CHAPTER – I

INTRODUCTION AND CONCEPTUAL FRAMEWORK

1.1. INTRODUCTION

Teaching is a series of events wherein a teacher attempts to change the behaviour of students along the intended direction. According to Joseph F. Callahan (1977) 1

“The teaching is helping students learn. It is neither merely telling something to a group of listeners nor explaining some topic, nor demonstrating your mastery of an important topic” (P. 3). If a pupil fails to show mastery of needed knowledge and skills it indicates a failure of both, may be more of the teacher.

Teachers play an important role in moulding the lives and careers of the students. The following is the common portrayal of the teachers of different standards:

An ordinary teacher reads;
an average teacher explains;
a good teacher demonstrates, but,
a great teacher inspires.

2According to Louis Raths, the main functions of a good teacher are explaining, informing, initiating, directing, administering, unifying the group, giving security, clarifying, diagnosing learning problems, preparing curriculum material, evaluating, recording, reporting, enriching community activities, organising and arranging classrooms, participating in school activities and in professional and civic life (N.N. Prabhallada, 1994, P. 11).

In the words of K. Venkata Reddy (1991), 3 the teacher is not merely an actor on the dais of his classroom; he is not merely a judge of the academic achievement of his pupils; he is not merely a director of co-curricular activities of his students; he is not merely an account - assistant of school office; he is not merely a record keeper of the periodical progress of his wards; he is not merely a supervisor of their studies and sports; he is not merely an assistant administrator to the Head; he is all these rolled into one (P. 1).
In fact, teacher is no longer the only source of information. His role is to organise the educational process. He actually requires training in improving systematically the organization of educational work of the school, in putting it on a scientific basis, and in matching it to the requirements of society by effecting greater economy and a more rational use of time, energy and resources.

1.2. QUALITIES OF A GOOD TEACHER

4First and foremost, teachers must be competent. They must stay current not only in their chosen profession, the profession of teaching, but also in the subject matter they teach. If the competent teacher can be described as an expert learner, then the students he or she teaches can be thought of as junior learners. By staying active in an array of professional, legal, ethical, political and policy activities related to the subject being taught, students learn to be professionals in the broadest meaning of the term. Professionals are people who continue their involvement with the subject matter after the formal coursework ends. Competent teachers encourage active learning, because active projects beyond lecturing instil a passion in students to continue to be involved beyond the boundaries of the classroom (retrieved from http://jan.ucc.nau.edu).

5Second, good teachers must be creative. The mass media have shortened the attention spans of most students, but also have made them creative users of technology. It is not too much to ask for comparable qualities of excitement and creativity from teachers. For example, courses should never be taught the same way twice. It is a strong advocate of reciprocal learning, a concept in which students take personal responsibility for their own learning. One way to help teachers and students move away from passive learning and toward reciprocal learning is by using case studies (retrieved from http://jan.ucc.nau.edu).

6The creative teacher also encourages a breadth of thought. In a technical field such as health care, teachers should be interested in more than just what students know. They should be concerned about student beliefs, values and relationships (retrieved from http://jan.ucc.nau.edu).

7The third characteristic of successful teachers is their ability to collaborate with students and treat them as partners. Learners expect to be treated as adults. When they
deal with clerks or counterparts, they expect a reciprocal relationship based upon respect. Why should they expect anything less from a teacher? Teachers and learners who enter into a partnership both benefit from the participatory learning environment. Collaborative techniques in the teaching environment include:

- The development of learning contracts, which allow students to have a stake in the development and outcome of the course.
- Determining which teaching methods enhance or inhibit student learning.
- Brainstorming about evaluation methods.
- Establishing a mutual agreement on conduct and expectations for students and the teacher (retrieved from http://jan.ucc.nau.edu).

The fourth characteristic of good teaching is perhaps the most basic: A good teacher cares. Any human relationship – whether husband and wife, worker and supervisor, patient and health care provider or teacher and student – requires caring social interactions. If these interactions are not present, the students will try to create them. No matter how competent, creative or collaborative a teacher is, learning seldom occurs unless the teacher cares (retrieved from http://jan.ucc.nau.edu).

Part of caring is establishing and maintaining trust. For teachers, one way to build trust is by allowing students to get to know them. Teachers who share insights about themselves give their students an appreciation for their knowledge, expertise and experiences. Opening up in the classroom can be an effective way of letting students know that they are valued, respected and trusted by their teacher (retrieved from http://jan.ucc.nau.edu).

Another way to express caring and improve classroom interactions is to network within the professional community. Teachers can introduce students to other professionals, involve them in discussion groups and professional activities, and encourage them to network with each other and with practicing professionals. By bringing students into the professional milieu, a good teacher exhibits caring behavior and shows respect for his or her students.
Peter Beidler (1997) lists 10 qualities that are vital to success in the teaching profession.

1. Most important is the desire to be a good teacher – one who succeeds in every aspect of teaching, just as teachers recognize students who really try to be good students, students also recognize teachers who really want to be good teachers.

2. Second, good teachers take risks.

3. Third quality of successful teachers is their positive attitude. The teacher who falls into the trap of cynicism or victimization will never be positive about teaching. Good teachers meet all challenges with a positive attitude.

4. Fourth, good teachers never have enough time and never finish their work, but they do not complain about the long hours because they love what they do.

5. Fifth, good teachers think of teaching as a form of parenting. The teachers use principles of good parenting in many situations, including caring about their students’ welfare, knowing when to be firm and when to give in, and apologizing when necessary. Good teachers, like good parents, know their students’ problems, insecurities and potential.

6. Sixth, successful teachers give their students confidence. They realize that what the students learn is less important than the learning process itself. Learning instils confidence.

7. Seventh, a good teacher is able to keep his or her students off balance. Complacent students are bored students. Teachers encourage learning when they try new techniques and introduce risks.

8. Eighth, good teachers try to motivate students by working within their own incentive system. Teachers who know their students’ likes, dislikes, problems and personal issues are more likely to be able to ‘push the right button’ and motivate students to learn. Every cohort wave of students has its own characteristics and unique incentive system. The good teacher stays aware of trends and uses this information to modify motivational techniques. Good teachers try to understand what makes students tick these days, and then they build on that knowledge to make them tock.

