Chapter Two

Theoretical Background in Teacher Education.

Introduction to chapter 2

This study aims at exploring the necessary to keep student teachers development of mathematics student teachers' performance during their practice teaching in cooperating schools. Therefore, there is a need to review the literature in many aspects of teaching practice and specifically in teachers' development.

This chapter deals with six issues mainly which are in connection with the research questions, the concept of development in the performance of the teacher, factors which affect the performance, supervision and teacher development, problems of pre-service and beginning teachers, models in teacher development, and standards of teaching competencies for teachers' performance completed by some remarks of facilities and function of observation.

The second part of this chapter deals with the theoretical background of the methodological bases in Mathematics' lessons, including the main aspect of the teaching and learning mathematics.

2.1 Literature Review

2.1.1 Concept of development in the performance of teacher

The definitions for teacher development and growth vary from one researcher to another and it is difficult to find one correct description (Moirera, 1996). Professional development of beginning teacher includes a good opportunity for every teacher to develop and extend knowledge, skills and understanding about teaching practice. It has been as entitlement for all, not merely remedial for some (Smith &Varma, 1996).

Barth 1990 claims that professional development is viewed as a critical component affecting pupil learning. "Probably nothing within a school has more impact on pupils in terms of skills development, self-confidence, and classroom behavior than the personal and professional growth of teachers".

Teacher needs to be actively engaged in his or her own professional development if growth is to be achieved. "When they observe, examine, question and reflect on their ideas and develop new practices that lead toward their ideas, pupils come alive, when teachers stop growing, so do their pupils"(Barth, 1990).

Linda Darling-Hammond says: "Teacher development is not only the renewal of teaching, but it is also the renewal of schools".

Professional development is a collaborative, on-going process in which the individual plays a critical role. In this construction of professional development, we see the teacher as: reflective practioner, someone who has a tacit knowledge base and who then builds on that knowledge through ongoing inquiry and analysis, continually rethinking and reevaluating her own needs and practices (Darling-Hammond, 1992).

2.1.2 Factors can affect the trainees' performance

Kagan (1992) says, "Professional growth is defined as changes over time in the behavior, knowledge, images, beliefs, or perceptions of novice teacher". And she also says that in her review about professional growth among preserves and beginning teachers: " there are many personal and contextual factors that can affect a novice's (i) acquisition of knowledge about pupils and (ii) ability to use that knowledge to modify preexisting beliefs and images.

Hollingsworth (1989) identifies four factors that appears to affect the acquisition of classroom knowledge by the novices: (1) their images of themselves as learners,(2) an awareness they need to temper initial beliefs and come to terms with classroom management,(3) the presence of a cooperating teacher who is a role model that facilitate growth,(4) placement with a cooperating teacher whose ideas and practices were somewhat different from the student teacher's beliefs.

In the model of Niemi (1989, 1992) teacher growth and teacher professional development are involved together and you cannot separate them. Niemi says that teacher profession is an ethical profession and teacher development is a pedagogical process and it will start very early in primary school. Teacher growth contains professional skills, the stages of the personal growth and cognitive processes (metacognitive areas).

In the model of Bell & Gillbert (1996), is show that professionalism contains different teaching strategies, beliefs and concept of development. Therefore, professional development contains changing concepts and beliefs about the person's own subject matter and teaching and learning. Personal development contains an individual teacher development, emotions and beliefs about education and instruction. The cognitive development contains teacher's metacognitive consciousness about her/his own learning. And the social development contains cooperation with other people.

Some researchers (Kagan 1992, Kow 1994) have tried to understand teachers' professional growth with qualitative methods. They have stressed on prospective teachers' cognition, beliefs and mental processes. Kagan (1992) formulated the theoretical model of student teachers that enter the university with personal beliefs about environment, children and pupils and with some pictures about themselves as teachers. Further she found that at the beginning of the study student teachers focus on themselves and step-by-step they build and rebuild the picture of teacher and get more skills to solve problems and to interact with different people.

Some studies indicate that the student teachers in their study move from concrete, undifferentiated thinking to more flexible, integrated thinking about educational matters, While Grossman & Richert (1988) reports that student teachers "felt they had learned practical survival skills, which they believed to be invaluable in their professional preparation". On the other hand many student teachers persist in viewing teaching as showing and telling, and learning as memorization (Calderhead, 1991; Mc Daniel, 1991).

One can summarize that student teachers are surrounded by a collection of pressures in the school site, as follows:

1. Learning to cope with procedural unknowns. (Britzman, 1991).
2. Feelings of insecurity over the curriculum. (Bullough, 1992).
3. The evaluations of supervisors. (Hollingsworth, 1993).
4. The wider school context. (Liston & Zeichner, 1990).

5. Their relationships with cooperating teachers. (Kagan, 1992).

Although; Borko et al., (1991) argue that these "contextual pressures" are contradictory and can stifle professional growth. Zeichner (1978) also found that professional development was constrained.

Given that the pre-service teachers' beliefs when they enter the university will affect their professional growth, some researchers have noted more attention should be paid to the student beliefs when they enter the practical program.

In order to encourage student teachers to develop beyond concerns about survival and procedural knowledge, Gore and Zeichner (1991) recommended a greater emphasis on self-reflection to help reconstruct beliefs, and Kagan (1992) advocated placing student teachers with cooperating teachers who could act as catalysts for cognitive dissonance even though this might cause some discomfort for the student teachers. If left untroubled, prior beliefs about teaching remain unchanged and teaching runs the risk of becoming routine, conservative, and non-problematic (Calderhead, 1988).

Mentoring programs pair novice teachers with outstanding experienced teachers who can explain school policies and practices, share methods and materials, and help solve problems. Mentors may also guide the professional growth of new teachers by promoting reflection and fostering the norms of collaboration and shared inquiry (Feiman-Nemser & Parker, 1992).

