NEEDS ASSESSMENT
WITH SPECIAL EMPHASIS ON INDIVIDUAL DIFFERENCES
BASED ON TEACHING AND ASSESSMENT METHODS
IN SCIENCE AND TECHNOLOGY CLASSES
BY PRIMARY SCHOOL TEACHERS

A THESIS SUBMITTED TO
THE GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES
OF
MIDDLE EAST TECHNICAL UNIVERSITY

BY

PINAR ÖZDEMİR

IN PARTIAL FULFILLMENT OF THE REQUIREMENTS
FOR
THE DEGREE OF DOCTOR OF PHILOSOPHY
IN
SECONDARY SCIENCE AND MATHEMATICS EDUCATION

FEBRUARY 2007

Approval of the Graduate School of the Natural and Applied Sciences

Prof. Dr. Canan Özgen
Director

I certify that this thesis satisfies all the requirements as a thesis for the degree of Doctor of Philosophy.

Prof. Dr. Ömer Geban
Head of Department

This is to certify that we have read this thesis and that in our opinion it is fully adequate, in scope and quality, as a thesis for the degree of Doctor of Philosophy.

Prof. Dr. Sibel Güneysu
Supervisor

Examining Committee Members

Prof. Dr. Fitnat Kaptan	(HU, ELE)	
Prof. Dr. Sibel Güneysu	(Başkent U, ELE)	
Prof. Dr. Ömer Geban	(METU, SSME)	
Assoc. Prof. Dr. Ceren Tekkaya	(METU, SSME)	
Assist. Prof. Dr. Ali Eryılmaz	(METU, SSME)	

I hereby declare that all information in this document has been obtained and presented in accordance with academic rules and ethical conduct. I also declare that, as required by these rules and conduct, I have fully cited and referenced all material and results that are not original to this work.

Name, Last name : Pınar Özdemir

Signature :

ABSTRACT

NEEDS ASSESSMENT
WITH SPECIAL EMPHASIS ON INDIVIDUAL DIFFERENCES
BASED ON TEACHING AND ASSESSMENT METHODS
IN SCIENCE AND TECHNOLOGY CLASSES
BY PRIMARY SCHOOL TEACHERS

Özdemir, Pınar

Ph.D., Department of Secondary Science and Mathematics Education

Supervisor: Prof. Dr. Sibel Güneysu

February 2007, 328 pages

The purpose of this study was to explore and investigate perceptions and needs of the primary school teachers' in 4^{th} and 5^{th} grade public schools in Yenimahalle and Çankaya districts related to the teaching and assessment methods based on individual differences in science and technology classes. Furthermore this study investigated the teachers' perceptions on new science and technology curriculum in Turkey and their perceptions on individual differences. The research type of this study include survey, causal-comparative, and also qualitative research in nature which are non-experimental research methods.

The study was conducted in the 2005-2006 academic year in Ankara. Three data collection methods were used to collect data from primary school teachers. First, a needs assessment questionnaire was administered on 155 primary school teachers. Then, the researcher carried out in depth interviews with 13 primary school teachers. Furthermore an observational case study including video typing in two science and technology classes was carried out. Quantitative part of the study was analyzed by descriptive and inferential statistics by using SPSS (e.g., frequences, percentage analysis, and analyses of variance). Qualitative part of the study was analyzed by using qualitative methods (Generating categories, themes, patterns and coding the data).

The findings from quanitative and qualitative data indicated that primary school teachers have various needs to apply teaching and assessment methods based on individual differences related to knowledge, experience, students, parents, administrators, resources, opportunities, time, and science books. Also teachers mostly use new approaches in new Science and Technology Curriculum such as individual presentations.

Keywords: Science education, individual differences, primary school teachers, needs assessment, teaching and assessment methods

ÖZ

FEN VE TEKNOLOJI SINIFLARINDA ÖĞRENCİ FARKLILIKLARINI TEMEL ALAN ÖĞRETİM VE DEĞERLENDİRME YÖNTEMLERİNE İLİŞKİN SINIF ÖĞRETMENLERİ IHTIYAÇ ANALİZİ

Özdemir, Pınar

Doktora, Orta Öğretim Fen ve Matematik Alanları Eğitimi Bölümü

Tez Yöneticisi: Prof. Dr. Sibel Güneysu

Şubat 2007, 328 sayfa

Bu çalışmanın amacı Ankara ili Yenimahalle ve Çankaya bölgesinde görev yapan ilköğretim 4. ve 5. sınıf öğretmenlerinin fen ve teknoloji derslerinde öğrenci farklılıklarını göz önüne alan öğretim ve değerlendirme yöntemlerine ilişkin görüşlerini ve ihtiyaçlarını belirlemektir. Bu çalışmada ayrıca sınıf öğretmenlerinin yeni fen ve teknoloji programına ve öğrencilerin bireysel faklılıklarına yönelik görüşleri de ortaya çıkarılmaya çalışılmıştır. Bu araştırma deneysel olmayan anket ve nitel araştırma yöntemlerini içermektedir.

Bu çalışma 2005-2006 öğretim yılı bahar döneminde Ankara'da gerçekleştirilmiştir. Sınıf öğretmenlerinden bilgi toplamak amacıyla üç farklı veri toplama yöntemi kullanılmıştır. Oncelikle 155 sınıf öğretmenine ihtiyaç analizi anketi uygulanmıştır. Ayrıca 13 sınıf öğretmeni ile yapılandırılmış görüşmeler yapılmıştır. Buna ek olarak iki ayrı fen ve teknoloji sınıfında video

kamera kullanılarak gözlem çalışması yapılmıştır. Araştırmada elde edilen nicel veriler SPSS paket programı kullanılarak (frekans ve yüzde hesapları, ANOVA), nitel veriler ise nitel analiz yöntemleri kullanılarak (kodlama, temalama) analiz edilmiştir.

Araştırmadan elde edilen verilerin nicel ve nitel analiz sonuçlarına göre sınıf öğretmenlerinin bireysel farklılıkları göz önüne alan öğretim ve değerlendirme yöntemlerinin kullanımlarına ilişkin birçok ihtiyaçları olduğu söylenebilir. Bu ihtiyaçlar daha çok bilgi, deneyim, öğrenciler, veliler, yöneticiler, kaynaklar, fırsatlar, zaman ve fen ve teknoloji kitapları ile ilişkilidir. Ayrıca sınıf öğretmenlerinin yeni fen ve teknoloji programında onerilen proje ve bireysel sunumlar gibi yeni yöntemleri kullandıkları belirlenmiştir.

