As a result, Mathematics teachers are expected to be adequately trained to teach the subject at primary and secondary schools. However, reports from colleges of education reveal that pre-service Mathematics teachers have problems of under-achievement in the course, as evident in the results of performance in mathematics.This has resulted in negative attitude to the subject and might be traceable to many factors among which are Mathematics Teaching Anxiety, Epistemological Belief, Success Expectancy,

Teaching Aptitude and Emotional Intelligence. Sufficient studies have not been carried out on how these factors have strongly linked to students' academic success,and the extent to which they could predict students' achievement in, and attitude towards, Mathematics among pre-service Mathematics teachers' in colleges of education in south-west, Nigeria, is yet to be determined.

This study therefore, investigated the extent to which these psychological variables (Mathematics Teaching Anxiety, Epistemological Belief, Success Expectancy, Teaching Aptitude and Emotional Intelligence.) predicted pre- service Mathematics teachers' achievement in, and attitude towards, Mathematics at colleges of education in south-west, Nigeria.

1.3 Research Questions

1. To what extent do pre-service Mathematics teachers' exhibit anxiety for the teaching of Mathematics?
2. What is the level of pre-service Mathematics teachers' Epistemological Belief about Mathematics?
3. What is the level of pre-service Mathematics teachers' success expectancy in Mathematics?
4. What is the level of pre-service Mathematics teachers' Emotional Intelligence in Mathematics?
5. What is the relationship between the psychological factors (Mathematics Teaching Anxiety, Epistemological Belief, Teaching Aptitude, Success Expectancy and Emotional Intelligence) and pre-service teachers':

(a) Achievement in Mathematics; and

(b) Attitude to Mathematics?

6. What is the joint predictive strength of the psychological factors (Mathematics Teaching Anxiety, Epistemological Belief, Teaching Aptitude, Success Expectancy and Emotional Intelligence) on pre-service teachers':

(a) Achievement in Mathematics; and

(b) Attitude to Mathematics?

7. What is the relative predictive strength of each of the psychological factors (Mathematics Teaching Anxiety, Epistemological Belief, Teaching Aptitude, Success Expectancy and Emotional Intelligence) on pre-service teachers':

(a) Achievement in Mathematics; and

(b) Attitude to Mathematics?

8. To what extent do the psychological factors (Mathematics Teaching Anxiety, Epistemological Belief, Teaching Aptitude, Success Expectancy and Emotional Intelligence) predict pre-service teachers':

(a) Achievement in Mathematics; and

(b) Attitude to Mathematics?

1.4 Scope of the Study

The study investigated Mathematics Teaching Anxiety, Epistemological Beliefs, Teaching Aptitude, Success Expectancy and Emotional Intelligence as predictors of pre-service teachers' achievement in and attitude to Mathematics. This study covered 300level pre-service mathematics teachers' in (federal and state) ten Colleges of Education in South-west Nigeria. This study covered some selected NCE II and III courses such as Trigonometric, calculus, numeration, Integration and matrices.

1.5 Significance of the Study

The study would add to the pool of studies on factors responsible for pre-service Mathematics teachers' poor performance in the subject.Findings from the study would also reveal the extent to which the independent variables individually and collectively predict pre-service mathematics teachers' achievement in, and attitude towards, Mathematics. The study would also be an eye-opener to counsellors and psychologists on factors they have to focus upon when trying to guide pre-service mathematics teachers' to academic success in the subject. This study would also make an important contribution to Mathematics educational research and practice. Furthermore, the government at various levels, especially those that are concerned with science and technology, would find this work useful, as it would provide information on how to provide quality education to the citizenry.

1.6 Operational Definition of Terms

Achievement in Mathematics: This refers to the overall performance of pre-service teachers in the Mathematics test used in this study.

Attitude to Mathematics: This refers to pre-service Mathematics teachers' disposition to Mathematics

Emotional Intelligence: This is pre-service Mathematics teachers' ability to monitor their own feelings and others' emotion, to discriminate among them, and to use the information to guide their thinking and action.

Epistemological beliefs: These beliefs focus on how pre-service teachers' come to know, their beliefs about knowing Mathematics, how those beliefs are a part of, and influence, cognitive processes in Mathematics class.

Mathematics Teaching Anxiety: This is pre-service teachers' feeling of tension that occurs during the teaching of mathematical concepts, theories and formulas or when solving mathematical problem.

Pre-Service Teachers: In this study, pre-service teachers' refer to the 300 level Mathematics students selected from the Colleges of Education that constituted the sample.

Success Expectancy: This is pre-service teachers' Mathematics expectations for success and the importance or value they attach to the various options perceived by the individual as available.

Teaching Aptitude: This is pre-service teachers' specific ability, potential, interest, satisfaction and fitness in teaching Mathematics.

CHAPTER TWO

2.0 REVIEW OF LITERATURE

This chapter presents a review of theoretical framework and relevant literature. The review covers the following sub-headings:

2.1 Theoretical Framework

2.1.1 Psychoanalytic Theory

2.1.2 Epistemological Beliefs

2.1.3 Teaching Aptitude and Theoretical Perspectives

2.1.4 Success Expectancy and Theoretical Perspectives

2.1.5 Emotional Intelligence and Theoretical Perspectives

2.2.0 Conceptual Framework

2.2.1 Achievement in Mathematics

2.2.2 Attitude to Mathematics

2.2.3 Mathematics Teaching Anxiety

2.2.4 Epistemological Belief

2.2.5 Teaching Aptitude

2.2.6 Success Expectancy

2.2.7 Emotional Intelligence

2.3 Empirical Review

2.3.1 Teachers' Mathematics Teaching Anxiety and Achievement in Mathematics

2.3.2 Teachers' Epistemological Belief and Achievement in Mathematics

2.3.3 Teachers' Teaching Aptitude and Achievement in Mathematics

2.3.4 Teachers' Success Expectancy and Achievement in Mathematics

2.3.5 Teachers' Emotional Intelligence and Achievement in Mathematics

2.3.6 Teachers' Mathematics Teaching Anxiety and Attitude to Mathematics

2.3.7 Teachers' Epistemological Belief and Attitude to Mathematics

2.3.8 Teachers' Teaching Aptitude and Attitude to Mathematics

2.3.9 Teachers' Success Expectancy and Attitude to Mathematics

2.3.10 Teachers' Emotional Intelligence and Attitude to Mathematics

2.4. **Appraisal of Literature**

2.1 Theoretical Framework

2.1.1 Psychoanalytic Theory

Psychoanalytic Theory of Sigmund Freud (1856-1939) was used for this study. The theory was first proponed by Sigmund Freud in later 19th century. Freud believed that people are simply actors in the drama of their own mind, pushed by the desire and pulled by the conscience.The emphasis is on the unconscious determinants of behaviour and the primacy of early childhood experiences on the dynamic interaction of components of the psyche as they move through psychosexual stages of development, and on the use of defense mechanisms to protect the ego.

Freud's psychoanalytic model has three major components:

- the structure of the personality;
- the defense mechanisms; and
- the stages of psychosexual development.

Freud's Structure of the Mind comprises*id*, *ego*, and*superego*. "Smooth integration of these three components minimizes anxiety and intra-psychic conflicts". The underlying unconscious conflicts, the anxiety that results and the defense mechanisms activated result in neurosis or neurotic disorders. In Sigmund Freud's topographical model of personality, the ego is the aspect of personality that deals with reality. While doing this, the ego also has to cope with the conflicting demands of the id and the super-ego.The id seeks to fulfill all wants, needs, and impulses while the superego tries to get the ego to act in an idealistic and moral manner.What happens when the ego cannot deal with the demands of our desires, the constraints of reality, and our own moral standards? According to Freud, anxietyis an unpleasant inner state that people seek to avoid. Anxiety acts as a signal to the ego that things are not going right.

Freud identified three types of anxiety. They are presented as follows:

Neurotic anxiety: Thisis the unconscious worry that we will lose control of the id's urges, resulting in punishment for inappropriate behaviour.

Reality anxiety: Thisis the fear of real-world events. The cause of this anxiety is usually easily identified. For example, a person might fear receiving a dog bite when he or sheis near a menacing dog. The most common way of reducing this anxiety is to avoid the threatening object.

Moral anxiety: Thisinvolves a fear of violating our own moral principles. In order to deal with anxiety, Freud believed that defense mechanisms helped shield the ego from the conflicts created by the id, superego, and reality.

Ego Psychology:

Anna Freud, Freud's daughter, named and described the major psychological defense mechanisms, which are still broadly accepted. Heinz Hartmann described psychological development from the perspective of adaptation, the employment of the defense mechanisms to allow the ego to fit together with its environment. Ego Psychology, with the following assumptions, focuses on this process as the central element of normal function andPsychopathology:

- ego psychological theory maintains that an undifferentiated matrix of psychic structure is present from birth, and that id, ego, and superego differentiate from it;
- there is a conflict-free sphere of development that encompasses the achievement of capacities such as motor skills and intelligence; and
- ego development continues beyond childhood.

Defense Mechanisms: Conflict between id and superego insists that the ego activates defense mechanisms to protect against anxiety. "Some ego defense mechanisms are adaptive and become coping strategies…" (*humor, anticipation, affiliation, altruism, self-assertion, self-observation, suppression, sublimation*) and "some are maladaptive and self-defeating." They also include Action Level Defenses (*acting out, regression, apathetic withdrawal, help-rejecting complaining and passive aggression*).

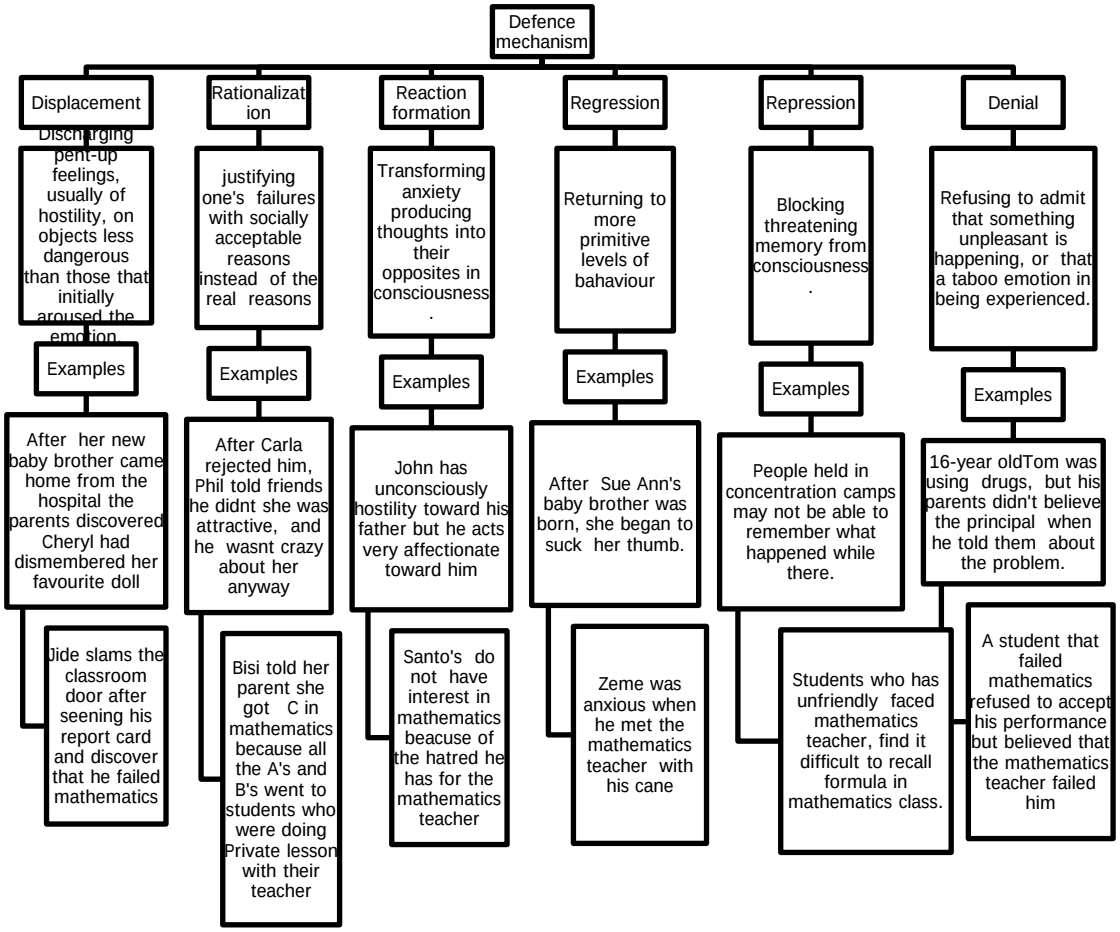

Figure 2.1: Anna Freud's Ego Defense Mechanisms Chart

2.1.2 Epistemological Beliefs

The process of making sense of the world begins at a very young age, and this initial understanding has a powerful impact on an individual‘s representation of concepts and information (Bransford, Brown, and Cocking, 2000). Because initial understanding plays a central role in the learning process, there is an increased interest in the role beliefs about knowledge and knowing play in the learning process. Known as personal epistemology, this area of study is concerned with the origin, nature, limits, methods, and justification of human knowledge (Hofer, 2002). Research geared towards epistemological development and epistemological beliefs is an important area that many educational researchers and psychologists continue to pursue (Hofer, 2001; Hofer and Pintrich, 1997). Because beliefs about knowledge and knowing influence learning and can even enhance teaching effectiveness, Hofer points out that the study of personal epistemology, as a construct with educational implications, is at a critical point in time (Hofer, 2001). Within the broad context of personal epistemologyreside an individual‘s epistemological beliefs. Epistemological beliefs focus on the manner in which individuals come to know, their beliefs about knowing, and how those beliefs are a part of, and influence cognitive processes (Hofer and Pintrich, 1997). These beliefs are activated as learners engage in learning and knowing. Hofer (2002) offers the following examples to illustrate how epistemological beliefs influence learning and knowing. As we read the morning paper, we make judgments about the credibility of the claims in the particular article. In our professional lives, we confront the learning of a new skill and make determination about their particular value (Hofer, 2002). In a more formal context, epistemological beliefs play an important role in most academic experiences.

Hofer clarifies how personal epistemology relates to learning and education in general. If epistemology is developmental and development is the aim of education, the goal of education is to foster epistemological development (Hofer, 2001). Furthermore, because epistemological thinking is a critical component of lifelong learning both in and outside of a classroom, epistemological beliefs impact the manner in which individuals resolve competing knowledge claims, evaluate new information, and make fundamental decisions that influence their own lives and the lives of others (Hofer, 2001). Much of the existing research on epistemological beliefs can also be traced back to the seminal work of William Perry. Perry‘s work began as documentation of undergraduate students’ college experiences at Harvard and

Radcliffe (Perry, 1999). The Harvard Bureau of Study Counsel noticed that students dealt with academic relativism in a variety of ways. In fact, some students found multiple frames of reference wholly unintelligible (Perry, 1999). The students' variety in interpretation of academic experiences also led to an equally wide variation in how students acted upon the experiences. Through their observations, counselors concluded that the escapability of relativism might well be a development of the twentieth century. The conclusion generated concern amongst the Harvard faculty because the growing person‘s response to pluralism in thought and values, and indeed his capacity to generate pluralism himself, are critical to the destiny of a democracy.

As a result, Perry began to explore how students responded differently to the diverse views of the university‘s academic and social environments (Hofer and Pintrich, 1997). His longitudinal study included interviews with Harvard undergraduates to collect descriptive accounts of their experiences. Based upon the interviews, Perry outlined a scheme of intellectual and ethical development that included nine positions as an ongoing organization of meaning making (Hofer and Pintrich, 1997; Perry, 1999). The nine positions of Perry‘s scheme are typically clustered into four sequential categories: (1) dualism, (2) multiplicity, (3) relativism, and (4) commitment within relativism (Hofer and Pintrich, 1997). The movement of students through the sequences of epistemological growth begins as individuals hold knowledge as being simple, dichotomous, certain, and handed down by authority. Perry noted that these beliefs are often characteristic of a first-year college student (Hofer, 2002). As epistemological beliefs develop and become more sophisticated, reasoning becomes more complex, relativistic and derived from reason, evaluation, and empirical evidence (Bendixen and Hartley, 2003; Schommer-Aikins and Easter, 2006). Perry emphasized that a dualistic view of knowledge was typically challenged and transformed over four years of college. Specifically, when students entered college, they tended to believe in simple, certain knowledge that is handed down by authority, yet as they reached their senior year, they believed in tentative, complex knowledge obtained through observations and reason (Hofer, 2002; Perry, 1999; Schommer-Aikens, 2002)

2.1.3 Teaching Aptitude and Theoretical Perspectives

According to Thorndike, there are three types of aptitudes, as follows: abstract or mechanical, concrete and social. Aptitude is further classified as verbal, numerical,

spatial, motor, musical, social, intelligential, natural, mechanical, teaching, academic, learning, etc.

Aptitudes stabilise in the early years of life, but there is no time of demarcation after which there is no effect on the formation of aptitudes. Generally it is considered that aptitudes are formed up to puberty. Aptitude is thus a present condition with a forward reference. It is a condition or set of characteristics regarded as indication of potentialities, but we can't be very sure that a person possessing a particular aptitude is going to succeed later in a job or occupation calling for the use of aptitude, because, aptitude as stated is a present condition and it may be influenced by other factors.

2.1.4 Success Expectancy and Theoretical Perspectives

Achievement motivation theorists attempt to explain people's choice of achievement tasks, persistence on those tasks, vigor in carrying them out, and performance on them (Eccles, Wigfield, and Schiefele, 1998; Pintrich and Schunk, 1996). As discussed by Murphy and Alexander, there is a variety of constructs posited by motivation theorists to explain how motivation influences choice, persistence, and performance. One long-standing perspective on motivation is expectancy–value theory. Theorists in this tradition argue that individuals' choice, persistence, and performance can be explained by their beliefs about how well they will do on the activity and the extent to which they value the activity (Atkinson, 1957; Wingfield, 1994; Wingfield; Eccles, 1983 and Eccles, 1992).Because of their important effects on academic achievement, adolescents' academic expectations have been widely studied within the field of adolescent development (Wigfield and Eccles 2002).

To conceptualize the formation of Success Expectancy, particularly the impact of previous academic achievement and the social context on students' academic expectations, Wingfield and Eccles (2002) developed the expectancy-value theory of achievement motivation. The theory states that the individual's expectations and values are influenced by their social context (parents, teachers, peers, neighbourhood, and community) and previous academic achievement. Once established, an individual's expectations and values then influence the individual's academic performance, persistence, and academic subject choice (Eccles and Wigfield 2002). In other words, the theory posits causal relationships from social context (e.g., parental expectations) to students' own expectations and to their Mathematics achievement.

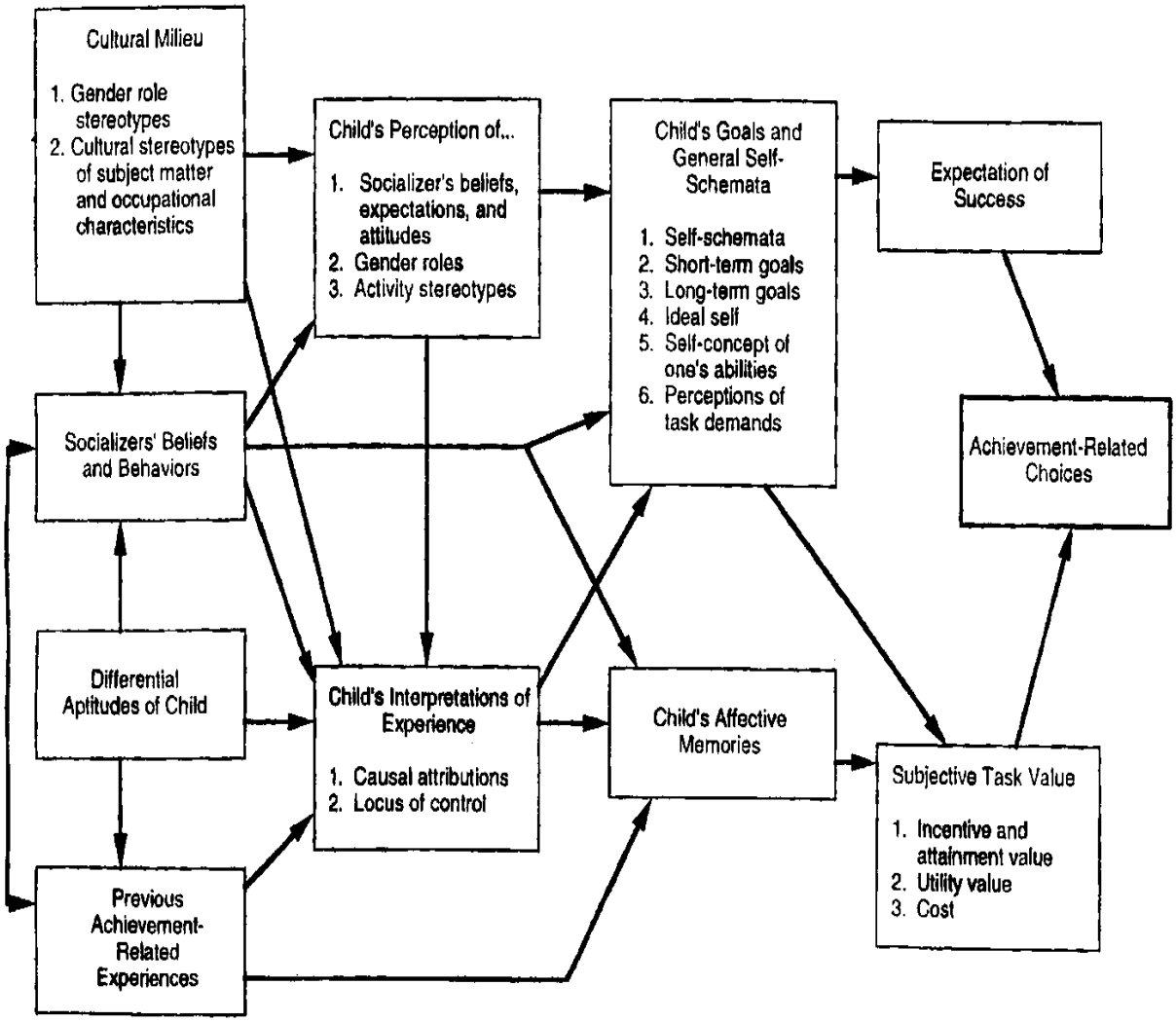

Figure 2.2: EXPECTANCY-VALUE THEORY

Eccles, Wigfield, and Colleagues' Expectancy–Value Model of Achievement Motivation.

The expectancy–value model was developed and assessed by Eccles, Wingfield, and their colleagues (Eccles, 1984; Wingfield, 1994; Wingfield and Eccles, 1992). Eccles (1984) proposed an expectancy–value model of achievement performance and choice. He hadstudied it initially in the Mathematics achievement domain. The most recent statement of this model is presented in the figure 2.2 above. As can be seen in the figure, expectation and values are assumed to directlyinfluence achievement choices. They also influence performance, effort, and persistence. Expectation and values are assumed to be influenced by task-specific beliefs such as ability beliefs, the perceived difficulty of different tasks, and individuals' goals, self-schema, and influencive memories. These social cognitive variables, in turn, are influenced by individuals'

perceptions of their own previous experiences and a variety of socialization influences.

2.1.5 Emotional Intelligence and Theoretical Perspectives

Peter Salovey and John Mayer first coined the term "emotional intelligence" in 1990 (Salovey and Mayer, 1990) and they have since continued to conduct research on the significance of the construct. Their pure theory of emotional intelligence integrates key ideas from the fields of intelligence and emotion. From intelligence theory comes the idea that intelligence involves the capacity to carry out abstract reasoning. From emotion research comes the notion that emotions are signals that convey regular and discernable meanings about relationships and that a number of basic emotions is universal (Mayer, Salovey and Caruso, 2002). They propose that individuals vary in their ability to process information of an emotional nature and in their ability to relate emotional processing to a wider cognition. They then posit that this ability is seen to manifest itself in certain adaptive behaviours (Mayer, Saloveyand Caruso, 2000).

Mayer and Salovey's conception of emotional intelligence is based within a model of intelligenceTthat is, it strives to define emotional intelligence within the confines of the standard criteria for a new intelligence (Mayer, Salovey, Caruso, and Sitarenios, 2003). It proposes that emotional intelligence comprises two areas: experiential (ability to perceive, respond, and manipulate emotional information without necessarily understanding it) and strategic (ability to understand and manage emotions without necessarily perceiving feelings well or fully experiencing them). Each area is further divided into two branches that range from basic psychological processes to more complex processes integrating emotion and cognition. The first branch, emotional perception, is the ability to be self-aware of emotions and to express emotions and emotional needs accurately to others. Emotional perception also includes the ability to distinguish between honest and dishonest expressions of emotion. The second branch, emotional assimilation, is the ability to distinguish among the different emotions one is feeling and to identify those that are influencing their thought processes.