School culture plays an essential role in the processing of teacher development; According to Linda Darling-Hammond, five factors are essential to provide the necessary school culture to enhance teacher development:

1. Norms of colleagueship, openness and trust;
2. Opportunities and time for discipline inquiry;
3. Teacher learning of content in context;
4. Reconstruction of leadership roles;
5. Networks, collaborations and coalitions (Darling –Hammond, 1992).

Although, a national governors' association report (1995) notes that systemic reforms place many demands on teachers improving subject-matter knowledge and pedagogical skills, understanding cultural and psychological factors that affect student learning, and assuming greater, and in some cases new, responsibilities for curriculum, assessment, outreach, governance, and interagency collaboration. Teachers need time to understand new concepts, learn new skills, develop new attitudes, reflect, assess, try new approaches and integrate them into their practice, and time to plan their own professional development (Cambone; 1995).

Moreover, Cambone (1995) points out that teachers as adult learners need both set-aside time for learning (e.g.: workshops and courses) and time to experience and digest new ideas and ways of working.

Teacher's beliefs and understandings serve as lenses through which changes is considered. Their knowledge systems are simultaneously the objects of change and factors that support or constrain the change process. This situation adds to the complexity of the change process and to the need for powerful professional development programs (Broke &others, 1995)

However; Teachers reject new programs and skills development when:

1. They are imposed. As McLaughlin (1990) notes, we cannot mandate what matters to effective practice.
2. They are encountered in the context of multiple, contradictory, and overwhelming innovations (Wernet, 1988).
3. Most teachers, other than those selected for design teams, have been excluded from their development (Fullen, 1991).

4. They are packaged in off-site courses or one-shot workshops that are alien to the purposes and contexts of teachers' work (Little, 1993).
5. Teachers experience them alone and are afraid of being criticized by colleagues or of being seen as elevating themselves on pedestals above them.

(Fullen &Hargreaves, 1991).

In their research, Berry and Ginsberg find high levels of teacher exhaustion. They cite five aspects of the profession which contribute to such high levels:

1. Excessive paper work;
2. Lack of time to prepare classes and to meat with other teachers;
3. Lack of opportunity for creativity in the classroom;
4. Excessive non-teaching duties;
5. Role conflict for having to do unnecessary tasks (Berry &Ginsberg, 1991).

These conditions are symptomatic of stressful environment. The factors contributing to burn out certainly involve the organizational climate and culture but factors also include personal and social /economic conditions. Glatthorn & Fox suggest the following as danger signals, which may indicate future burnout for an individual:

1. Increased absence from school.
2. Withdrawal from leadership positions or extra curricular activities.
3. Increased negativity towards parents and pupils.
4. Use of old lesson plans.
5. Use of more individual pupil practice work sheets.
6. Declining interest in or avoidance of professional development activities.
7. Increased isolation (Glatthorn & Fox, 1996).

As teachers begin their self-evaluation, they can explore their attitudes, values and perceptions in the critical areas referenced in the conceptual map. This structured model represents one approach to reflective practice, which occurs in isolation. More recent literature looks at the need for reflective practice in context of the individual's professional practice and the importance of feedback as a stimulus for professional growth.

According to Judith Little (1993), one test of teachers' professional development is its capacity to equip teachers individually and collectively to act as shapers, promoters, and well-informed critics of reform". At the same time, Little cautions against leveling full responsibility for implementing education reforms on teachers. She has identified five areas as being integrally tied to enhanced teaching and therefore essential to professional development:

1. Reforms in subject-matter teaching;
2. Equity for diverse student populations;
3. Changes in the nature, extent, use of assessment;
4. The social organization of schools;
5. And the professionalization of teaching.

Each suggests the need for teachers to gain new knowledge and enhance skills.

Beatie (1995) suggests that "when student teachers and cooperating teachers can engage in inquiry and reflection necessary to challenge their practices and change the stereotypes of teaching and learning that currently exist, they can overcome :obstacles to reform".

Three fundamental factors appear to affect the nature and speed of professional growth among pre-service and beginning teachers:

1. The biography of a novice;

2. The nature of the particular service program; and
3. The school/classroom context in which teaching occurred (Kagan, 1992).

Kagan suggests that a net goal of pre-service education should be to encourage biographical reflection in order to help resolve the novice's image of self as teacher.

The necessary and proper focus of a novice's attention and reflection may be inward: on the novice's own behaviors, beliefs, and image of self as teacher. Novices who do not possess strong images of self as teacher when they first enter the classroom may be doomed to flounder. Instead of expecting novices to reflect on the moral and ethical implications of classroom practices, teacher educators might be wiser to guide novices through their practice teaching: for example, helping them to examine their prior experiences in classrooms, and their tendencies to assume that other learners share their own problems and propensities.

2.1.3 Supervision and Teacher Development

Teaching mathematics during the training course is shaped according to the model of cooperating teachers. As student teachers borrow routines they are not merely mimicking, but rather making an attempt to research into one's own pedagogy they fit between the routine and how one wishes to teach.

Barker and Desrochers (1992) advise that, "After the student teacher observes, teaching techniques should explain what is done as well as why it is done". They also suggest that copying the teacher "provides a smoother transition and should be followed with originality and experimentation in teaching". Teachers use a lesson plan format as method to begin coaching student teachers and follow up with discussion. The student teacher observes his/her cooperating teacher, then; the two of them discuss the lesson together, talking about the parts of a good lesson. The role of supervisor in this case is to shift the discussion into the following questions:

What did you think of the opening?
Could you state the objectives?
Which of the activities were the most successful?
Did you notice the way the lesson was closed?