Anahtar Kelimeler: Fen eğitimi, bireysel farklılıklar, sınıf öğretmenleri, ihtiyaç analizi, öğretim ve değerlendirme yöntemleri

To My Parents

ACKNOWLEDGEMENTS

It is not possible to complete a doctoral dissertation with a single effort. Supports in many aspects were needed throughout this journey. First of all, I would like thank my supervisor Prof. Dr. Sibel Güneysu for her patience, guidance, support and recommendations. Without her support for improving my skills and knowledge, my goal would have been more difficult to achieve.

I would like to also thank my dissertation committee members Assoc. Prof Dr. Ceren Tekkaya and Assist. Prof. Ali Eryılmaz for their valuable comments and feedbacks and for providing continuous support throughout this project.

I wish also thank to Prof. Dr. Fitnat Kaptan and Prof Dr. Belma Tugrul for providing me such a working environment in my department to find every support when I needed and for their positive personality.

During this long journey, I was so lucky since I got help from one of my friend Alper Kocabuğa who was always ready to solve my any kinds of difficulties and provide a strong support for my research.

Special thank was for my best friend Dr. Oylum Akkuş as she was always with me especially during my most difficult time. I could not think any life without her friendship. Also thanks go to my room mate Serkan Yılmaz for his friendship and creating a peaceful working environment.

While and after collecting a huge amount of data and I was in trouble, pre-service science teachers and my friends were my helpers to deal with this issue. To calculate the inter rater reliability; my colleagues Ilke Önal and Oylum Akkuş coded the qualitative data. Thank them so much for carrying out such a hard work. Thanks also go to preservice science teachers, Güngör Güçlü, Sezer Yıldız, Merve, Aysun Cebeci, Ciğdem, Zehra Yaşar, Betül Erbektaş, Mehmet Karartı, Özge Yüce and others for help to collect and format data.

Without my family pray, support, and love, I cannot be here. I am very respectful of them. Even though they are far away from me in distance, they are always with me.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF ABBREVIATIONS

ABBREVIATION

NA:	Needs Assessment
LS:	Learning Styles
ID	Individual Differences
TAMBID:	Teaching and assessment methods based on individual differences
NSTC:	New science and technology curriculum of Turkey
OSC	Old science curriculum
MEB:	Ministry of Education in Turkey
Sig:	Significance
Df:	Degree of freedom
N:	Sample size
YOE	Years of Experience
α:	Significance level

CHAPTER 1

INTRODUCTION

This chapter discusses the background of the study. Primary school teachers' perceptions and needs in using science teaching and assessment methods based on individual differences (TAMBID) are explored in this study. To fully understand the context of the study, many factors need to be considered. Among them are; new science and technology curriculum in Turkey, needs of the teachers, and learning theories based on individual differences. Problem and sub-problems of the study, and the definition of the important terms were provided. The significance including potential applications, and implications of the study are also the issues to be addressed in this chapter.

To meet the needs of the 21st century, changing our schools with respect to the quality of teaching has become the major concern in educational settings for several years. The world is changing at an accelerating pace and schools are expected to educate and prepare students for this fast changing world. Therefore, a process for school empowerment including various aspects of change in curriculum, shared decision-making, accountability, strategic and operational planning are the main concerns (Rose & Nicholl, 1999).

In many developing countries, many changes for educational reform have been made in schools. For instance, they have implemented class size reduction in all grades and various types of instructional strategies implemented in classrooms by considering and assessing their usability and effectiveness. Furthermore, it is known that today's students are changing and teachers face more intense challenges with students today than teachers did thirty years ago and so primary school teachers need to know effective ways to deal with the complicated student situations encountered daily in classrooms. It is achieved mostly by knowing the students and taking their needs and individual differences into consideration. Teachers should consider that children in a classroom perceive and interpret the same event differently. They might consider their individual differences of the students by using various teaching strategies appropriate for each of the student. To achieve this, teachers continually search for better, more effective ways of helping children learn. It is proposed that the whole class approach in which only a single teaching strategy is used for intact class to instruction is found to be inadequate for meeting individual differences and needs in the classroom. Also no single method can be considered the best method just as no method can be categorically labeled inappropriate. However a teacher can draw from numerous and varied instructional strategies, techniques, and activities, each of which can be effectively utilized for some children, in some situations, and some of the time. The challenge of individualized instruction is that of finding a better fit for each child when planning an instructional curriculum. It is known for a long time but was not applied in many schools. Therefore, it is important for the teachers to find the best fit for each child which is not an easy task (Stahl & Anzalone, 1970; Good & Stipek, 1983; Deiro, 2005).

American National Science Teacher Association (1998) and national (Ministry of Education, 2005) organizations recognize that good teachers are the most important element in successful learning. Because it is the teacher who plays the most important role in the application of various types of strategies, it is not easy for teachers to adapt and use a new method in his/her classes. Classroom environment and learning in students are created by teachers. This is the reason why teachers implementing the same curriculum using the same materials to the students having similar properties may get different results. Whether or not teachers have effective teaching skills is one of the important factors that affect the achievement in the classroom. By this way, it will be easy for teachers to achieve learning in students (Açıkgöz, 1996). Sometimes teachers resist to the changes and improvements related to the new teaching and assessment methods in the curriculum. Multiple intelligences (MI) is among such methods. For example, regarding the use of MI in classes, Gardner (1995) suggested three good reasons why teachers have been afraid to teach in a way that reflects contemporary theories of intelligence.

1. Teachers often don't know how to implement the theories in the classroom, and they recognize that incorrect implementations of a theory can do harm.
2. Teachers might recognize that, even when specific educational interventions based on these theories are attempted, probably are not supported by empirical research.
3. Teachers might believe that the interventions hurt rather than increase achievement in classroom, and nationally standardized tests that emphasize memory more than they do the sophisticated kinds of thinking required for some of these programs.

In this context, teachers should select and implement a new teaching method in a planned and successful manner. Orlich et al., (2004) identified four variables that determine the selection of teaching methods for a specific lesson time. These are the content and the objectives of the lesson, teachers' properties, student properties and the learning environment. Also, selection of a teaching method that teachers will use in the lesson affects all of these variables. Whenever there is any educational change, teachers are always asked to master new skills and responsibilities to adapt these new changes. Whether the teachers are ready to apply these changes in their classroom or whether they are qualified to apply these changes is uncertain and open to investigation. Teachers may have different needs which have an important influence on implementation of the new science and technology curriculum effectively. In fact, to know the fact that the success of these changes depends on the ability of the teachers to adopt these changes, it is important to investigate teachers` perceptions and needs in applying teaching methods in science and technology classes.