The third branch, emotional understanding, is the ability to understand complex emotions (such as feeling two emotions at once) and the ability to recognize transitions from one to the other. The fourth branch, emotion management, is the ability to connect or disconnect from an emotion depending on its usefulness in a given situation (Mayer and Salovey, 1997). A depiction of this four-branch model is

illustrated in Figure 2.3 which outlines the four branches and the corresponding stages in emotion processing associated with each branch.

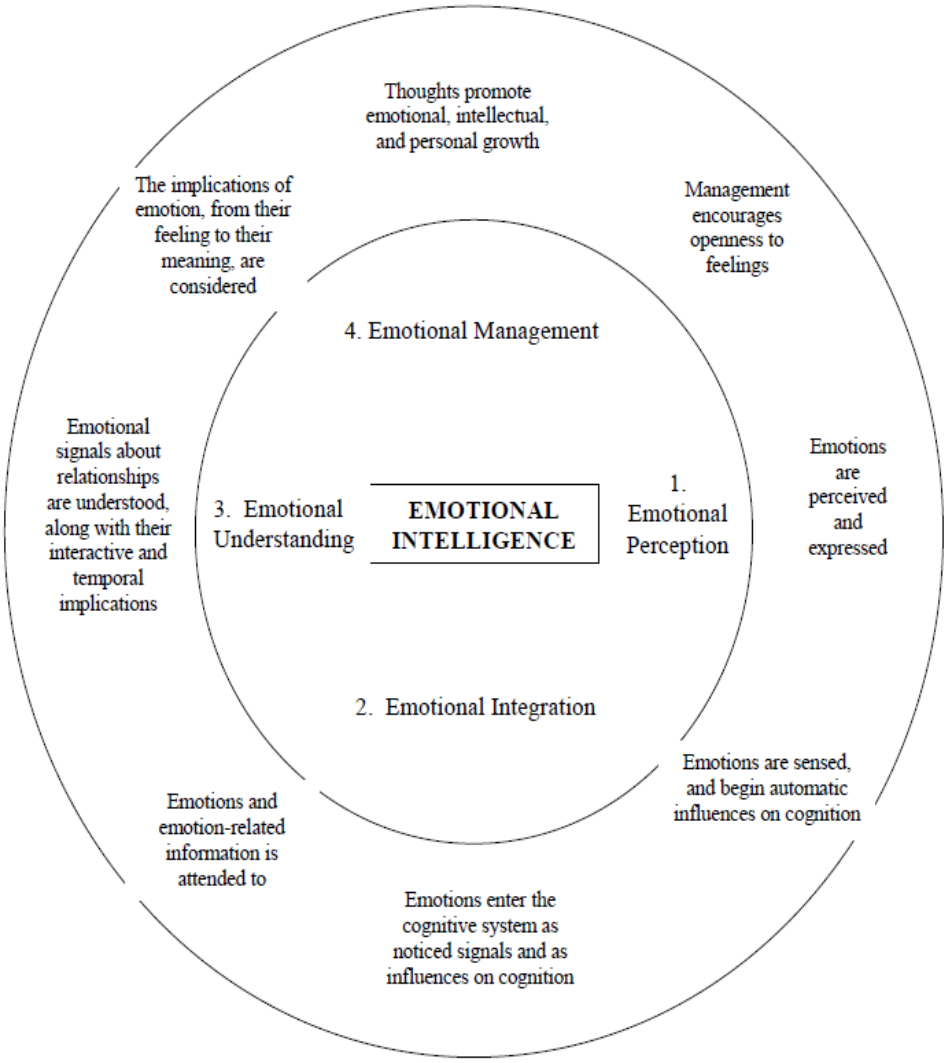

Figure 2.3. Branch Model of Emotional Intelligence

Mayer and Salovey (1997). Four Branch Model of Emotional Intelligence

Bar-On: A Mixed Model of Emotional Intelligence

The director of the Institute of Applied Intelligences in Denmark and consultant for a variety of institutions and organizations in Israel, Reuven Bar-On,developed one of the first measures of emotional intelligence that used the term "Emotion Quotient". Bar-On's model of emotional intelligence relates to the potential for performance and success, rather than performance or success itself, and it considered process-oriented rather than outcome-oriented (Bar-On, 2002). It focuses on an array of emotional and social abilities, including the ability to be aware of, understand, and express oneself, the ability to be aware of, understand, and relate to others, the ability to deal with strong emotions, and the ability to adapt to change and solve problems of a social or

personal nature (Bar-On, 1997). In his model, Bar-On outlines five components of emotional intelligence: intrapersonal, interpersonal, adaptability,stress management, and general mood. Within these components are sub-components, all of which are outlined in Table 2. He posits that emotional intelligence develops over time and that it can be improved through training, programming, and therapy (Bar-On, 2002).

Bar-On hypothesizes that those individuals with higher than average E.Q.'s are in general more successful in meeting environmental demands and pressures. He also notes that a deficiency in emotional intelligence can mean a lack of success and the existence of emotional problems. Problems in coping with one's environment is thought by Bar-On to be especially common among those individuals lacking in the subscales of reality testing, problem solving, stress tolerance, and impulse control. In general, he considers emotional intelligence and cognitive intelligence to contribute equally to a person's general intelligence, which then offers an indication of one's potential to succeed in life (Bar-On, 2002).

Table 2: Bar-On's Model of Emotional Intelligence

Components	Sub-Components
Intrapersonal	Self Regard Emotional Self-Awareness Assertiveness Independence Self-Actualization
Interpersonal	Empathy Social Responsibility Interpersonal Relationship
Adaptability	Reality Testing Flexibility Problem Solving
Stress Management	Stress Tolerance Impulse Control
General Mood Components	Optimism Happiness

Bar-On (2002) Mixed Model of Emotional Intelligence

2.2. Conceptual Framework

2.2.1 Concept of Achievement in Mathematics

In the era of fast technological advancement, keeping up with the latest innovation and inventions that technology can offer is essential in order to be relevant now and in the future (Idris, 2006).Educators have to be prepared to deal with enormous

challenges in Mathematics education and to forge ahead because holding on to the old and familiar ways would mean putting students at a disadvantage in a world that is fast embracing technology (Ames, 1992; Dunham and Dick, 1994). In Mathematics, this would mean that the order and treatment of most topics would need to be aligned to innovations and new technologiesso that the students can function with optimal advantage with their surroundings. In particular, the place of algebra needs to be examined such that routine manipulation becomes less important, and topics, such as linear algebra and modeling, are becoming more important. Algebraic proof may be of greater important since there is more opportunity for more rigorous mathematical argument once a good intuitive understanding is acquired through investigation with the help of technology, such as TI-84 graphing calculator. Mathematics achievement is an object of much interest and of utmost importancein any secondary school (Idris,2002;Dunham and Dick,1994).

Mathematics achievement is defined as a measure of the ability of students to understand, analyze and answer specially designed test items based on the standard syllabus. The level of achievement exhibited by the students will categorize them as high or low Mathematics achievers. In the present ever-demanding, success-oriented society, Mathematics achievement is often seen as a key factor in ensuring the success of a student in the school system (Ministry of Education, 2000).Mathematics teachers also face increasing demands to improve students' performances in the subject, and this is by no means a simple task in many parts of the country. Many students have the misconception that Mathematics, or anything related to it, is confusing and, therefore, difficult to learn, let alone master (Pomerantz, 1997;Romberg, 1991).An area of concern in many Mathematics classes is the attitude of students towards the subject. Specifically, many students find the topic on straight lines difficult and boring.

Many students also believe that drawing and interpreting statistical plots as well as interpreting coordinate geometry is tedious and even confusing (Bitter and Hafield, 1994;Herrera, 2002).This poor attitude towards learning Mathematics often leads to the poor appreciation of these two topics, which will consequently result in poor Mathematics achievement. This poor attitude could be attributed to a number of reasons, namely the students (a) were not able to visualize what they were learning, (b) believed that plotting and drawing graphs were tedious and time consuming,(c) imaginedthat plotting graphs was a routine procedure and thus became boring, or

thoughtthat problem solving situations, activities and the answers that were generated were two unit. These factors will tend to make learning Mathematics unpopular and uninteresting.

Often in schools where students adopt ability goals, they come to believe that success is defined in terms of how they do in comparison to others. Mistakes and failures, because they indicate lack of ability, are threats to a student's self-confidence, expansion of knowledge, and gain of understanding (Maehr and Mify, 1997). Success means being able to do something you could not do before. When students adopt learning goals, they take on more challenging tasks, persist longer, are less inhibited by mistakes and failure, and use higher-level thinking skill than when they focus on ability goals(Ames,1992;Elliot and Dweck, 1988).Fast technological advancement poses great challenges to Mathematics educators in Nigeria. Therefore, for the teachers to be prepared in dealing with such enormous challenges, they have to embracechanges for improvement and development.. More so, Mathematics teachers need to be familiar with these technological trends so that they remain relevant in the present and future. In secondary school Mathematics, this means that the order and treatment of most topics would need to change.

The teaching and learning of Mathematics in many Nigerian schools havebeen reported to be too teacher-centered,where students are not given enough opportunities to develop their own thinking skills. This situation invariably results in students becoming passive receivers of information, which in many cases do not result in conceptual understanding. Many students are not able to comprehend what their Mathematics teachers teach because the subject content is taught with the intention of coveringthe syllabus and preparing for examinations. Little regard is given to how well the students understand mathematical concepts. Research has also shown that students in many of today's Mathematics classrooms have little opportunity to explore mathematical patterns and processes (Ross and Kurtz, 1993) which can help them understand mathematical concepts better.

In addition, teacher-oriented classes are usually carried out without the help of teaching aids. Moreover, most existing teaching aids are inanimate objects that cannot respond and complement the varying levels of students' understanding in typical a classroom setting. These teaching or learning aids hardly allow opportunities for students to be creative and imaginative in their thinking and reasoning. Such tools do not allow students to consider 'what-If' situations, which are very useful and effective

for building conceptual understanding. It is by considering alternative mathematical situations that better understanding can be developed (RossandKurtz,1993). Poor reasoning skills are also another area of concern among secondary school students. Many are unable to extract necessary information from a given body of data, and many more are unable to interpret answers and make conclusions. However, the students should not always be blamed for their lack of thinking and reasoning skills. Much of the problem may lie with the pedagogical approach (DunhamandDick,1994).Teacher-centered classrooms seldom encourage or involve students in mathematical communication and in making logical reasoning. Traditional teaching approach places more emphases on how much the students can remember rather than on how well the students can think and reason. Thus, learning is imposed and seldom brings satisfaction to the students.

Therefore, learning Mathematics, for many weak students, becomes uninteresting and boring. This poor attitude towardslearning thesubject is not helpful for the students, as it may lead to poor Mathematics performances (Dunham and Dick, 1994). The reason for students' poor attitude towards Mathematics may also be because teachers always do the talking while students just listen. Instead, teaching and learning mathematics should portray an active and dynamic classroom with the students thinking, learning and applying what they have learnt. Mathematics should be enjoyable and interesting to learn. Thus, building good attitudes towards the learning ofMathematics, it is hoped, can help to improve students' performance in the subject.

In addition, Mathematics is traditionally thought of as the memorization of formulae, the long and monotonous computation and manipulation of numbers. It is also traditional to think that the tools to computing and manipulating Mathematics are the pencil and paper. Finally, it is also assumed that the conventional way of delivering lesson is the talk and chalk method. However, Mathematics has always been concerned with logic and reasoning, numbers sense, problem solving and a search for relationships and abstract thinking (Pomerantz,1997). Therefore, educationists are earnestly looking beyond the traditional approaches to enhancing the teaching and learning process.

2.2.2 Concept of Attitudes to Mathematics

As a complex social phenomenon, attitude has a long history in mathematics education. The construct finds its origin in the field of social psychology (Allport,

1935), in connection with the problem of foreseeing individuals' choices in contexts like voting andbuying goods. Research develops more toward the formulation of measuring instruments than towards the theoretical definition of the construct, producing instruments that have given theoretical and methodological contributions great importance (such as those by Thurstone and Likert). In the field of mathematics education, research on attitude has been motivated by the belief that '*something called "attitude" plays a crucial role in learning mathematics"*(Neale, 1969). However, the goal of highlighting a connection between a 'positive' attitude and achievement has not been reached. The lack of a theoretical framework that characterizes research on attitude towards mathematics is partially shown by the fact that a large portion of studies about attitude does not provide a clear definition of the construct itself: attitude tends rather to be defined implicitly and a posterior through the instruments used to measure it (Leder, 1985; Daskalogianni and Simpson, 2000). When a definition is explicitly given, or can be inferred, it mainly refers to one of the three definitions:

McLeod,(1992) defines attitude towards mathematics as a positive or negative emotional disposition towards mathematics. According to Hart (1989), an individual's attitude toward mathematics is defined in a more complex way by the emotions that he/she associates with the subject. This, however, has a positive or negative value by the individual's beliefs towards mathematics, and by how he/she behaves. As a bi-dimensional definition, in which behaviours do not appear explicitly, (Daskalogianni and Simpson, 2000) therefore, it implies that attitude towards mathematics is the pattern of beliefs and emotions associated with the subject. Kulm(1980) suggests that 'it is probably not possible to offer a definition of attitude toward mathematics that would be suitable for all situations, and even if one were agreed on, it would probably be too general to be useful..In this way, the definition of attitude assumes the role of a *working definition'*(Daskalogianni and Simpson, 2000). Furthermore, Fishbein and Ajzen (1975) opined that attitudes are generally regarded as having been learnt. They predispose an individual to an action that has some degree of consistency and can be evaluated as either negative or positive.

The word "attitude" is defined within the framework of social psychology as a subjective or mental preparation for action. It defines outward and visible postures and human beliefs. Attitudes determine what each individual will see, hear, think, and do. They are rooted in experience and do not become automatic, routine conduct. In

addition “attitude” means the individual’s prevailing tendency to respond favourably or unfavourably to an object(person or group of people, institutions or events) (Morris and Maisto, 2005). Attitudes can be positive (values) or negative (prejudices). According to Kreitner and Kinicki (2007), there are three components in a feeling or an emotion one has about an object or situation either to like or dislike. The cognitive component is the belief or idea one has about an object or situation, whereas the behavioural component of attitude reflects how one intends to act or behave towards someone or something (Kreitner and Kinicki, 2007).

The attitudes of students towards learning affect their success, interests and job selection (Koc and Sen, 2006). Especially some students have quite negative opinions about mathematics because of negative behaviours of teachers or wrong experiences. These students have some prejudice such as mathematics is a complicated subject and only those who have mathematics intelligence can learn it. This situation continues during the school years and students’ self-confidence gradually disappears as a result. Changing the negative attitudes of students into positive can be provided if the teachers increase the positive experiences of students towards the subject (Koc and Sen, 2006).

Mathematics attitude is viewed as a predisposition to respond in an unfavourable or favourable way to mathematics. By accepting this view, mathematics attitude includes that there is a positive relation between mathematics attitude and mathematics achievement (Kabiri and Kiamanesh, 2004; Kiamanesh,et’al, 2004). Some of these variables are intelligence quotient (Blair, Gamson, Thorne, and Baker, 2005; Bull and Scerif, 2001; Evansetal., 2002;Grissmer,2000) and motivation for mathematics (Khoush,et’al,2005;Yunus and Ali, 2009).Many students taking mathematics courses have a negative attitude towards mathematics. This attitude can be described as mathematics anxiety or feeling of tension, or fear; it interferes with mathematics performance. In that sense, as noted by Carr(1990), attitudes can be modified only by each individual when they become aware, through elements and evidence,that new postures would be better to deal with the surrounding world.

2.2.3 Concept of Mathematics Teaching Anxiety

Mathematics teaching anxiety can be defined as “the stress experienced by teachers in teaching mathematical concepts, theories, formulas or problem solving” (Peker, 2006). According to Peker (2009), “Mathematics teaching anxiety can also be defined as pre- and in-service teachers’ feelings of tension that occur during the teaching

ofmathematical concepts, theories, and formulas, or during problem solving." This type of anxiety is different from the more commonly used term, "Mathematics anxiety", because it is based on an individual's anxiety about his/her ability to *teach* Mathematics. Conversely, Mathematics anxiety tends to focus on an individual's anxiety regarding his/her lack of Mathematics content knowledge or Mathematics confidence. Mathematics anxiety is more internally focused and reflects how the individual views his/her own ability to interact with the subject.On the other hand, Mathematics teaching anxiety is more externally focused and reflects how the individual views his/her ability to engage children in an interaction with the subject. Mathematics teaching anxiety can be independent of an individual's weak Mathematics history or background.

Therefore, a person may not experience *Mathematics anxiety* and may be very confident about his/herMathematics knowledge, but he/she may experience *Mathematics teaching anxiety* because he/she is not confident about his/her ability to teach the Mathematics that he/she knows to children. Currently, research regarding Mathematics teaching anxiety (MTA) can be difficult to isolate within the larger context of Mathematics anxiety (MA). However, a Turkish researcher recently developed an instrument titled "Mathematics Teaching Anxiety Scale" (MATAS) (Peker, 2009). In his research, Peker investigated interactions between scores on the MATAS and different learning styles, as well as differences in MATAS scores between elementary and secondary teachers. Anxiety has been described as an intrinsic part of the human condition that has been recognized as one of the most pervasive psychological phenomena of our time (Cubberly,Weinstein and Cubberly, 1986). Also, Mathematics teaching anxiety has been related to success in Mathematics teachers' problem solving ability(Akinsola, 2008).Anxiety for teaching Mathematics is a frequent fear of pre-service teachers and is associated with teaching Mathematics. It may reflect real or perceived knowledge deficits in Mathematics content as well as in Mathematics teaching skills, and memories of past occurrences of Mathematics failure (Levine, 1993) due to information processing strategies of students (Peter,2009).

Levine (1996) has stated that the anxiety of prospective teachers who experience high levels of Mathematics teaching anxiety are related to unpleasant experiences that have a relation with insufficient math knowledge and teaching mathematics. Therefore, the close relationship of beliefs about the nature, learning

and teaching of mathematics, with the in- class practices of the teachers, brings to mind the anxiety in teaching Mathematics that might be experienced by teachers who come from class environments where traditional teaching models are in the foreground, and who have developed algorithmic based beliefs about Mathematics. In fact, in a study carried out on prospective teachers by Peker (2009b), the teaching anxiety of the group who had been trained using problem solving strategies was considerably lower than the group trained by traditional methods. Again, in another study realized by Peker (2009), the math teaching anxiety of a group trained by micro-teaching methods was significantly lower than the group trained by the traditional teaching model.

On the other hand, research indicated that abstract discussions regarding mathematical concepts increased the teaching anxiety of the pre-service elementary school teachers who had high levels of anxiety for teaching Mathematics. Moreover, using manipulative materials, getting familiar with developing creative teaching strategies for teaching Mathematics and learning to design lesson plans in mathematical concepts reduced the teaching anxiety level of the pre-service elementary school teachers (Levine, 1996).Similarly, Peker (2008) has stated that as the need to concretize the subject to be taught increases, so does the Mathematics teaching anxiety of the prospective teachers.Mark and Ashcraft (2002) define Mathematicsteaching anxiety as “a feeling of tension, apprehension, or fear that interferes with the teaching of Mathematics”.

Mathematics teaching anxiety has most often been explained according to the inability of a person to perform Mathematics calculations, such as “an inability by an otherwise intelligent person to cope with quantification, and more generally, Mathematics” and “feelings of tension and anxiety that interferes with the manipulation of numbers and the solving of mathematical problems in a wide variety of ordinary life and academic situations” (Godbey,1997; Perry, 2004).Godbey (1997) stated that negative self-talk can be the root cause of Mathematics teaching anxiety in some pre-service teachers. Mathematics anxiety in elementary school students indicates that its onset coincides with early years of schooling. This could in part be due to social learning from parents and teachers with Mathematics anxiety or negative perceptions of the subject. Parents or teachers might give children mixed messages (Williams, 1988) about Mathematics. They might emphasize how highly difficult Mathematics is and at the same time tell them how Mathematics skills are of essential

importance for their future achievements. Vann (1993) observes that Mathematics anxiety in mothers was significantly predictive of Mathematics anxiety in children.

This could be so for excessive expectations as well. As pointed out by Geçtan (1995), children of parents with excessive expectations whose love and acceptance are conditional to how well the children live up to these expectations have high degree of anxiety. These circumstances might lead to self-consciousness about one's performance and to anxiety arising from not living up high standards of parents. Children's excessive self-critical attitude might cause anxiety disproportionate to their failure in living up to these expectations. In fact, studies do show that low self-esteem, confidence and efficacy are closely related to Mathematics anxiety (Uusimaki and Nason, 2004; Woodard, 2004).Negative school experiences might also contribute to the development of Mathematics anxiety (Bursal and Paznokas, 2006). For example, teachers' threatening and authoritarian attitudes could lead to a fearsome classroom climate in which students might hesitate to ask questions or answer the teachers' questions. Furthermore, students fearing their Mathematics teacher might have a conditioned reaction to Mathematics as well. Observing teachers giving Mathematics homework as a punishment could also cause students to perceive Mathematics as unpleasant (Oberlin, 1982; as cited in Thomas and Furner, 1997).

As punishment is inherently negative, extra Mathematics assignments as a punishment could play a role in cultivating negative attitude toward Mathematics in students who receive the punishment as well as those who witness it. Low grades or failure in Mathematics could also lead to Mathematics anxiety or exasperate students' existing levels of anxiety for the subject (Norwood, 1994; Satake and Amato, 1995; Townsend, Moore, Tuck, andWilton, 1998; Reynolds, 2001; Ma and Xu, 2004). Failure in Mathematics and fear and anxiety about it could cause extreme feelings of dislike about the subject. Indeed, Hopko et.al. (2003) observed that persons with Mathematics anxiety make more mistakes in dealing with Mathematics problems. Such mistakes lead to lower grades in Mathematics which in turn increases anxiety about the subject. Consequently, the vicious cycle of anxiety, failure and anxiety is perpetuated.Literature on Mathematics anxiety often highlights adults' contribution to children's fears. Anxiety is a psychological state which consists of fear, worry, dread and tenseness (Parham, 1988). When faced with a situation, the individual might experience both fear and anxiety (Özer, 1997). Mathematics anxiety is a multi-sided structure and is intertwined with the terms of fear, worry and tenseness.

As mentioned before, teachers and parents could do so by projecting their own fears of Mathematics, giving mixed messages about Mathematics, and by having high expectations for Mathematics achievement from children. These factors might lead to overly sensitive attitudes toward Mathematics. For instance, no one can solve every Mathematics problem, and it is quite normal that children would, at times, make mistakes while dealing with Mathematics. However, children with such sensitivities might have more extreme reactions to such errors, such as believing that they cannot do Mathematics and, thus, they hate the subject. Hence, researchers often recommend parents and teachers to set positive role models, have democratic attitudes, and are supportive of children in order to foster competence in Mathematics. Effective use of counselling and guidance services could have preventive functions by aiding children with effective study skills and helping them cope with feelings, such as fear of failure.

2.2.3.1 Relationship between Mathematics Anxiety and Mathematics Teaching Anxiety

There is a noticeabledistinction between Mathematics anxiety and Mathematics teaching anxiety that is important for pre-service teacher education. Pre-service teacher education programmes may treat much of pre-service teachers' anxieties about Mathematics teaching by addressing the phenomenon as a pre-existing condition. In fact, some pre-service teachers may have confidence in their own abilities in Mathematics; and, therefore, they do not experience Mathematics anxiety (MA).At the same time, they may be uncomfortable communicating mathematical ideas to children, and experience Mathematics teaching anxiety (MTA). In these instances, pre-service teachers with Mathematics anxiety may receive support while pre-service teachers with no Mathematics anxiety may not receive support, whereas they too may need support for teaching.

A review of the literature on elementary pre-service teachers' Mathematics anxiety often refers to weak mathematical backgrounds, histories, and experiences for this population. It seems intuitive that teachers who have negative feelings and abilities in any subject area, such as Mathematics, would then have difficulty teaching the subject to students. As already documented in many studies, Mathematics anxiety can be considered a pre-existing condition or a negative Mathematics attribute that elementary pre-service teachers bring with them as they enter teacher preparation programs. However, this focus on Mathematics anxiety as a pre-existing condition

overlooks the anxiety that may develop as a result of teaching Mathematics, or *Mathematics teaching anxiety*.