One of my student teachers said that about those questions "I think being able to observe someone teaching mathematics before I teach and focus into supervisor's questions, because it will be a great asset, it will give me a chance to see and think how mathematics lesson is handled ". At the same time the reader has to know student teachers and their supervisors have little control over determining the goals of the class and lack the authority to change the content of the curriculum.

Jeuthe (2000) says that: "supervision is a life-line for educating teachers and for their further professional development". At the same time, Focuses on successful supervision which depends on the personality, qualifications of an individual supervisor, and a well-organized communication between all people that are involved in the process of pre-service teacher training.

The role of teacher educators is very important: they have to recognize their students' beliefs and to know how they can be influenced (Bramald, Hardman&Leat, 1995).

The university supervisor plays an important role during training by providing an orientation for all student teachers under his/her supervision. He/She conducts an individual feedback for each case of student teachers on a regular basis to ensure that the student teachers' progress are coming up to date, so the supervisor must be available for communications and spend a great deal of time in the schools. We understand this role for the university supervisor as a

helper, a vacillator, a counselor, a giver feedback and active participant in the process of teacher training.

The role of supervisor is critical in complementing and extending the professional development opportunities that we provide for beginning teachers in practicum setting. Unfortunately, it is a role that is often overlooked and undervalued in conversations about pedagogical practices in teacher education. There are three steps: professionally ready, carefully selected, and continually supported working together for the professional development of student teachers to ensure that all advisors are:

1. Professionally ready, that is, advisors wishing to work with student teachers are provided with professional development opportunities that prepare them for that role and clearly outline what is expected of them in that role;
2. Carefully selected from those who have completed the initial professional development program; and
3. Continually supported as they undertake their role as advisors.

Borko & Mayfield (1995) have notice that the relationship between student teachers and both supervisors and cooperating teachers can be such that a student teacher can get totally new ideas about learning, teaching and reflection.

New approaches to reflection may be presented during some courses but teaching practice may strengthen traditional beliefs (Nettle, 1998). Some students became frustrated when they encounter the conflict ideas and the reality they met in classrooms.

Many researchers have found that the crises have an important meaning when student teachers study teacher profession and teachers work as competent teachers (Nias, 1989,Bullough, 1991,Kelchtermans, 1994).

Therefore, it is important for student teachers to keep in touch with the supervisor and cooperating teacher; in other words, feedback from supervisor and cooperating teacher towards student teachers' work is a must. The system should be confirmed this fact.

However, feedback system is the most effective when the following criteria are used during practice teaching:

(1) It is specific.
(2) It is descriptive rather than judgmental.
(3) It takes into account the needs of both the receiver and the giver of feedback.
(4) It is directed towards the behavior, which the receiver can do something about.
(5) It is solicited rather than imposed.
(6) It is well timed.
(7) It is checked to ensure clear communication.
(8) It is checked with others to ensure accuracy.

(Vella, 1995).

Consequently, feedback from a varity of perspectives can influence teacher's practice: from colleagues, supervisors, and pupils as well as parents can impact an individual's learning. Such on-going discussions enhance an individual's expertise and improve the quality of teaching. (Vella, 1995).

Most supervisors all over the world agree that the formal, initial preserves training is inadequate for beginning teachers to successfully perform their teaching duties in the classroom (Huling-Austin, 1992,Kagan, 1992,Vonk, 1993,Weinstein, 1988).

As programs help pre-service teachers understand the significance of theoretical and abstract content and their need for procedural knowledge, pre-service teachers can come to see the complexities of teaching (Kagan, 1992). It is the thought and action associated with the field experience, which determines its value (Johnston, 1994). Pre-service teachers need

specific help interpreting the classroom experience in an atmosphere conductive to reflective discourse. University supervisors must take the time to help each student teacher appreciate the complex task of learning to teach and devise differing teaching strategies most appropriate to her or him (Ball & Feiman-Nemser, 1988; Goodman, 1988; Grossman, 1989; Johnston, 1994b).

Supervisors should assist student teachers analyze not only their successes but highlight things learned that are inappropriate to teaching and might be reinforced if left unchallenged (Feiman-Nemser & Buchmann, 1985; Fosnot, 1989), so helping them moves from being "unconfident answer-knowers to confident question-askers" (Kutz 1992). By mutually constructing these experiences, the supervisor and the student teacher create a sense of collaborative resonance and collegiality (Cochran-Smith, 1991).

2.1.4 Problems of Pre-service and Beginning Teachers

There are problems faced by beginning mathematics teachers. Many educators in Jordan say that there is lack of pre-service education directed towards student teachers in their practice teaching. This is followed by what is going in schools during practice teaching, and highlights the problem that faces the student teachers. In the same context, most educators all over the world agree that the formal initial pre-service training is inadequate for beginning teachers to successfully perform their teaching duties in the classroom (Huling-Austin, 1992, Kagen, 1992, Vonk, 1993, Weinstein, 1988).

Chakalisa, P.A., Motswiri, and Yandila C.D. (1995) say that there are problems in the area of teachers of Mathematics and that focus in:

1. Determining what part, depth and extent of the content should be taught;
2. Designing lesson plans and running them;
3. Timing their lessons, disciplining pupils in class and motivating them to learn.
4. Lacking knowledge of the individual pupils they teach.

Although, Hawk (1994) says that beginning teachers in Mathematics do not have problems with the knowledge of content of their teaching subjects. However, if the content was not covered during their courses at the university, they have serious problems to teach it.

Consequently, beginning teachers lack mentors in their schools to assist them settle down in their teaching profession. The importance of mentor-ship is well documented in many studies of beginning teachers (Bey & Holmes, 1990; Brooks, 1987; Huling-Austin, 1990; Huling-Austin et.al. 1989).