9. The ninth quality is do not trust student evaluations of teaching.

10. But the 10th quality is listen to their students (retrieved from http://jan.ucc.nau.edu).

Peter Beidler makes an interesting distinction between the ninth and tenth qualities. First, he notes that student evaluations can be deceiving. Good teachers tend
not to believe the positive evaluations and agonize over the one or two mediocre ones, continually trying to improve their teaching. Mediocre teachers do the opposite – they trust the good evaluations and brush off the negative ones. Beidler believes strongly that the best teachers are those who listen to what their students say about good teaching in general rather than about any one particular teacher. For example, in surveys, students almost universally state that the best teachers are those who are available, accessible, approachable and, most importantly, are excited about what they teach. A teacher who models his or her teaching style on the characteristics valued by students will be a successful educator (retrieved from http://jan.ucc.nau.edu).

1.3. MATHEMATICS AND ITS APPLICATIONS

Mathematics is the study of quantity, structure, space, and change. Mathematicians seek out patterns, formulate new conjectures, and establish truth by rigorous deduction from appropriately chosen axioms and definitions (Courant and Robbins, 1996).

There is debate over whether mathematical objects such as numbers and points exist naturally or are human creations. The mathematician Benjamin Peirce called mathematics “the science that draws necessary conclusions”. Albert Einstein, on the other hand, stated that “as far as the laws of mathematics refer to reality, they are not certain; and as far as they are certain, they do not refer to reality” (retrieved from http://en.wikipedia.org)

Through the use of abstraction and logical reasoning, mathematics evolved from counting, calculation, measurement, and the systematic study of the shapes and motions of physical objects. Practical mathematics has been a human activity for as far back as written records exists. Rigorous arguments first appeared in Greek mathematics, most notably in Euclid’s Elements. Mathematics continued to develop, for example in China in 300 BC, in India in AD 100, and in the Muslim world in AD 800, until the Renaissance, when mathematical innovations interacting with new scientific discoveries led to a rapid increase in the rate of mathematical discovery that continues to the present day (Eves, 1990).
Mathematics is used throughout the world as an essential tool in many fields, including natural science, engineering, medicine, and the social sciences. Applied mathematics, the branch of mathematics concerned with application of mathematical knowledge to other fields, inspires and makes use of new mathematical discoveries and sometimes leads to the development of entirely new mathematical disciplines, such as statistics and game theory. Mathematicians also engage in pure mathematics, or mathematics for its own sake, without having any application in mind, although practical applications for what began as pure mathematics are often discovered (Peterson, 2001).

The history of human civilization reveals the necessity of counting, measuring, weighing and drawing, in all aspects of environment. Qualitative sciences soon became quantitative with phenomenal advancement. The basic necessities, the derived requisites, means of comfort, convenience and progress require mathematical knowledge and skill in planning and designing, in producing and consuming, in estimating and evaluating, by counting and measuring, drawing and calculating in microcosms and macrocosms. Mathematics is an integral part of the universe whose every aspect is quantitative.

Mathematics arises from many different kinds of problems. At first these were found in commerce, land measurement, architecture and later astronomy; nowadays, all sciences suggest problems studied by mathematicians, and many problems arise within mathematics itself. For example, the physicist Richard Feynman invented the path integral formulation of quantum mechanics using a combination of mathematical reasoning and physical insight, and today’s string theory, a still-developing scientific theory which attempts to unify the four fundamental forces of nature, continues to inspire new mathematics. Some mathematics is only relevant in the area that inspired it, and is applied to solve further problems in that area. But often mathematics inspired by one area proves useful in many areas, and joins the general stock of mathematical concepts. A distinction is often made between pure mathematics and applied mathematics. However pure mathematics topics often turn out to have applications like number theory in cryptography. This remarkable fact that even the purest mathematics often turns out to have practical applications is called the unreasonable effectiveness of mathematics. As in most areas of study, the explosion of knowledge in the scientific age has led to specialization: there are now hundreds of specialized areas in mathematics. Several areas
of applied mathematics have merged with related traditions outside of mathematics and become disciplines in their own right, including statistics, operations research, and computer science (Johnson and Lapidus, 2002).

In the computer world of today, mathematics plays an important role and the future is going to be more mathematically inclined. The basic knowledge of modern mathematics is a vital one for day-to-day life. In every profession connected with applied sciences, a working knowledge of mathematical concepts is a necessity to understand the deep foundations, which carry the various subjects upon them.

Modern civilization stands on a foundation of applied mathematics; without mathematics the earth could not support the present population. This statement will be accepted by any one, familiar with the work of modern scientists and engineers, and with the part played by mathematics in their accomplishment. Mathematics is a universal language. The existence of different languages is a barrier between people, but the language of numbers denoted by one’s fingers and the common notation, symbols and certain constants, combined with the inherent properties of geometrical figures, have made mathematics a universal language. The history of man reveals the necessity of counting, measuring, weighing and drawing in all aspects of the environment.

As a natural corollary, mathematics has the right way to enter into all sciences. It enters into minute cells and distant stars, infinitesimal electrons and velocity of light, the thickness of a hair, and the girdle round of earth. In the present day, mathematics has come to be recognized as the key to every science and every subject that has used mathematics for progress. Administrations and industries and all institutions use a good deal of mathematics. Farmers, doctors, engineers, clerks, tailors and mechanics succeed or fail in their profession by their ability to use time, money, and energy and their skill in mathematical computation.

Historical maps and charts, geographical latitudes and exports, chemical formulae and grammar in language in short all subjects require mathematical calculations at the least expected corner. In every modern society mathematics plays a dominant role. Government and administrations, taxes and levies, the political and economic machinery, banking and insurance, auditing and accountancy, railways and roads, posts and telegraphs cannot function without the basic instrument mathematics. Mathematics has a
vital role and its importance cannot be denied. Its place in the school curriculum is significant and unique. In short, mathematics is a great catalyst. Without this catalyst, there is no survival. Mathematics will continue to exist in its many splendour form.

1.4. VALUES OF LEARNING MATHEMATICS

Values in mathematics education are the deep affective qualities which education aims to foster through the school subject of mathematics and are a crucial component of the classroom affective environment. As a result of demands that students become more economically oriented and globally conscious, mathematics educators are being challenged about which values should be developed through mathematics education. Our concern is that, although values teaching and learning inevitably happen in all mathematics classrooms, they appear to be mostly implicit. Thus it is likely that teachers have only limited understanding of what values are being taught and encouraged.

16Culture is ‘an organised system of values which are transmitted to its members both formally and informally’ (McConatha and Schnell, 1995, P. 81). 17It is reasonable, then, to postulate that despite the rather similar, canonical form of school mathematics being taught in different educational systems around the world today, its nature and content in any one culture actually reflect that particular culture’s outlook towards, and interpretation of, life events (Nunes, 1992). In other words, like many other school subjects, school mathematics is value-laden.