Much of the research conducted in the area of linking Mathematics anxiety to Mathematics teaching anxiety has used similar instruments to measure these constructs. Several studies have administeredMathematics anxiety instrument (such as the aforementioned MARS) to pre-service teachers, followed by administering a different instrument to measure Mathematics teachers' efficacy, the *Mathematics Teaching Efficacy Beliefs Instrument* (MTEBI) (Enochs, Smith and Huinker, 2000). Bursal and Paznokas (2006) found that pre-service teachers' Mathematics anxiety scores, as measured by the *Revised-Mathematics Anxiety Survey* (R-MANX), were negatively correlated with their levels of Mathematics efficacy beliefs, as measured by the MTEBI (high anxiety scores correlated with low efficacy scores). Gresham (2008) implemented a similar study using the MARS and MTEBI instruments with pre-service teachers and found that, "the pre-service teachers with the lowest degree of Mathematics anxiety had the highest levels of Mathematics teacher efficacy". Swars, Daane and Giesen (2006) found similar results implementing the MARS and the MTEBI with clinical interviews and report, "findings revealed a significant, moderate negative relationship between Mathematics anxiety and Mathematics teacher efficacy". All three of these studies were conducted within a Mathematics method course semester which included some form of field experience.

In the three previous studies, which all investigated Mathematics anxiety and Mathematics teaching efficacy, the latter two studies (Swars et al, 2006; Gresham, 2008) also implemented structured interviews, following the scores rendered from the Mathematics anxiety and efficacy instruments. In both studies, researchers only interviewed pre-service teachers that fell into the "highest" or "lowest" Mathematics anxiety spectrums, based on MARS scores. The Gresham (2008) study interviewed twenty out of 156 pre-service teacher participants (ten with high Mathematics anxiety, and ten with low Mathematics anxiety) and the Swars et al. (2006) study interviewed four pre-service teachers out of the 28 study participants. Findings stemming from the interview portion in both of these studies showed that pre-service teachers in both the high and low Mathematics anxiety categories expressed some form of positive feeling when asked about teaching Mathematics to students. Swars et al. (2006) wrote, "All four of the pre-service teachers, regardless of level of Mathematics anxiety, indicated that they believed they could teach Mathematics effectively" while Gresham stated,

"Of the 20 pre-service teachers interviewed, 18 revealed that they believed they could teach Mathematics effectively" (2008). What these two studies reveal is that pre-service teachers in both the high and low groups of Mathematics anxiety all expressed some level of efficacy, or confidence, toward teaching Mathematics to elementary students. What these studies do not present is information on the pre-service teachers who are between these two extremes and their explanations of how Mathematics anxiety, or lack thereof, has influenced their Mathematics teaching. The studies also raise questions as to why some pre-service teachers' Mathematics anxiety scores may correlate with their Mathematics efficacy beliefs, yet their own verbal explanations of Mathematics teaching offer different perspectives.

2.2.3.2 Teachers/ Student Relationship and Mathematics Anxiety

Teacher-student relationships are characterized by mutual acceptance, understanding warmth, closeness, trust, respect, care and corporation (Good and Brophy, 2000; Kruase,Bochner and Duchesne, 2006; Larrivee, 2005; Noddings, 2005; Smeyers, 1999).However, mathematics anxiety is said to be a feeling of tension and anxiety that interfere with the manipulation of numbers and the solving of mathematical problems in a wide variety of ordinary life and academic situation (Richardson and Suinn, 1972). These feelings can cause the students to become physically ill. They can cause students' thought processes to become literally frozen with the result being that the students would give up. Miller and Mitchell (1994) also revealed that a student's relationship with the teacher plays a significant role in the student's ability to learn mathematics. These researchers further observed that anxiety could also be as a result of a bad experience with a past teacher. Mathematics teachers that show their students a sincere, caring attitude by working to help them to overcome this terrible impediment to learning will not soon be forgotten by these students (Norwood, 1994).

A meta-analysis study by Kruase, Bochner and Duchesne, (2006) identifies the types of teachers, as they are seen from the students' point of view in relation to mathematics anxiety: 27% appreciates the quality of being receptive to creation, 23% mentions the relational capacity (cooperation, dialog, opening up), 18% underlines a very good professional training, 18% considers that the teacher must be a good pedagogue, 18% mentions being receptive to new things, 12% accentuates personality traits (friendly, intelligent, tolerant) while 7% appreciates as very important, the teachers' vision on life.

Empirically,(Schifirent, 1997) study results identify some factors such as dress code, language, receptiveness to students' mathematics problems, taking part in student's mathematics quiz competitions, teacher personality type, student-teacher activities. Schifirnet concludes that a teacher represents "not only the specialist or the person with a vast culture, but also the personality with a well-contoured profile, demonstrated in his professional, social daily behaviour and in his relations with the students. The teacher's interactions with the students lead to a change in paradigm.In contrast, a large number of studies suggest that theteachers' relationship with students may be evident for a longer period of time in mathematics learning. Murnane and Phillips (1981) found that teachers' support and receptiveness had a significant positive effect on elementary student achievement in mathematics. Ferguson (1991) found that at the high school level, Texas students taught by teachers who are contributing to an improved sense of academic achievement had significantly higher test scores on students' mathematics learning. In the most extreme case, Clotfelter, Ladd, and Vigdor(2006,2007a) found evidence of growing teacher relationship with students about twenty or more years in their analyses of North Carolina students' data, although more than half of the gains in teachers' relationship with students occurred during mathematics teaching.

These findings suggest that there is more empirical support for teachers-students' relationship that automatically rewards students' mathematics learning. Positive relationship, which includes measures of students' ability to increase mathematics learning gains, would likely be a more effective way to identify and remove anxiety level, and ultimately improve students' quality of learning(Aaronson, Barrow and Sander, 2007).

2.2.4 Concept of Epistemological Belief

Within the last decades, the research on teachers' beliefs has become an increasingly growing domain of Mathematics education (Philip, 2007). Despite being the central notion, the concept of beliefs remains undefined (Pehkonen, 1994). Nevertheless, it is possible to mention some of its main attributes: "Beliefs–psychologically held understandings, premises, or propositions about the world that are thought to be true"(Philipp, 2007).Thus, beliefs can be understood as a special type of mental state possessing an explanatory relevance to human behaviour and a semantic aspect to human understanding in the sense of a cognitive approach to psychology.

The semantic aspect of beliefs can be expressed by propositional attitudes of the form “person x believes that p” where p is a proposition, typically formulated in ordinary language and fulfilling the conditions of opaque or intentional contexts (Chisholm,1955, cited in Boris, 2009).The proposition p has not to be true, concepts occurring in p are generally not interchangeable to other ones of the same reference, and the objects mentioned in p have not to be existent. For instance, Karl may believe that Zeus lives on the morning star, whereas he denies that Zeus lives on the evening star. Although in both proposition, the respective expression refers to the same object, the planet Venus, and, additionally, he would be wrong in both cases. This example demonstrates that propositional attitude are typically saturated by subjective meanings and truth-values and, furthermore, that beliefs areisolated, but connected to each other. Kral would hold both propositions true, if he knew that the respective stellar objects in fact are identical, forexample,if he possessed some other beliefs relevant to this question.

This consideration leads to three topics which are extensively discussed within the research on beliefs (Philipps, 2007):

1) What is the difference between knowledge and beliefs? According to different epistemological backgrounds, the answer is either that knowledge is a true or a subjectively justified belief. In both cases, knowledge allows no degree of conviction.
2) What is the difference between values and beliefs? Normally, only propositional attitudes, which are truth-apt, are regarded as beliefs. Attitudes which do not solely consist of neutral statements, but also of subjective likes or dislikes, norms, and prescriptions are normally designated as values and as beliefs.
3). It is supposed that beliefs are not isolated, but form a system of beliefs, which is organized in a quasi-logical manner. For example, in the study carried out by Ertekin et al. (2009), on teacher candidates in the domains of Mathematics and social sciences, it was determined that the beliefs of the candidates in the subscale of “belief that learning requires talent”, in the epistemological belief scale, were quite different. In a similar study, Paulsen and Wells (1998) determined that the epistemological beliefs of college students differed in conjunction with their field of study.

Comprehensive reviews of studies illustrated the relevance of epistemological beliefs for learning and problem solving (Op't Eynde et al., 2006). In our opinion, when the level of epistemological beliefs about the nature of knowledge is considered, it is clear to what extent a prospective teacher who, as mentioned before, sees Mathematics as a total of rules to be memorized, will endeavour to learn mathematical subjects in university education, together with preliminary learning. Belief does only influence how students learn but they may also form an obstacle for effective learning. This means that students, who hold negative beliefs about Mathematics, become more often passive learners and place more emphasis on remembering rather than understanding (Kirsti, 2009).Beliefs are concerned with truth, meanings, ideas and certainty or conceptions. Based on this, some teachers and students tend to see Mathematics as a subject of "calculables" (Hannula, 2009) though expert teachers did not opt for deep understanding.

Furthermore, because of a lack of meaningful effort, students' learning of Mathematics will also be insufficient. The incomplete cognitive level of a prospective teacher with insufficient content knowledge will also cause the development of various negative effective characteristics. Therefore, the lack of similar studies in literature makes it necessary to determine the existence and degree of correlation between two variables. For this reason, the present study aims to investigate whether there is a correlation between the epistemological beliefs and the Mathematics teaching anxiety of prospective teachers, and to contribute to Mathematics teaching and literature.

Although the above mentioned literature points out the teacher's tendency to attribute learning difficulties mainly to students and their own limitations, the reality is not necessarily so. The students' difficulties in learning Mathematics, and sources of these difficulties, can be related to many other factors, including teachers themselves and the teaching. For a comprehensive appreciation of sources of students, difficulties, we find the theoretical framework of obstacles to learning helpful. We find this framework useful in examining not only sources of student difficulties but also teachers views of sources of students difficulties.

Inspired by the work of Bachelard (1938/2002) on epistemological obstacles, Brousseau (1997), and later on Cornu (1991), introduced epistemological, psychological (cognitive) and pedagogical (didactical) obstacles in an attempt to make sense of students' mathematical difficulties. Cornu (1991), based on the work of

Brousseau (1997), describes epistemological obstacles as occurring due to the nature of the mathematical concepts themselves. In elucidating epistemological obstacles, Cornu (1991) cites Bachelard (1938/2002) and indicates that "epistemological obstacles occur both in the historical development of scientific thought and in educational practice". To Bachelard, epistemological obstacles have two fundamental features:

"They are unavoidable and essential constituents of knowledge to be acquired, they are found, at least in part, in the historical development of the concept" (cited in Cornu, 1991).

As these features suggest, epistemological obstacles may well reside in the nature of the concepts to be learnt. For that reason, an epistemological obstacle is often viewed as a piece of, not a lack of, knowledge, which is interpreted as functioning well within a frequency. Epistemological obstacles also, as the second feature suggests, were encountered by the scientists during the historical development of the concepts. The difficulties and dilemmas that the scientists encountered during the construction process of the concepts can well be taken as an evidence of epistemological obstacles that the concepts pose.

To exemplify the presence of epistemological obstacles, several researchers focus on the limit concept and its historical development (Sierpinska, 1987;Cornu, 1991). Cornu (1991), for instance, presents several epistemological obstacles regarding the limit concept. One of epistemological obstacles that he presents is related to the idea of whether the limit is attained or not. He notes that the debate around this issue lasted throughout the history of the concept, and there were disagreements and different interpretations amongst mathematicians. He provides the views of Robins (1697-1751), Jurin (1685-1750) and D'Alembert (1717-1783) regarding this issue and quotes Robins and D'Alembert zactually stating that the limit can never be attained and Jurin stating that the limit can be attained. Here, it is critical to note that Robins and D'Alembert's interpretation of the limit concept was different from its current interpretation; as it is now accepted that the limits of constant functions are attainable.

Interestingly, the studies that have been carried out regarding students' conceptions of the limit concept show similar interpretations amongst the students as well (Williams, 1991; Cornu, 1991; Akbulut and Işık, 2005). These studies clearly show that what has been the problem or obstacle for the scientists may well be a

problem or obstacle for the students as well. This similarity can be taken as an evidence for the existence of epistemological obstacles that the limit concept presents due to its nature. Epistemological obstacles can, hence,are interpreted as causing difficulties for the students, and be sources of the difficulties that students encounter. In this study, the researcher considers students' difficulties related to epistemological obstacles as being epistemological and use the term "epistemological causes" while referring to the difficulties arising from the nature of concepts.

2.2.5 Concept of Teaching Aptitude

Aptitude is considered to be an important characteristic necessary to fulfil the above responsibility, because it can predict the future success or failure of an individual in one occupation or areas of occupation. According to Tasleem and Hamid (2012), aptitude may be described as a specific ability or a specific capacity distinct from the general intellectual ability, which helps an individual to acquire degree of proficiency or achievement in a specific field.

The word "aptitude" is derived from the word "Aptos" which means "fitted for". The term is differently defined by different psychologists, as many cases do happen, but these different definitions agree in certain essentials, such as "Present ability", role of training, case of acquiring proficiency, interest in activity, and so on.

Feiman (2001) has defined an 'aptitude' as a combination of characteristics indicative of an individual's capacity to acquire (with training) some specific knowledge, skill or set of organized responses such as the ability to speak a language, to become a musician, to do mechanical work". He has also pointed out that aptitude is different from skill and proficiency. "Aptitude refers to those qualities characterizing a'person's ways of behaviour which serve to indicate how well he can learn to meet and solve certain specified kinds of problems'.

Aptitude refers to "quality of being fit for a purpose or position". If so, Teacher Aptitude is the quality of being fit for teaching profession. That is why, Teacher Aptitude is considered as the Introduction determinant factor of effective teaching. If the teachers are empowered with necessary skills and competence, they can inculcate the skill in other persons, particularly in their pupils. A teacher with teaching aptitude encourages students to use active techniques to create more knowledge and then to reflect on and talk about what they are doing and how their understandings are changing. Researchers suggest that teacher's knowledge of subject matter and students' learning and teaching methods, are important elements of

effective teaching, which are very much related to Teacher Aptitude. Although an educational system has excellent resources, if the teachers lack teaching aptitude and are incompetent or indifferent to their responsibilities, the whole program is likely to be ineffective and largely wasteful.

Anees (2005) has provided substantial evidence favouring teaching aptitude, for quality education. Complexity and multi-dimensional nature of teaching aptitude warrants a comprehensive study of the factors related with it. A modern view of teaching aptitude includes professional activities on the school level, such as co-operating in teams, building professional learning communities, participating in school development, and evaluating and changing working conditions. These activities shape the learning environment on the school level, that is, the school climate, ethos and culture, and thus directly and indirectly (via classroom-level processes) influence students' learning. Many factors are responsible for shaping the quality of education in the country. These factors range from ideological and socio economic needs to the existing structure of education system as well as defined theories, practices of teaching, learning and teachers' teaching aptitude.

2.2.6 Concept of Success Expectancy

Educational research has identified many factors that could influence students' school achievements. These include teacher educational expectations, and teacher and student perceptions of students' school experiences. There are numerous studies about the relationships between teacher expectations of students' future school attainment and school achievements. Other studies have provided evidence that teacher's perceptions of students can positively or negatively influence students' performances and achievement. Self-fulfilling prophecy is one of the main theories that have been used to explain the influence of teacher expectations and perceptions of students on students' achievements. Empirical studies testing this theory have reported different conclusions. Another line of research examines more closely the connections between students' educational expectations, their school experiences, and achievements. Student perceptions of school experiences as reflected in their self-evaluations of academic abilities and achievements and feelings of disengagement are closely related to their educational outcomes.However, we have limited knowledge about how each factor influences, and is influenced by, other factors when all are taken into consideration across time.

Also, most of the research mentioned above were conducted in the U.S. and other developed countries. To date, only a few studies in the context of developing countries have examined the reciprocal relationships among teachers' and students' expectations, their perceptions of children's school experience, and students' achievement over time. In the setting of a developing country, where the social structure and educational systems, as well as conceptions on the roles of teachers and the values of education, might be different from those in the developed countries. Exploring the mechanisms through which school processes may influence students' educational outcomes will bring insights into the educational stratification research, and will provide an opportunity to test the theoretical frames that are often used in educational stratification research as well. This study aims to answer the following main questions:

1) Whether there is stability or change over time in teacher and child expectations, their perceptions of school experience, and achievements;
2) Whether there is reciprocal relationships between teacher expectations and achievements and between child expectations and achievements; and
3) Whether teacher and child interpretations of child school experience mediate these relationships. In this study, teacher interpretation of child school experience refers to teacher assessments of child learning abilities and achievement levels, as well as study habits.

From the analysis of the background subject knowledge, we can discover that the expectation and achievements of the subject-matter is not an understatement but a right step in the right direction. In Schofied (1981)paper, the subject matter knowledge is considered as a measurable performance indicator for assessing teacher's Mathematics achievements.In the past decade, teachers' subject matter knowledge was measured by the scores achieved on standardized tests by number of academic modules bynumber of courses taken in university. In Hong Kong, most educators have the same view on taking Mathematics subject matter, as Mathematics teacher's Mathematics achievement. But these quantitative measures do not only represent the teachers' entire knowledge but also includes pedagogical content knowledge.

This research work is focused onMathematics teachers pedagogical content knowledge considered as another category of teachers subject matter knowledge which can be described as knowing the way of representing and formulating the

subject matter and making it comprehensible to students. As teacher instructional devices influence the process of learning, it istherefore, important to understand how teachers explain Mathematics knowledge to students. What they emphasize and what they do not, and what method they choose to help students understand. Teachers' pedagogical content knowledge is influenced by their subject matter knowledge Shulman(1986; Ball,1991).The interrelationship between the two is not clear enough up to the present time. There is very little research, especially in Hong Kong, studying this correlation among Mathematics teachers. Therefore, there are strong rationales to support the researcher to investigate the relation.

2.2.7 Concept of Emotional Intelligence

Emotional intelligence is defined as the subset of social intelligence that involves the ability to monitor one's own and other's feelings and emotions, to discriminate among them and to use this information to guide one's thinking and actions (Mayer and Salovey, 1990). Simply stated, emotional intelligence is a learned ability to identify, understand experience and express human emotions in healthy and productive ways. Emotion experience and expression are unique to each teacher and student. No one else thinks, expresses feelings,behavesor acts in the same way.

It is a confluence of developed ability to (1) know and value self (2) build and maintain a variety of strong, productive and healthy relationship (3) get along and work well with others in achieving positive results and (4) effectively deal with the pressures and demands of daily life and work. The development of emotional intelligence is an intentional, active and engaging process. Influencive learning requires a person-centred process for teachers' and students' growth and development. When emotional intelligence skills are the focus of learning, teachers and students are building human development behaviours that are intricately related to the positive outcomes of achievement, goal achievement and personal well-being.

There has been considerable research into the influence of emotional maturity on work performance of people, however, the impact of the same on academic performance has not been that extensively delved into. There have indeed been some studies that demonstrate the predictive effects of emotional intelligence on academic achievement (Marquez, Martin and Bracket, 2006; Adeyemo, 2007), but just a few of them have sought to provide evidence of empirical relationship between students' emotional intelligence and their scores in their studies.

Current trends show that educational psychologists have begun to address

what has historically been regarded as the soft side of individual differences. This includes mood, feelings and emotions in relation to academic achievement, away in which students function and perform in accordance with the anticipated tasks at hand. Different levels of competence nest in emotional intelligence. As defined, emotional competence is a learned capability based on emotional intelligence that results in outstanding performance at work (Goleman, 1998b).Research indicating a close connection between intelligence and school performance is plethora. The pattern of association absented between emotional intelligence and the academic achievement of students is consistent with the position of Schutte, Malously , Hall Haggarly, Cooper, Golden, and Dornherin (1998), Tapia (1998), Ogundokun (2007). Their positions point in the direction of significant relationship existing between emotional intelligent and academic achievement of students. But by contrast,Koifman (1998); Sutarso,Baggett, Sutarso and Tapia (1996), have showed no relationship between emotional intelligence and academic achievement.

In 1983, *A Nation at Risk: The Imperative for Education Reform*reported that American teacher education programs were unable to attract academically able students to the teaching profession. The report echoed the oft-cited quotation, “Those who can, do. Those who can’t, teach.” The nearly 30 years following this report have seen a multitude of new and heightened standards regarding teacher quality. Great efforts have been made to ensure the intellectual competence of teachers in hopes of increasing students learning. Zumwalt and Craig (2005) note that, “…policy makers, politicians and government officials, leaders of the business and philanthropic communities, and educators at all levels, have worked to raise standards for prospective teachers and upgrade teacher education programs” (p. 158). Many of these efforts have centred on the intellectual ability of those wanting to teach. For example, raising minimum GPA requirements for acceptance into teacher education programs, along with increasing the acceptable GPA needed to qualify for student teaching and graduation have been used to eliminate teacher candidates with questionable academic performance. Likewise, using college entrance exam scores (viz., SAT, ACT) is a frequent method for determining a candidate’s academic ability.

These reform efforts focus on intellectual and academic indicators of teacher education program applicants prior to their acceptance into schools of education, as well as during their preparation programs. It is anticipated that these increased standards for programme admission will help make the teaching profession less of a

"dumping ground for low achievers" (Zumwalt and Craig, 2005). More recently, teacher tests, such as the Praxis series of exams, have been greatly emphasised and utilised in determining intellectual competence, particularly the subject matter and pedagogical knowledge of those entering the classroom (Zumwalt and Craig, 2005). Each of these efforts is ultimately aimed at increasing the quality profile of teacher candidates in hopes of increased student achievement.

In the United States, teacher preparation accrediting organisations, such as the NationalCouncil for Accreditation of Teacher Education (NCATE), have increased standards and accountability for teacher education programs (NCATE, 2006) in an attempt to improve teacher quality. Relevant to a discussion of evaluating teacher candidates, NCATE's first standard is focused largely on teaching candidates' knowledge, skills, and disposition (NCATE, 2006). Teacher candidate skills desired by NCATE include the ability to maintain a professional disposition and accurately assess and analyse student learning (NCATE, 2006). NCATE's inclusion of teacher dispositions, to include values such as caring, fairness, honesty, responsibility, and social justice, together with professional commitment and ethics has drawn some criticism (Murray, 2007). While few argue the need for the moral and ethical development of teachers, NCATE's proposed teacher dispositions are difficult to define and nearly impossible to measure (Borko, Liston, and Whitcomb, 2007; Murray, 2007). NCATE's efforts, while criticised, are a notable effort to increase the quality profile of teacher candidates.

Other organisations, such as the Interstate New Teacher Assessment and Support Consortium (INTASC, 1992), also provide assistance to states and teacher education programs in their evaluation efforts. INTASC provides evaluation rubrics designed to be consistent with the recommendations of both teacher education researchers (i.e., Fenstermacher and Richardson, 2005) as well as NCATE standards, and which can be modified to meet individual state and institutional needs. INTASC has created ten standards for assessment, which it believes, reflect the knowledge, skills, and disposition that beginning teachers must possess. These standards are enumerated as follows:

- Content Pedagogy. The teacher understands the central concepts, tools of inquiry, and structures of the discipline he or she teaches and can create learning experiences that make these aspects of subject matter meaningful for students.

- Student Development. The teacher understands how children learn and develop, and can provide learning opportunities that support a child's intellectual, social, and personal development.
- Diverse Learners. The teacher understands how students differ in their approaches to learning and creates instructional opportunities that are adapted to diverse learners.
- Multiple Instruction Strategies. The teacher understands and uses a variety of instructional strategies to encourage student development of critical thinking, problem solving, and performance skills.
- Motivation and Management. The teacher uses an understanding of individual and group motivation and behaviour to create a learning environment that encourages positive social interaction, active engagement in learning, and self-motivation.
- Communication and Technology. The teacher uses knowledge of effective verbal, nonverbal, and media communication techniques to foster active inquiry, collaboration, and supportive interaction in the classroom.
- Planning. The teacher plans instruction based upon knowledge of subject matter, students, the community, and curriculum goals.
- Assessment. The teacher understands and uses formal and informal assessment strategies to evaluate and ensure the continuous intellectual, social, and physical development of the learner.
- Reflective Practice: Professional Growth. The teacher is a reflective practitioner who continually evaluates the effects of his or her choices and actions on others (students, parents, and other professionals in the learning community) and who actively seeks out opportunities to grow professionally.
- School and Community Involvement. The teacher fosters relationships with school colleagues, parents, and agencies in the larger community to support students' learning and well-being. (INTASC, 1992, pp. 14-34)

Although the use of evaluation rubrics based on INTASC standards by no means provides a cure-all for the difficult and complex challenge of assessing the competence and performance of student teachers, they are generally accepted by schools of education.While increasing academic and intellectual standards for those desiring to enter teacher education programs may certainly be warranted, there are

undoubtedly other qualities that may predict future teacher effectiveness. As Ayers (1993) notes, “Teaching is more than transmitting skills; it is a living act, and involves preference and value, obligation and choice, trust and care, commitment and justification” (p. 20). Those who have taught are likely to agree with Zumwalt and Craig (2005) that, “teaching requires a mix of intellectual and personal qualities” (p. 183). Following their study of distinguished teachers, Baiocco and deWaters (1998), established what they term the “supertraits” of teaching. Their list includes: 1) enthusiasm, 2) sociability/friendliness, 3) organisation, 4) conscientiousness, 5) optimism, and 6) flexibility. Others, including Gardner (1983) and Goleman (1995), have created similar lists of ideal traits.