Victoria P. Jaus (2001) says that in her study of using the INTASC (Interstate New Teacher Assessment and Support Consortium) standards to understand and analyzing the performance problems of student teachers, performance problems were defined as behaviors that did not meet the expectations jointly set by university and public school professions; including knowledge, skills and dispositions expected of competent beginning teachers.

The types of performance problems that student teachers had, particularly in their efforts to individualize their planning, instruction, classroom management, and assessment to meet the needs of all pupils. At the same time there were another type of problems that arose from the student teacher' personality and demeanor, time-management skills, and organizational abilities.

Furthermore, These types of problems are reflected in the literature on beginning teacher development.

Therefore, student teachers should receive additional training on the job or at least be assisted by their former instructors or senior teachers in their schools. This takes different

forms but it aims to help them and decrease their problems that could be brought by the teaching environment both in and outside the classroom.

2.1 5 Models in teacher development

The researcher finds some models of pre-service teachers development & beginning teachers growth, which highlight this study in order to support its line in exploring and analyzing.

The researcher believe that the rich experience of a good cooperating teacher is a very important model that guideline the practice teaching for student teachers during training course.

Vonk (1993) has developed a model of professional development for beginning teachers. It consists of three dimensions:

(1) Personal; (2) environmental; (3) knowledge and skills.

The personal dimension involves "self-concept by the teacher". It includes the teacher's knowledge of himself and ideas about "good practice".

The environmental dimension involves the teacher's interaction with his or her working situation. It includes new responsibilities, and having to adapt to school environment as well as coping with expectations from colleagues.

The knowledge and skills' dimension is concerned with pedagogical content knowledge, classroom knowledge and management skills as well as teaching skills.

Fuller (1960s) initiated a series of clinical studies to examine student teachers' motivation, perceptions, problems, and attitudes toward teaching. In research of teacher professional development, Fuller's (1969) model of concerns has long been used to explain student teachers' stages of development as teachers. In the model, Fuller (1969) theorized that teacher concerns can be classified into three distinct categories "self concerns" which center around the individual's concern for their own survival related to their teacher preparation program; "task concerns" which focus upon the duties that teachers must carry out within the school environment, and "impact concerns" which are related to one's ability to make a difference and to be successful with his/her pupils and the teaching/learning process.

Fuller (1969) believed that as pre-service teachers move through their training, their concerns move from self to task, then to concerns impact.

Fuller & Bown (1975) developed the following model of four stages:

1. Pre-teaching concerns: becoming teachers have realistic interaction with their pupils, but unrealistic interaction with other teachers.
2. Early concerns about survival: becoming teachers have some kind of ideas about their own success and survival. Also they have opinions about teaching contents.
3. Teaching situation concerns: becoming teachers are worried about their own teaching, but they are not so much worried about pupils and their learning.
3. Concerns about pupils: becoming teachers are worried about their own skills to recognize pupils, social needs, and their emotions. Also they are worried about how to respond to pupils as individuals.

A number of researchers about teachers' concerns have been conducted based on Fuller's model. For example, O'Connor and Taylor (1992) have conducted concerns study on the students in California state University to ascertain what are the concerns of pre-service teacher as based on progress through their professional programs. Based on the findings, O'Connor &Taylor (1992) suggest that teacher educators need to have knowledge about pre-

service and novice teachers' concerns and to address their concerns in order to decrease the rate of attrition of teacher candidates within their progress. Whether there are a cultural or social differences is also an interesting area of investigation.

O'Connell's (1994) study indicate that the first year of teaching is not what the novice teachers expected and many of the previous beliefs and optimism had broken in face of the reality. Thus, the degree of readiness that pre-service teachers are prepared for teaching is reflected in confidence and optimistic view held by them before and after teaching practice. The images, metaphors and beliefs often seem to be established before student teachers begin their training as teachers and could be quite resistant to change (Korthagen, 1991).

Based on that, you can see how it is important for student teachers to be knowledgeable about the subject matter they need to teach for the purpose of teaching and how to organize that knowledge for novice learners. They need to know the structures of their discipline, because without this knowledge, they may misrepresent both the content and the nature of the discipline itself.

Kagan (1992) says that, Pigge & Marso (1989) found that," the student teachers became less concerned about themselves and more aware of classroom variables as they progressed through the practical teaching program. Their attitudes about teaching, their future impact on pupils, and their probable success in teaching remained optimistic and unchanged".

According to findings of Kagan's review of 40 studies, she indicated that:

1. Teachers grew in pedagogical problem solving during their pre-service program and during their first year of teaching.
2. Pre-service and novice teachers begin with inadequate knowledge of pupils and classrooms.
3. Pre-service teachers tend to benefit from their own experiences as pupils.
4. Learning to teach involves not just the acquisition of content knowledge but detailed knowledge of pupils and classrooms.
5. Almost every one of the 40 studies reviewed by Kagan's confirmed that: university courses fail to provide novices with adequate procedural knowledge of classrooms, adequate knowledge of pupils or the extended practical needed to acquire that knowledge, or a realistic view of teaching in its full classroom/school context.
6. The emphasis on developing skill and rating performances results in a serious oversimplification of the process of becoming a teacher, which must be viewed in relationship to biography and conceptions of self-as-teacher and to the teacher's entire life situation…. the problem of finding oneself as a teacher, of establishing a professional identity is conspicuously missing from most lists of beginning teachers' problems.
7. Classroom teaching appears to be a peculiar form of self-expression in which the artist, the subject, and the medium are one; whether any academic program of study can truly prepare someone to practice it is a question that one doesn't dare to ask.

Niikko (2000) found the following themes and categories, which can be understood as the results of the research as follows:

First theme: Teacher development as successive stages;

1. A part of development stages of adulthood.
2. Cycle of career choice and profession career.
3. Cognitive-psychological phenomenon.