18There is generally acknowledged to be a close relationship between values and attitudes, reaching back to Rokeach (1973), 19with values occupying a more central and deeply held position than attitudes, which are often considered to be reflected in our patterns of response to particular situations (Seligman et al., 1996). However, it appears that research efforts in the affective dimension in general, and in values in particular, have been both relatively recent and scarce. 20This is due in part to rather fuzzy understandings of, agreement with, and distinction among the various affective variables such as attitudes, beliefs and values (McLeod, 1992). 21To make matters worse, related terminology has also been used interchangeably, as in religious values. The word ‘value’ itself also has several different meanings (Seah, 1999). 22Another contributing factor is that the reliability of affective studies has generally been questionable in the academic field (Southwell, 1995).
Specifically among subjects offered in schools, mathematics has not enjoyed as much academic/research attention in affective issues as some other subjects, such as the languages, literature studies, physical education (23Aplin and Saunders, 1996; 24Lee and Cockman, 1995), and the sciences (25Allchin, 1999; 26Proctor, 1991). It may be that these other subjects deal with aspects of life experiences more directly and more explicitly, so that values can be easily associated and discussed within them. Mathematics, on the other hand, often deals with abstract entities and ideas, and with how these are applied to real-life situations. Values in mathematics, then, is a relatively more implicit conception.

27The affective dimension, however, is but one of the components of educational outcomes, the other components being the cognitive and psychomotor dimensions (Krathwohl, Bloom and Masia, 1964). There have been many mathematics educational studies on what Raths, Harmin and Simon call value indicators, such as interests, attitudes and beliefs. However, as Bishop notes, a number of such studies have exposed inconsistencies between value indicators and subsequent teacher decisions and actions (28Sosniak, Ethington and Varelas, 1991; 29Thompson, 1992). This then brings into focus a greater need to examine values, which represent a more influential affective force.

It is primarily concerned with values of mathematics and of mathematics education, rather than those more global such as social, economical, ecological, moral, and so forth – although they are not necessarily discrete.

The affective dimension of the ‘Taxonomy of Educational Objectives’ views values and value complexes as representing the internalisation of value indicators through the valuing process. Values in mathematics education, then, are the deep affective qualities which education fosters through the school subject of mathematics. They represent an individual’s internalisation and cognitisation of affective variables (such as beliefs and attitudes) in the context of the culture of the community in which the individual finds himself/herself. They are inculcated through the nature of mathematics and through the individual’s experience in the mathematics classroom. These values equip the individual with cognitive and affective lenses that shape and modify his/her way of perceiving and interpreting the world, and guide his/her choice of course of
action.  

Buxton (1981) and Fasheh (1982) indicate this in relation to mathematics teaching practices, while Martin (1997) shows how values can enter into the mathematical modelling process.

The recent developments in culture and mathematics, such as Bishop’s (1988) research on enculturation, Harris’s (1991) research with Aboriginal students, and Powell and Frankenstein’s (1997) overview on ethno-mathematics and the politics of mathematical knowledge, have brought the issue of values into greater focus, raising awareness of non-Western mathematical ideas together with non-Western beliefs and values. It seems it is only since the realisation that there exist mathematical ideas other than those in the canonical mathematics curriculum of the West (Howson and Wilson, 1986) that there has been any concern about values teaching in mathematics. Until twenty years ago mathematics was considered a value-free and culture-free subject. That is no longer the case.

However, the realisation that mathematics teaching is as value-laden a school subject as any other has not meant that there are any clear ideas about how such values are taught. In fact we can state categorically that there is no empirical research to date on values teaching in mathematics. McLeod (1992) in one of the most comprehensive reviews of the affective research literature failed to find any research focussed on values. The tone of his discussion however makes it clear that ideas about both beliefs and attitudes towards mathematics do relate to the deeply held values of both teachers and students.

Wilson’s (1986) chapter is one of the rare writings about values in mathematics teaching and the book in which it appears contains many useful points. Science educators have been almost as remiss as mathematics educators in their failure to address values, but Poole’s (1995) book has made a huge contribution to knowledge. In the book already noted (Bishop, 1988) has a chapter on the values underlying Western mathematics, and in Bishop (1991) values in the mathematics teaching process are analysed and discussed. Clarkson (1991) discussed issues of values embedded in different cultures and their implications for mathematics learning. This project is a natural development from those analyses, and seeks to begin the difficult process of gaining some empirical basis for claims about values teaching in mathematics classrooms and about how to improve teachers' knowledge in this area.
At present there are three principal literatures which have been used to frame the project, and which in turn will be informed by the project. These are the literatures on the affective domain and values education generally (Raths, Harmin and Simon, 1987), on affective aspects of mathematics education (McLeod, 1992), and on social and cultural aspects of mathematics education (Bishop, 1991).

Bishop (1991) has identified three kinds of values to be considered in the mathematics classroom: the general educational, the mathematical, and the specifically mathematics educational. General educational values are qualities which teachers, schools and/or the society/culture aim to inculcate in their pupils, but which are not mathematical in nature. These often have a moral overtone and are essential for the maintenance and enhancement of the social fabric. For example, a general educational value is portrayed when a mathematics teacher makes use of the context of a practice question to discuss issues pertaining to gambling or environmental conservation. Taplin’s (1997) discussion of promoting human values through different approaches of teaching mathematics refers to this class of values in particular.

Mathematical values are associated with the nature of mathematical knowledge itself, and are derived from the way mathematicians of different cultures have developed the discipline of mathematics. Based on White’s (1959) ideological, sentimental and sociological components of culture, Bishop (1988) classified values of mathematical culture. He identified three corresponding, complementary pairs of mathematical values, namely, rationalism/objectism, control/progress, and openness/mystery.

One important idea regarding these pairs of mathematical values is that of complementarity: neither value in any pair is more significant than the other. But are these pairs portrayed equally in practice? Commonly encountered negative attitudes of pupils towards the subject, which are often carried into adulthood, has led Bishop (1988) to suspect that schools may not have achieved a balanced portrayal and transmission of these complementary pairs of mathematical values. Seah’s (1999) preliminary analysis of four secondary mathematics textbook series from Singapore and Victoria, Australia, has also provided evidence to support Bishop’s (1988) proposal that there exist in these textbooks a predominant emphasis of the values of:
objectism over rationalism
control over progress
mystery over openness.

The relative emphasis of objectism is characterised by the frequent use of symbols which are treated as objects to be manipulated – often without understanding. So teachers hear pupils complain that a novel concept is ‘too difficult to understand, sir’.