In addition to changes in teaching methods in the curriculum, pedagogy, facilities and schedules, another important change has been in the practice of assessment. Traditional tests (eg. multiple choices, short answer and essays) require students to show their knowledge in a predetermined manner. As students do not learn the same way, they cannot be assessed in a uniform fashion (Brualdi, 1996). The preferred assessment process is a portfolio, allowing students to illustrate concepts in drawings, audiotape, diaries, or reports over the term. In addition to the portfolios, projects, exhibitions, and presentations also provide opportunities to assess the different types of teaching strategies by allowing students to explain the material in their own ways using their different skills (Armstrong, 2000; Checkley, 1997; Gardner, 1983; Hoerr, 1996; Miller, 1984).

According to the views of Penick (1995), there will be no educational reform until instructional reform changes in what the teacher does in the classroom to create an environment where learning takes place. He believed that changing the curriculum is not adequate, the philosophy of teaching that the teachers possessed must be changed (Penick, 1995). To date, there has been limited research regarding primary school teachers' needs and perceptions of the teaching methods based on individual differences in science and technology classes and related practices (Dindar & Yaman, 2002; Idris, 2002).

There is also a need to assess the teachers' knowledge and perceptions related to the new teaching strategies based on new science and technology curriculum. One of the aims of this study was formulated to identify the needs of primary school teachers in science and technology classes. The researcher hopes the data collected would provide insight into the needs of primary school teachers. The resulting information can be used to design appropriate primary school teachers' educational programs to enhance teachers' subject knowledge and experience about the strategies that they can use in science and technology classes. However further studies are needed to accomplish these goals because the generalization of this study is limited to a sample of primary school teachers.

1.1 New Science and Technology Curriculum in Turkey

In Turkey for many years, many efforts have been made to change the science curriculum to adapt to the educational reforms all over the world. The primary school science curricula (4^{th}- 8^{th} grade) were revised recently (MEB, 2005). Through this curriculum, modifications in new science and technology curriculum (NSTC) include changes in students' roles and the teacher's role, teaching and learning process by suggesting teachers to use new teaching and assessment methodologies which are mostly student-centered (MEB, 2005). During the preparation and the development of the NSTC, there were collaborative efforts and studies among the science educators, curriculum specialists, primary school teachers, and university science faculty members. The aims of the primary science curriculum has been changed and extended in the new curriculum. To give an example, one of the aims of NSTC includes preparing students to be scientifically literate citizens who are able to use scientific facts in their daily life. In this new perspective, students are to be equipped with advanced thinking; perception and problem solving skills; enabling them to interpret different cultures and contribute to modern civilization as well as mastering their own national culture.

Until 2001-2002 education year, in primary schools science lesson which was called life science was taught as a combination of social and environmental sciences (Ministry of National Education, 1992). With the implementation of eight-year compulsory education, primary school science curriculum was changed and pilot application of the curriculum started to be used in schools in 2001-2002 education years. Then, the primary school science curriculum has further modified in 2004 and started to be applied at 4^{th} and 5^{th} grade in 2005-2006 education years. Technology and science continue to play a major role in shaping modern world and today's nations are much more closely linked by technology than any other time in history. NSTC of Turkey considered this fact about technology and in the new curriculum there is also an integration of technology into the school curriculum and so the name of the lesson was also changed as "Science and Technology". By looking at the theoretical and conceptual framework of NSTC, it can be said that it is different from the former program in many respects. Summary of the main features of the 2004 Primary school 4th and 5th grades NSTC are as follows (Ministry of National Education, 2005);

1. Science topics are handled by integrating with the technology.
2. Teaching and learning approaches are based on the constructivist view which brings students to the center of education and give opportunities for the students to learn by doing.
3. As the program is based on the constructivist view, basic principles for the assessment procedure are also changed. Alternative assessment approaches are used.
4. Teaching learning and assessment processes are greatly changed compared to the former program. Main points of the NSTC are summarized in Table 1.1.
5. Content is designed by considering the spiral approach. In upper classes, content is extended.
6. Seven learning field were suggested supporting the science and technology literacy. Four of them are related to the scientific concepts and principles (Living Things and the Life, Matter and Change, Physical Events, World and Universe) and the other three are related to scientific literacy (Scientific process skills, science-technology-society-environment, attitudes and values).
7. In each grade level, objectives related to the scientific process skills, science technology-society and environment, values and attitudes are determined and listed. Also al of them were related with the concepts.

Table 1.1 Basic Perspectives in Science and Technology Curriculum

Less Emphasis	***More Emphasis***
Memorizing the knowledge and rote learning	Development of understanding and skills
Details in content of the topics	Development of understanding based on concepts and real life
Evaluation and assessment and by testing	Alternative evaluation and assessment methods
Expository teaching	Constructivism
Teacher and curriculum centered teaching	Student centered teaching
Avarage type student centered teaching	**Teaching emphasizing student differences**
Strict application of the curriculum	Flexible application of the curriculum
Competitive and individualized learning	Cooperative learning

As shown in bold in Table 1.1, students are the focus of the center in the curriculum. It is stated that there are differences as well as similarities among a group of students based on individual differences. While selecting the teaching methods for the lesson, students constitute the essential part of the process and the individual differences (ID) of the students are taking into consideration during the teaching and learning processes. Examples for the individual differences stated in the NSTC that can be seen in a group of students are shown in Figure 1.1. It is emphasized in the NSTC that teachers should integrate the differences among the students into the learning environment. Some ways suggested to provide such an environment are listed below (MEB, 2005);

Teachers should

a. Take into consideration that their students have different learning styles (LS) and learning speed.
b. Use methods and materials supplying various individual and cooperative learning environments.

c. Use appropriate materials for the students having different language skills, gender, special features, learning disabilities and having physical handicap.

d. Be also sure that teaching and learning strategies that they decide on to use in a lesson are appropriate for students' developmental level, motivation, needs, interests, experiences and also giving opportunities to show all students' learning.