Second theme: Teacher development as a learning process:

1. As personal, social and professional integration.
2. Of environmental context.

Niikko (2000) says about stages of teacher development as follows:

1. The stage of acute consciousness of self,
   Student teacher cannot defend very well when she/he meets new situation.
2. The stage of sinks or swims adaptation,
   Student teacher concentrates further on herself/himself although she/he has some skills to manage different situations.
3. The stage of understanding the situation without power to control one's own activity in it,
   Student teacher responds to situations with learnt habits although she/he knows the things in theory.
4. The stage of relative mastery, in which a person can both understand and control one's own activity in the art which is learned,
   Student teacher stars to control her/his behavior and to understand the meaning of her/his action in certain profession.
5. The stage of learning to teach what one has masterd; student teacher understands the difficulties, which she/he meets.

Gregorc (1973) has described four stages of commitment in teacher development;

1. Student teacher begins to develop initial concepts about the purposes of education and the nature of teaching.
2. The level of commitment tends to be based on the individual's minimal expectations of the school.
3. Student teacher tests concepts about self, education, subject matter, she/he contributes to the varied resources of the school.
4. Student teacher is trying to realize full potential as an individual teacher.

Berliner (1986,1987) developed the theoretical model of teacher cognitive skills using cognitive schema theory. Berliner named the stages: novice stage; advanced stage; competent stage; proficient stage and expert stage.

The environment in education is a very important component of research. Every environment has its own culture and influences on teachers' behavior and action. Karila (1997) says that teacher development is viewed as a learning path, teachers build their expertise in the interaction of self, life history, subject matter and environment.

2.1.6 Standards of teaching competences for teachers' performance

School of Education and Allied studies at Bridgewater College found out the common teaching competencies for student teachers, (Handbook, 2000): the following competencies were expressed:

(1) Subject Matter knowledge,
(2) Communication skills,
(3) Instructional strategies,
(4) Evaluation,
(5) Problem solving,
(6) Deals equitably and responsibly with all learners,
(7) Professionalism.

Many studies have investigated the teacher knowledge and ability of mathematics teachers. Fennema and Franke (1992) built up a model for examination and discussion on teachers' knowledge as it occurs in the context of the classroom. The model, which shows interactive and dynamic nature of teacher knowledge, includes the components of teacher

knowledge of the content of mathematics, knowledge of pedagogy, knowledge of pupils' cognitions, and teacher's beliefs.

Shulman (1986, 1988) also proposed a framework for analyzing teachers' knowledge that distinguished between different categories of knowledge: subject matter knowledge, pedagogical content knowledge, and curricular knowledge.

Also Cochran et al. (1993) confirms that a teacher's knowledge and ability should include four aspects:

(1) Knowledge of a particular subject,
(2) Knowledge of common teaching ability,
(3) Knowledge of pupils' backgrounds, and
(4) Knowledge of teaching environment.

In addition, Krainer (1994) also proposed 4-dimentions of knowledge of mathematics teachers:

(1) Abilities,
(2) Attitudes,
(3) Reflection, and
(4) Autonomy and networking.

Leou (1995) mentioned that the teaching behavior evaluation instrument was applied to assess the teaching competency during student teachers' practice. This evaluation focuses on:

(1) The teacher's teaching skills,
(2) The material's organization and presentation,
(3) The learning environment created between pupils and teachers, and
(4) The teacher's teaching attitudes as four crucial aspects of teacher training.

The University of Alaska; (1997) publishes the teacher performance standards in nine areas as follows:

(1) Describe the teacher's philosophy of education,
(2) Understands how pupils learn and applies that knowledge in the teacher's practice,
(3) Teaches pupils with respect for their individual and cultural characteristics,
(4) Knows the teacher's content area,
(5) Facilitates, and assesses pupils learning,
(6) Creates and maintains a learning environment,
(7) Works as a partner with parents and with the community,
(8) Participates in and contributes to the teaching profession, and
(9) Uses instructional technology as a tool to enhance pupils learning.

The following standards (performance-based standards) are listed for mathematics teacher candidates in Colorado and reflect the knowledge and the skills required of beginning teachers:

(1) Knowledgeable about mathematics and mathematics instruction,
(2) Knowledgeable about strategies of teaching,
(3) Planning practice,
(4) Assessment techniques,
(5) Classroom management,
(6) Individualization of instruction, and
(7) Knowledgeable about technology.

Therefore, as one can see there is agreement among studies in the following aspects of performance:

(1) Content Knowledge,
(2) Lesson Plan,
(3) Strategies of Teaching,

(4) Classroom Management, and
(5) Assessment of Teaching.

At the same time, we can summarize the different theoretical models and theories of student teacher development into three forms:

(1) Student teacher development as growing process, which consists of successive stages.
(2) Student teacher development as mixture of learning process and personal growth.
(3) Student teacher development as an individual case, a contextual phenomenon.

Also the main problems, which face the beginning teachers of mathematics, raised in literature, could be summarized into the following points:

(1) Strategies of teaching,
(2) Designing lesson plans and running them,
(3) Disciplining pupils in the class,
(4) Timing the lessons,
(5) Lack of knowledge of the individual pupils they teach,
(6) Lack of skills of assessment teaching, and personality problems related to organizational abilities,
(7) Motivating the pupils to learn.

According to the concerns of pre-service teacher education, the literature highlights this area and describes the movement of the student teachers during their training from self to task, step by step.

From the aforementioned it's obvious (for the reader) that the researcher emphasize essential elements, he deems constitute a basis for his understanding of the student teacher performance, and the following were these elements:

(1) Lesson planning,
(2) Mastering of subject matter,
(3) Classroom management,
(4) Variety in implementing teaching methods,
(5) Using the suitable methods for the topic,
(6) Various instruction skills such as: dealings with pupils, communication channels,
(7) Using the questioning technique,
(8) Designing achievement tests,
(9) Classroom interaction,
(10) Motivation and promoting pupils,
(11) Given clear feedback, and
(12) Interested with problem solving approach.