Goleman (1995) in particular has identified a set of abilities and personal characteristics vital to life success known as emotional intelligence. Goleman’s definition of emotional intelligence begins with five parts: 1) knowing emotions, 2) managing emotions, 3) motivating oneself, 4) recognising emotions in others, and 5) handling relationships (p. 43). This depiction of emotional intelligence is broad enough to include impulse control, hardiness, self-awareness, and character. Remarkably, this model of emotional intelligence, together with the “supertraits” of teaching, appears to align with NCATE’s depiction of desirable teaching dispositions. Efforts focused on teacher recruitment and education which focus almost entirely on measures of traditional intelligences such as GPA and college entrance exam scores, and IQ, may benefit from a shift in focus toward such characteristics.

One conception of emotional intelligence, referred to as the ability model, may potentially inform teacher education. Proponents of the ability model typically define emotional intelligence as, “the ability to perceive and express emotion accurately and adaptively, the ability to understand emotion and emotional knowledge, and the ability to use feelings to facilitate thought, and the ability to regulate emotions in oneself and in others” (Salovey and Pizarro, 2003). The ability model originally proposed by Salovey and Mayer (1990) has narrowed to include four basic emotional abilities.Titled the four-branch model, these four abilities of emotional intelligence are: (1) perceiving emotions, (2) using emotions to facilitate thought, (3) understanding emotions, and (4) managing emotions. The four concepts are explained in the following section:

- **Perceiving Emotions**

The first branch of the model involves perceiving emotional states. This branch is dependent on an individual's ability to accurately assess his/her own emotions. "If each time an unpleasant feeling emerged," note Mayer, Salovey, and Caruso (2000), "a person turned his attention away, he would learn nearly nothing about feelings" (p. 109). Perceiving emotions includes the ability to recognise the feelings of others. This ability involves, "paying attention to and accurately decoding emotional signals in facial expressions, tone of voice, or artistic expressions" (Salovey and Pizzaro, 2003, p. 264). Individuals high in this branch of emotional intelligence are able to make accurate emotional appraisals of those around them by attending to these various expressions (Mayer et al., 2004).

Using Emotions to Facilitate Thought

The second branch of this model focuses on the ability to take feelings into account when problem solving or reasoning (Salovey and Pizzaro, 2003). The emotional facilitation of thought relates to how emotion alters cognition and impacts thought (Mayer and Salovey, 1997; Mayer et al., 2000). Emotions can either be helpful or detrimental to cognitive abilities, a catalyst or an interruption. Individuals strong in this ability use emotions to facilitate and assist their thinking (Mayer, Salovey, and Caruso, 2004).

- **Understanding Emotions**

The ability to understand how emotions change or evolve in self and others is an important aspect of emotional intelligence. This ability is demonstrated by one's competency in recognising, labelling, and grouping similar emotions (Mayer and Salovey, 1997). Understanding emotions also relates to the ability to, "analyze emotions, appreciate their probable trends over time, and understand their outcomes" (Mayer et al., 2004, p. 199).

- **Managing Emotions**

The fourth branch in this model of emotional intelligence is centred on one's ability to manage emotions. While emotionally intelligent people may not always wear emotions on their sleeve, nor do they bury them. Mayer et al. (2000) note specifically, "Management encourages emotions to be experienced, although not always expressed" (2000, p. 108). Thus, managing emotions in an emotionally intelligent

way requires an understanding of appropriate time and setting for emotional expression.

While it has been hypothesised that highly emotional intelligent individuals are drawn to occupations involving social interactions such as counselling and teaching (Mayer et al., 2004), studies exploring emotional intelligence among teachers using the ability model have just begun. Recently Perry, Ball, and Stacey (2004) developed the Reactions to Teaching Situations measure (RTS) to help implement research related to emotional intelligence and teaching. The RTS includes 10 vignettes of typical teaching situations and provides teachers with four response options representing each of the four branches of emotional intelligence. Using the RTS with 211 teachers in Austrailia, Penrose, Perry, and Ball (2007) found that emotional intelligence was positively associated with teacher self-efficacy. Based upon this finding, Penrose et al. contend that enhancing teacher's emotional intelligence may increase efficacy and subsequently lead to improved student achievement. Furthermore, the authors recommend developing pre-service teacher education courses designed to increase teacher candidates' emotional intelligence (Penrose et al., 2007). To date, however, no research has been conducted to determine how emotional intelligence impacts, or predicts, student teaching performance. At a time when teacher education programs are working hard to recruit the highest quality applicants and increase the effectiveness of their teaching candidates, exploring the potential relationship between emotional intelligence levels and teaching effectiveness should be considered.

2.3 Review of Empirical Studies

2.3.1 Teachers' Mathematics Teaching Anxiety and Achievementin Mathematics

Poor performance in Mathematics has been linked to an increase in Mathematics teaching anxiety (Hopko, 2003). Belief and expectations to perform poorly on Mathematics problems could also lead to Mathematicsteaching anxiety (Özer, 1997) or intensify students' existing anxiety. Mathematics anxiety can be experienced to such a degree that children might perceive their performance in the subject as a measure of their self-worth and a reason for losing value in the eyes of parents and teachers. Thus, students with these excessive worries develop negative attitudes toward Mathematics which are expressed as "I can't do Mathematics" or "I hate Mathematics." However, since they do have to deal with Mathematics, these beliefs

lead to a great deal of distress and unease (Townsend et al., 1998). Various studies have demonstrated a negative correlation between Mathematicsteaching anxiety and Mathematics performance (Pajares and Urdan, 1996). Research has shown that self-efficacy beliefs influenced the relationship between Mathematics teaching anxiety and Mathematics achievement; that is, Mathematics teaching anxiety mediates the effect of Mathematics self-efficacy on Mathematics teaching (Kabiri, 2003). Akinsola (2013) sees mathematics teaching anxiety as being a severe discomfort or uneasiness that occurs when a person is asked to perform mathematically or required to manipulate numbers. Teachers with a high level of mathematics teaching anxiety often possess a low level of teacher self-efficacy. They sometimes avoid teaching mathematics altogether and pass their fear of the subject onto their students. Among pre-service teachers, those with a low level of mathematics teaching anxiety had strong beliefs in their ability to be effective mathematics teachers, while those with a high level of mathematics teaching anxiety had less confident views of their ability to teach the subject effectively (Akinsola, 2013).

In the same vein, a prominent theory regarding the negative impact of anxiety on cognitive task performance (attentional control theory) (Eyesenck, 2007) suggests that anxiety compromises performance via limiting the successful operation of attention shifting and inhibitory processes. For instance, anxious individuals, when in the context of emotion inducing stimuli, tend to exhibit poorer control of saccades (Ansarie, 2008;Wieser, 2009),and poorer performance in an emotional Stroop paradigm (Reinhold Dunneetal, 2009). This evidence is also consistent with the suggestion that Mathematics anxiety involves a reduction in control related working memory capacity(Hopkoetal, 1998; Ashcraftand Krause, 2007; Beilock, 2008). This implies that anxiety reduces level of performance and the cognitive ability of an individual.

Today, Mathematics anxiety is an important and common phenomenon in students from elementary through college and university levels. In order to understand Mathematics anxiety, one should firstlearn the complexity of this concept (Uusimaki and Nason, 2004). Richardson and suinn (1972) define Mathematics anxiety as “feelings of tension that interfere with the manipulation of numbers and the solving of mathematical problems in a wide variety of ordinary life and academic situations” (cited in Newstead, 1998). According to Trujillo and Hadfield (1999), the causes of Mathematics anxiety can be classified in three categories: personality factors,

environmental factors and intellectual factors. The personality factors include reluctance to ask questions due to shyness, low self-esteem, and, for females, viewing Mathematics as a male domain. Environmental factors include negative experiences in the classroom, parental demands, insensitive teachers, and use of the traditional teaching method, where Mathematics is taught and thought of as the memorization of formulas, and the long and monotonous computation and manipulation of numbers (Idris, 2006). Intellectual factors include being taught with mismatched learning styles, student attitude and lack of persistence, lack of confidence in mathematical ability, and the lack of perceived usefulness of Mathematics. According to Cassady and Johnson (2002), high levels of emotionality are considered to be in examination when the individual maintains a high level of self-confidence regarding performance.

. Mathematicsteaching anxiety is found to have a negative relationship with Mathematics performance and achievement (Hembree, 1990; Richardson andSuinn, 1972). In the past, researchers have reported a consistent but small negative relationship between Mathematics anxiety and performance; correlation generally ranging from about -0.11 to -0.36, indicating that students with higher levels of Mathematics anxiety tend to have lower level of Mathematics performance(Cooper and Robinson, 1989; Morris, Davis and Hutchings, 1981).

This negative relationship also appears at the elementary and secondary school levels(Meece, Wigfield and Eccles, 1990).Hembree (1990) reports an average correlation of -0.34 for school students, concluding that Mathematics anxiety seriously constrains performance in mathematical tasks and that reduction in anxiety is consistently associated with improvement in students' achievement.

Kartoon and Mahmoood (2010) opined that Mathematics anxiety often leads to avoidance of Mathematics by those who experience it. Often students who are anxious, bored, and fearful towards Mathematics, or who do not comprehend the importance of Mathematics in professional and personal life, are the ones most likely to avoid the study of Mathematics. It cannot be stressed more forcefully the fact that Mathematics is truly the gateway to engineering, scientific, and technological fields. Mathematics anxiety in students has become aconcern for our Indian society. Evidence of students' poor attitude and high levels of anxiety toward Mathematics is abundant.

2.3.2 Teachers' Epistemological Belief and Achievementin Mathematics

Epistemological beliefs are subjective theories about the structure and boundaries of knowledge and about the nature of knowledge acquisition (Hofer and Pintrich, 1997). Sophisticated epistemological beliefs are seen as both an important goal of instruction and a key predictor of achievement (Hofer, 2001). For these reasons, the last two decades have seen lively psychological discussion on the epistemological beliefs of students (for an overview, see Hofer and Pintrich, 2002) and, more recently, of teachers (Sinatra and Kardash, 2004).

Despite this intense interest, and several important theoretical and empirical contributions to research on epistemological beliefs and their effects on thinking and learning (see Hofer and Pintrich, 2002), no consensus has yet been reached on many of the central questions in this Weld of research (Pintrich, 2002). Ongoing debates address, for instance, the relationship of epistemological beliefs to academic achievement (e.g. Wood and Kardash, 2002) and Welds of study (e.g. Jehng, Johnson, and Anderson, 1993). Progress in these areas is subject to the implementation of rigorous methodological standards in terms of research designs, samples, and statistical analyses (e.g. Wood and Kardash, 2002).

The starting point of modern empirical studies on epistemological beliefs can be traced to the work of Perry (1970). Perry studied the way university students deal with knowledge and knowledge acquisition, and how they come to grips with the uncertainties of knowledge. Based on his interviews with students, Perry developed a scheme describing the development of epistemological beliefs. His model encompasses four broad developmental steps (see Hofer and Pintrich, 1997). Persons with a *dualistic view* see statements about reality as either "right" or "wrong"; in case of doubt, experts will be able to provide the correct answers. The dualistic view is succeeded by a conception of *multiplicity,* in which different views on reality are accepted. However, respondents at this stage still assume that future research will provide "correct" answers to unresolved questions. In the third stage, the *relativisticworld view,* all knowledge is seen as a human construction that is uncertain and that might be proven wrong; no one approach can be construed to be superior to another. Finally, students may reach the stage of *commitment within relativism* that enables them while acknowledging that there is no certainty or absolute truth—to commit to specific views of reality and to judge the quality and appropriateness of different approaches to reality accordingly.

Perry's (1970) analyses prompted numerous studies examining the development of epistemologicalbeliefs and their relations to other constructs, and were a catalyst for stimulating scientific discussion and debate (King and Kitchener, 1994; Hofer and Pintrich, 2002). The development of standardized questionnaires to tap epistemological beliefs (Duell and Schommer-Aikins, 2001) as a parsimonious alternative to interview-based assessment procedures was a milestone in research on epistemological beliefs. These questionnaires typically cover several dimensions. Perhaps the best-known instrument is Schommer's (1990) questionnaire on "beliefs about knowledge and learning," which covers four dimensions (stability of knowledge; structure of knowledge; speed of learning; ability to learn; see Duell and Schommer-Aikins, 2001). Based on an extensive review of the literature and a thorough theoretical exploration of dimensions used in research on epistemological beliefs, Hofer and Pintrich (1997) argued in favor of focusing on beliefs on the *nature ofknowledge* (with certainty of knowledge and simplicity of knowledge as sub-dimensions) and beliefs on the *nature of knowing* (with source of knowledge and justification of knowledge as sub-dimensions) as the core dimensions of epistemological beliefs. The present analysis focuses on the *certainty* dimension.

A strong belief in the certainty of knowledge indicates that a student believes scientific theories and results to be certain, "true," and stable. This kind of standpoint is considered to reflect an unsophisticated view of the nature and boundaries of human knowledge, and assumed to have negative consequences for learning (e.g., low-level processing). The certainty dimension is a core component of almost all conceptions of epistemological reasoning (Schommer, 1990; King and Kitchener, 1994; Hofer, 2000). For instance, it is an essential element of Perry's (1970)description of young college students who according to his model believe that there is a"right" answer to everything. The reflective judgment model (King and Kitchener, 1994) maps students' progression from a belief in the certainty of knowledge to a view that knowledge is uncertain and contextual. In Schommer's (1990) questionnaire, the certainty aspect is encapsulated in the "stability of knowledge" dimension (sample item: "Scientists can ultimately get to the truth"). Similarly, in Hofer's empirical studies (e.g. Hofer, 2000), the certainty dimension was identified in factor analyses.

In the field of education, epistemological beliefs have been an important construct for the past two decades, and have frequently been used to predict

achievement or achievement-related behavior (Buehl and Alexander, 2001). It has been assumed that similar to motivational constructs (Köller, and Baumert, 2005) sophisticated epistemological beliefs will positively influence the learning process, and factors such as the choice of learning strategy (Kardash and Howell, 2000) have been proposed as mediating mechanisms. A significant relationship between achievement and epistemological beliefs has indeed been found in several non-experimental and experimental studies (Hofer, 2000). However, the strength of this relationship varies across samples and depends to some degree on the dimensions examined. For instance, in the Schommer (1993) study with more than 1000 high school students, grade point average (GPA) was significantly negatively predicted by the four dimensions covered in the questionnaire (quick learning, stable knowledge/certainty, simple knowledge, fixed ability). When controlling for verbal IQ, however, only the quick learning dimension remained significant.

The effect of the quick learning dimension on academic achievement was confirmed in a longitudinal extension of the Schommer (1993) study by Schommer, Calvert, Gariglietti, and Bajaj (1997). However, neither stable knowledge/certainty nor two other dimensions significantly contributed to the explanation of GPA in either study. Similarly, stable knowledge/certainty beliefs were not significantly related to math test performance in a study with 139 undergraduate and graduate students (Schommer et al., 1992). The stable knowledge/certainty dimension did, however, predict inappropriately absolute conclusions in a study with 86 junior college students who completed several comprehension tasks after reading text passages (Schommer, 1990). Similarly, Kardash and Scholes (1996) reported that beliefs about the certainty of knowledge predicted the types of conclusions drawn by high school students (*N*D96) after reading mixed evidence on a controversial topic (causes of AIDS). The stronger the students' beliefs in the certainty of knowledge, the more likely they were to draw conclusions that failed to take into account the inconclusive nature of information provided. The certainty dimension was also significantly related to achievement in a study with 326 first year college students (Hofer, 2000). In this study, certainty scores on both a domain-general and a domain-specific measure were the strongest predictors of academic achievement. Findings show that the higher their certainty scores, the lower the students' academic standing.

Using data from the German extension to the Third International Mathematics and Science Study (TIMSS), (Köller et al,2000; Köller, 2001) examined the physics

achievement of upper secondary students at three course levels (advanced physics course, basic physics course, no physics course). To tap epistemological beliefs, they adapted an instrument specifically tailored to physics (Labudde, 1998) that includes a certainty scale (item example: “Knowledge from the Weld of physics is beyond all doubt”) and adualism scale (item example: “There is only ever one correct solution in physics”). In line with their expectations, the findings showed that, after controlling for course level, certainty was negatively related to physics achievement (partly mediated by lower interest in physics), whereas dualism was associated with less use of elaboration techniques in the learning process. Taken together, although certainty beliefs have been found to predict academic achievement in several studies, results have not been unequivocal. However, the non-significant findings may in part be attributable to the design of the studies in question.

As pointed explained by Wood and Kardash (2002), studies on epistemological beliefs often lack the power to detect small to moderate effect sizes. In addition, most studies rely on convenience samples, which may decrease the likelihood of finding significant effects. Moreover, although there likely is a link between cognitive abilities (intelligence) and epistemological beliefs, many studies examining the relationship between epistemological beliefs and academic achievementhave not taken cognitive abilities into account. Likewise, characteristics of the family environment that are conducive to academic progress (e.g., socioeconomic standing, cultural capital; see Buchmann, 2002) are often disregarded. Hence, even in the studies that have found a link between certainty beliefs and academic achievement, third variable explanations may apply.

2.3.3 Teachers’ Success Expectancy and Achievementin Mathematics

Achievement in any meaningful endeavour is marked by a history of high expectations that provide the challenge and inspiration necessary to press the individual to his/her highest level of performance. Though there are supportive components of success - environment, general and special abilities, personal work habits and attitudes, and even chance (Tannenbaum, 1997), the central factor is high expectations. One’s own expectations of oneself are important in the sense that people usually set their goals first and then develop their action plans accordingly. Others’ expectations of individuals are also critical, since people tend to strive to accomplish what is expected of them. In both cases, without high expectations, individuals invariably drift toward mediocrity or even failure.

The case is no less true in education. The strong relationship between Success Expectancy and academic achievement has been well established both theoretically and empirically (Johnson, Livingston, Schwartz, and Slate, 2000; Marzano, 2003). Schools with exceptional levels of academic achievement consistently demonstrate high expectations and goals supported by data-driven collaboration and ongoing assessments (Schmoker, 2001). Within the individual classroom, there is a clear correlation between teacher expectations and student achievement. "High expectations represent an overall orientation toward improvement and growth in the classroom, which has been demonstrated to be a defining characteristic of benchmark schools…. Effective teachers not only express and clarify expectations for student achievement, but also stress student responsibility and accountability for striving to meet those expectations" (Stronge, 2002,p.3). Perhaps as important as expectations by schools and teachers are parents' academic expectations for their children. Parents' expectations have been shown to be a significant predictor of student success across age groups, races, and nationalities (Seginer, 1983; Kaplan, Liu, and Kaplan, 2001). For this reason, the relationship between Success Expectancy and achievement has remained a recurring theme in education reform discussions since Ronald Edmonds spawned the effective schools movement (Thomas and Bainbridge, 2001).

Certainly, there are other factors that augment high expectations, but the bedrock of academic achievement is high expectation. Even if educators could straighten out all of the supporting factors - finance, teacher quality, equity issues, etc., without high academic expectations for themselves and/or high expectations of others for them, students would still not reach high levels of achievement.Research in educational stratification has identified the links between teacher educational expectations for student future education attainments and student school outcomes. Studies found that in general teachers tend to have lower educational expectations for students from low income families as compared with their peers from higher income families, and for students from minority groups.

At the same time, students from disadvantaged families tend to have lower expectations themselves. These low expectations are closely connected with student poor achievements at school and a high drop-out rate later. Using data from the Chicago Longitudinal Study, Gill and Reynolds (1999) found that teacher expectations are strong predictors of student reading and math achievements among African American children. Smith, Jussim and Eccles's (1992) study found that

teacher expectations in middle school have latent effect on student high school standard test scores.

One of the recognized mechanisms whereby teacher expectations may influence school outcomes is through their influence on student educational Success Expectancy, their self-concept of abilities and attainment values. In turn, these factors have been identified as predictive of later school outcomes including grades, test scores, and dropping out. Muller et al. (1999) found that teacher expectations are the strongest predictor of whether students have aspirations to attend college. Using data from the New Hope study, Benner and Mistry (2007) found that teacher expectations have a strong impact on student achievements, and this impact is mediated by student expectations and the self-concept of competency.

Student educational Success Expectancyis associated with both behavioural choices that facilitate academic success and educational attainments. The positive impact of student educational expectations on attainment holds even when controlling for previous achievements. Eccles and Wigfield (2002) argue that expectations are closely related to achievement performance; at the same time, they are influenced by individual interpretations of previous achievements. They point to the cyclical influence between expectations and achievements. Several studies have reported the reciprocal relationship between child educational expectations and school achievements. Bui's (2007) study found that the impact of school achievements on educational expectations is stronger than in the opposite direction. The above studies point to the interrelationship among teacher and student educational Success Expectancy and student academic achievements at school. However, the reciprocal effects between Success Expectancy and achievements over time are less clear. Another line of research focuses on the impact of teacher perceptions of students such as evaluations of student academic abilities, performance, and behaviours at school. Previous research has shown that teacher perceptions of student cognitive and non-cognitive skills can positively or negatively influence student performances and achievements, be they accurate or not.

Modern Mathematics has a deductive-axiomatic structure and generally shows a hierarchical construction. So, it is hard to understand a mathematical concept without being aware of its preliminary subjects. This deductive-axiomatic structure of Mathematics depends on undefined terms, definitions and logical rules (Swadenerand Soedjadi, 1988). Absolutist philosophers; who see Mathematics from this perspective,

appreciate it as an abstract science and also they think that it is interested in generalization, theory and abstractions. So, Mathematics is seen as a field which has no social choice and with which only a few people concerns. And Mathematics is value-free; that is to say, it is neutral (Ernest, 1991; Bishop, 2002).

In fact, Mathematics is value-laden. It is not neutral. Yet, values are generally taught implicitly rather than explicitly in Mathematics. However, values are rarely taken seriously at Mathematics educational discussions and Mathematics teachers are generally interested in operations that have only one answer. They don't believe values teaching in Mathematics lessons (Clarkson, 2000). Nowadays, curriculum programmes are prepared in this way. Programmes prepared usually focus on students' achievements. At curriculum, although there some expressions about values teaching, we meet a little information about their developments. But, it is an obligation that one has more information about values which play a vital role in mathematics educational development (Bishop, 2000).

They play an important role in students gaining their personal and social identities. Especially, this side of values can be seen at front side in Mathematics lessons.Because values influence students' choices concerning about Mathematics or not concerning about it significantly (Fitz, Simons and Seah, 2001). Sam and Ernest (1997) classify the values about Mathematics education into three such as; i) Epistemological Values: They are the values which are about theoretical side of Mathematics learning and teaching such as; accuracy, systematicness, and rationalism and also characteristics, appreciation and acquiring of mathematical knowledge. For example; accuracy, being analytical, rationalism and problem solving. ii) Social and Cultural Values: They are the values that indicate human's responsibilities about Mathematics education for society.These includecompassion, integrity, moderation and gratitude. iii) Personal Values: Values that influence a person as an individual or a learner.Such as; curiosity, thriftiness, patience, trust and creativity. Bishop classifies values taught in Mathematics lessons into three different types by making them more specialized than that of Sam and Ernest.These are; general educational values, mathematical values and Mathematics educational values (Bishop, 1999).

Mathematical proofs need to be taught to students. Some of these are briefly explained here:

Rationalism

What is important in Mathematics has been and will be shown by mathematicians.

Mystery

All that matters in Mathematics is getting the right answer(s), never mind the methods used. Product

Mathematics assessment should focus on multiple-choice and short-answer questions.

Product

Full marks should be awarded for correct method shown, even if the numerical value is wrong.

Process

What is learnt in school Mathematics is relevant to life and work.

Relevance

The new Mathematics method is what school Mathematics should be about. School Mathematics is about understanding and learning ideas.

Concept

The role of the Mathematics teacher is to teach concepts and demonstrate associated skills.

Authority

School Mathematics provides us with tools for successful problem-solving. Tool

As a teacher, I believe that student group work is essential in their Mathematics learning experience.

2.3.4 Teachers' Teaching Aptitude and Achievementin Mathematics

Effective teachers have a good command of their subject matter and have a better academic performance. Without conceptual competencies a teacher can never create a strong basement of academic development in his students. As so many reforms and recommendations occur in the field of evaluation system, like,formative and summative evaluation, continuous and comprehensive evaluation etc., themarks or scores gained by a student is the ultimate word of achievement now also. Academic Achievement becomes the corner stone of the developmental path of education and really, it becomes a strong determinant of effective teaching. Though there are so many studies related to academic achievement in different areas of student related problems, studies related to student teachers, teachers and teaching profession are very few in number. The reviewed studies related to academic achievement are presented below. Gopalacharyalu (1984) in a study of relationship between certain

psychology factors and achievement of student teachers in teacher training institutes of Andhra Pradesh tried to find out whether differences in the psycho-sociological factors of student teachers accounted for significant differences in their achievements. He also tried to identify the psycho- sociological factors that significantly predicted the achievements of student teachers. The results showed that attitude towards teaching and attitude towards training influence achievement in theory and total achievement significantly. It was also found that age and locality of student teachers have significant influence on achievement in theory and total achievement.