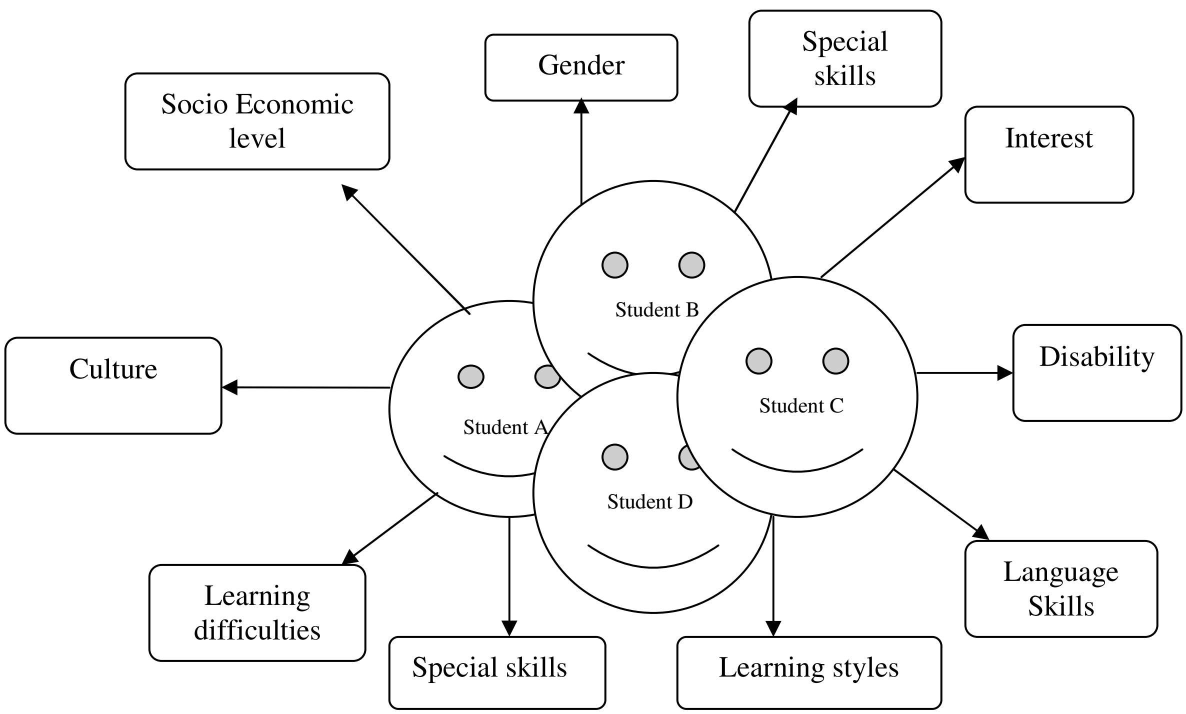


Figure 1.1 Possible Differences Among Students

For many years, to get rid of the difficulties in science teaching and to satisfy the needs of students, new approaches for teaching science have been proposed in many countries. The studies and the suggestions are consistent with the NSTC. There are lots of different learning theories proposed that can be used to help guide a teaching/learning process. Some of these learning theories are Neuroscience, Brain-Based Learning, LS, and Multiple Intelligences. Based on these learning theories, new strategies for science teaching were proposed by many educators like inquiry based teaching, problem-based learning, project-based learning, learning based on laboratory and experiments, learning through observations, cooperative learning, computer-assisted learning, and creative drama (Adıgüzel, 2002; Harlen, 1998; Kolb, 1984; Özdemir & Akkuş, 2005; Sizer, 1999). In this study, teaching and assessment methods based on individual differences are taken into account. At that point, it is important to consider the individual differences and to know how individuals might be different from each other which constitute the essential part of the theoretical framework of this study. Indeed, there are some teaching and assessment approaches based on ID which fully support the aim of this study. These approaches which will be discussed in Chapter 2 include multiple intelligences, right brain/left brain, emotional intelligence, brain based learning and a number of learning style models. These approaches help teachers to answer the question that 'Which individual differences can I take into account and how can students differ from each other affecting the teaching and assessment strategies to be used. These questions find answers by some of the educator studies on the related issue. These are indeed related with the suggestions in the NSTC. Some of the researchers developed various approaches. To give an example, they stated that students may be differ in their multiple intelligence (Gardner, 1983), learning style (Witkin, et al., 1977), special needs (Hall, 2002), and even their gender (Stark & Gray, 1999). These may all affect students' learning and understanding the lesson and teachers have to deal with ID during teaching and learning process.

To sum up, it is essential for the teachers to take individual differences of the students into account. In this study, main focus is on individual differences of the students. Specifically, primary school teachers' perspectives about individual differences were one of the concerns in this study. The other concerns of this study related with the ID are; whether and how teachers consider the ID while selecting the teaching and assessment methods in science and technology classes; and their needs to use teaching and assessment methods based on the ID of the students.

1.2 Significance of the Study

A critical component to structuring an individualized and personalized science curriculum for learners is the teacher. The need to continuously improve professionally is necessary for teachers to teach science in order to respond to a wide range of demands as a result of this rapid and ever changing world. In the view of Shirley and Nafsiah (2004), the teachers need to update skills and knowledge in subject area where the discipline of science (Biology, Physics and Chemistry) is continuously evolving. Educational research continues to reveal new insights and methods about teaching and learning which science teachers need to incorporate in their teaching practice. Teachers should also be trained to use the new approaches in their teaching to improve the quality in science teaching and learning. It is a familiar phenomenon that, in many countries, teachers graduated from other faculties other than education are often made to teach science subjects that they are not trained for (Idris, 2002).

Also review of literature reveals that the teachers have various needs to teach science meaningfully and effectively. In various studies on needs of science teachers, perceptions and beliefs of teachers are explored and analyzed to determine the needs. Actually, teacher knowledge, experiences, and beliefs have a strong influence on what is going on within the classroom (Anderson & Mitchener, l994; Connelly & Clandinin, l988). As science and technology curriculum are changed and brought to our nation's schools, much thought and effort needs to be given to what are teachers' experiences and beliefs and what processes cause change in individual teacher practices as well as deep and longlasting change in science classrooms (Anderson & Mitchener, 1994; Carter, l990). Over the years, in the classroom setting, teachers' experiences and beliefs greatly influences their practice and how they respond to educational change (Van Driel, Beijaard & Verloop, 2001). In this context, to get teachers perceptions' regarding their practice in science teaching is extremely important. Without a close examination of teacher beliefs, the teacher educator cannot be confident that the teachers are prepared to implement the practices suggested in the curriculum. Because the teachers' improvement about acquiring and understanding new ideas, changing their way of teaching, and acquiring new knowledge and skills is a key ingredient to educational reform. As stated in the literature, there are two crucial areas of elementary science education that are closely linked and must be explored together to facilitate the success of students in science. First, teachers must have proficiency in both content and pedagogical areas to prepare students for success and second, curricula must be used by the teachers aligned with standards and designed on accepted learning theories (Anderson & Helms, 2001; Anderson & Mitchener, l994).