Turning our attention to the third category of values in the mathematics classroom, the norms and practices of doing school mathematics as advocated by mathematics teachers, textbooks and to a lesser degree, perhaps, the school ethos, reflect values which are both mathematical and educational. Examples of such values would include encouraging/expecting pupils to display in detail their problem-solving workings, to double-check answers for accuracy, and to work through mathematics practice questions efficiently.

Of course, these three categories of values in the mathematics classroom do not exist exclusively of one another. Depending on the socio-cultural context of a classroom, the mathematical value of rationalism, for example, can also possibly be portrayed as a general educational value and/or a mathematics educational value.

The interaction between values in the mathematics classroom and institutional, societal values is, we believe, two-way in nature. Using Allchin’s (1999) terminology, other values are imported into values in the mathematics classroom just as some of the latter values are exported to the larger context of institution, society or culture. For example, institutional values shape values in the mathematics classroom as much as values in the mathematics classroom influence the development of institutional values.

Mathematics is a subject of great educational values and makes a major contribution in achieving the aims of education. The main aim of education is to develop the individual in such a way that he becomes a contributory member of society. Mathematics is valuable to the individual in many respects. The following values can be derived through the teaching of mathematics.
a) Practical Value

One may find a large number of practical applications of mathematics in life. The knowledge of mathematics is needed at every step or stage of life. Life becomes a hell without the knowledge of mathematical calculations. A labourer uses mathematical knowledge to calculate wages, to make purchases from market etc. He adjusts his budget with the help of mathematics. Various fundamentals of mathematics such as addition, subtraction, multiplication etc., are used in daily life. The knowledge of mathematics is used by engineers, doctors, industrialists, administrators and all others in one way or the other way.

In the present world, it seems impossible to live without having a basic knowledge of mathematics. Generally, all of us suffer from a misconception because of the feeling that whatever is taught in mathematics in higher classes is of little or no use to common man. Such a knowledge is seldom used by an individual in his later life. Talking about mathematics Napoleon said the progress and improvement of mathematics are linked to the prosperity of the state (K.S. Sidhu, 1992). Mathematics will continue to occupy a prominent place in man’s life. To create system in life, people have to fix timings, prices, wages, rates, discounts, lengths, breadths, areas, volumes etc. In the present day, people are likely to feel more and more about the practical value of mathematics in their life.

b) Disciplinary Value

The development of reasoning power and discipline are the two major aims of learning mathematics. According to Locke Mathematics is a way to settle in the mind a habit of reasoning (K.S. Sidhu, 1992, P. 18). Reasoning in mathematics possesses the characteristics such as simplicity, accuracy, certainty of result, originality, verification of results, concentration of mind etc. Then the minds of the individuals get disciplined to accept and work on intended lines.

c) Cultural Value

Mathematics has great cultural values. It is mainly responsible for the progress of civilization. It has been rightly said “Mathematics is the mirror of civilization”. There is a considerable amount of dependence on mathematics in every field of
technological advancement. The modern inventions owe their origin to mathematics mostly. Some famous scientists like James Watt, Galileo, Pascal etc., were also mathematicians. Mathematics is a pivot for all arts. The symmetry of a picture or a portrait, the beauty of geometric design and the rhythm of music are nothing but mathematics, revealing the typical characteristics of a culture.

d) Aesthetic Value

Mathematics possesses immense aesthetic value. According to Thorndike, Education as a whole should foster the higher, impersonal pleasures (Sudhir Kumar, 2000). There are many interesting riddles and paradoxes in mathematics.

e) Utility Value

In modern times, newspapers, magazines, journals, bulletins etc. are full of mathematical symbols and terms and for properly understanding these, the knowledge of mathematics is essential.

1.5. TEACHING OF MATHEMATICS

For teacher of every subject, method is important. Method is nothing but a scientific way of presenting the subject, keeping in mind the psychological and physical requirements of the children. For effective learning of mathematics, the method has to be as good as the content. It is through method only it is possible to make a subject interesting and useful. Method of teaching mathematics differs from stage to stage and from age group to age group. While teaching a set of pupils with varying interests, aptitudes and attitudes, one has to be aware of the psychological basis of teaching-learning process. Pupils tend to learn mathematics through a meaningful approach rather than by a mechanical process.

Some of the important methods of teaching mathematics are the following:

i) Analytic and synthetic method

ii) Inductive and deductive method

iii) Lecture method

iv) Heuristic method

v) Psychological method
There are many techniques, which can be effectively used for the teaching of mathematics. Some of these are oral work, homework, assignments, self-study, group work and supervised study etc. Microteaching is more effective in the development of these skills in comparison with traditional method. Major skills in teaching mathematics namely skills of developing a concept, a principle, applying an inductive approach, applying a deductive approach, applying a problem solving approach and figure drawing are isolated. Teachers trained in these skills through microteaching are superior in their mathematics teaching competency scale than their counterparts who follow the traditional approach.

The teacher must both uncover and build students’ common mathematical knowledge. Being attuned to the base of common knowledge of the class, it is crucial to understand where the students are and where they are prepared to head. The teacher’s explanations depend on the closeness of understanding about the students’ current base of accepted knowledge. Decisions about when to introduce a term or an idea, when to make a distinction, and when to raise a challenge – all of these are fundamental in helping students to build and extend what they know. Working to extend not only individual students’ knowledge but also what is commonly accepted among them is central to the teacher’s work.

The notion of collaboration has become an important idea in the field of education. A number of recent studies have investigated the classroom culture with an underlying assumption that learning/teaching is a collaborative effort involving teachers and students (Cobb, Wood, Yackel and McNeal, 1992). This development is consistent with the basic premises of the social constructivist perspective of learning/teaching (Bruffee, 1986), which has become widely accepted in the education research community (American Association for the Advancement of Science [AAAS], 1994). Because teacher development is also a process of learning/teaching, and because being a teacher involves a wide range of knowledge, understanding the role of collaboration in
teaching and learning is crucial (National Council of Teachers of Mathematics [NCTM], 1991). A number of recent reform documents call for collaborations among colleges, schools, business, and government agencies in preparing future teachers.

**Qualities of A Good Mathematics Teacher**

The success or failure of a mathematics course mainly depends upon the teacher of mathematics. A keen and well-informed teacher who loves his subject and believes in its value will succeed in spite of difficulties and handicaps. A teacher is more like a gardener who tends each plant, examines water and sees that the plant may take its own nourishment. The teacher should be a guide, helper and a friend. The mathematics teacher is an integral part of the process of education.