Patil (1984) studied the relationship between interest, attitude and intelligence with teaching in relation with other variables like achievement and sex of B.Ed student teachers and found that intelligence, attitude and interest are positively correlated with teaching. Wali (1985) examined the relationship between various demographic correlates, academic background of teachers and teaching effectiveness. Implications for teacher preparation, such as, inculcating proper values, proper selection and giving due importance to family background have been drawn on the basis of the study of six factors. Bose (1993) studied the correlates of teacher effectiveness of 160 student teachers and found that positive significant relationship exists between teacher effectiveness and each of the predictor variables like intelligence, teaching attitude, self-confidence and previous academic achievement. Cornelius (2000) investigated the factors influencing teacher competence of teacher trainees at the secondary level revealed that intelligence, attitude towards teaching profession, and academic achievement of teacher trainees are the discriminating factors of the different groups of subjects.

Smith and Kenneth (2000) conducted a study on Self Concept and verbal academic achievement of primary and secondary student teachers. Results revealed that significant difference between the two cohorts of student teachers on the self-reported measures of self-concept and text anxiety. The results also reveal that verbal academic self-concept has significant and positive direct effect on verbal academic achievement. The indirect effect of verbal academic self-concept mediated by worry component of test anxiety, is found to be significant for secondary student teachers. Results supported the proposition that an individual's self-concept has a major direct influence on the worry component of test anxiety and in addition, a more dominant direct effect on verbal academic achievement. Yeung and Watkins (2000) investigated twenty seven student teachers' personal sense of teaching efficacy in Hong Kong. The

results pointed out that teaching efficacy is viewed in terms of the dimensions of concern for instructional participation and learning needs of pupils, communication and relationship with pupils, academic knowledge and teaching skills, lesson preparation, management of class discipline, teaching success, commitment and a sense of self confidence.

Twille et al. (1992) conducted a study in improving Academic Achievement in Inner City Schools: Do Attitude of Parents and Teachers Make a Difference? The study was done to determine whether or not the attitude of parents and teachers were related to the academic achievement of elementary school students. Seventy-one teachers, 49 parents, and thirty-two fourth grade students served as participants. Teachers' responses were used to supplement the development of the "Parent Teacher Attitude Questionnaire" (PTAQ). Parents completed pre-tests of the PTAQ. "Parent Version," were exposed to strategies designed to facilitate academic achievement and were then administered post-tests of the PTAQ-P-Students were tested on a pre-test-post-tests basis in English, Mathematics and reading student's scores were compared using dependent 't' tests. Performance in all academic subjects improved significantly. Parent's responses to the PTAQ-P did not change significantly. The Teacher performance factor of the PTAQ-P was significantly related to two academic tests: the English Pre-test and the Mathematics post- test. The school requirement factor was found to be significantly related to the reading pre-test. Changes in parent's responses to the test were positively correlated with three of the student's academic gain scores. .

Baxter and Anthony. (1993) conducted a study on improving Teaching candidates' Attitudes toward Learning Theoretical knowledge. The study tested the hypothesis that teacher candidates who were exposed to a theory oriented normative model and given theory - oriented reinforcement within a practice-oriented context would manifest more positive attitudes toward learning theoretical knowledge than those who were not so exposed. Results proved the hypothesis is plausible.Benton, Gary and Others (1993) conducted a study about the Professional Development School's Impact on Student Teachers’ Attitudes. The purpose of this study was to determine if student teacher's attitudes toward their student teaching experiences differed significantly after the addition of professional development school experiences. Two groups of student teachers were compared. A one way analysis of variance revealed significant differences for 7 of the 38 items.

Goodwin, Deborah, Derring, Rosemarie (1993) investigated the integration of interactive video technology in to a traditional teacher education programme, analysing student attitudes about classroom management strategies. Students completed a survey following a seminar demonstration of an interactive videodisk on classroom management. Subjects revealed positive attitudes toward the use of interactive video. Huber, Tonyal, Kline, Frank (1993) conducted a study on Attitude toward Diversity: Can Teacher Education programme really make a difference? They concluded that teacher education programme was revised to developed sensitive, nurturing teachers who understand student diversity. Pretests and post-tests examining students professional and personal opinion about diversity found that field experiences create significant differences in attitudes toward diversity and social distance preference in educational settings.

Skariah (1994) studied creativity of teacher trainees' in relation to their self-concept, attitude towards teaching profession and success in teaching and found that high teaching success group and high attitude towards teaching group are more creative than the other groups.Anderson and Dewayne (1995) studied about the pre-service Teacher's Attitude toward children. Results from a teacher attitude questionnaire given to 1,405 pre-service teachers revealed large differences in attitudes toward children, associated with age, gender, and major. The most positive were females in elementary, least positive males in secondary. Those in special education were most positive, in music art and physical education least positive. Whether these attitudes manifest themselves in the classroom remains unknown.

Kumar (1995), in a study, found that there is significant difference in the attitude of male and female teacher trainees towards teaching profession. Reddy (1995) studied the attitudes of student teachers and success of student teachers, and reported that attitude of teachers do not significantly influence the success of student teachers. Roos, Marie and Others (1995) in their study on the Influence of Early Field Experiences on the attitudes of Pre-service Teachers, investigated the effects of early field experience on the attitudes of elementary pre-service teachers toward teaching. Pre-test and post-test data were collected by means of an instrument employing a semantic differential scale measuring attitudes toward teaching. Results offer support for the inference that these pre-service elementary teachers have positive attitudes toward teaching prior to early field experience and have even more positive attitudes toward teaching after their easily field experience. Balan (1996) found no significant

gender difference in attitude towards teaching of student teachers of Kerala and there exists significant

2.3.5 Teachers' Emotional Intelligence and Achievement in Mathematics

Emotional intelligence has become a major topic of interest in scientific circles as well as in the lay public since the publication of a bestseller by the same name in 1995 (Goleman). Despite this heightened level of interest in this new idea over the past decade, scholars have been studying this construct for the greater part of the twentieth century; and the historical roots of this wider area can actually be traced back to the nineteenth century. Publications began appearing in the twentieth century with the work of Edward Thorndike on social intelligence in 1920. Many of these early studies focused on describing, defining and assessing socially competent behaviour (Thorndike, 1920; Moss et al., 1927;Moss and Hunt, 1927; Doll, 1935; Chapin, 1942). Edgar Doll published the first instrument designed to measure socially intelligent behaviour in young children (1935).

Possibly influenced by Thorndike and Doll, David Wechsler included two subscales ("Comprehension" and "Picture Arrangement") in his well-known test of cognitive intelligence that appear to have been designed to measure aspects of social intelligence. A year after the first publication of this test in 1939, Wechsler described the influence of non-intellective factors on intelligent behaviour which was yet another reference to this construct (1940). In the first of a number of publications following this early description moreover, he argued that our models of intelligence would not be complete until we can adequately describe these factors (1943). Scholars began to shift their attention from describing and assessing social intelligence to understanding the purpose of interpersonal behaviour and the role it plays in effective adaptability (Zirkel, 2000). This line of research helped define human effectiveness from the social perspective as well as strengthened one very important aspect of Wechsler's definition of general intelligence: "The capacity of the individual to act purposefully" (1958). Additionally, this helped position social intelligence as part of general intelligence.

The early definitions of social intelligence influenced the way emotional intelligence was later conceptualized. Contemporary theorists like Peter Salovey andJohn Mayer originally viewed emotional intelligence as part of social intelligence (1990), which suggests that both concepts are related and may, in all likelihood, represent interrelated components of the same construct. At about the same time that

researchers began exploring various ways to describe, define and assess social intelligence, scientific inquiry in this area began to centre around alexithymia (Ruesch, 1948; MacLean, 1949), which is the essence of emotional-social intelligence in that it focuses on the ability (or rather inability) to recognize, understand and describe emotions.

Two new directions that paralleled and possibly evolved from alexithymia were psychological mindedness (Appelbaum, 1973) and emotional awareness (Lane and Schwartz, 1987). Research exploring the neural circuitry that governs emotional awareness (Lane, 2000), as well as additional emotional and social aspects of this concept (Bar-On et al., 2003; Bechara and Bar-On, in press; Bechara, 2000; Damasio, 1994; Lane and McRae, 2004; LeDoux, 1996), has begun to provide tangible evidence of the anatomical foundations of this wider construct which some have questioned as an intangible myth (Davies, 1998; Zeidner, 2001;Matthews et al., 2003).

2.3.6 Teachers' Mathematics Teaching Anxiety and Attitude to Mathematics

In the midst of a technological era, declining Mathematics scores in 'Scholastic Aptitude Test' as well as poor Mathematics scores had been published in the third 'International Mathematics and Science Study'. The other notable consequences of Mathematics anxiousness are the inability to do Mathematics, the decline in Mathematics achievement, the avoidance of Mathematics courses, the limitation in selecting college majors and future careers and the negative feelings of guilt and shame (Betz, 1978 and Richardson and Suinn, 1972).Hence, the professional and economic gains that will result from changing Mathematics anxiety into Mathematics confidence cannot be overstated. Not only that the psychological boost that comes with Mathematics achievements is also regarded as important for students and others alike (National Research Council, 1989).

Studies point out a host of factors associated with Mathematics anxiety. These variables range from environmental factors such as family pressure for higher achievement, to intellectual factors as learning styles or to personality factors such as low self-esteem (Uusimaki and Nason, 2004; Woodard, 2004). In other words, Mathematics anxiety is a multifaceted construct with influencive and cognitive dimension. Personality. Self-concept, self-esteem, learning style, parental attitudes, high expectation of parents, negative attitudes toward Mathematics, avoidance of Mathematics, teachers' attitudes, ineffective teaching styles, negative school

experiences and low degree of achievement in Mathematics are among the concepts and constructs related to Mathematics anxiety (Hadfield and McNeil, 1994; Williams,1994;Cook,1998;Woodard, 2004; Bursal and Paznokas, 2006;).

A review of some literature suggests that low achievers in Mathematics frequently accompany the incidence of Mathematics anxiety. Ma (1999) found that the relationship between Mathematics anxiety and Mathematics achievement is significant. It was also found that once Mathematics anxiety takes shape, its relationship with Mathematics achievement is consistent across grade levels. Satake and Amato (1995) and Hardfield (1992) also reported similar findings. A high level of anxiety is associated with a lower level of achievement (Quilter and Harper, 1988).
Other than achievement, Tapia (2004) reported that students having little or no Mathematics anxiety, scored significantly higher in motivation than students with some or high Mathematics anxiety, and students with some Mathematics anxiety scored significantly higher than students with high Mathematics anxiety. Bretscher (1989) found that students who were involved in learning because they wanted to be, scored significantly higher than their counterparts.

They further contented that reflectance motivation was a predictor of Mathematics achievement. This influence is understandable since students with high motivation usually enjoy doing Mathematics, stick at problems until they are solved and become absorbed in their mathematical problem solving activities. Levine (1995) described Mathematics anxiety as involving feeling of tension that interfere with doing mathematical operations. Mathematics anxiety existed around a set of circumstances in which students suffered from fears that were based upon years of painful experiences with Mathematics (Miller and Mitchell, 1994). Mathematics teaching anxiety has been defined as the feeling of tension, helplessness, mental disorganisation and dread one has when required to manipulate numbers and shapes and the solving of mathematical problems (Ashcraft and Faust, 1994). Fennema and Sherman (1976) described Mathematics anxiety as involving strong feelings of fear and apprehension when faced with the possibility of dealing with a Mathematics problem.

Norwood (1994) emphasized that Mathematics anxiety did not appear to have single cause, but was, in fact, the result of many different factors such as truancy, poor self-image, poor coping skills, teacher attitude and emphasis on learning Mathematics through drill without understanding. However, Greenwood (1984)

further stated that the principal cause of Mathematics anxiety has been in teaching methodologies. He said Mathematics classes did not encouraged reasoning and understanding. The problems with Mathematics anxiety would not go away until teachers applied the problem solving process to the teaching of arithmetic and Mathematics (Geenwood, 1984).

Butterworth (1999) believes that a lack of understanding is the cause of anxiety and avoidance and that understanding based learning is more effective than drill and practice. A lack of confidence when working in mathematical situations is described by Stuart (2000) as the cause of Mathematicsteaching anxiety. Highly Mathematics anxious individuals will be less fluent in computation, less knowledgeable about Mathematics, and less likely to have discovered special strategies and relationships within the Mathematics domain (Ashcraft and Faust, 1994).

2.3.7 Teachers' Epistemological Belief and Attitude to Mathematics

With regard to psychological obstacles, Cornu (1991) describes them as occurring because of the personal development of the students. Such factors as students‟ abilities, capabilities, motivation, prior conceptions and knowledge, learning experience regarding the concept to be learnt, ways of thinking and developmental stages all influence how students learn and sometimes explain why they have difficulties in learning. These factors can sometimes be the sources of students' difficulties in learning mathematical concepts. We refer to such factors as psychological causes of student difficulties.

1.) It should be noted here that Brousseau (1997) describes psychological (ontogenetic) obstacles mainly as occurring due to the limitation of the student at some period of his/her development and he does not provide further information on this issue. In this paper, however, we use the term psychological obstacles in a more comprehensive way for the purpose of our analysis.

Students' conceptions like "multiplication always makes bigger" can be given as an example of psychological cause. This conceptualization of multiplication, normally, generates correct responses as far as whole numbers are concerned. It presents, however, an over-generalization as this cannot apply to rational numbers (Graeber, 1993). This example essentially suggests that students sometimes over-generalize what they learn and that can cause them to make errors in the learning of successive concepts. In the words of Shulman (1986), students' prior conceptions or

misconceptions influence how and what they learn and it is sometimes these conceptions that can cause the learning difficulties for students.

Cornu (1991) describes pedagogical obstacles as occurring as a result of the nature of the teaching and the teacher2. Although Cornu (1991) does not provide much detail regarding this issue, we consider pedagogical obstacles in relation to such factors as teachers' teaching approaches, teachers' use of analogies and metaphors, course books and the way concepts and topics are being covered in the textbooks and curricula. To use a more generic expression, we use the term "pedagogical causes of students' difficulties" in explaining pedagogy-caused student difficulties in learning a concept.

2.) The same situation is the case for pedagogical obstacles. Brousseau (1997) describes pedagogical (didactical) obstacles mainly as happening due to the choice of the educational system (didactic transposition). Here we, nevertheless, use the term in a more inclusive way for our purposes. An example will be helpful to illustrate a pedagogy-caused student difficulty. Tanner (2000) states that teachers generally use "fruit and salad approach" to introduce the addition of two algebraic expressions, such as, $2a+3b$ in algebra teaching. This kind of expression is often explained to students by teachers through the use of some materials, such as 2 apples and 3 bananas. However, Pimm (1987), as cited in Tirosh, Even, and Robinson (1998), puts forward reservations regarding this approach, warns against its potential role in causing learning difficulties for students and notes that "it leads to confusion between a being apples and a being „the number of apples...The algebraic expression is not an analog of 5 apples, nor is 5 apples a possible interpretation of 5a… the letters themselves are standing for numbers". In fact, some studies have shown the disadvantages of using this approach in introducing algebraic expressions. Booth (1988), for example, shows that some students thought that the expression $2a + 5b$ is equal to $7ab$ on the grounds that „2 apples plus 5 bananas is 7apples-and-bananas". Tirosh et al. (1998) also point out that this approach may lead students to think algebraic expressions, such as $2a$ and $3b$, cannot be multiplied, that is one cannot multiply apples and bananas. All these suggest that sometimes the way materials are used and the way the teaching is conducted can be the causes of, or at least play a role in the emergence of, student learning difficulties for mathematical concepts.

Although we have presented these obstacles separately, it is often almost impossible to attribute student difficulties to just one particular obstacle and that the

difficulty can stem from any combination of these obstacles. Further to this, in this paper we interpret obstacles more than just only being as “pieces of knowledge” and regard them as being sources of the student difficulties as well. In the context of this study, epistemological, psychological and pedagogical obstacles are described as the causes of students’ learning difficulties and the researcher will employ the terms “epistemological, psychological and pedagogical causes” while referring to the sources of learning difficulties.

2.3.8 Teachers’ Success Expectancy and Attitude to Mathematics

In examining the mechanisms through which teacher perceptions may influence student outcomes, research points to self-fulfilling prophecy effects. Teachers expect students to continue to act or perform according to previously established patterns and may disregard contradictory evidence of change, and this initially erroneous belief leads to its fulfilment. Teacher perceptions of students may lead to different treatment in daily interactions between the teachers and the students. Marshall and Weinstein (1984) point out that differential teacher treatment can influence student learning directly (e.g., the opportunity to learn), and this treatment can also have indirect effects. Teacher perceptions signal to student’s messages about their capabilities to learn to the extent that students internalize these messages, and their performance may reflect the beliefs of the teacher. In this way, teacher perception effects are mediated by student perceptions of competency.

Students from disadvantaged social groups seem to be more vulnerable to the negative self-fulfilling effect. Analyzing data from New Zealand, Rubie-Davies and his colleagues came to the conclusion that teachers have obvious lower academic expectations and judgments for Maori students than students of other ethnic groups. Although the Maori student achievements were similar to other students at the beginning of the year, by the end of the year, Maori students had made the least gains of all groups.Other studies present different conclusions. After reviewing the past three decades of empirical studies on teacher perceptions and academic expectations of students and their association with student achievements, Jussim and Harber conclude that self-fulfilling prophecies do occur, but these effects are typically small, and they do not accumulate greatly across perceivers or over time. Teacher expectations may predict student outcomes specifically because these expectations are accurate rather than self-fulfilling effects. They suggest the claims that self-fulfilling prophecy effects accumulate over time are based on the assumptions that teachers do

not change their perceptions of students even if the perceptions are not accurate, and the perceptions remain the same across multiple teachers and over time. On the other hand, students are passively influenced and change their behaviour accordingly. The results of some empirical studies have shown that these assumptions are not valid.

Ferguson (2003) argues that teacher perceptions may lead to differences in their behavioural interaction with students, and teacher and student behaviours might be both causes and consequences of racially disparate perceptions and expectations regarding achievements. He concludes that teacher perceptions, expectations and behaviours interact with student beliefs, behaviours and work habits in ways that help to perpetuate and even to expand the black-white test score gap. The magnitude of this effect could be substantial if effects accumulate from kindergarten through high school (Ferguson, 2003).Student daily participation in school is an important aspect of educational experiences. Hallinan points out that learning are “a social psychological as well as a cognitive process.” How students perceive their school experience, including self-evaluation of achievements and efforts as compared with peers, and feelings of disengagement from school is closely linked to both achievements and plans for future schooling. Some scholars argue that student engagement is one of the most important factors related to student academic success and the prevention of school drop-out. Other studies consider student engagements themselves as important academic outcomes and identify the factors that influence student engagements, including teacher’s roles in shaping student feelings about school.

2.3.9 Teachers’ Teaching Aptitude and Attitude to Mathematics

Attitude towards Teaching Profession is an emotionalised tendency, organized through teaching experiences to react positively towards teaching." It is a learned emotional response, set for or against teaching. Individuals will have positive attitudes towards those objects which enable them to achieve the values held and form negative attitudes towards objects which hinder the achievement of values. Studies reviewed in this area are presented below. Roy (1971) studied the relationship between teacher attitude and teaching efficiency and found a positive relationship between them.In a study conducted by Sukhwal (1976) on attitudes of married lady teachers towards teaching profession, those teachers who have favourable attitude towards teaching profession had the highest percentage of problems in actual work situations.George G. Austin (1979) conducted a study on the effect of student teaching and pretesting on student teachers attitude and found that attitude of student teachers can be improved

by student teaching experience provided that they are not pre-tested concerning their attitudes. Taiwo (1980) studied the influence of previous exposure to science education on attitude of pre-service science teachers towards science teaching. Major finding was: previous exposure to science education as a discipline before registering for bachelor's degree in science education in Nigerian Universities seems to significantly influence the attitude towards science teaching.

Bhandarkar (1980), in a study on polytechnic teachers' attitude towards teaching profession and its correlates, found that attitude towards teaching profession is not significantly related to the qualification of the teachers. Ramakrishnaih (1980)revealed through his study that women teachers have a significant and more favourable attitude towards teaching than men teachers. Gupta, (1984) conducted a study on Attitude of Teachers and found that male and female teachers differ significantly in attitude towards teaching profession. Rawat and Sreevastava (1984) conducted a comparative study of the attitude of male and female teacher trainees towards teaching. Significant difference was found between male and female teacher trainees in their attitude towards teaching profession.

Khatoon (1985) in a study on the relationship between teacher's classroom verbal behaviour and attitude towards teaching found that teachers' attitude towards teaching has nothing to do with the teachers' influence in classroom. Austin (1985) found significant differences between attitudes of teachers and principals concerning various aspects of main streaming practices. Teachers show a great deal of concern about classroom behaviour and academic progress of students, whereas principals tend to show a greater concern about philosophy of students. Mahapatra (1987) studied the comparative role of intelligence, attitude and vocational interest towards success in teaching. It was found that intelligence, attitude towards teaching and vocational interests are predictor variables of teaching success.

Ramakrishnaih, (1989) analysed the attitude of college teachers towards teaching profession and it was found that (i) generally college teachers have a favourable attitude towards teaching (ii) Teachers below 35 years of age have a more favourable attitude towards teaching than the middle age group and the high age group. Poozhikuth (1989) found that female teachers have high attitude towards teaching than male teachers and age is not significantly associated with attitude towards teaching whereas length of service is associated with attitude towards teaching. Karp, Karen and Silliman (1991) conducted a study on the Elementary

School Teachers' Attitudes toward Mathematics. The teaching behaviour and instructional methods of elementary school teachers were investigated to determine whether teachers with positive attitude toward mathematics employ different methods in mathematics instruction than those with negative attitudes. Overall, teachers with negative attitudes employed methods that fostered dependency whereas teachers with positive attitudes encourage student initiative and independence.

Pugh Ava and Others (1991) conducted a study to determine programme effectiveness.Students were surveyed at the end of the spring and fall semesters for 6 years, examining their attitudes towards theory and practical application in teacher education. The study noted whether they felt competent about subject matter, audio-visuals, classroom management and routine, and communication. Results found their attitudes more positive in the fall on all four measures.

Ruscoe, Gordon and Others (1991) analyse the Qualitative and quantitative perspectives on Teacher Attitudes. Since 1988, teacher analyses suggest that simultaneous involvement with more than one type of restructuring has a positive effect on teacher attitudes. In subsequent interviews with teachers and administrators. While showing appreciation for shared decision making, teachers more often accounted for their positive attitudes by describing a supportive administrative style.Koontz and Franklin (1992) in their study to investigate teacher trainees' attitude towards instuructional media selected two groups: 168 students and 170 pre-service teachers. Based on the final results of the study, it was concluded that a formal course in the selection and utilization of instructional media can function as a primary factor in the development of student's attitudes in a positive direction. Mathai (1992) found that attitude towards teaching profession is a significant predictor variable of success in teaching. In the study, the effects of Hands-on, Minds-on Teaching Experiences on Attitudes of Pre-service Elementary Teachers (1992) Pedersen and Mecurdy examined the effects of a science method course on the attitude of the pre-service elementary teachers (N=145) toward teaching science. Results indicated a significant positive change in attitude that was not significantly different for low and high science achievers.

Piel, John and Others (1992) conducted a study in the Educational Attitudes of Pre-service Teachers. Two populations of undergraduate students (pre-service elementary education majors and non-education majors) were compared with respect to their attitudes toward learning. Data suggest that education majors' attitudes reflect

generalized ambivalence toward important subject areas taught in elementary school, with significantly more positive attitudes displayed toward reading and literature. In spite of highly visible recommendations for more extensive academic coursework, results indicate the impracticability of addressing teacher competence through added coursework before appropriate attitude adjustment processes have been planned and implemented.

2.3.10 Teachers' Emotional Intelligence and Attitude To Mathematics

The literature reveals various attempts to combine the emotional and social components of this construct. For example, Howard Gardner (1983) explains that his conceptualization of personal intelligences is based on intrapersonal (emotional) intelligence and interpersonal (social) intelligence. Additionally, Carolyn Saarni (1990) describes emotional competence as including eight interrelated emotional and social skills. Furthermore, it has been shown that emotional-social intelligence is composed of a number of intrapersonal and interpersonal competencies, skills and facilitators that combine to determine effective human behaviour (1988, 1997b, 2000).3 Based on the above, it is more accurate to refer to this construct as "emotional-social intelligence" rather than "emotional intelligence" or "social intelligence" as had been suggested for some time (2000). Throughout this article,this wider construct will be referred to as "emotionalsocial intelligence" ("ESI").