Teachers need the opportunity and support to examine their current practices in relation to the goals of science teaching and learning. The framework of theories based on individual differences provides educators with a means to examine their instructional practices and their beliefs about student ability. There are multiple pathways to learning, and theories with their teaching and assessment methods encourage teachers to examine them critically. The learning of science should entail more than the verbal-linguistic and logical-mathematical intelligences; teachers should capitalize on all ways of knowing (or all of the multiple intelligences) in order to make science more meaningful, relevant, and personalized for all students (Goodnough, 2001).

The studies demonstrated that in Turkey, students' achievement in science lessons and in international examinations is not well (TIMSS International Science

Report, 1999; Mutlu & Aydoğdu, 2003). In the Third International Mathematics and Science Study (TIMSS), 1999 Benchmarking Study, students' performance in Turkey was very low (Ersoy, 2006). It is clear that improvements should be made for education. With the current curriculum, students can not learn the basic science concepts and principles. For this purpose, it is clear that the science curriculum have to be changed in terms of its content and other dimensions (Ersoy, 2006). It is also probable that improving the science performance of students in Turkey depends upon first improving their teachers' preparation. Teachers and their perceptions are the focus of this study.

For the science teaching to be effective, the selection of the teaching and assessment methods are essential (Semerci, 2001, cited in Mutlu & Aydoğdu, 2003). The data obtained from the survey in this study for a group of primary school teachers would be essential to have a comprehensive picture for the teaching and assessment methods that the teachers use in their classrooms, whether they use any strategies focusing on individual differences of the students, their knowledge and practices regarding the teaching and assessment methods based on individual differences of the students. The qualitative part of this study including interviews and observations will support and extend the findings of the survey part of the study. In this study, the needs of science teachers in Ankara will also be determined in order to apply TAMBID in science and technology classes. The resulting information might also be used to design appropriate science teachers' programs to enhance teachers' subject knowledge and experience about the strategies that they can use to apply the TAMBID in science and technology curriculum.

There are many studies that investigated the needs assessment of teachers in various disciplines. However there are no studies undertaken on the needs assessment of primary school teachers in using teaching and assessment methods based on individual differences within the classroom in science and technology classes in Turkey. To summarize, the purpose of this study was threefold. First, identifying the teaching and assessment methods that 4^{th} and 5^{th} grade primary school teachers use in science and technology classes, second, exploring perceptions of primary school teachers' related to NSTC in Turkey in terms of teaching and assessment methods. Lastly, the needs of teachers in Ankara to apply TAMBID in science and technology classes were explored.

As no needs assessment studies was conducted related with this issue, this study can be a mirror for the new science and technology curriculum in terms of teaching and assessment methods and might be a model for the further studies.

1.3 The Research Problem

What are the perceptions and needs of public schools 4^{th} and 5^{th} grade primary school teachers in Yenimahalle and Çankaya districts related to the teaching and assessment methods based on individual differences in science and technology classes?

1.4 Subproblems

1. Which teaching and assessment methods do primary school teachers use in science and technology classes?

2. What are teachers' practices related to teaching and assessment methods based on individual differences within the classroom in science and technology classes? Do they use teaching and assessment methods focusing on individual differences like learning styles or multiple intelligences?

3. What are teachers' perceptions related to new science and technology curriculum in Turkey in terms of teaching and assessment methods?

4. What are teachers' perceptions related to individual differences of the students?

5. What are the needs of primary school teachers to apply the teaching and assessment methods based on individual differences in science and technology classes?

6. Do teachers' top priority needs related to teaching and assessment methods based on individual differences of the students differ with regard to their gender, grade level they teach, the program they graduated and their years of experience?

1.5 Definition of Terms

Primary School Teacher: One who is teaching in first stage of elementary schools. For this study, 4^{th} and 5^{th} grade teachers, who are assigned to teach science in addition to the other subjects.

Teaching strategy: General ways to determine teaching methods by following a line from suggested activities (Bilen, 1993, p. 24) or a plan and/or educational blue print that the teacher create in order to effectively execute lesson plans for the year. For instance, in multiple intelligence theory, teaching strategies are various types of activities prepared in light of the types of the intelligences (Gardner, 1983).

Assessment: To determine the reaching point of specified objectives after applying the planned educational activities (**Alkan & Kurt, 2000**).

Need: It is a noun and stands for the measured discrepancy or gap between two conditions-the "what should be" or desired status of an entity and the "what is" or its current status (Witkin, 1984)

Needs Assessment: A systematic study of a problem or innovation, incorporating data and opinions from varied sources in order to make effective decisions or recommendations about what should happen next (Rossett, 1988).

CHAPTER 2

REVIEW OF THE RELATED LITERATURE

In this chapter, the conceptual framework and previous studies that constitute the theoretical and empirical background for this study are presented and discussed. Conceptual framework of the study provided the context within which this study was undertaken. It includes teaching and assessment approaches in science and technology, changing face of science education in Turkey, and new science and technology curriculum of Turkey regarding teaching and assessment methods. The literature review will cover the following areas; studies on teaching and assessment in science and technology education, learning theories based on the TAMBID, different lessons with different students, how can a science class can be individualized, teachers` perceptions and practices on the TAMBID, need and need assessment, needs of teachers to teach science and to use the TAMBID, and the studies on needs of teachers and the TAMBID in Turkey.

2.1 Conceptual Framework

2.1.1 Teaching and Assessment Approaches in Science and Technology

In much of the literature of pedagogy, the terms ‘teaching approaches’, ‘teaching strategies’, ‘teaching skills’, and ‘teaching methods’ have been used interchangeably as also stated by (Proctor et al., 1995). In this study, the term ‘teaching strategies’ is used to refer to the approaches, methods or activities that primary teachers’ use in science and technology classes. Figure 2.1 summarized the terms for teaching strategies in relation to an overall model of teaching and learning in primary classroom (Proctor et al., 1995, p. 73). Based on Figure 2.1, he stated that the choice of a teaching approach might be influenced by three significant strands in primary school education; (a) How children learn and develop, (b) The curriculum to be delivered, and (c) The teacher’s choice of organizational and teaching strategies. Also he said that the choice of teaching approach is dependent on the teacher and there is no one correct way to teach.