All those points and others could be the importance for the best performance in mathematics classroom.

2.1.7 Facilities that help trainees

The major objective of the student teaching experience is to provide pre-service teachers with the opportunity to develop skills that allow them to diagnose and solve problems that involve the application of principles and theories in their respective subject matter specialty (Handbook of Utah State University, College of Education, 99).

Management and organization are critical to success in the classroom (Handbook, 99).

"The main facilities commented in the handbook was the co-operating teacher, who can help the student teacher to develop the self confidence by some guidelines:

1. show how to organize time, and materials in order to meet the instructional goals,
2. provide examples of transition from one activity to another,
3. provide the student teacher with a repertoire of effective discipline techniques".

2.1.8 Observation

Observation is the first part of the training course. It has an objective, it is not random task.
The Handbook of Utah University, 99, commented about the observation: "there is probably nothing that makes student teachers more nervous than to know that they are being observed by another adult. In their desire to avoid uncomfortable situations for their student teachers, many co-operating teachers avoid the type of situation in which they are obviously down to observe the teaching behavior of their student teacher. This is unfortunate because there are some good reasons for this formal approach to observation".
As one can see the observation represent an issue should be discussed among the team of training. On the other sides, trainees need to be aware of the purpose and advantages of the observation.
On the same context, it is commented in the Handbook the observation takes in consideration all parts of the lesson, with specific note of the instructional behavior including in the classroom. "Some co-operating teachers find it helpful to make written notes of items that should be discussed with the student teacher. These notes may or may not be shown to student, but in either event they become the basis for conferences" Utah University, 1999.

2.2 Theoretical background of the methodological base of Mathematics' lessons

The researcher had worked as a teacher for 14 years and 6 years as a supervisor. And in cooperation with some his colleagues (the group of mathematics including three supervisors, three professors, three qualified cooperating teachers) they set up some norms and criteria for guiding mathematics lessons which were performed by the student teachers during their practice teaching:

2.2.1 A good Mathematics lesson includes

1. Clear objectives, often displayed and discussed with the class;
2. Opportunity to develop and refine mental calculation skills;
3. The teacher is involved in direct teaching, with the whole class, a group or, occasionally, with individuals or pairs;
4. Teaching strategies and activities appropriate to the purpose of the lesson, which keep all pupils involved;
5. Resources are used effectively to support pupils understanding of mathematical ideas and the development of their calculation strategies.
6. Careful and precise use of mathematical vocabulary, reading and re-reading number sentences, emphasising the correct terms, notation and symbols.

(The University of Jordan, Amman, 2000).

At the same context; International Handbook of Mathematics Education, part one (1996), points that; a good lesson should be verify some conditions:

1. Concepts are integrated. When the lesson has many concepts or some concepts related with others; they should be integrated in structures and meaning.
2. Problems have to be solved without unique strategies, which means the variation of solutions is a necessary aspect of lesson activities.

3. Lesson plan has clear goals (objectives).
4. Higher goals lessons emphasize reasoning skills, communication, and the development of a critical attitude. Together, these are called “higher order thinking skills”.
5. Make use of integrating technology to have more real applications reachable for classroom experience.
6. Using materials.

According to Abele, 1999, that pointed about lesson structure in his unpublished “Reader“:
“ Mathematical instructional programs should focus on teachers’ lesson planning as the prerequisites for the pupils learning process. For an independent training of students, it is necessary that a lesson:
1. Starts with a problem from the point of view of math;
2. Gives the pupils the possibility of problem solving, and through this training skills;
3. Offers the pupils the possibility of self-control;
4. Gives the same possibility of training and understanding to slow and quick learners by the means of different training tasks.”

Moreover, Abele says about the situations of learners during some lessons:
“A lesson for training skills must have some main characteristics:
1. The pupil himself / herself must be active.
2. He / She must do often this activity.
3. He / She should like this activity.
4. He / She should do it understandingly.”

(Abele, 1999).
Kizlik, 2002, says that about five common mistakes in writing lesson plan make a bade lesson. If you know how to avoid them you will get a good lesson. Those mistakes are: Objectives, Assessment, Materials, Instruction in which the teacher will engage is not efficient for the level of intended pupil learning and pupil activities.
A lesson plan that contains one or more of these mistakes needs rethinking and revision (Kizlik, 2002).
We can say a good teacher is often a good planer and thinker. You can improve your lesson by thinking carefully about what the lesson is supposed to accomplish.
Libby Quattromani, 2001, says something about the critical elements of lesson plans. Those elements are: Objectives/outcomes, Key concepts, Skills, and/or Strategies to be taught, Essential questions to be asked, Procedure for implementing instruction, Closure, Assessment, and Lesson adaptations. Furthermore, it is important that teachers have a clear rational for choosing all the elements of the lesson plan and relating the learning to real life needs and experiences.
In observing my student teachers, how to develop their lesson plans as well as how to implement lessons in mathematics classroom. I found two types of notes. The first are as follows:
1. The objectives of the lesson do not specify what he/she will actually do that can be observed or shown.
2. The evaluation part of the lesson is disconnected from the behaviour indicated in the objectives.
3. The materials specified in the lesson are not related to the actual described learning activities.
4. The teaching method(s) in which the teacher will engage is (are) not efficient for the level of intended pupil learning.
5. The pupils roles described in the lesson plan are not clear in a direct and effective way to the lesson objectives.

6. The teacher role described in the lesson plan is not directed to the lesson objectives.
7. The distribution of time estimates into parts of lesson plan dose not exists.