Since the time of Thorndike (1920), a number of different conceptualizations of ESI have appeared which have creating an interesting mixture of confusion, controversy and opportunity regarding the best approach to defining and measuring this construct. In an effort to help clarify this situation, the Encyclopedia of Applied Psychology (Spielberger, 2004) suggested that there are currently three major conceptual models: (a) the Salovey-Mayer model (Mayer and Salovey, 1997) which defines this construct as the ability to perceive, understand, manage and use emotions to facilitate thinking, measured by an ability-based measure (Mayer et al., 2002); (b) the Goleman model (1998) which views this construct as a wide array of competencies and skills that drive managerial performance, measured by multi-rater assessment (Boyatzis et al., 2001); and (c) the Bar-On model (1997b, 2000) which describes a cross-section of interrelated emotional and social competencies, skills and facilitators that impact intelligent behaviour, measured by self-report (1997a, 1997b) within a potentially expandable multi-modal approach including interview and multi-rater assessment (Bar-On and Handley, 2003a, 2003b)

2.4 Appraisal of Literature

The review of literature in the area of the study has shown that there have been several attempts made by some scholars and researchers towards improving the teaching and learning of Mathematics in schools. The review of related literature shows univariate relationship, or linear relationship, of each of the independent variables and dependent measure. None of the studies has combined all the variables in a single study as it is done in this current study.

CHAPTER THREE
METHODOLOGY

The research methodology for this study is discussed in this chapter. This includes research design, population of the study, sample and sampling technique, research instruments, administration of the instruments, and method of data analysis.

3.1 Research Design

The study adopted a survey research method. The investigator did not manipulate any of the independent variables (Mathematics teaching anxiety, Epistemological Belief, Teaching Aptitude, Success Expectancy and Emotional Intelligence) in the study. Besides, all these variables were already present.

3.2Variables of the Study

There are two categories of variables in this study. They are independent and dependent variables.

3.2.1 Independent Variables

These are characteristics of pre-service teachers that can influence their achievement in mathematics and attitude toward mathematics. These are

(a) Mathematics Teaching Anxiety;

(b) Epistemological Belief;

(c) Teaching Aptitude;

(d) Success Expectancy; and

(e) Emotional Intelligence.

3.3.2 Dependent Variables

The dependent variables of this study are pre-service teachers'

(a) Achievementin Mathematics; and

(b) Attitude to Mathematics.

3.3 Population of the Study

The population of this study comprised all pre-service Mathematics teachers in all the colleges of education in south-west, Nigeria. The colleges of education included those in Ogun, Lagos, Osun, Ekiti and Oyo states in the south-west Nigeria.This population is understudied becausepre-service Mathematics teachers are the potential Mathematics teachers in both primary and junior secondary schools. Three hundred level students were chosen for the study because these were the pre-service teachers that had just concluded their professional teaching practice where their pedagogical knowledge had been measured.

3.4 Sampling and Sample

Multi-stage sampling technique was adoptedto select the pre-service Mathematics teachers.At the first stage, a total enumeration sampling technique was used to select all the eleven Colleges of Education (four federal and seven states) in the south-West Nigeria. One college was used to validate the research instruments while the remaining ten were involved in the study.

Table 3.1: Type and Number of Selected Colleges of Education inSouthWestern Nigeria

S/N	Type of College	Selected Colleges	Total Number
I	Federal	3	4
Ii	State	7	7
	Total	10	11

At the second stage, purposive sampling technique was used to select 1450 (300 levels) pre-service Mathematics teachers (656 males and 794 females) and their ages ranged between 20 to 28 years.

Table 3.2: Names of colleges of education and total numbers of pre-service Mathematics teachers

S/N	Name of colleges	Number of male	Number of Female	Total
1	Federal College of Education,Abeokuta	110	40	150
2	Federal College of Education (Special),Oyo	55	30	85
3	Federal College of Education(Tech), Akoka	96	29	125
4	Adeniran Ogunsanya College of Education, Oto-Ijanikin, Lagos	165	70	235
5	Emmanuel Alayande College of Education, Oyo	162	88	250
6	Ikere-Ekiti College of Education, Ekiti	115	70	185
7	Ilesa College of Education, Ilesa	96	60	156
8	Ila-orunogun College of Education,ila-orungun	75	35	110
9	Micheal Otedola College of Primary Education, Epe	56	29	85
10	Tai Solarin College of Education, Omu-Ijebu	49	30	79
	Total	656	794	1450

Thecriterion used for the selection of 300level pre-service mathematics teachers isthat they had just completed their teaching practice exercise, hence, the independent and

dependent variables could be measured.At the third stage, stratified sampling technique was adopted to ensure that300 levels were adequately sampled.This gave a total of 1450 pre-service mathematics teachers in the 10Colleges of Education involved in this study.

3.5 Research Instruments

Seven instruments were used for this study. They are:

1. Mathematics Teaching Anxiety Scale (MATAS);
2. Epistemological Belief Scale (EBS);
3. Teaching Aptitude Test (TAT);
4. Success Expectancy Scale (SES);
5. Emotional Intelligence Scale (EIS);
6. Mathematics Achievement Test (MAT); and
7. Attitude towards Mathematics Scale (AMS).

3.5.1 Mathematics Teaching Anxiety Scale (MATAS)

To determine the pre-service teachers' Mathematics teaching anxiety level towards the teaching of the subject, the study adopted Mathematics Teaching Anxiety Scale (MATAS) developed by Akinsola (2002).. It is made upof demographic information of the pre-service teachers and 25 items rated on a 4-point likert-type scale (Almost Never, Seldom, Often, Very Often), and the degree to which each statement characterized their feeling towards the teaching of Mathematics. The respondent scores are 1point for Almost Never to 4points for Very Often. Low scores indicate low Mathematics teaching anxiety; high scores indicate high Mathematics teaching anxiety. It has a reliability coefficient of 0.77, using cronbach - alpha measure.

3.5.2 Epistemological Belief Scale (EBS)

The scale that was adapted to measure the Epistemological Belief ofpre-service teachers' beliefs on Mathematics teaching and Mathematics achievement consistedof demographic information about the pre-service teacher and 25-item scale developed by Schommer (1994).The scale has a four likert response format ranging from SA = Strongly Agree to SD = Strongly Disagree. It has a reliability coefficient of0.83, using cronbach - alpha measure.

3.5.3 Teaching Aptitude Test (TAT)

Teaching Aptitude Test (TAT) was adapted to measure pre-service

teachers'Mathematics teaching aptitude and Mathematics achievement. It consists of demographic information of the pre-service teachers and 20-item multiple choice test developed by Akinsola (2014). Each item has four options A to D, one correct answer and three distractors. It has a reliability coefficient of 0.84, using cronbach-alpha measure.

3.5.4 Success Expectancy Scale (SES)

Success Expectancy Scale (SES) was used to measure pre-service teachers' expectation on Mathematics teaching and Mathematics achievement. It consists ofdemographic information of the pre-service teachers and 25-itemscale which was developed by the researcher. The scale has a four likert response format ranging from SA = Strongly Agree to SD = Strongly Disagree. It has a reliability coefficient 0.75, using cronbach - alpha measure.

3.5.5 Emotional Intelligence Scale (EIS)

Emotional Intelligence Scale (EIS) was adapted from Swindurne University Emotional Intelligence Test (SUEIT).It consists of demographic information of the pre-service teachers and Mathematics achievement. It has four dimensions with a total of 20 items, rated on a 4-point likert format (i.e, 1 = Strongly Agree, 2 = Agree, 3 = Disagree, 4 = Strongly Agree). It has a reliability coefficient Emotional intelligence scale0.81, using cronbach - alpha measure.

3.5.6 Attitude towards Mathematics Scale (ATMS)

The attitude towards Chemistry Scale was developed by Berberoglu (1990). This scale consistsof demographic information of the pre-service teacher and fifteen items. It has a four-point likert-type formation of (1) Strongly Disagree – (4) Strongly agree. Its cronbach alpha reliability co-efficient is 0.83

3.5.7 Mathematics Achievement Test (MAT)

Mathematics Achievement Test (MAT) was a 20-item multiple choice tests with four options A-D, constructed by the researcher to measure 300level Pre-Service Mathematics Teacher's cognitive achievement in mathematics. The MAT has two sections:The first section contained the demographic variables of the pre-service Mathematics teachers such as name of the college, subject combination, level and gender. The second section consisted of 20 multiple choice items on the selected topics in 300 level syllabus. The topics are calculus, ordinary differential equation, Integration, trigonometry and matrix

The test items were generated around the three levels of cognitive domain, put

forward by the Education Testing Service of the United States of America, and used in Nigeria by Yoloye(1982) and Okpala(1985). The table presents specification of the test.

Table 3.3: Table of Specification of Mathematics Achievement Test (MAT)for 300 Level Pre-Service MathematicsTeachers

S/N	TOPICS	COGNITIVE LEVEL OF QUESTION			TOTAL	PERCENT(%)
		KNOWLEDGE	UNDERSTANDING	THINKING		
1	Calculus		4	2	2	10
2	Numeration	1,11	5	14,19	5	25
3	Integration		18,17		2	10
4	Trigonometry	3,9,10	6,8,15,16		7	35
5	Matrices	7,20	12	13	4	20
	TOTAL	7	9	4	20	100

3.6 Validation of Mathematics Achievement Test

An initial pool of 30 items was developed. These were subjected to face and content validity by mathematics lecturers at the Federal College of Education, Abeokuta and lecturers in educational evaluationat theUniversity of Ibadan. The experts were requested to determine the suitability of the test for the target population, in terms of form, content, clarity and the behavioural objectives of the items. The 20-item validated MAT was then administered to twenty five (25) 300 level pre-service teachers outside the sample. The result was used to calculate the average item difficulty of the test and its reliability index. These are done using Kuder-Richardson formula 20 (KR 20). It has reliability index of 0.89 and an average item difficulty value of 0.55.

3.7 Validation of the Instrument

To ensure validity of the instrument used in the collection of data, it was given to the researcher's supervisor and experts in the field of counselling psychology at the University of Ibadan. In addition, to determine the reliability of each of the scale, the researcher pre-tested them using 50 respondents, drawn from Adeyemi College of Education,Ondo,who were not part of the study sample. Using the cronbach-alpha method, the reliability of each scale was 0.77 for Mathematics teaching anxiety scale, 0.83 for Epistemological Belief scale, 0.75 for Success Expectancy Scale, 0.81 for

Emotional intelligence scale, 0.83 for Attitude towards Mathematics Scale, and 0.84 for Teaching Aptitude Test.

3.8 `Administration of Instrument

The administration of the questionnaire lasted for 12 weeks. The researcher travelled to the 10 colleges of education in the south-west Nigeria. Before administering the questionnaire, the researcher had sought permission from the school authorities of the participants. To facilitate and ensure a successful administration of the instruments, ten research assistants were recruited and trained about the study and how to administer the questionnaires and the achievement tests. The pre-service teachers were informed about the importance of the study and their need to participate. The researcher, due to the volume of the questionnaire, divided the questionnaire copies into two (2) sets, and administered the first set to the pre service teachers on the first day of each visit. After the administration of the first set of the questionnaire to the pre service teachers on the first day, at each of the selected schools, the researcher went and administered the second set of the questionnaire to the Pre-service teachers the following day while achievement test was administered on the last day.

3.9 Method of Data Analysis

The data were analysed using descriptive and inferential statistics. Descriptive statistics used included frequency count, mean, percentages and standard deviation of the research questions 1 - 4. Multiple Regression Analysis was used as the inferential statistics to determine the composite and relative prediction of independent variables on dependent variables.

CHAPTER FOUR

RESULTS AND DISCUSSION

This chapter presents the results of the study. The results were presented in the order in which the research questions were raised.

4.0 Presentation of Data

Research Question 1: To what extent do pre-service Mathematics teachers' exhibit anxiety for the teaching of Mathematics?

Table 4.1: Level of Pre-service Mathematics teachers' teaching anxiety rating

N/S	Statements	N	mean	std
1	I usually feel disorganized when teaching Mathematics.	1450	3.36	.90
2	I usually have queasy stomach when teaching Mathematics.	1450	3.32	.96
3	I usually feel helpless when disseminating Mathematics to my pupils.	1450	3.30	.91
4	I always feel uncomfortable when solving Mathematics problem to my pupils.	1450	3.27	.95
5	I usually experience cold sweat when teaching Mathematics.	1450	3.27	.95
6	I am always tensed up when I'm about to teach Mathematics.	1450	3.24	.93
7	I always panic when teaching Mathematics.	1450	3.24	.94
8	I'm not confident when it comes to teaching Mathematics.	1450	3.23	1.00
9	I always feel distress when teaching Mathematics.	1450	3.21	.96
10	My mouth usually becomes dry when teaching Mathematics.	1450	3.20	.97
11	I sometimes clench my fists when teaching mathematics.	1450	3.19	.99
12	When I'm about to teach Mathematics I usually experience sweating palms.	1450	3.18	1.01
13	I'm always feeling unpleasant when teaching Mathematics.	1450	3.10	1.02
14	I always feel that my inadequate mathematical knowledge contributes to my poor teaching of the subject.	1450	3.06	1.02
15	I usually feel shameful for my inability to teach Mathematics very well.	1450	3.05	1.04
16	I feel that lack of confidence on my part influences the ways I teach Mathematics.	1450	3.03	1.02
17	I tend to be nervous when I'm about to teach Mathematics.	1450	3.01	1.01
18	I become wholly absorbed in the subject when teaching Mathematics.	1450	2.98	1.06
19	I have to force myself in teaching Mathematics.	1450	2.97	1.09
20	I always like to teach in the lower primary i-iv	1450	2.93	1.09
21	I tend to evade the teaching of Mathematics.	1450	2.91	1.06
22	I have a tendency to think about other things when teaching Mathematics.	1450	2.90	1.11
23	I'm always anxious to teach Mathematics.	1450	2.73	1.13
24	I always mark all Mathematics assignments given to my pupils	1450	2.46	1.18
25	How often do you like to teach Mathematics in your class?	1450	2.43	1.11
	Weighted average	1450	3.06 (76.5%)	1.02

The level of Pre-service teachers' Mathematics Teaching Anxiety rating reveals that the anxiety level of the pre-service teachers is high. The weighted average of 3.06 is

higher than the bench mark mean (2.5). In addition to this,76.5% of the respondents indicated that they exhibited anxiety often and only 24.5% indicated that they do not have anxiety.Similarly item two x = 3.32 and 78.7% indicated that the teachers have queasy stomach when teaching mathematics. However, only items 24 and 25 indicated no anxiety (x = 2.46; 48% and x = 2.43; 46%). These two items are related marking overall.

Research Question 2: What is the level of pre-service Mathematics teachers' Epistemological Belief about Mathematics?

Table 4.2:Level of Pre-service Mathematics teachers' epistemological belief rating

S/N	Items	N	Mean	Std
1	It bothers me when lecturers don't tell students the answers to complicated problems.	1450	3.13	1.14
2	I really appreciate lecturers who organize their lectures carefully and then stick to their plan.	1450	3.95	1.24
3	I try to do all of my assignments as soon as possible after they have set.	1450	3.94	1.12
4	While I am studying, I often think of real life situations to which the material that I am learning would be useful.	1450	3.85	1.15
5	I like information to be presented in a straight forward fashion; I don't like having to read between the lines.	1450	3.83	1.17
6	If something can be learned, it will be learned immediately	1450	3.81	1.22
7	I usually become increasingly absorbed in my work the more I do.	1450	3.78	1.21
8	I like lecturers who present several competing theories and let their students decide which is best.	1450	3.74	1.25
9	A good lecturer's job is to keep students from wandering off the right track.	1450	3.37	1.29
10	Instructors should focus on facts instead of theories.	1450	3.69	1.23
11	It is difficult to learn from a textbook unless you start at the beginning and master one section at a time.	1450	3.65	1.27
12	Too many theories just complicate things.	1450	3.64	1.22
13	Working on a difficult problem for an extended period of time only pays off for really smart students.	1450	3.64	1.26
14	If lecturers would stick more to the facts and do less theorizing, one could get more out of college.	1450	3.63	1.20
15	Forming your own ideas is more important than learning what the textbooks say.	1450	3.60	1.28
16	If a person tries too hard to understand a problem, they will most likely end up being confused.	1450	3.58	1.27
17	It is annoying to listen to lecturers who cannot seem to make their mind up as to what they really believe.	1450	3.57	1.27
18	Being a good student generally involves memorizing a lot of facts.	1450	3.54	1.31
19	I generally restrict my study to what is specifically set as I think it is unnecessary to do anything extra.	1450	3.48	1.29
20	Students who learn things quickly are the most successful.	1450	3.33	1.43
21	Almost all the information you can understand from a textbook you will get during the first reading.	1450	3.21	1.37
22	It's a waste of time to work on problems that have no possibility of coming out with a clear-cut answer.	1450	3.19	1.42
23	If you don't learn something quickly, you won't ever learn it.	1450	2.98	1.50
24	If you haven't understood a chapter the first time through, going back over it won't help.	1450	2.88	1.53
	Weight Average	1450	3.57 (71.40%)	1.29

The rating of items on Epistemological Belief shows that the weighted average of 3.57is higher than 2.5 which is the benchmark. Similarly 71.40% of the respondents indicated that the teachers have a positive epistemological belief.

Research Question 3: What is the level of pre-service Mathematics teachers' success expectancy in Mathematics? **Table 4.3: Level of Per-service Mathematics teachers' success expectancy rating**

S/N	Items	N	Mean	Std
1	I will be able to use basic communication and mathematics skills for purposes and situations that I may encounter throughout my life.	1450	3.46	0.77
2	I will be able to develop ability to think and solve problems in school situations and in a variety of situations that I may encounter in life.	1450	3.34	0.81
3	I will be able to develop ability to become a self-sufficient individual.	1450	3.31	0.83
4	I will be able to develop ability to connect and integrate experiences and new knowledge from all subject matters to acquire new information.	1450	3.31	0.82
5	I will be able to develop ability to apply core concepts and principles from Mathematics to what I may encounter throughout my life.	1450	3.29	0.77
6	I will be able to use various mathematical Ideas and procedures to reason and solve problems appropriately and accurately.	1450	3.28	0.86
7	I will be able to have credit at WAEC and NECO for the sake of admission for further studies.	1450	3.28	0.86
8	I will be able to use problem solving process to develop situations to relatively complex life problems.	1450	3.28	0.91
9	I will be able to demonstrate knowledge and skills that promote mathematical activity and involvement in mathematical activity throughout my life.	1450	3.26	0.86
10	I will be able to develop confidence in choosing and preparing for a career that is mathematically inclined.	1450	3.25	0.85
11	I will be able to demonstrate skills and work habits that lead to success in future schooling and mathematics related works.	1450	3.25	0.84
12	I will be able to use mathematical and scientific way of thinking and working to solve real life problems.	1450	3.24	0.85
13	I will be able to understand economic principle and make economic decisions that have mathematical/calculation consequences in daily living.	1450	3.23	0.84
14	I will be able to recognize and understand the relationship between people and geography and apply my Mathematics knowledge in real-life situations.	1450	3.23	0.87
15	I will be able to use critical thinking skills such as analyzing, prioritizing, categorizing, evaluating and	1450	3.32	0.84

	comparing to solve a variety of problems in real- life situations.			
16	I will be able to understand and appropriately use statistics and probability.	1450	3.22	0.88
17	I will be able to demonstrate the skills to evaluate and use services and expectation resources available in my community mathematically	1450	3.21	0.86
18	I will be able to connect knowledge and experiences from different subject areas, most especially the ones that have mathematical concepts.	1450	3.21	0.94
19	I will be able to understand mathematical structure concepts including the properties and logic of various mathematical systems.	1450	3.20	0.90
20	I will be able to use creative thinking skills to develop or invent novel, constructive ideas or products.	1450	3.20	0.85
21	I will be able to interact effectively and work cooperatively with the many ethnic and cultural groups in my community and nation.	1450	3.19	0.87
22	I will be able to demonstrate strategies for becoming and remaining mentally and emotionally healthy.	1450	3.19	0.87
23	I will be able to use Mathematics concepts to organize information to develop or change understanding of other concepts.	1450	3.18	0.90
24	I will be able to identify, analyse and use patterns such as cycles, series and trends to understand past events and predicts possible future events.	1450	3.16	0.89
Weighted Average		1450	3.26 (81.5%)	0.84

Table 4.3 indicates that 81.5% of the pre-service teachers have a high success expectancy in mathematics.The weighted average mean of the twenty-five items is 3.16 which is higher than the benchmark (2.5). This implies that the pre-service teachershave a high success expectancy.

Research Question 4: What is the level of pre-service Mathematics teachers' Emotional intelligencein Mathematics?

Table 4.4: Level of Pre-Service Mathematics Teachers' Emotional Intelligence rating

S/N	Statements	N	Mean	Std
1	Difficult situations bring out emotions in me that I find hard to deal with	1450	2.54	.99
2	I can still concentrate when I am worried	1450	2.51	.99
3	I find it difficult to talk about my feelings with others	1450	2.51	1.00
4	When I'm under stress, I tend to get irritated by those around me	1450	2.51	1.01
5	I can tell how others are feeling	1450	2.49	1.00
6	I find it hard to tell how others are feeling from their body language alone	1450	2.49	.97
7	Others find it easy to pick-up how I am feeling	1450	2.47	1.00
8	I can tell whether others like each other or not	1450	2.42	1.01
9	I delight in the multiplicity of human characters and I am sensitive to help them gain insight.	1450	2.41	.96
10	I am able to express myself on all levels and in all situations	1450	2.39	1.00
11	I often feel at home with the things around me	1450	2.37	.99
12	People regularly come to me to help them gain insight and I help them to gain it.	1450	2.35	.99
13	I got stressed out when I am under a lot of pressure	1450	2.34	.97
14	I am at peace with others	1450	2.32	1.05
15	Our feelings are useful when solving problem	1450	2.31	1.07
16	I use my feelings to help me create new ideas.	1450	2.31	.98
17	I can tell how others feel by the tone in their voice	1450	2.31	1.02
18	I listen with understanding and compassion and I am known for doing so	1450	2.28	.99
19	I try to make myself happy to get over being frustrated	1450	2.27	1.05
	Weighted Average	1450	2.40 (60%)	1.00

Table 4 indicates that the pre-service Mathematics teachers have emotional intelligence in mathematics. The weighted average mean of 2.4 indicates that low emotional intelligence and the percentage of student that disagreed is about 60%.

Research Question 5a: What is the relationship between the psychological variables (Mathematics Teaching Anxiety, Epistemological Belief, Teaching Aptitude, Success Expectancy and Emotional Intelligence) and pre-service teachers' achievement in Mathematics?

Table 4.5a:Summary of correlation matrix showing the relationships between independent variables and pre-service teachers' Achievement in Mathematics

Variables	Maths Achievement	Mathematics Teaching Anxiety	Epistemo logical Belief	Success Expect.	Emotional Intelligence	Teaching Aptitude	Mean	Std. Dev.
Mathematics Achievement	1						8.59	4.46
Mathematics Teaching Anxiety	.098*	1					76.57	12.35
Epistemological Belief	.043	.274*	1				89.25	17.42
Success Expectancy	.053*	.332*	.386*	1			81.38	13.07
Emotional Intelligence	.034	.046	.153*	.211*	1		47.99	12.39
Teaching Aptitude	.415*	.148*	.062*	.101*	.021	1	7.73	3.38

* Sig. at p< .05 level

The results from table 5.1a show a significant relationship between Mathematics Teaching Anxiety and Achievement in Mathematics (r= 0.10; p<0.05), Success Expectancy and Achievement in Mathematics (r= 0.05; p<0.05) and Teaching Aptitude and Achievement in Mathematics (r= 0.42; p<0.05).There is no relationship between Achievement in Mathematics and Epistemological Belief (r= 0.04, p> 0 .05) and Achievement in Mathematics and Emotional Intelligence (r= 0.03; p> 0.05).

Research Question 5b: What is the relationship between the psychological variables (Mathematics Teaching Anxiety, Epistemological Belief, Teaching Aptitude, Success Expectancy and Emotional Intelligence) and pre-service teachers' attitude to Mathematics?