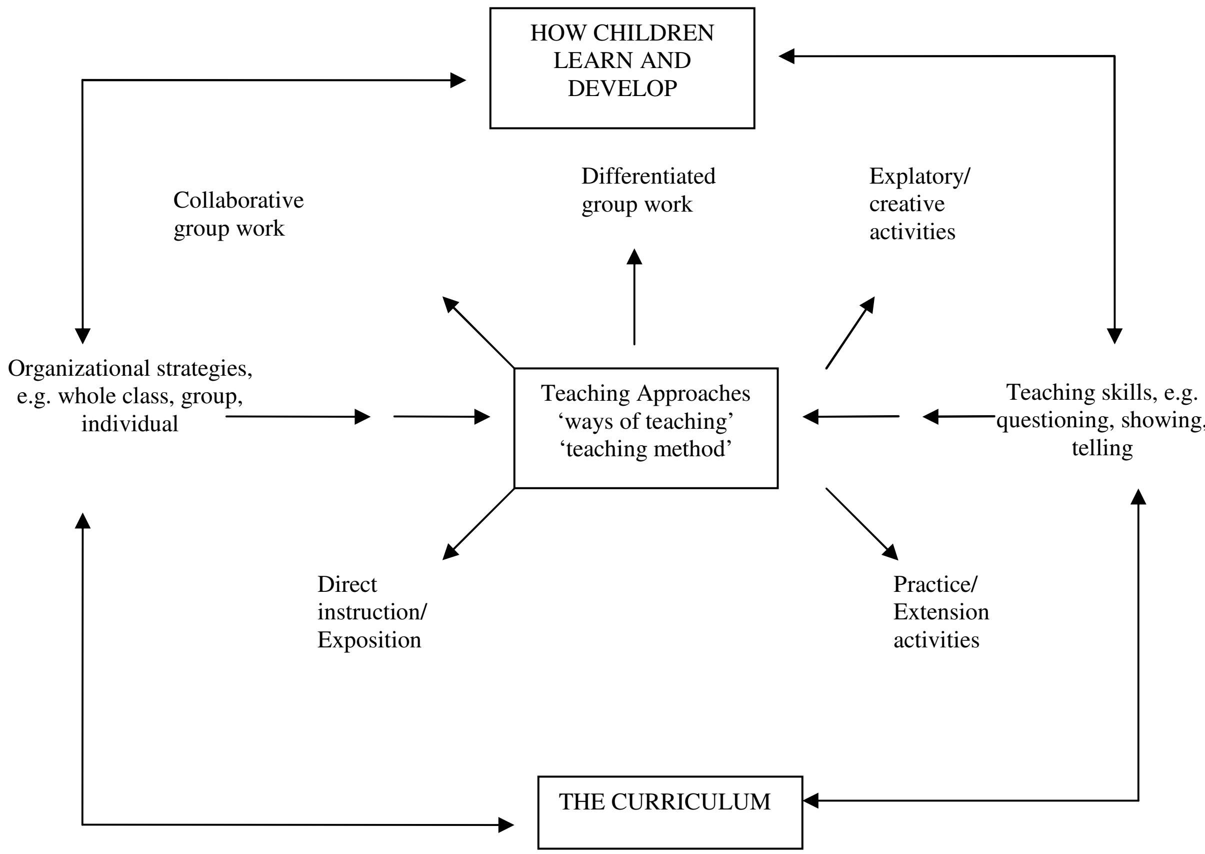


Figure 2.1 Selection of Teaching Approaches in Primary Schools (Proctor et al., 1995, p. 73)

In addition to the teaching approaches shown in Figure 2.1, there are also other theories for teaching. For example, drama based instruction which is in accordance with Howard Gardner's theory of multiple intelligences is one of the approaches proposed for students with different intelligences can experience a wide variety of activities offering them several ways of learning the concept (Gardner & Hatch, 1989; Adıgüzel, 2002; Özdemir, 2006). The other approach proposed by Tomlinson (1995) is differentiated instruction which is an important method for the purpose of this study.

Accoring to Tomlinson (1995), a teacher should be able to to differentiate or adapt instruction to respond to the diverse student needs found in inclusive, mixed-ability classrooms. A differentiated classroom offers a variety of learning opportunities designed to tap into different readiness levels, interests, and learning profiles. In a differentiated class, the teacher uses (1) a variety of ways for students to explore curriculum content, (2) a variety of sense-making activities or processes through which students can come to understand and "own" information and ideas, and (3) a variety of options through which students can demonstrate or exhibit what they have learned. A class is not differentiated when assignments are the same for all learners and the adjustments consist of varying the level of difficulty of questions for certain students, grading some students harder than others, or letting students who finish early play games for enrichment. It is not appropriate to have more advanced learners do extra math problems, extra book reports, or after completing their "regular" work be given extension assignments. Asking students to do more of what they already know is hollow. Asking them to do "the regular work, plus" inevitably seems punitive to them (Tomlinson, 1995).

Four characteristics shape teaching and learning in an effective differentiated classroom are (Tomlinson, 1995; p.45);

1. Instruction is concept focused and principle driven. All students have the opportunity to explore and apply the key concepts of the subject being studied. All students come to understand the key principles on which the study is based. Such instruction enables struggling learners to grasp and use powerful ideas and, at the same time, encourages advanced learners to expand their understanding and application of the key concepts and principles. Such instruction stresses understanding or sense-making rather than retention and regurgitation of fragmented bits of information. Concept-based and principle-driven instruction invites teachers to provide varied learning options. A "coverage-based" curriculum may cause a teacher to feel

compelled to see that all students do the same work. In the former, all students have the opportunity to explore meaningful ideas through a variety of avenues and approaches.