At the same time, the following points are easy to find in their lesson plans. For the majority of them, those are the second type of notes:

1. The pre-learning or the learning prerequisites is (are) adequate as well as described in the lesson plan.
2. The follow up activities as they are described in their lesson plans.
3. The closure of the lesson as a summary of the main points of the lesson.
4. The concern of environment and classroom culture.
5. The using of life activities as well as described.
6. The using of stimulation, and motivation to develop the carry out of the plan.

During the period of school practice a selection of these norms were an important basis for orientation. Besides these examples of norms we use the following suggestions. To give a further illustration, some examples of mathematics tasks question and answers are added.

2.2.2 What should the mathematics teacher do?

(Suggestions for student teachers, workshop, Paul Broadbent, 2001).

Objectives	Implementations
1.Make clear to the class what they will learn.	1.Write the key objective in simple language on the board.
	2.Talk to the pupils about the focus of lesson.
	3.Encourege the pupils to provide a heading for any written work.
2.Make links to previous lesson.	1.Begin the lesson by making a connection between what the pupils are about to do & what they have done before or to what they already know.
	2.Be explicit if the lesson is an extension of the previous day's lesson.
3.Maintain pace & keep all the pupils on-task.	1.If the lesson is largely work with the whole class, think about ways of involving the pupils in pairs or individually for short bursts.
Prepare for the Plenary.	2. If the lesson is group work, plan carefully for those groups working independently.
	3.Arrange something short for the pupils to or talk about during the plenary.
	4. Lookout for common errors that will need to be put right.
4.Give pupils a deadline for completing their work.	1.Tell the pupils how many minutes they have to do task and what time the next stage in the lesson will start.
	2. Remind them when there are five 5 minutes left to finish their work.

2.2.3 The function of the main part of the lesson

(suggestions for student teachers, workshop, Paul Broadbent, 2001).

Function	Organisation
1.Introducing a topic Numbers & some operations.	Whole class, using a 1-100 number grid. When asked, pupils work in pairs, doing examples using their own grids.
2.Demonstrating how to subtract 19, 29, 39, 49,by subtracting the nearest multiple of ten and adjusting by one.	When asked pupils work in pairs, Doing examples using their own grids.
3.Extending previous work and developing vocabulary: Extending the idea of rounding to the nearest multiple to help pupils subtract 28, 38, and 48. Practicing subtracting in different contexts; finding the difference, taking away and counting on.	Working in 3 differentiated groups: 15 pupils on textbook pages to topic as taught; 10 pupils on extension sheet subtracting near multiples of 100 from 3-digits number. 5 pupils working with the teacher using 1-100 grid and subtracting multiples of 10.
4.Using and applying what has been learned: 5.Solving problems involving money (one Jordan Diner) 6.Finding the difference between two amounts.	Differentiated tasks for each group 15 pupils finding change from1JD 10 pupils working with teacher to investigate coin patterns when giving change. 5 pupils finding simple changes from 50 F using real coins.
7.Assessing pupils learning: Using the 1-100 grid to construct At least ten subtractions where what is subtracted is close to a multiple of 10 (57-29) Every pupil does the same task.	Assess how each pupil copes with the task. Some may want to explain the patterns. Some may not be able to generate their subtractions.

2.2.4 Planning (centering pupils' learning)

The following planning; show us variation of planning which centred pupils' learning (taken from the Jordan/Math-Workshop, 1999);

Subject: Fractions.

Objectives: The pupils after the lesson should be able to:

1) Define the concept of fractions.
2) Describe a coloured part for given diagrams by using fractions.
3) Locate given fractions on the line of numbers.

Role of the teacher.	Role of the pupil.	Time.
Explain the following example: Divide a big piece of cake into four equal parts, and clarify that every part represents ¼ of the big piece.	Watch and share their teacher while dividing and answering her/his questions.	5-6 m.
Divide the following shape(s) into 8 equal parts; (5 equal parts) Determine the value of each part by using fractions.	The pupils doing (answering) the activities by groups. 5 pupils work as a group. Others work as a group of two.	8-9 m
Questions for discussion: (Coloured chalk is needed) 1) Describe the coloured parts for each diagram by using fractions. 2) Construct another diagrams for the following fractions: $2\frac{1}{3}$; $1\frac{2}{5}$; 1/6.	Pupils working as: Groups (numbers into the groups are open but not more than 6) Individually. Groups of two. At the end each group should present it's work.	9-12 m
The teacher asks pupils to draw the line of numbers on their copybooks.	The pupils draw the line within limit time that given.	1-2 m
After 2 minutes he/she asked them to locate the fractions ¼; 1/3; ½; 2/5; and 3/6 on different lines.	Pupils execute the activity.	6-8 m
Check the answers; give complements; motivate and correct wrong answers.	Answer the question and make discussion.	5-8 m
Ask pupils to do homework: page 75: 4, 5, 7, and 10.	Execution in the class partially.	1-2 m

Evaluation:

In the last 5 minutes the teacher offer the following work sheet:

1) Suppose that you have 10 similar apples and you have eaten 3 of them. Define the eaten apples by using fractions and describe that part by a diagram using a fraction.

2) Locate the following fractions on the line of numbers: 2/3, 5/9.

2.2.5 Ways of questioning:

Closed questions	Open questions
Count these cubes?	How could we count these cubes?
A pen costs 3JD, a book costs 7JD, what What do they cost altogether?	and a pen & a book cost 10JD, could each one cost?
What is 6 – 4?	Tell me two numbers with a difference of 2?
What is 2 + 6 – 3?	What numbers can you make with 2, 3, and 6?
Is 16 an even number?	What even numbers lie between 10 and 20?
Copy and complete this Addition table:	Find different ways of compelting this table:

+	4	7
2		
6		

	3	4
	7	

What are four threes?	Tell me 2 numbers with a product of 12?
What is 7×6?	If $7 \times 6 = 42$, what else can you work out?
How many centimetres are in a meter?	Tell me 2 lengths that together made 1 metre?
What is one fifth add four fifth?	Write eight different ways of adding two numbers to make 1?