Table 4.5b: Summary of correlation matrix showing the relationships between independent variables and pre-service teachers' attitude to Mathematics

Variables	Attitude to Maths	Mathematics Teaching Anxiety	Epistemological Belief	Success Expect.	Emotional Intelligence	Teaching Aptitude	Mean	Std. Dev.
Mathematics Achievement	1						40.94	9.86
Mathematics Teaching Anxiety	.293*	1					76.57	12.35
Epistemological Belief	.340*	.274*	1				89.25	17.42
Success Expectancy	.484*	.332*	.386*	1			81.39	13.06
Emotional Intelligence	.291*	.046	.153*	.211*	1		47.99	12.39
Teaching Aptitude	.031	.148*	.062*	.101*	.021	1	7.75	3.38

* Sig. at p< .05 level

The results from table 5.1b show a positive significant relationship between Attitude to Mathematics and Mathematics Teaching Anxiety (r=0.29; p<0.05), Attitude to Mathematics and Epistemological Belief (r=0.34; p<0.05), Attitude to Mathematics and Success Expectancy (r=0.48; p<0.05) and Attitude to Mathematics and Emotional Intelligence (r=0.29; p<0.05), but no significant relationship between Attitude to Mathematics and Teaching Aptitude (r=0.03; P>0.05).

Research Question6a: What is the joint predictive strengthens of the psychological variables on pre-service teachers' achievement in Mathematics?

Table 4.6a:**Summary of Joint predictive strengthof the independent variables on pre-service teachers' achievementin Mathematics**

R	R Square	Adjusted R Square
.417	.174	.171

A N O V A						
Model	Sum of Squares	df	Mean Square	F	Sig.	Remark
Regression	4927.052	5	985.410	60.966	.000	Sig.
Residual	23372.129	1446	16.163			
Total	28299.181	1451				

0.05 level of significance

Table 4.6a shows the joint predictive strength of the five independent variables on the dependent variable (achievement in Mathematics). The table also shows a coefficient of multiple correlation (R = 0.417) and an Adjusted R^2 of 0.171. This means that 17.1% of the variance in the achievementwas accounted for by five predictor variables when taken together. The F-ratio revealed that the joint relationship is also significant ($F_{(5,1446)}$ = 60.97; $p<0.05$). This implies that the joint prediction of the psychological variables to the Achievement in Mathematics was significant and that other variables not included in this model may have accounted for the remaining variance**.**

Research Question 6b: What is the jointpredictive strength of the psychological variablesno Pre-Service Teachers Attitude to Mathematics?

Table 4.6b: Summary of joint predictive strengthof the independent variables on pre-service teachers' attitude to Mathematics

R	R Square	Adjusted R Square
.557	.310	.308

A N O V A						
Model	Sum of Squares	DF	Mean Square	F	Sig.	Remark
Regression	43774.149	5	8754.830	130.210	.000	Sig.
Residual	97223.236	1446	67.236			
Total	140997.39	1451				

0.05 level of significance

Table 4.6b shows the joint predictive strength of the five independent variables to the prediction of the Attitude to Mathematics. The table shows a coefficient of multiple correlation (R = .557) and an Adjusted R^2 of .308. This means that 30.8% of the variance in the Pre-service Mathematics attitude was accounted for by five predictor variables when taken together. It was also revealed that the joint contributions is significant ($F_{(5,1446)}$ = 130.21; p< .05). This implies that the joint prediction of the psychological variables to the teachers' attitude to Mathematics was significant and that other variables not included in this model may have accounted for the remaining variance.

Research Question7a: What is the relative prediction of each of the psychologicalvariables on pre-service teachers' achievement in Mathematics?

Table 4.7a: **Summary of relative prediction of the independent variables on pre-service teachers' achievementin Mathematics**

Model	Unstandardized coefficient		Standardize coefficient	t	sig
	B	Std. Error	Beta contribution (β)		
(Constant)	3.100	.894	.037	3.467	.001
Mathematics Teaching Anxiety	1.309E-02	.009	.037	1.413	.158
Epistemological Belief	1.679E-03	.007	.007	.251	.802
Success Expectancy	-2.620E-03	.009	-.008	-.285	.776
Emotional Intelligence	8.722E-03	.009	.024	.998	.319
Teaching Aptitude	.535	.032	.409	16.913	.000

Table 4.7a reveals the relative prediction of the psychological variable to the achievement of the pre-service Mathematics teachers. The regression analysis reveals that it is only teaching aptitude in Mathematics that had significant relative contribution to the achievement in the Mathematics of the pre-service Mathematics teachers (B = 0.535; t = 16.91; p <0.05). Others, like Mathematics Teaching Anxiety (B = 0.013; t = 1.41; p>0.05), Epistemological Belief (B =0.002; t = .25; p>.05), Success Expectancy (B = -0.003; t = -0.29; p >0.05) and Emotional Intelligence (B = 0.009; t = 1.00; p>0.05) had no significant relative contribution to the Achievement in Mathematics of the Pre-Service Teachers.

Research Question 7b: What is the relative prediction of each of the psychological variables on Pre-Service Teachers' Attitude to Mathematics?

Table 4.7b: **Summary of relative prediction of the independent variables to Pre-service teachers' attitude to Mathematics**

Model	Unstandardized Coefficient		Stand. Coefficient	T	Sig
	B	Std. Error	Beta Contribution (β)		
(Constant)	-2.285	1.824		-1.253	.211
Mathematics Teaching Anxiety	.107	.019	.135	5.682	.000
Epistemological Belief	8.050E-02	.014	.142	5.904	.000
Success Expectancy	.263	.019	.348	13.986	.000
Emotional Intelligence	.152	.018	.190	8.493	.000
Teaching Aptitude	-.106	.065	-.036	-1.650	.099

Table 4.7b reveals that the five independent variables (Mathematics Teaching Anxiety, Epistemological Belief, Success Expectancy, Emotional Intelligence and Teaching Aptitude) predictedpre-service Mathematics teachers' attitude to Mathematics. With the use of the standardized regression coefficient to determine the relative contributions of the independent variables to the explanation of the dependent variable, Success Expectancy (B = 0.263; t = 13.99; p< 0.05) had the largest contribution; followed by Emotional Intelligence (B = 0.152; t =8.49; p< 0.05); followed by Mathematics Teaching Anxiety (B = 0.107; t =5.68; p< 0.05) and then by Epistemological Belief (B = 0.081, t =5.90; p> 0.05). Teaching Aptitude (B = -0.106; t = - 1.65; p >0.05) did not have significant relative contribution to attitude to Mathematics.

Research Question 8a: To what extent do the psychological variables (Mathematics Teaching Anxiety, Epistemological Belief, Teaching Aptitude, Success Expectancy and Emotional Intelligence) predict pre-service teachers' achievement in Mathematics?

As presented intable 4.7a, it is only Teaching Aptitude (TA) that had significant relative contribution to pre-service teachers' achievement in Mathematics (β =0.41; t = 16.91; $p<0.05$). Hence, it is the only psychological variable that predicted the teachers' achievement in Mathematics. The prediction equation is then given by:

$$Y = a + b_1X_1 + b_2X_2 + b_3X_3 + b_4X_4 + b_5X_5$$

where Y = achievement in Mathematics; 'a' is the constant,X_1 = Teaching Aptitude, X_2 = Mathematics Teaching Anxiety, X_3 =Emotional Intelligence, X_4 =Epistemological Belief, X_5 = Success Expectancyb_1 to b_5 is the co-efficient to X .

For any given Achievement score Y, the prediction is

$$Y = 3.10 + 0.535X_1 + 0.013X_2 + 0.009X_3 + 0.002X_4 – 0.003X_5$$

Research Question8b: To what extent do the psychological variables (Mathematics Teaching Anxiety, Epistemological Belief, Teaching Aptitude, Success Expectancy and Emotional Intelligence) predict pre-service teachers' attitude to Mathematics?

Table 4.7b shows thatSuccess Expectancy, Emotional Intelligence, Mathematics Teaching Anxiety and Epistemological Belief were the psychological factors that predictedper-service Mathematics teachers' attitude to Mathematics. The prediction equation is given by:

$Z = a + b_1k_1 + b_2k_2 + b_3k_3 + b_4k_4 + b_5k_5$ where Z denote attitude to Mathematics; a = constant, k_1 = Success Expectancy, k_2 = Emotional Intelligence, k_3 = Mathematics Teaching Anxiety, k_4 = Epistemological Belief, k_5 = Teaching Aptitude b_1 to b_5 are co-efficient of k.

For any value of attitude Z;

$$Z = 0.263K1 + 0.152K_2 + 0.107K_3 + 0.081K_4 – .0.106k_5 - 2.285$$

4.2 Discussion of Findings

4.2.1 Level of pre-service Mathematics teachers' teaching anxiety

The findings of the study revealedthat the anxiety level of the pre-service teachers is high. This result affirmed the submission of Levine (1996) that having a high level of Mathematics teaching anxiety is related to unpleasant experiences which have a relationship with insufficient Mathematics knowledge. Therefore, the close relationship of beliefs about the nature, learning and teaching of Mathematics with

theclass practices of the teachers highlights the anxiety in teaching Mathematics that might be experienced by teachers, who come from class environments where traditional teaching models are emphasised, and who have developed algorithmic-based beliefs about Mathematics.

4.2.2 Level of pre-service Mathematics teachers' epistemological belief about Mathematics

The findings of this study showed that the level of pre-service teachers' epistemological belief in the subject (Mathematics) is above average. This findings is similar to the claim of Köller, and Baumert(2005)thatmotivational constructs like epistemological beliefs will positively influence the learning process, and factors such as the choice of learning strategy. Kardash and Howell (2000) have been proposed as mediating mechanisms. This finding is also similar to the findings of Hofer (2000) which established a significant relationship between achievement and epistemological beliefs. However, the strength of this relationship varies across samples and depends to some degree on the dimensions examined.

4.2.3 Level of pre-service Mathematics teachers' success expectancy in Mathematics

The findings of this study revealed that success expectancyof pre-service Mathematics teachers' is high. This is in line with the findings of Schmoker (2001) that Schools with exceptional levels of academic achievement consistently demonstrate high expectations and goals supported by data-driven collaboration and on-going assessments. Within the individual classroom, there is a clear correlation between teacher expectations and student achievement. This result further justifies the assertion of Schmoker (2001) that high expectations represent an overall orientation toward improvement and growth in the classroom, which has been demonstrated to be a defining characteristic of benchmark schools.

4.2.4 Level of pre-service Mathematics teachers' emotional intelligence in Mathematics

The findings of this study showed that the level of pre-service Mathematics teachers' understanding of their own emotional intelligence and that of their students during mathematics teaching is low. This shows that per-service could not control emotion during teaching and learning in Mathematics class. This finding is in line with Beverly,Williams and Kitterlin (2012) that there was a positive relationship between

information technology leaders emotional intelligence score and subordinates' job performance ratings.

4.2.5 Relationship between predictor variables and achievement in Mathematics

The findings of this studyindicated Mathematics teaching anxiety, success expectancy and teaching aptitude had significant relationship with Mathematics achievement while Epistemological Belief and Emotional Intelligence had no significant relationship with Mathematics achievement. The significant weak positiverelationship between Mathematics teaching anxiety and achievement could be as a result of higher levels of Mathematics Teaching Anxiety exhibited by the pre-service teachers. Also, the relationship between success expectancy and Mathematics achievement showed that success expectancy possessed by pre-service teachers, could bring about achievement in Mathematics. The relationship between teaching aptitude and Mathematics achievement could be influenced by other factors.

These findings are not in line with the findings of Copper & Robinson, (1989) Morris, Davis & Hutchings(1981) which showed consistent negative relationship between Mathematics teaching Anxiety and achievement in Mathematics, indicating that pre-service teachers with higher levels of Mathematics Anxiety tend to have lower level of Mathematics achievement. This relationship could be attributed to the claim of Tollefson (2000) that the amount of effort invested is a product of the expectation of success and the value of the rewards. This relationship was the strongest of all psychological factors. This is a direct pointer to the fact that of all the teaching aptitude in Mathematics, if developed in pre-service Mathematics teachers, they will be able to master the content. Consequently, their proficiency as well as achievement will be greatly enhanced. These findings agree with those of Pandey (2012) that aptitude has a significant relationship with mathematical intelligence.

The findings of the study also showed that there was no significant relationship between epistemological belief and achievement in Mathematics. This means that epistemological belief has no relationship with achievement in Mathematics. Therefore, epistemological beliefs do not influence achievement in Mathematics. This finding agrees with the claims of Pintrich (2002) that no consensus has yet been reached on many of the central questions on the relationship between epistemological belief and achievement in Mathematics. Emotional intelligence was found not to have a significant relationship with achievement in Mathematics. This

finding contradicts the findings of Ogundokun and Adeyemo (2010) and Azuka (2012) that emotional intelligence positively predicts students' achievement in Mathematics.

4.2.6 Relationship between predictor variables and attitudeto Mathematics

The findings of this study indicated a significant positive relationship between mathematics teaching anxiety and attitude to Mathematics.This finding is in line with the discovery of Lee, and Nanyang (2006), who assessed the pre-service teachers' attitudes to Mathematics and Mathematics teaching anxiety. Their findings show that students have the feeling of being stressed when they cannot think clearly, and of being lost and nervous when solving mathematical problems.

The finding of this study also showed that Epistemological Belief has a significant positive relationship with pre-service teachers' attitude to mathematics. This is in agreement with the assertion of Hofer (2002) that learners are likely to have a positive disposition towards learning if their belief is activated.

The findings of the study also showed thatsuccess expectancy has a significant positive relationship with students' attitude to mathematics. This finding is in line with the findings of Ferguson (2003) that teachers'expectation and behaviour interact substantially with the students' behaviour.

The findings of this study also indicated that emotional intelligencehad significant relationships to Attitude to Mathematics. This is line with the finding of Jeya, Balakrishnan, Wana and Wana (2012) that emotional intelligence has a strong contribution with attitude of students towards computer science.

4.2.7 Composite contribution of predictor variableson pre-service teachers'achievement in Mathematics

The findings of this study showed that the predictor variables had a joint contribution to students' achievement in Mathematics. This revealed that joint influence of the psychological variables on achievement in Mathematics of pre-service teachers was significant. This implies that the joint contribution of the independent variables to the dependent variable was significant and that other variables not included in this model may have accounted for the remaining variance. This agrees with the findings of Akinsola (2008) that Mathematics anxiety, mathematics teaching efficacy belief, locus of control and studyhabits contributed 62.8% to the total variance of in-service teachers' problem solving ability in Mathematics.

4.2.8 Composite contribution of predictor variable onpre-serviceteachers' attitude toMathematics

The findings of this study showed that the predictor variables had a joint contribution of 30.8% to the total variance of the pre-service teachers' attitude towards Mathematics. This implies that the joint contribution of the independent variables to the dependent variable was significant and that other variables not included in this model may have accounted for the remaining variance.The findings of this study aligns with the findings of Bayaga and Newman (2014) that psychological variables like (mathematics self-concept, parents' level of education, home background, teaching, school climate and attitude) contributed about 20% to the total variance of the students' attitude to mathematics.

4.2.9 Relative contribution ofpredictor variablesonpre-serviceteachers'achievement in Mathematics The result revealed that only teaching Aptitude had a significant relative contribution. However, Mathematics Teaching Anxiety, Epistemological Belief, Success Expectancy and Emotional Intelligence did not have a significant relative contribution. The findings of this study on the relationship between mathematics teaching anxiety and achievement disagrees with the findings of Peker (2008) that Mathematics teaching anxiety of pre-service Mathematics teachers in mathematics has a significant influence on their learning styles in Mathematics. This implies that having anxiety towards teaching mathematics is not a disadvantage to passing the subject. Also, the findings of this study is not in agreement with that of Vanessa, Nicole and Helena (2009) that some cognitive and some pedagogical factors were strongly associated with mathematics anxiety among pre-service teachers.

Furthermore the findings of this study about success expectancy are in disagreement with the findings of Bernard and John (2003) that motivation to learn mathematics is related to mathematics self-concept among secondary school students. The findings of this study are also not in line with the findings of Zarafshan and Ardeshiri (2012) that emotional intelligence has a negative relationship with English proficiency of pre-service teachers.

On Epistemological belief the findings of this study is not in line with the findings of Akbari, Jahromi, Haghighi and Rasteger (2010) that epistemological belief has a mediating role on students achievement in mathematics.

4.2.10 Relative contribution ofpredictor variables to pre-serviceteachers' attitude to Mathematics

The relative contribution of psychological variable to the prediction of the dependent variable (Attitude towards Mathematics) showed that Mathematics Teaching Anxiety,Epistemological Belief, Success Expectancy and Emotional Intelligence were significant but only teaching aptitude was not.The finding about teaching aptitude implies increasing the pre-service teachers' teaching aptitude will make no difference in the attitude towards mathematics. This is not in line with the findings of Skipper and Charles (1993) that teaching aptitude has a significant predicting power over teaching effectiveness and by extension their attitude towards Mathematics.

The findings of this study on epistemological belief corroborates the findings of Xinrong (2015) that epistemological belief about information communication technology influences the pre-service elementary science teachers' attitude towards mathematics. This finding on epistemological belief confirms the findings of Sunger (2007) which showed that epistemological belief and attitude towards science teaching of pre-service elementary teachers have a strong predicting power on their attitude to science.The findings of the study according to Andile and Abayomi (2012) show that outcome expectancy was a good predictor of conception in mathematics.

The findings of the study about emotional intelligence are in accord with the findings of Colomeischi and Colomeischi (2015) that Romanian students' emotional intelligence has a significant relative contribution to students' attitude towards Mathematics. Similarly the finding of this study reaffirms the findings of Jeya, Balakrishnan, Wana and Wana (2012) that emotional intelligence has a strong contribution to attitude of students towards computer science.

In addition to this, the findings of this of this study concerning the Mathematics teaching anxiety agrees with the findings of Alan,Nancy and Jin-ah (2013) which showed that there is a relationship between lack of confidence in teaching ability of early childhood pre-service teachers and mathematical content knowledge. Also, the finding of this study supports the findings of Haciomeroghu (2012) that there is a significant relationship between Mathematics Anxiety and Mathematics teaching anxiety.

CHAPTER FIVE

SUMMARY OF FINDINGS, CONCLUSION AND RECOMMENDATIONS

5.1 Summary of Findings

Summary of the researchfindings is presented as follows:

1. The anxiety exhibitedby the pre-service Mathematics teachers' in teaching Mathematics is high, and this has influence on their achievement in, and attitude to,Mathematics.
2. Epistemological belief of pre-service Mathematics teachers in Mathematics is above average, and this has a positive influence on the teaching and learning of Mathematics.
3. Pre-service Mathematics teachers' expectation is high. This shows that success expectancy has positive impact on the achievement and attitude of pre-service Mathematics teachers.
4. If pre-service Mathematics teachers can control their emotions during teaching and learning of Mathematics, it will enhance achievements of the students in Mathematics and their attitude to the subject.
5. Three out of the five independent variables (Mathematics Teaching Anxiety, Success Expectancy and Teaching Aptitude) had asignificant relationship with pre-service Mathematics teachers' achievement in Mathematics.
6. There was a significant joint contribution of the five independent variables to the prediction of pre-service Mathematics teachers' achievement in Mathematics.
7. Only one out of the five independent variables (Teaching Aptitude) had a significant relative contribution to the achievement in Mathematics of the pre-service Mathematics teachers.
8. Hence, it is only one of the Psychological variables that predicted the teachers' achievement in Mathematics. The prediction equation is given as:
   $Y = 3.10 + 0.543X_1 + 0.013X_2 + 0.009X_3 + 0.002X_4 – 0.003X_5$
9. Four out of the five independent variables (Mathematics Teaching Anxiety, Epistemological Belief,Success Expectancy and Emotional Intelligence) had asignificant relationship with pre-service Mathematics teachers' attitude to Mathematics.
10. There was a significant joint contribution of the five independent variables to the prediction of pre-service teachers' attitude to Mathematics.

11. Four out of the five independent variables (Mathematics Teaching Anxiety, Epistemological Belief,Success Expectancy and Emotional Intelligence) had asignificant relationship with pre-service Mathematics teachers' attitude to Mathematics.

12. Hence, three of the Psychological factors predictedthe teachers' attitude to Mathematics. The prediction equation is given thus:

$Z = 0.263K1 + 0.151K_2 + 0.107K_3 + 0.081K_4 - .0.106k_5 - 2.285$

5.2 Conclusion

This study revealed the extent to which psychological variables predicted pre-service teachers' achievement and attitude towards Mathematics. This study, therefore argues that Mathematics teaching anxiety is the most potent predictor of pre-service teachers' achievement in Mathematics. This is followed by success expectancy and teaching aptitude. It could also be inferred that success expectancy is the most potent predictor of pre-service teachers' attitude to Mathematics, followed by epistemological belief, Mathematics teaching anxiety and emotional intelligence.

5.3 Recommendations

Based on the findings of the study the following recommendations are made:

1. Pre-service teachers are enjoined to develop adequate study skills as this would ensure improvement towards excellence in Mathematics teaching. This invariably would discourage anxiety in Mathematics teaching
2. To reduce Mathematics teaching anxiety in pre-service Mathematics teachers, educators should use different approaches to prevent Mathematics anxiety.
3. Mathematics lecturers should employ the services of a counsellor to help reduce or overcome anxiety for the teaching of Mathematics.

5.4 Limitations of the Study

It is important to acknowledge that this study has some limitations. They are:

1. The samples used for the study were drawn from federal and state colleges of education in south-west, Nigeria which is just a geopolitical zone in the country. The population excludes private colleges of education and pre-service Mathematics teachers at the university level. It also excludes samples from other geopolitical zones in the nation.

2. Another limitation is the uncooperative dispositionsof some pre-service mathematics teachers in responding tothe questionnaire.

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5.5 Suggestion for Further Studies

The following suggestions are offeredspecifically to benefit researchers who may like to replicate this study, especially in Nigeria:

The sample of the study should be extended to cover more colleges of education and more pre-service Mathematics teachers in other geographical zones in order to widen the scope of the study. This should incorporate ethnic and cultural influences.

Other psychological variables that could influence and predict the achievement in Mathematics and attitude to Mathematics of pre-service teachers should beinvestigated by researchers.

Researchers should explicitly investigate the correlation between achievement in Mathematics and attitude to Mathematics of pre-service teachers.

5.6 Contribution to Knowledge

The study has provided a strong basis for bridging the gap of past research on the relationship between psychological variable, achievement in Mathematics and attitude to Mathematics on Per-service teachers in south-west, Nigeria.

The study showed that Mathematics teaching anxiety, epistemological belief, teaching aptitude, success expectancy and emotional intelligence are strong predictors of attitude to Mathematics of pre-service teachers.

This study has further highlightedthe understanding of psychological basis for learning and the paramount roles of emotions in learning.

It also contributed to pre-service teachers' understanding of the negative roles of anxiety and phobia on the achievement of pre-service teachers in Mathematics.

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APPENDIX I

DEPARTMENT OF TEACHER EDUCATION

FACULTY OF EDUCATION

UNIVERSITY OF IBADAN, IBADAN

Dear Respondent,

I am a student of the above institution conducting a research on the Mathematics Teaching Anxiety, Epistemological Belief, Success Expectancy, Teaching Aptitude and Emotional Intelligence as Predictor of Pre-Service Teachers' Achievement in and Attitude to Achievement. Your assistance is highly solicited in this study. All information provided shall be treated with utmost confidentiality.

Thanks you.

SECTION A

Instruction: Please fill in the needed details and tick the ones that you think are appropriate.

Demographic Data

1. Name of the College ……
2. Subject Combination ……
3. Level 200 ( ) 300 ( )
4. Gender Male ( ) Female ( )

SECTIONS B

Mathematics Teaching Anxiety Scale (MATAS)

Almost Never (AN), Seldom (S), Often (O), Very Often (VO)

S/N	ITEM	AN	S	O	VO
1	I always feel uncomfortable when solving Mathematics problem for my pupil.				
2	I am always tensed up when I'm about to teach Mathematics.				
3	I usually feel helpless when disseminating Mathematics to my pupils.				
4	I usually feel disorganized when teaching Mathematics.				
5	I'm not confident when it comes to teaching Mathematics.				
6	I always feel that my inadequate mathematical knowledge contributes to my poor teaching of the subject.				
7	How often do you like to teach Mathematics in your class?				
8	I feel that lack of confidence on my part influences the ways by which I teach Mathematics.				
9	I always panic when teaching Mathematics.				
10	I always feel distress when teaching Mathematics.				
11	When I'm about to teach Mathematics I usually experience				

	sweating palms.				
12	My mouth usually becomes dry when teaching Mathematics.				
13	I usually experience cold sweat when teaching Mathematics.				
14	I usually have queasy stomach when teaching Mathematics.				
15	I sometimes clench my fists when teaching Mathematics.				
16	I usually feel shameful for my inability to teach Mathematics very well.				
17	I tend to be nervous when I'm about to teach Mathematics.				
18	I'm always anxious to teach Mathematics.				
19	I always like to teach in the lower primary I – iv.				
20	I'm always feeling unpleasant when teaching Mathematics.				
21	I become wholly absorbed in the subject when teaching Mathematics.				
22	I have to force myself to keep on teaching Mathematics.				
23	I have a tendency to think about other things when teaching Mathematics.				
24	I always mark all Mathematics assignment given to my pupils				
25	I tend to evade the teaching of Mathematics.				