2. On-going assessment of student readiness and growth are built into the curriculum. Teachers do not assume that all students need a given task or segment of study, but continuously assess student readiness and interest, providing support when students need additional instruction and guidance, and extending student exploration when indications are that a student or group of students is ready to move ahead.
3. Flexible grouping is consistently used. In a differentiated class, students work in many patterns. Sometimes they work alone, sometimes in pairs, sometimes in groups. Sometimes tasks are readiness-based, sometimes interest-based, sometimes constructed to match learning style, and sometimes a combination of readiness, interest, and learning style. In a differentiated classroom, whole-group instruction may also be used for introducing new ideas, when planning, and for sharing learning outcomes.
4. Students are active explorers. Teachers guide the exploration. Because varied activities often occur simultaneously in a differentiated classroom, the teacher works more as a guide or facilitator of learning than as a dispenser of information. As in a large family, students must learn to be responsible for their own work. Not only does such student-centeredness give students more ownership of their learning, but it also facilitates the important adolescent learning goal of growing independence in thought, planning, and evaluation. Implicit in such instruction is (1) goal-setting shared by teacher and student based on student readiness, interest, and learning profile, and (2) assessment predicated on student growth and goal attainment (Tomlinson, 1995; p. 45).

In order to improve instruction, teachers are also suggested to develop ways of determining what students know and how they represent what they learn. New forms of assessment method have been developed in the past 10 years (Welch, 1995). As methods to assess learning change, it is clear that how they are used must also be modified. Black (2003) proposed three problems for quality assessment practices; (1) current assessment methods do not include students in their learning; (2) grades tend to cause competition rather than learning; (3) feedback is not encouraging low-achieving students. Traditional forms of assessment including pencil and paper tests are now used in conjuction with performance tests, student portfolios, laboratory investigations, and written essays to measure student achievement and to provide a complete and depth picture of students' learning (Hein & Price, 1994).

Black and William (2004) stated that formative assessment differs from summative assessments in that they provide information that can be used by teachers and students to modify the teaching and learning activities in which they are engaged. They suggested that when students are faced with contradicting views, the teacher can offer feedback and work with them. To be effective, science teachers need specific examples to implement changes in their assessment practices.

2.1.2 Changing Face of Science Education in Turkey

Understanding the nature, content and aims of the science education reforms in Turkey, theoretical basis of these reforms is important. Without knowing the past of these reforms, it might be difficult to understand the context. In this study, emphasis is on the individual differences in teaching and assessment methods in science (TAMBID) and this idea emerged from the reforms in the science curriculum in Turkey. Therefore to examine the science curriculum development for the years may help to understand the context of the study.

The Turkish education system and science education developments can be examined after 1923 in two phases, before 1960 and after 1960 (Ayas, Cepni, & Akdeniz, 1993). The Turkish education system was steady from 1923 to the 1960's. Science teaching in secondary schools was for the selected students who wanted a career in science. During this period, Turkey educational system was mostly influenced by John Dewey's advices during his trip to Turkey (Farrell, 1967). His influence on Turkish educational system was on changing the philosophy of teaching and learning. His idea on this issue was that students working in groups on a central project related to their own interests were the key to learning. He also stated that "The basic aim and purpose of schools in Turkey ought to be reform and progressive gradual development". Dewey pointed out that "education should be understood as a primary investment in future generations who will be responsible for fulfilling the promise of the Turkish experiment. (Dewey, 1983, p. 275). Dewey visited Turkey in 1924 and tried to make changes within the Turkish education system by bringing and introducing his idea to Turkey. According to Dewey, the big problem of all schools in Turkey is the disconnection between school studies and the real life of students who have done in school has nothing to do with real life. (Turan, 2000; Wolf, 1996).

After 1960s, the development and improvement of science education accelerated. In this second phase of the reforms, the most important reform was the establishment of the Scientific and Technical Research Council of Turkey (Türkiye Bilimsel ve Teknik Araştırma Kurumu, TUBİTAK) in 1963. After that time, MEB and TUBİTAK studied collaboratively and tried to improve the science curriculum of Turkey. At that time, science curriculum of America was taken as a model for the changes in the curriculum. However this curriculum was not be successful in Turkey conditions mostly because of the differences in cultures and students' characteristics in two countries (Karagözoğlu & Murray, 1988; Duman & Williamson, 1996).

There have been increasing efforts to improve Turkish educational system especially since 1992. In the way of being a full member of the European Union and this leads to the changes in education, the Turkish government now gives more importance to education in Turkey and the Ministry of National Education handles the problems in education and set the educational requirements of the 21st century as a priority (Aşkar & Akkoyunlu, 1994). To achieve these purposes, the MEB has become a member of many international educational curriculums and projects such as the International Association for the Evaluation of Educational Achievement in 1998 and the Third International Mathematics and Science Study Repeat (TIMSS-R) for 8th graders. Turkey is also a member of Organization for Economic Co-operation and Development (OECD) and so takes part in the some programs like International Student Assessment for 9th graders (Ministry of National Education, 2003).

One of the most important reforms in education for Turkey was to change the compulsory education by increasing from five years to eight years. This was done in August, 1997 by the MEB and the Turkish government. With this reform, education system has completely reorganized and so the primary science curriculum. Turkey still continues to improve its educational system, especially in the areas of learning theories, curriculum development, and educational technology by placing the students at the center of education.

2.1.3 New Science and Technology Curriculum of Turkey Regarding Teaching and Assessment Methods

In light of all of the developments mentioned above, science and technology curriculum has been currently changed and started to be used in 4th and 5th grade in 2005-2006 education year. With regard to the teaching methods in the NSTC, constructivist teaching strategies are suggested for the teachers to be used in science and technology lessons, which are all student centered approaches. Although the constructive view of teaching and learning is not directly the scope of this study, for the theoretical framework, it is summarized and compared to the traditional view in Table 2.1 (Brooks & Brooks, 1999, p. 17).

Table 2.1 Differences in the Traditional and the Constructivist Classrooms

Traditional Classrooms	***Constructivist Classrooms***
Curriculum is presented part to whole, with emphasis on basic skills.	Curriculum is presented whole to part with emphasis on big concepts.
Strict adherence to fixed curriculum is highly valued.	Pursuit of student questions is highly valued.
Curricular activities rely heavily on textbooks and workbooks.	Curricular activities rely heavily on primary sources of data and manipulative materials.
Students are viewed as “blank slates” onto which information is sketched by the teacher.	Students are viewed as thinkers with emerging theories about the world.
Teachers generally behave in a didactic manner, disseminating information to students.	Teachers generally behave in an interactive manner, mediating the environment for students.
Teachers seek the correct answer to validate student learning.	Teachers seek the students’ point of view in order to understand students’ present conceptions for use in subsequent lessons.
Assessment of student learning is viewed as separate from teaching and occurs almost entirely through testing.	Assessment of student learning is interwoven with teaching and occurs through teacher observations of students at work and through student exhibitions and portfolios.
Students primarily work alone.	Students primarily work in groups.