A mathematics teacher apart from being a teacher of a particular subject is essentially a teacher at first. The qualities of a mathematics teacher may be divided into two categories.

a) General qualities

b) Special qualities

**a) General Qualities**

Much is expected from a teacher in order to play a leading role in any scheme of education. Briefly the qualities and range of his activities may be summarized as below. He should have;

- Well-integrated and effective personality.
- Love for discipline.
- Sympathetic, affectionate and impartial behaviour.
- Adequate general knowledge.
- Knowledge of the current trends in modern Indian education.
- Progressive and dynamic outlook.
- Love for his students and desire to help them in their self-development.
- Satisfactory relationship with parents of the students and members of the community.
- Essential knowledge and skill for fulfilling obligation like framing of timetable, organization of co-curricular activities, maintaining discipline, maintenance of various records, setting of a question paper or planning other evaluation devices.
b) Special Qualities

(i) Command over the subject Mathematics

He should be academically well equipped. He should know his subject well and in true sense be the master of his subject. The level of his information and competency should always be much higher than that of the information he is expected to impart. There is a knowledge explosion especially in a subject like mathematics. Therefore, it is essential for a mathematics teacher to enrich his knowledge of the subject. He should try to revise what has been studied by him during his academic career. He should try to acquire this enriched knowledge through formal education, self-education or other opportunities provided from time to time. Reading of good books, journals and research contributions etc., may suitably help in this direction.

(ii) Ability to teach Mathematics effectively

A teacher of mathematics should have undergone a proper teacher-training course in order to imbibe the following qualities:

- He must be familiar with the aims and objectives of teaching mathematics at all levels of education.
- He should have essential mathematical skills, e.g. computation, drawing etc.
- He must know and use proper devices and techniques for the teaching of his subject according to the availability of the resources and demands of the situation.
- He should be able to make his students learn the practical use of the subject mathematics in day-to-day life and in learning of other subjects.
- He should possess the ability of organising mathematics club, guiding mathematical projects, administering and scoring of standardised tests.
- He should be able to provide guidance and remedial teaching for the backward students in mathematics.
- He should be able to cultivate originality, creativity and ingenuity among his students for the solution of mathematics problems.
- He should be able to frame suitable problems and assign appropriate homework to his students.
In this way a good mathematics teacher should have competency and ability of realizing the aims and objectives of teaching mathematics through his knowledge, understanding, skills, interest and aptitude. He should have developed a typical mathematics nature in his working and behaviour by adopting systematic and logical approach in his working, brevity and simplicity in his expression, truthfulness, neat and cleanliness in his exposition and behaviour, regularity, punctuality and duty boundness in his function and sympathy and sweetness harmonized with frankness in his dealing.

1.6. FACTORS INFLUENCING THE TEACHING OF MATHEMATICS

1.6.1. TEACHER EFFECTIVENESS

A growing body of evidence suggests that teachers are the most important factor influencing student outcomes (Goldhaber and Brewer, 1997; Rockoff, 2004; Sanders and Rivers, 1996). Recent studies suggest that the effects of teaching on student learning are substantial—especially for poor and minority students—and accumulate over time. According to a recent estimate, a poor child who has a high quality teacher for five consecutive years would have large enough learning gains to close the achievement gap with higher-income students (Rivkin et al., 2005). Given the importance of quality teaching, there is great interest in understanding teacher quality and identifying the teacher characteristics that are most predictive of student achievement.

Among the essential teacher characteristics, the one that is often considered is her teaching competence. That is why a number of researchers have focused on five measurable characteristics of teacher quality: teaching experience, teachers’ preparation (selectivity of preparation program and degree level), coursework (number and types of courses), certification status and academic performance. A large body of research suggests that teacher effectiveness is not strongly correlated with these observable teacher characteristics (Goldhaber and Brewer, 1997). Goldhaber and Brewer (1997) estimated that observable teacher characteristics explain less than 5% of the variation in teacher effectiveness measured as students’ gain in standardized testing. Positive associations between these characteristics and teacher effectiveness have been reported in past research (Aaronson, Barrow and Sanders, 2007; Darling-Hammond, 2000; Harris and Sass, 2007) but it is unclear what these characteristics convey about teachers’ professional knowledge. In measuring teacher quality, prior research used
narrowly defined measures of teacher quality, which are poor indicators of the teachers’ knowledge and skills that matter for student learning (Wilson et al., 2001). Past research may have been limited in its capacity to assess the relationship between teachers’ knowledge and teacher effectiveness if teachers’ knowledge has not been adequately measured (Hill, Rowan and Ball, 2005). Therefore, scholars have promoted the consideration of indicators that measure the content of teachers’ knowledge (Rowan, Chiang and Miller, 1997).

Research has been consistent in finding a positive relationship between teachers’ academic proficiency and teacher effectiveness. Academic proficiency was usually defined as teachers’ performance on tests of professional knowledge (subject matter or pedagogy) or tests of general academic ability (basic skills, general knowledge). Compared to measures such as credentials and amount of coursework, some of these tests may represent more direct measures of teachers’ professional knowledge. However, they are valid only if they accurately reflect the knowledge and skills required of teachers.

Teachers’ grades are imperfect measures of professional knowledge. If grades are determined accurately and fairly, they should reflect how much teachers learned in their courses. However, education coursework may not cover the entire range of the necessary knowledge for effective teaching (Mehrens and Philips, 1989). Further, high grades do not guarantee that the material was learned (Holmes Group, 1986). In other words, a grade point average does not precisely reveal what the teachers learned but only serve as an indication of demonstrated knowledge and skills that may be related to teacher effectiveness. Teachers’ grades may also reflect general academic ability, motivation and preparation for fulfilling the requirements of each course. Despite these limitations, scholars have argued that indicators of teachers’ academic performance are potentially better predictors of teacher effectiveness compared to tests or other measures used in past research because they go beyond measuring simple exposure to programs or training (Goldhaber and Brewar, 1997).

The collection of student ratings is not the only way or the best way but rather one way to evaluate instruction. Professionals in the field of teacher evaluation advocate a multiple-source and multiple-method approach to evaluating teaching effectiveness. The collection of student ratings should be combined with data collected from different
sources using various methods such as peer review, teaching portfolios, classroom-observations, or self-evaluation. The use of students’ ratings for evaluating teacher effectiveness is the single most researched issue in all of higher education (Ory, 2001).

The most accepted criterion for measuring good teaching is the amount of student learning that occurs. There are consistently high correlations between students’ ratings of the “amount learned” in the course and their overall ratings of the teacher and the course. Those who learned more gave their teachers higher ratings (Cohen, 1981; Theall and Franklin, 2001).