APPENDIX II

DEPARTMENT OF TEACHER EDUCATION

FACULTY OF EDUCATION

UNIVERSITY OF IBADAN, IBADAN

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Thanks you.

SECTION A

Instruction: Please fill in the needed details and tick the ones that you think are appropriate.

Demographic Data

1. Name of the College ……
2. Subject Combination ……
3. Level 200 ( ) 300 ( )
4. Gender Male ( ) Female ( )

SECTIONS B

EPSTEMOLOGICAL BELIEF SCALE (EBS)

Strongly Agree(SA), Agree(A), Strongly Disagree(SD), Disagree (D)

S/N	ITEMS	SA	A	D	SD
1	It bothers me when lecturers don't tell students the answers to complicated problems.				
2	If something can be learned, it will be learned immediately				
3	I like information to be presented in a straight forward fashion; I don't like having to read between the lines.				
4	It is difficult to learn from a textbook unless you start at the beginning and master one section at a time.				
5	Students who learn things quickly are the most successful.				
6	Forming your own ideas is more important than learning what the textbooks say.				
7	Almost all the information you can understand from a textbook you will get during the first reading.				
8	If a person tries too hard to understand a problem, they will most likely end up being confused.				
9	Too many theories just complicate things.				

10	Instructors should focus on facts instead of theories.				
11	I like lecturers who present several competing theories and let their students decide which is best.				
12	If you don't learn something quickly, you won't ever learn it.				
13	If you haven't understood a chapter the first time through, going back over it won't help.				
14	While I am studying, I often think of real life situations to which the material that I am learning would be useful.				
15	I try to do all of my assignments as soon as possible after they have been set.				
16	I usually become increasingly absorbed in my work the more I do.				
17	I generally restrict my study to what is specifically set as I think it is unnecessary to do anything extra.				
18	If lecturers would stick more to the facts and do less theorizing, one could get more out of college.				
19	Being a good student generally involves memorizing a lot of facts.				
20	Working on a difficult problem for an extended period of time only pays off for really smart students.				
21	I really appreciate lecturers who organize their lectures carefully and then stick to their plan.				
22	If I can't understand something quickly, it usually means I will never understand it.				
23	It's a waste of time to work on problems that have no possibility of coming out with a clear-cut answer.				
24	It is annoying to listen to lecturers who cannot seem to make their mind up as to what they really believe.				
25	A good lecturer's job is to keep students from wandering from the right track				

APPENDIX III

DEPARTMENT OF TEACHER EDUCATION

FACULTY OF EDUCATION

UNIVERSITY OF IBADAN, IBADAN

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Thanks you.

SECTION A

Instruction: Please fill in the needed details and tick the ones that you think are appropriate.

Demographic Data

1. Name of the College ……
2. Subject Combination ……
3. Level 200 ( ) 300 ( )
4. Gender Male ( ) Female ( )

SECTIONS B

SUCCESS EXPECTANCY SCALE (SES)

Strongly Agree(SA), Agree(A), Strongly Disagree(SD), Disagree (D)

S/N	ITEMS	SA	A	D	SD
1	I will be able to use basic communications and Mathematics skills for purposes and situations that I may encounter throughout my life.				
2	I will be able to develop ability to apply core concepts and principles from Mathematics to what I may encounter throughout my life.				
3	I will be able to develop ability to become self – sufficient individual.				
4	I will be able to develop ability to become responsible members of a family, work group, or community, including effectiveness in community service.				
5	I will be able to develop ability to think and solve problems in school situations and in a variety of situations that I may encounter in life.				
6	I will be able to develop ability to connect and integrate experiences and new knowledge from all subject matters to acquire new information.				

7	I will be able to use various mathematical ideas and procedures to reason and solve problem s appropriately and accurately.				
8	I will be able to use mathematical and scientific way of thinking and working to solve real life problems.				
9	I will be able to identify, analyze and use patterns such as cycles, series and trends to understand past events and predicts possible future events.				
10	I will be able to understand economic principle and make economic decisions that have mathematical / calculation consequences in daily living.				
11	I will be able to interact effectively and work cooperatively with the many ethnic and cultural groups in my community and nation.				
12	I will be able to understand mathematical structure concepts including the properties and logic of various mathematical systems.				
13	I will be able to understand and appropriately use statistics and probability.				
14	I will be able to recognize and understand the relationship between people and geography and apply my Mathematics knowledge in real-life situations.				
15	I will be able to demonstrate strategies for becoming and remaining mentally and emotionally healthy.				
16	I will be able to demonstrate the skills to evaluate and use services and expectation resources available in my community mathematically				
17	I will be able to have credit at WAEC and NECO for the sake of admission for further studies.				
18	I will be able to develop confidence in choosing and preparing for a career that is mathematically inclined.				
19	I will be able to demonstrate knowledge and skills that promote mathematical activity and involvement in mathematical activity throughout my life.				

20	I will be able to demonstrate skills and work habits that lead to success in future schooling and mathematical related works.				
21	I will be able to use critical thinking skills such as analyzing, prioritizing, categorizing, evaluating and comparing to solve a variety of problems in real- life situations.				
22	I will be able to use creative thinking skills to develop or invent novel, constructive ideas or products.				
23	I will be able to use problem solving process to develop situations to relatively complex life problems.				
24	I will be able to use Mathematics concepts to organize information to develop or change understanding of other concepts.				
25	I will be able to connect knowledge and experiences from different subject areas, most especially the ones that have mathematical concepts.				

APPENDIX IV

DEPARTMENT OF TEACHER EDUCATION

FACULTY OF EDUCATION

UNIVERSITY OF IBADAN, IBADAN

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Thanks you.

SECTION A

Instruction: Please fill in the needed details and tick the ones that you think are appropriate.

Demographic Data

1. Name of the College ……
2. Subject Combination ……
3. Level 200 ( ) 300 ( )
4. Gender Male ( ) Female ( )

SECTIONS B

EMOTIONAL INTELLIGENCE SCALE (EIS)

Strongly Agree(SA), Agree(A), Strongly Disagree(SD), Disagree (D)

S/N	ITEM	SD	D	A	SA
1	I can tell how others are feeling				
2	I try to make myself happy to get over being frustrated				
3	Our feelings are useful when solving problem				
4	People regularly come to me to help them gain insight and I help them to gain it.				
5	I often feel at home with the things around me				
6	I am able to express myself on all levels and in all situations				
7	I can still concentrate when I am worried				
8	I can tell whether others like each other or not				
9	When I'm under stress, I tend to get irritate by those around me				
10	I find it difficult to talk about my feelings with others				
11	I find it hard to tell how 0yhers are feelings from their body language alone				
12	Difficult situations bring out emotions in me that I find hard to deal with				
13	I am able to express myself on all levels and in all situations				
14	Others find it easy to pick-up how I am feeling				
15	I got stressed out when I am under a lot of pressure				
16	I delight in the multiplicity of human characters and sensitive I				

	help them to gain it				
17	I use my feelings to help me create new ideas				
18	I am at peace with others				
19	I listen with understanding and compassion and I am known for doing so				
20	I can tell how others feel by the tone in their voice				

APPENDIX V

DEPARTMENT OF TEACHER EDUCATION

FACULTY OF EDUCATION

UNIVERSITY OF IBADAN, IBADAN

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Thanks you.

SECTION A

Instruction: Please fill in the needed details and tick the ones that you think are appropriate.

Demographic Data

1. Name of the College ……
2. Subject Combination ……
3. Level 200 ( ) 300 ( )
4. Gender Male ( ) Female ( )

SECTIONS B

ATTITUDE TOWARDS MATHEMATICS SCALE (ATMS)

Strongly Agree(SA), Agree(A), Strongly Disagree(SD), Disagree (D)

S/N	ITEM	SD	D	A	SA
1	Mathematics is a subject that I like a lot				
2	I like reading books mathematics topics				
3	Mathematics lessons are generally very boring				
4	I want to learn more about mathematics				
5	Mathematics is an enjoyable branch of science				
6	At of all the branches of science teaching, I would most like to be mathematics teacher				
7	I do not like the mathematics lesson at all				
8	The mathematics “irritates me”				
9	I enjoy teaching my friends mathematics				
10	Mathematics is so simple to understand				
11	I enjoy mathematics lessons better than other lessons				
12	Teaching mathematics will help me earn a living				
13	I will use mathematics in many ways as an adult				
14	Study mathematics is just as good for women as for men				
15	I would expect a woman mathematician to be a forceful type of person				

APPENDIX VI

DEPARTMENT OF TEACHER EDUCATION

FACULTY OF EDUCATION

UNIVERSITY OF IBADAN, IBADAN

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Thanks you.

SECTION A

Instruction: Please fill in the needed details and tick the ones that you think are appropriate.

Demographic Data

1. Name of the College ……
2. Subject Combination ……
3. Level 200 ( ) 300 ( )
4. Gender Male ( ) Female ( )

SECTIONS B

TEACHING APTITUDE TEST

1. If majority of students in your class are weak in mathematics, you should …….

(a) Not care about the intelligent students

(b) Keep your speed of teaching fast so that students comprehension level may increase

(c) Keep your teaching slow

(d) Keep your teaching slow along with some extra guidance to bright pupils

2. Mathematics teacher who is not able to draw the attention of his students should

(a) Evaluate his teaching method and improve it

(b) Resign from the post

(c) Find fault in his pupils

(d) Start dictating

3. Arrange the following teaching process in order

(i) Relating the present knowledge with the pervious knowledge

(ii) Evaluation

(iii) Re-teaching

(iv) Formulating objective

(v) Presentation of materials

(a) I, ii, iii, iv (b) ii, I, iii, iv, v (c) v, iv, iii, I, ii (d) iv, I, v, ii, iii

4. Which of the following is the most important single factor underlying the success of beginning a mathematics teacher?

(a) Scholar (b) Communicative ability (c) Personality and its ability to relate to the class and to the pupils (d) Organisational ability

5. The field of education is permeated by conflicts and misconception because

(a) Problems in education call for subjectivity of interpretation

(b) Problems encountered in teaching are not amenable to rigorous scientific investigation

(c) There are not good teaching methods and procedures

(d) Teachers are not worthy of doing rigorous scientific investigation

6. Discipline in mathematics class can be maintained effectively by

(a) Knowing the cause of indiscipline and handling it with stern hand

(b) Providing a programme which is according to thee/wed and interest of the pupils

(c) By putting on fanly clothes in the classroom

(d) All of the above

7 Mathematics teacher in the class is ……

(a) The president of the group

(b) A director of the group

(c) A leader and guide of the group

(d) All of the above

8. All of the following statements regarding a mathematics teacher are correct except

(a) A friend, guide and philosopher

(b) Teachers what the students do not know

(c) The leader of the class

(d) Changes his attitudes and behaviour according

9. The first important step in teaching mathematics is

(a) Planning before hand

(b) Organizing material to be taught

(c) Knowing the background of students

(d) None of the above

10. Suppose you are teaching mathematics in a rural school where lastism and narrow mindedness victimize you, for better adjustment there you should

(a) Uplift the humanistic values beyond these narrow wall and develop scientific temper in your students

(b) Be submissive there and save your job at all costs

(c) Rebel against such attitudes as it is against the norms of the society

(d) None of the above

11. An effective mathematics teacher is expected to

(a) Encourage the students the make initiative

(b) Reduce the anxiety level of students to moderate level

(c) To make students feel that education is their need

(d) All of the above

12. Suppose you are an ambitious teacher. You have high ideals for classroom teaching but your hard labour goes in vain. The reason underlying this problem may be

(a) Your teaching level is above the ability level of students

(b) Individual differences among students make your efforts futile

(c) Both of those

(d) None of the above

13. If a child is a back bencher and is unable to watch the chalkboard clearly. As a result he stands, sees and sits repeatedly. What inference will you draw regarding the case?

(a) The child is of short height as compared to his class mates

(b) The chalkboard is under shining effect of light

(c) The child has defective vision

(d) Both (a) and (c)

14. Effective mathematics teaching means

(a) Love, co-operation, sympathy, influenceion and encouragement give to students

(b) Corporal punishment given to students at the time of moral offences

(c) Individualized instruction and open classroom discussion

(d) Both (a) and (c)

15. If you come across to teach a blind student along with the normal students what type of behaviour you are expected to exhibit as a mathematics teacher

(a) Take care of him with sympathy

(b) Don’t give any extra attention because majority of students may suffer

(c) Arrange the seat in the front row and try to keep your teaching pace, according to him without making the other students suffer

(d) None of the above

16. If a student becomes unconscious in mathematics class what will you do first

(a) Rushing to the principal's office and canvassing for help impatiently

(b) Telephoning student's parents and waiting for them

(c) Giving first aid to him and trying to contact any nearby doctor

(d) Making arrangement to send him to his home

17. If a student is constantly rubbing his eyes and is inattentive during solving of mathematics problems on the chalkboard he/she is having

(a) Adjustment problem

(b) Hearing problem

(c) Visual problem

(d) All of the above

18. A professional requirements of mathematics teacher as explained in the UNESCO publication is/are

(a) Mastery over the subject and competency for teaching

(b) Innovativeness in approach and teaching strategies

(c) Justice to the profession

(d) All of the above

19. While teaching mathematics, if there is some disturbance in the class, than teacher should

(a) Keep quite for a while and then go on

(b) Not bother of what is happening in the class

(c) Punish those causing disturbance

(d) All of the above

20. A teacher meeting his students for the first time should

(a) Start teaching without caring the students' likes and dislikes

(b) Develop rapport with the class

(c) Give a broad outline of the whole subject

(d)Both (b) and (c) both

APPENDIX VII

DEPARTMENT OF TEACHER EDUCATION

FACULTY OF EDUCATION

UNIVERSITY OF IBADAN, IBADAN

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Thanks you.

SECTION A

Instruction: Please fill in the needed details and tick the ones that you think are appropriate.

Demographic Data

1. Name of the College ……
2. Subject Combination ……
3. Level 200 ( ) 300 ( )
4. Gender Male ( ) Female ( )

SECTIONS B

MATHEMATICS ACHIEVEMENT TEST (MAT)

1.) Without using tables, evaluate $(343)^{1/3}$ X $(0.14)^{-1}$ X $(25)^{-1/2}$

(a) 10 (b) 12 (c) 18 (d) 7

2.) $\frac{dy}{dx}$= 2x – 3 and y = 3 when x = 0, find y in terms of x.

(a) $2x^2 – 3$ (b) $x^2 – 3x$ (c) $x^2 – 3x – 3$ (d) $x^2 – 3x + 3$

3.) Find the derivative of y= Sin^2 (5x) with respect to x.

(a) 10 Sin5xCos5x (b) 5Sin5xCos5x (c) 2Sin5xCos5x (d) 15Sin5xCos5x

4.) If $y = x^2 – \frac{1}{x}$, find $\frac{dy}{dx}$.(a) $2x – \frac{1}{x^2}$ (b) 2x + x2 (c) 2x – x2 (d) $2x + \frac{1}{x^2}$

5.) The time taken to do a piece of work is inversely proportional to the number of men employed. If it takes 45men to do a piece of work in 5days, how long will it take 25men? (a) 15days (b) 12days (c) 5days (d) 9days

6.) If -2 is the solution of the equation 2x + 1 – 3c = 2c + 3x – 7, find the value of c.

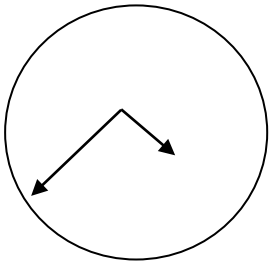
(a) 4 (b) 3 (c) 2 (d) 1

7.) If N = $\begin{bmatrix} 3 & 5 & -4 \\ 6 & -3 & -5 \\ -2 & 2 & 1 \end{bmatrix}$

Find N . (a) 17 (b) 23 (c) 65 (d) 91

8.) If $\text{Tan}\theta = \frac{3}{4}$, calculate $\text{Sin}^2\theta - \text{Cos}^2\theta$. (a) $^{16}/_{25}$ (b) $^{24}/_{25}$ (c) $^{7}/_{25}$ (d) $^{9}/_{25}$.

9.)



In the diagram above are two concentric circles of radii r and R respectively with centre O. If r = $^{2}/_{5}$ R, express the area of the shaded portion in terms of π and R.

(a) $^{21}/_{25}\ \pi\ R^2$ (b) $^{9}/_{25}\pi\ R^2$ (c) $^{21}/_{23}\pi\ R^2$ (d) $^{5}/_{9}\pi\ R^2$

10.) The range of the data k + 2, k – 3, k + 4, k – 2, k, k – 5, k + 3, k – 1 and k + 6 is

(a) 10 (b) 11 (c) 6 (d) 8

11.) If $m\log_{16} r = \log_4 r$, find the value of m. (a) ¼ (b) ½ (c) 2 (d) 4

12.) Given that P = $\begin{pmatrix} Cos\emptyset & -Sin\emptyset \\ Sin\emptyset & Cos\emptyset \end{pmatrix}$ and Q = $\begin{pmatrix} Sin\emptyset & Cos\emptyset \\ Cos\emptyset & Sin\emptyset \end{pmatrix}$, find P + Q .

(a) 1 (b) $2\text{Sin}^2\emptyset$ (c) 0 (d) $2\text{Cos}^2\emptyset$

13.) Given that P = $\begin{pmatrix} 2 & -1 \\ 4 & 3 \end{pmatrix}$ and Q = $\begin{pmatrix} 1 & -3 \\ 0 & -3 \end{pmatrix}$, find QP – PQ.

(a) $\begin{pmatrix} -8 & -1 \\ -8 & -11 \end{pmatrix}$ (b) $\begin{pmatrix} -12 & -7 \\ -16 & 12 \end{pmatrix}$ (c) $\begin{pmatrix} -12 & -1 \\ -16 & -12 \end{pmatrix}$ (d) $\begin{pmatrix} -9 & -20 \\ -16 & 9 \end{pmatrix}$

14.) The functions f and g are defined on the set of real numbers by

f: x $\longrightarrow$ x2 + 2x – 3

g: x $\longrightarrow$ 3x – 4,

find the values of x for which fog = gof.

(a)1 or 3 (b) -1 or -3 (c) -1 or 4 (d) 1 or -4

15.) If α and β are the roots of the equation $5x^2 - 3x - 9 = 0$ form the equation whose roots are $^1/\alpha$ and $^1/\beta$.

(a) $15x^2 + 5x - 27$ (b) $9x^2 + 3x - 5$ (c) $27x^2 - 9x - 15$ (d) $27x^2 + 9x - 15$

16). Simplify $\frac{1}{1 - \sin \emptyset} + \frac{1}{1 + \sin \emptyset}$

(a) $1 - \sin^2\emptyset$ (b) $2\text{Cosec}^2\emptyset$ (c) $1 - \cos^2 \emptyset$ (d) $2\sec^2\emptyset$

17). Evaluate $\frac{4x^3 + 2x - 2}{x^4 - 1}$

(a) $\text{In } (x-1)(x+1)^2(x^2+1)^1/_2 + \tan^{-1}x + C$ (b) $\text{In}(x+1)(x+1)^2(x^2+1)^1/_2 + \tan^{-1}x + C$

(c) $\text{In}(x-1)(x-1)^2(x^2+1)^1/_2 + \tan^{-1}x + C$ (d) $\text{In}(x^2-1)(x-1)^2(x^2+1)^1/_2 + \tan^{-1}x + C$

18) Evaluate $\int_1^6 (2x+3)dx$. (a) 12 (b) 18 (c) 50 (d) 36

19) If $\frac{x + 7}{(x + 3)(x - 4)} = \frac{m}{x + 3} + \frac{n}{x - 4}$, what is 3n – 4m? (a) 8 (b) 7 (c) 6 (d) 5

20) If the determinant of a matrix is zero, the matrix is called a ……..

(b) Unit matrix (b) Symmetric matrix (c) Diagonal matrix (d) Singular matrix

APPENDIX VIII

LIST OF COLLEGES USED FOR THE STUDY

1. Adeniran Ogunsanya College of Education,Oto-Ijanikin, Lagos
2. Emmanuel Alayande College of Education,Oyo
3. Federal College of Education ,Abeokuta
4. Federal College of Education (Special),Oyo
5. Federal College of Education(Tech), Akoka
6. Ikere-Ekiti College of Education, Ekiti
7. Ilesa College of Education, Ilesa
8. Ila-orunogun College of Education,ila-orungun

9. Micheal Otedola College of Education, Epe
10. Tai Solarin College of Education, Omu-Ijebu

Plate1: Some Pre-service mathematics teachers' and research assistant at Federal college of Education,Akoka

Plate2: Some Pre-service mathematics teachers, researcher and research assistant at Federal college of Education,Akoka

Plate3: Some Pre-service mathematics teachers at Ikere Ekiti College of Education ,Ekiti

Plate4: Some Pre-service mathematics teachers and research assistant at Ikere Ekiti College of Education, Ekiti

Plate5: Some Pre-service mathematics teachers at Federal College of Education, Abeokuta

Plate6: Some Pre-service mathematics teachers at Federal College of Education, Abeokuta

Plate7: Some Pre-service mathematics teachers and research assistant at Federal College of Education, Abeokuta

Plate8: Some Pre-service mathematics teachers and researcher at Emmanuel Alayande College of Education, Oyo

Plate9: Some Pre-service mathematics teachers and research assistant at Emmanuel Alayande College of Education, Oyo

Plate10: Some Pre-service mathematics teachers and researcher at Adeniran Ogunsanya College of Education, Oto-Ijanikin

Plate11: Some Pre-service mathematics teachers at Adeniran Ogunsanya College of Education, Oto-Ijanikin.

Plate12: Some Pre-service mathematics teachers and research assistant Tai Solarin College of Education, Omu-ijebu

Plate13: Some Pre-service mathematics teachers and researcher Tai Solarin College of Education, Omu-ijebu

Plate14: Some Pre-service mathematics teachers at Micheal Otedola College of Education, Epe

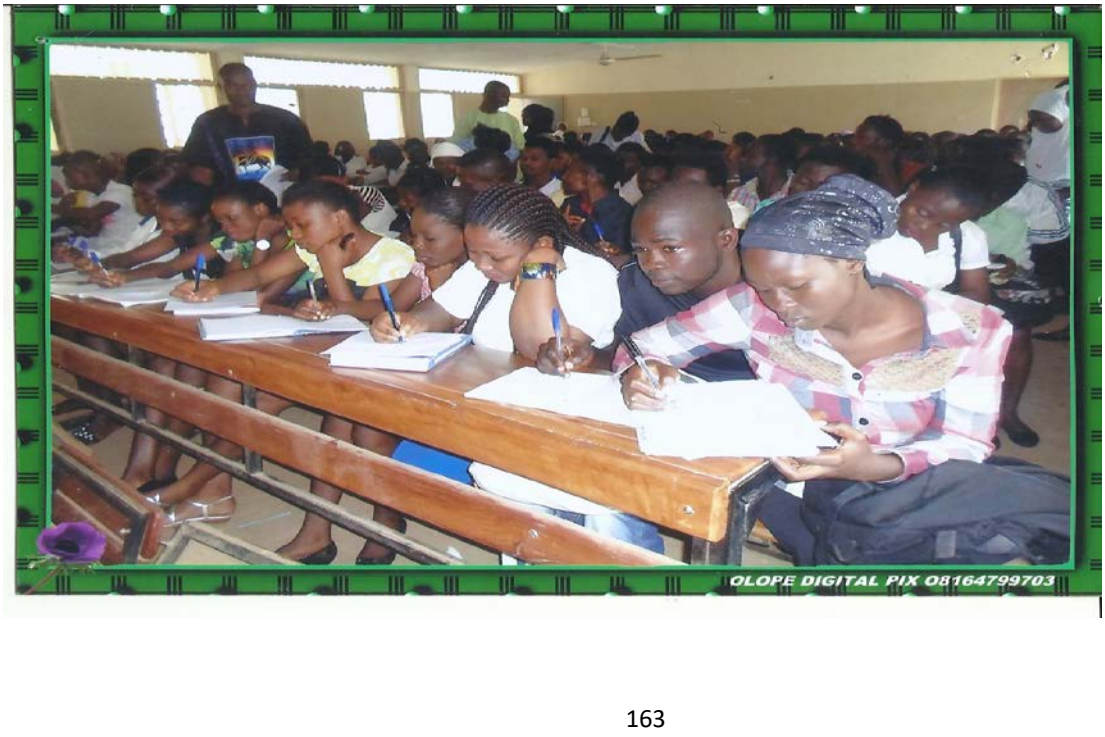


Plate 15: Som
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Plate 14: Some Pre-service mathematics teachers , researcher and researcher at Osun state College of Education, Ilesa

Plate13: Some Pre-service mathematics teachers, researcher and research assistant at Osun state College of Education, Ilesa

Plate 14: Some Pre-service mathematics teachers , researcher and researcher at Osun state College of Education, Ilesa