2.2.6 Ways of answering:

Recalling facts	
What is …1 more than 6? …7 times 8…4 squared? How many metres in 1 kilometre?	Pupils show number of fingers, Pupils hold up number cards. Pupils say….
Using facts Double 250. If 46 – 10 is 36, what is 46 – 11? If 7×6=42, what is 14×6? 7×12? Tell me two numbers with a product of 36?	Give 1-minute time limit. Give "thinking time", and note several different answers.
Hypothesising or Predicting Estimate how many words there are on this page. What is the next number: 1, 3, 7, and 15,31… If we rolled dice 50 more times, how might the chart change?	When counting, pupils can say the answer in unison. Pupils work in pairs, give a longish thinking time. They can write or say their answers.
Designing or Comparing procedures How could we count this pile of coins? How could you subtract 97 from 210? Are there other ways of doing it?	Pupils work in pairs; give time they can write their answers. Pupils work in groups & then report back as a group.
Interpreting results What do you notice about multiples of 5? What have you found out about the product of two odd numbers?	The whole class can answer in unison, after a brief silent "think". Pupils work in pairs, give a longish thinking time. Choose several pairs to explain their answers.
Applying reasoning You have four coins: £2, £1, 20p, 2p. How many different amounts can you make? Why is the sum of any two odd numbers an even number?	Pupils work in pairs or small groups. Give a longish thinking time; they can present their answers.

2.3 Teaching and Learning Mathematics

2.3.1 Teaching Mathematics

"Effective mathematics teaching requires understanding what pupils know and need to learn and then challenging and supporting them to learn it well" (NCTM, 2000).

Pupils learn mathematics through the activities that the teacher provide. Thus, the effective mathematics teaching in all classes depends on the type of the activities , experiences, and the classroom management that represent the professional component of the teaching career. Some psychologists name the outcome of classroom management by the environment of the classroom interaction. Nevertheless, theoretical knowledge is known about effective mathematics teaching, but this knowledge should guide professional approach of Mathematics teachers during their designing the activities.

We refer to the professional standards for teaching mathematics (NCTM, 1991) presented six standards for the teaching of Mathematics. They determinate:

1. worthwhile mathematical tasks;
2. the teacher's role in discourse;
3. the pupil's role in discourse;
4. tools for enhancing discourse;
5. the learning environment;
6. the analysis of teaching and learning.

As one can see, the first standard was "the task". Of course, we suppose that the Mathematics teacher knows and understands deeply the subject matter (mathematical content knowledge), but it is not enough to get effective mathematics teaching by mastering the mathematical content knowledge. So, the type of activity is the point that the teacher should foster during his or her planning.

"Effective mathematics teaching requires a serious commitment to the development of pupils' understanding of mathematics. Because pupils learn by connecting new ideas to prior knowledge, teachers must understand what their pupils already know". (NCTM, 2000).

As a result, the teacher should know knowledge about his or her pupils, and what they know about the certain topic. Because they can design the activities and the lessons that respond to, and build on pupils' knowledge. Teachers have different styles and strategies for helping pupils to learn certain topic, and there is no one strategy to teach. NCTM, 2000, p17, addressed that there is "no one right way to teach mathematics. One of the complexities of mathematics teaching is that it must balance purposeful, planned classroom lessons with the ongoing decision making that inevitably occurs as teachers and students encounter unanticipated discoveries or difficulties that lead them into uncharted territory. Teaching mathematics well involves creating, enriching, maintaining, and adapting instruction to move towards mathematical goals, capture and sustain interest, and engage pupils in building mathematical understanding."

2.3.2 Learning Mathematics

"Pupils must learn mathematics with understanding, actively building new knowledge from experience and prior knowledge." (NCTM, 2000, p19).

Learning without understanding has been a persistent problem since at least the 1930s, and it has been the subject of much discussion and research by psychologists and educators over the years, for example, Brownell, 1947; Skemp, 1976; Hiebert & Carpenter, 1992.

The kinds of activities' teachers provide clearly play a certain role in determining the extent and equality of pupils' learning. So, learning with understanding can be engaged by classroom interaction, when the pupils have opportunity to solve and to think among ordered discussion that is organized by the teacher when he or she plays the role of organizer during the lesson and then during the discussion. By having pupils' talk about their informal strategies, teachers can help them become aware of, and build on, their implicit informal knowledge (Lampert, 1989). Moreover, in such settings, procedural fluency and conceptual understanding can be developed through problem solving, reasoning, and argumentation. For example; problem solving approach:

Problem solving means engaging in a task for which the solution methods are not known in advance. In order to get a solution, pupils who use this approach should draw on their knowledge through thinking new mathematical understanding. Pupils should have opportunities to solve complex problems that require an effort to reflect on their thinking

Good activities give the pupils the chance to modify and extend what they know. The issue in this context depends on the teacher, if he or she creates opportunities to the pupils or not.

Polya, 1957, says that strategies of problem solving include using diagrams, looking for patterns, listing all possibilities, trying special values or cases, working backward, guessing and checking, creating an equivalent problem, and creating a simpler problem.

Good problem solvers become aware of what they are doing and frequently self-assess. Teachers play an important role in helping to enable pupils to start using this technique, especially when the teachers use the following questions:

1. Before we go on, are we sure we understand this?
2. What are our options?
3. Are we making a progress?
4. What are the other variations?

Such questions help pupils to check their understanding from time to time in order to think and to develop mathematical knowledge.