Teaching in the absence of learning is just talking. A teacher’s effectiveness is again about student learning. However, all teachers realize that what a student learns is not always within the teachers’ control.

Teachers also have limited control over many of the most important factors that influence students’ learning, including students’ attitudes, background knowledge of the course content, study and learning skills, time students will spend on their learning, their emotional readiness to learn, and on and on. Since there is clearly a shared responsibility between the teacher and the student as to what that student learns, and because many students are able to learn in spite of the teacher, while others fail despite all of the best efforts of a skilled practitioner, the definition of “teacher effectiveness” appears to be “an act of faith” on the part of students and teachers to do their best.

Teachers and teacher educators play a critical role in the improvement of mathematics education. Students learn mathematics through the experiences that teachers provide. Thus, students' understanding of mathematics, their ability to use it to solve problems, and their confidence in, and disposition toward, mathematics are all shaped by the teaching they encounter in school. The improvement of mathematics for all students requires effective mathematics teaching in all classrooms (National Council of Teachers of Mathematics [NCTM], 2000, p. 16-17). This statement of NCTM about School Mathematics (2000) describes the intimate relationship between student learning and mathematics teaching. Recognizing that teachers play a critical role in the improvement of mathematics education leads to questions about what types of support and experiences are necessary for teachers to carry out their role more effectively. All national documents and projects support the concept of teaching as a complex endeavor with multiple
approaches. Successful teaching depends on teachers’ ability to make decisions based on their knowledge of the mathematics, the curriculum expectations, the classroom/ school environment, and the needs of the students. Effective teachers understand what students know and need to learn and then challenging and supporting them to learn it well. Teachers gain the ability to make effective and appropriate decisions through their experiences in pre-service and in-service professional development programs.

Three major tenets of effective teacher of mathematics are:

- Effective teaching requires knowing and understanding mathematics, students as learners, and pedagogical strategies.
- Effective teaching requires a challenging and supportive classroom learning environment.
- Effective teaching requires wide general knowledge and application of varied skills.

These tenets have implications for professional development programs for mathematics teachers.

1.6.2. PROFESSIONAL AFFILIATION

Teaching is rightly being considered in present times as a profession and teachers have to play the roles of professionals. They have to become active members of their professional organisations, which strive to elevate their professional, social and economic status by trying to improve their service and salary conditions, and also by providing welfare services to the teaching community, which also conduct research studies to help for the advancement of the professional knowledge and its practice, and which serve as common form bringing all the professionals under one banner.

The teacher should develop the requisite professional - mindedness and acts as a professional in and out of school hours to guide, assist, offer consultation services etc., and thus helping the parents, students, his colleagues and other public interested in education in an appropriate manner. Therefore, a successful teacher is presumed to have a strong attribution towards his profession.

The use of projective technique for studying motivation and allied characteristics is an established procedure in the field of psychology. 77McClelland (1951), 78Atkinson
et al. (1954) and others have perfected the techniques and scoring procedures for assessing varied motivational categories. Interestingly enough, they have evolved a valid scheme of procedure for studying Need for Affiliation. It has been shown in the procedure that the prime factor for identifying the presence of n-Affiliation is Affiliation Image. Affiliation Imagery is defined as, “establishing, maintaining or restoring a positive affective relationship with another person” (Atkinson, 1966).

Professional affiliation means a positive affective relationship one may establish or maintain or restore with a person much involved in that profession or professional activities of his choice.

The aforesaid definition derives home the fact that teachers having greater professional affiliation will certainly be different from those who may lack the necessary level of affiliation towards the profession. A teacher of mathematics is said to be a person of greater affiliation towards teaching of mathematics because of her external manifestations guided by her creative thinking and imagination. A person of such stature is deviant from her colleagues in presenting the subject matter, in classroom interactions and in extending her service to the students and public, beyond classroom situations. Her methodology will be different from class to class and situation to situation. Being investigative and creative, she keeps the students motivated and alive all through her class and helps them sustained that interest and involvement in dealing with the learning of mathematics inside and outside the premises even in her absence.

The students who have got guidance from such teachers of greater professional affiliation will be different from the students tutored by teachers of traditional type in approaching not only mathematics but also other subjects for gaining a good understanding of the concepts and the related skills. Therefore, professional affiliation enables the teachers of mathematics to take up the task of teaching mathematics in a wider perspective paying attention to mastering the intricacies of the subject.

1.6.3. JOB SATISFACTION

Job satisfaction refers to the way one feel about events, people and things in his working situation. According to Blum (1956), job satisfaction is based on “the results of various attitude the person has towards his job, towards related factors and towards
life in general” (P. 124). Hence job satisfaction is the pleasant and positive attitude possessed by an employee towards his/her job as well as his/her life.

Job satisfaction has been defined as a pleasurable emotional state resulting from the appraisal of one’s job (81Brief and Weiss, 2002); an affective reaction to one’s job; and an attitude towards one’s job (82Weiss, H.M., 2002). 83Weiss (2002) has argued that job satisfaction is an attitude but points out that researchers should clearly distinguish the objects of cognitive evaluation which are affect (emotion), beliefs and behaviours (P. 194). This definition suggests that attitudes towards jobs by taking into account the feelings, beliefs, and behaviors.

Various investigations show that when a person is satisfied with his/her work the employer profits and the nation prospers. This is the reason why satisfaction in the job becomes a serious consideration for all. The teacher can remain satisfied in his/her job only when opportunities for the satisfaction of his/her social and ego needs are provided.

Satisfaction is an emotional response. Job-satisfaction may be defined as a ‘pleasurable or positive emotional state resulting from the appraisal of one’s job or experience’. It is also said to be a mental attitude of an employee towards his/her job. This may be again defined as the result of various attitudes a person holds towards his/her job, towards related factors and towards life in general. Job-satisfaction depends on many factors like personality, intelligence, influence of environmental factors, family size, age, sex and experience.

Teaching is an immensely rewarding profession. Love of knowledge, devotion to duty and selfless service to humanity are the higher values of life being achieved through this profession. Unless and until one feels satisfied in his/her profession he/she cannot execute the values of his/her noble profession.

**Determination of Job Satisfaction**

Job satisfaction describes how content an individual is with his or her job. It is a relatively recent term since in previous centuries the jobs available to a particular person were often predetermined by the occupation of that person’s parent. There are a variety of factors that can influence a person's level of job satisfaction; some of these factors include the level of pay and benefits, the perceived fairness of the promotion system
within a organisation, the quality of the working conditions, leadership and social relationships, and the job itself (the variety of tasks involved, the interest and challenge the job generates, and the clarity of the job description/requirements).

There are two types of variables that determine the job satisfaction of an individual. These are (1) organizational variables and (2) personal variables.

**Organizational Variables**

1. **Occupational Level**: The higher the level of the job, the greater the satisfaction of the individual. This is because higher level jobs carry greater prestige and self-control. This relationship between occupational level and job satisfaction stems from social reference group theory in that our society values some jobs more than others. Hence people in valued jobs will like them more than those who are in non-valued jobs. The relationship may also stem from the need-fulfilment theory. People in higher-level jobs find most of their needs satisfied than when they are in lower level ones.

2. **Job Content**: Greater the variation in job content and the less the repetitiveness with which the tasks must be performed, the greater the satisfaction of the individuals involved. Since job content in terms of variety and nature of tasks called for is a function of occupational level, the theoretical arguments given above apply here also.

3. **Considerate Leadership**: People like to be treated with consideration. Hence considerate leadership results in higher job satisfaction than inconsiderate leadership.

4. **Pay and Promotional Opportunities**: All other things being equal these two variables are positively related to job satisfaction. An explanation for this finding lies in both theories discussed above.

5. **Interaction in the Work Group**: Here the question is: When is interaction in the work group a source of job satisfaction and when it is not? Interaction is most satisfying when –
   a) It results in the cognition that other person’s attitudes are similar to one’s own, since this permits the ready calculability of the other’s behaviour and constitutes a validation of one’s self;
   b) It results in being accepted by others; and
   c) It facilitates the achievement of goals.
**Personal Variables**

For some people, it appears most jobs will be dissatisfying irrespective of the organizational conditions involved, whereas for others, most jobs will be satisfying. Personal variables like age, educational level, sex etc., are responsible for this difference.

1. **Age**

Most of the evidence on the relation between age and job satisfaction, holding such factors as occupational level constant, seems to indicate that there is generally a positive relationship between the two variables up to the pre-retirement years and then there is a sharp decrease in satisfaction. An individual aspires for better and more prestigious jobs in later years of his life. Finding his channels for advancement blocked, his satisfaction declines. The studies of Bernal and McDaniel (1998) and Oshagbemi (1998) gave the relationship between the age of the teachers and their job satisfaction clearly.

2. **Educational Level**

With occupational level held constant there is a negative relationship between the educational level and job satisfaction. The higher the education, the higher the reference group which the individual looks to for guidance to evaluate his job rewards. The total effect of education qualification on job satisfaction of teachers was found out by Glenn and Weaver (1982).

3. **Role Perception**

Different individuals hold different perceptions about their role, i.e., the kind of activities and behaviours they should engage in to perform their job successfully. Job satisfaction is determined by this factor also. The more accurate the role perception of an individual the greater his satisfaction. Best, Stapleton and Downey (2005) suggested that employees’ work role may directly and indirectly associated with job satisfaction, where employees who are low on work self-evaluation and who perceived a constraining work environment are at risk for burning out and becoming dissatisfied on the job.
4. Sex

There is as yet no consistent evidence as to whether women are more satisfied with their jobs than men, holding such factors as job and occupational level constant. This was confirmed by the study of Cheung and Scherling (1999).

1.6.4. MANIFEST ANXIETY

Anxiety among teachers has been a major mental health concern in any educational institution. Arem (1993) defines math anxiety as a clear-cut, negative, mental, emotional, and/or physical reaction to mathematical thought processes and problem solving. The construct of anxiety, although rarely noted in higher secondary mathematics education, best described the reactions with the higher secondary teachers. These practicing higher secondary teachers exhibited what appeared to be symptoms of anxiety (e.g., unwillingness to complete homework assignments, avoidance of participating in collaborative problem solving) to the level that prevented engagement in mathematical lessons. Results revealed from the study of Babette M. Benken and Nancy Brown (2007) that the complex relationship between teachers’ anxiety and professional identity, including fear of public recognition of a lack of content knowledge, was crucial to learning.

The pressure from school authorities would be more severe in an educational system, where competition is keen and opportunities for higher education limited. However, no study has yet investigated the degree and the pattern of manifestation of anxiety, and the empirical relationship between anxiety and performance of teachers at higher secondary school level.

The concept of anxiety is a loosely defined term. A useful paradigm for reviewing the diverse field of anxiety research has been proposed by Phillips, Martin, and Meyers (1972). They summarized the various factors under antecedents, concomitants, and consequences of anxiety. Two common constructs were used in conceptualizing anxiety: The dispositional construct, “trait anxiety”, is primarily a function of past experience and has an internalized locus. The situational construct, often referred to as “state” or “situational anxiety”, is directly a function of stressful conditions and has a contemporary locus.
Studies on the consequences of anxiety on intellectual functioning and on learning have generally found that these effects are more maladaptive and debilitating than adaptive and facilitating (Spence, 1958; Taylor, 1958; Mandler and Sarason, 1952). However, the relationship between anxiety and performance is a complex one depending on the nature of anxiety measures used (Mandler and Sarason, 1952), nature of the task (Sieber, 1969), stage in the learning process (Spielberger and Smith, 1966), or the presence of reinforcement or feedback (Horowitz and Armentrout, 1965; Morris and Fulmer, 1976). Under certain conditions, anxiety may not hinder performance or may even facilitate performance (Spielberger and Smith, 1966; Lekarczyk and Hill, 1969).

Anxiety is a painful uneasiness of mind concerning impending or anticipated ill. Hence, anxiety is a response to a hidden and subjective danger. But, fear is a response to an obvious and objective danger. Arthur T. Jersild et al., (1978) correctly said Fear exists so generally in contemporary life that our time has been called the ‘Age of Anxiety’ (P. 318). According to Harry Stack Silluvian (1953), high anxiety cuts off both insight and foresight (P. 355).

Mandler and Sarson (1952) identified the highly anxious man as the one who is unduly concerned about his progress in school, who worries about not understanding what their management is saying or what they expect of him, who characteristically experience tension when called upon to answer questions and who suffers acute distress before and during school sessions. Moreover, according to them, many experienced school authorities are unable to identify anxious teachers in their management. Often unrecognized are those bright, strongly motivated teachers who are clearly adequate in their school work, yet highly anxious about their own abilities and then standing with the management. Such teachers are not able to realize their potential to the maximum.

1.7. HIGHER SECONDARY EDUCATION

The course of study that can fill the gulf between secondary and higher education is considered as higher secondary education. The Indian Education Commission (1966) visualized a flexible educational structure and decided to adopt the uniform pattern of 10+2+3.
The first stage covers 10 years of schooling for all children. It contains general education with emphasis on science and mathematics and the addition of new subjects like work-experience, physical education and aesthetic activities.

The second stage or +2 is of two years duration where diversified and specialized courses are provided with more emphasis on vocationalization. This stage regarded that higher secondary can be in general education or in vocational education.

The third stage is the college course of three years duration, leading to the first degree.

**Important Features of Higher Secondary Education**

In the booklet entitled “10+2+3 - A Major Change in School Education” published by the Ministry of Education and Social Welfare, Government of India, New Delhi (1975), the following important features of education at the higher secondary stage have been pointed out:

1. The goals of national integration, training for democratic living, cooperativeness, cultural and religious tolerance have been duly emphasized in the courses of languages and social sciences and find ample scope in community service.
2. For the promotion of intellectual capacities, the teaching of subjects like Maths, Languages, Science and Social Sciences have been emphasized.
3. The course provides a core of knowledge so as to create a general base, which would enable pupils to undertake work or pursue further studies - academic or vocational. With the introduction of work experience, a step in the direction of inculcating right attitudes towards work has been taken.
4. The schools may undertake suitable activities of community service such as village uplift, slum clearance, working in hospitals to nurse the sick, removal of illiteracy in addition to work experience.
5. Vocationalization of education at +2 stage is sound from the economic, moral and social point of view.
6. Diversification or streaming of students is based on the psychological principle of individual differences, which can help them in specializing according to their talents.
Need for Higher Secondary Education

1. The atmosphere in the school will be improved with +2 stage in schools. It becomes more encouraging and motivating.
2. The school stage will be strengthened and its standards will improve because of it’s lengthening to 12 years and it brings more competent staff and better equipment to the school.
3. It will enable the schools to prepare the gifted students intensively for the universities and also to provide remedial action for shortcomings arising from weakness in early education.
4. By vocationalizing this stage intensively, a fair proportion of students can be diverted into different walks of life, thus reducing the pressures on university admissions.
5. Students will be mature enough to take decision about their future career.
6. The standard of higher education will also improve as the students will be better prepared and more mature.

Curriculum of Higher Secondary Education

It includes vocational and non-vocational courses. In vocational higher secondary courses, education is mainly related to vocational value of education. In this scheme, certain skills are acquired by the students through the study of technology related science, agriculture or any other work, which need manipulating skills.

In non-vocational courses, at the higher secondary stage of general education, courses are diversified as to enable the pupils to study a group of any three subjects in depth.

Almost in all higher secondary students, the academic streams are formed with mathematics, science, and arts subjects. In mathematics group, the subjects are generally mathematics, physics, chemistry, biology and computer science.

The curriculum designed for higher secondary education shows the importance being given to mathematics to a large percentage of students who may have the inclination to proceed in the academic stream or in the vocational course of study. Many of the subject groups have mathematics as a constituent subject to help individuals to be more productive in the chosen course of study. As it has been pointed out earlier a
developed country like ours is in need of a strong manpower who can take up jobs in
different fields of activity and also individuals who can break new paths for greater
economic and social development.

To ensure the balanced development of the adolescent’s total personality, the
curriculum provides half the time to subjects, one-fourth of the time to language and one-
fourth to physical education, arts and crafts, moral and spiritual education.

From all these it is clear that the students may be in a state of stress at the higher
secondary school stage. Therefore, the teachers are expected to be highly sympathetic
towards the students and listen to the difficulties and problem in a sympathetic manner.
A teacher needs to maintain a liaison with the guardians. He may invite the guardians to
the school and try to discuss with them the various problems of the students. He should
be courteous to them when they come to see him. He should also try to maintain a
proper and courteous relationship with the community at large. He should be up-to-date
with regard to the latest researches in the field of his subject.

1.8. NEED FOR THE STUDY

As is the course concerned, so is also with the teachers teaching different subjects
in higher secondary classes. Though all subjects are important for the overall
development of the individuals, Mathematics which is said to be queen of all subjects, in
fact, commands the attention of all – teachers as well as the students. The ability to solve
mathematical sums is equated with one’s intellectual competence to deal with problems
encountered day-in and day-out. The very fact, that most of the students feel
uncomfortable with mathematics, is an undisputable one. Therefore, the teachers
teaching mathematics are expected to be extremely competent and highly humane in
their approach while teaching mathematics. Very often, the mathematics teachers noted
for their competence and caliber are proved to be unsuccessful in the classroom because
the majority of the target group-sit awestruck or feel dreadful at the work displayed on
the blackboard. The main reason for such a phenomenal act of the students may be
attributed to the emotional block that stands between the teacher and the taught. It is not
merely the ability of the teacher to deal with mathematical problems and theories but it is
the closeness the teacher establishes with the students which make the understanding
easier.
Only in this context, the educationists as well as the psychologists speak of teacher effectiveness. Along with the teaching competence, a teacher is required to have the knowledge to understand the need and problem of the students related to the cognitive, affective and psychomotor domains, and the skill of fulfilling their requirements and smoothen the process of thinking by providing all necessary linkages with all aspects of learning. Such a careful adoption of the varied principles of good and conducive teacher behaviour, a teacher could be effective in imparting learning in an effective manner, how difficult or confusing the subject may be. In short, the overall achievement of the teacher in bringing out positive and significant development in all the three domains of the learners decides his/her effectiveness in teaching the subject. Therefore, the investigator being a PG teacher of mathematics opines that the effectiveness of learning is not simply a correlate of teaching competence, but a product of teaching competence and all conducive teacher behaviour which brings the learner closer to the teacher. That is, the teacher effectiveness which is nothing but a sum total of conducive teacher behaviour and his/her teaching competence is the major factor responsible for a good learning outcome in classroom situation. Therefore, the investigator would like to probe into teacher effectiveness of teachers teaching mathematics in order to understand the teacher behaviour manifested by the mathematics teachers in higher secondary schools. Hence, the problem for her research is stated as given below:

TEACHER EFFECTIVENESS OF POSTGRADUATE TEACHERS TEACHING MATHEMATICS IN HIGHER SECONDARY SCHOOLS IN TIRUNELVELI REVENUE DISTRICT
1.9. REFERENCES


5. Ibid

6. Ibid

7. Ibid

8. Ibid


10. Ibid


46. Ibid


49. Ibid


53. Ibid


64. Ibid


79. Ibid


83. Ibid, P. 194.


95. Ibid