The other concern stated in the NSTC is that, student centered strategies provide appropriate learning opportunities for the students by stimulating higher order thinking skills like analytic and creative thinking skills. Suggested teaching strategies in the new curriculum which are listed toward the teacher centered to the student centered are shown in Table 2.2.

Table 2.2 Suggested Teacher and Student Centered Teaching Strategies in the NSTC (MEB, 2005)

Teacher Centered Strategies			*Student Centered Strategies*		
Lecturing	Demonstration	Whole Class Discussion	Role Playing	Project	Independent Study
	Story telling	Video	Peer Teaching	Library Search	Learning Centers
		Simulations	Field Trips	Questioning	Programmed learning
		Practice and Drills	Cooperative learning	Discovery	Individualized teaching systems
			Drama	Problem based learning	
			Games		

In the new curriculum, it is also clarified that, based on the suggested teaching strategies, teachers have to select the appropriate strategies to acquire the determined objectives. They are expected to provide appropriate learning environment for their students. The role of the teacher is the facilitator by guiding the students. As for the evaluation and assessment of students, strategies are constructed by taking the constructivist view of teaching and learning process. The summary of the framework underlying in the new curriculum related to the assessment and evaluation was given in Table 2.3 (MEB, 2005). In the curriculum, it is suggested that teachers should offer multiple assessment opportunities for their students to exhibit their knowledge, skills and attitudes. The NSTC give emphasis on alternative assessment and evaluation strategies rather than traditional strategies. The suggested traditional and alternative assessment and evaluation strategies in the NSTC are summarized in Table 2.4.

Table 2.3 Comparison of Traditional and Alternative Assessment and Evaluation Strategies (MEB, 2005)

Less Emphasis	***More Emphasis***
Traditional assessment and evaluation methods	Alternative assessment and evaluation methods
Evaluation independent of learning and teaching	Evaluation as a part of learning and teaching
Evaluation of knowledge acquired easily or learned by heart	Evaluation of meaningful and intensive learned knowledge
Evaluation of partial knowledge independent from each other	Evaluation of well constructed knowledge network
Evaluation of scientific knowledge	Evaluation of scientific understanding and logic
Evaluation to learn the knowledge that students do not know	Evaluation to learn what do students understand
Evaluation activities at the end of the semester	Evaluation activities proceeds during all semester
Evaluation of teachers only	Besides teacher evaluation, group evaluation and self evaluation

Table 2.4 Suggested Traditional and Alternative Assessment Strategies in NSTC (MEB, 2005)

Traditional Strategies	***Alternative Strategies***
Multiple choice tests	Performance evaluation
True-False questions	Portfolio
Matching questions	Concept mapping
Fill in the blank questions	Structured grids
Short answer questions	Diagnostic branching tree
Essay type questions	Word relation
Question-answer	Project
	Drama
	Interviews
	Written reports
	Demonstration
	Poster
	Group or peer evaluation
	Self evaluation

In new approaches, to assess the students knowledge does not depend on the paper and pencil tests anymore but on alternative assesments as shown in the Table 2.4. Such assessments include strategies like open ended questions, teacher observations, student portfolios, self assessments and group projects which are appropriate assessment tools for student centered classrooms as suggested in the NSTC.

A sampling of every day science achievement of students may be incorporated into a science portfolio. The portfolio, as an example, may contain the following entries (Hein & Price, 1994; Black, 2003);

1. Snapshots of hands on approaches from ongoing lessons and units of study.
2. Written work pertaining to summaries, outlines, book reports, as well as of expository, creative, and narrative writings.
3. A video tape of collaborative endeavors of students to notice the quality of interactions.
4. Tape recordings of oral presentations such as a book report.
5. Drawings of construction items made for science experiments and demonstration.
6. Dramatizations, evaluated on a five point scale, pertaining to a unit on famous scientists.
7. Self evaluation of students in terms of quality criteria.
8. Art products such as murals, diagrams, and other illustrations developed of what was studied in science units of study.
9. Test results of classroom developed tests measuring achievement in ongoing units and lessons.
10. Student / teacher planning of what is left to learn within a specific unit in science.

A carefully designed rubric may also be used to assess the quality of each portfolio (Ediger, 2001). Whether the teachers integrate these strategies into their assessment procedures, demonstrate the degree of their using new strategies and taking into account the students' differences as the students will select the strategy by themselves to put into their portfolios based on their different characteristics.

2.2 Review of Related Studies

2.2.1 Studies on Teaching and Assessment in Science and Technology Education

Many authors and researchers have addressed the question "What is Science?" and "What is Science Education?" Science is a process of searching for fundamental and universal principles that explains causes and effects in the universe (Rutherford & Ahlgren, 1989, National Research Council, 1996). The method includes hypothesis, repeatable experiments, observations and new hypothesis. Science is not a collection of facts and theories. The process by which we develop theories is science, not the theories themselves. Science is the field of study which attempts to describe and understand the nature of the universe in whole or part. Over the past decade, science education reform recommendations have been quite evident. In developed countries, policy reports are suggesting comprehensive changes in science teaching and learning (American Association for the Advancement of Science, 1993).

Recent calls for reform in science education (American Association for the Advancement of Science, 1993; National Research Council, 1996; Council of Ministers of Education in USA, 1997) have emphasized the need for science to be accessible to all students and for all students to have the opportunity to attain high levels of scientific literacy. Although scientific literacy can have several dimensions, scientific literacy require that students acquire not only an understanding of the theoretical and conceptual principles of science, but also develop an understanding of the nature of science and relations between science, technology, society, and the environment and develop skills of scientific inquiry and problem-solving. Such reforms in science teaching require a fundamental change in the teacher's role, and many specialists have pointed to the need for teachers to change their conceptions and practices concerning the teaching of science (James, 1972; Klopfer, 1971;

Humphreys, et al, 1982; Miller, 1984; Hodson, 1998; Longbottom & Butler, 1998). The educational researchers tried to find the ways to improve science education and to contribute to the Science education reforms. Based on this issue, in some studies themes are identified to be considered in science education. Some of these themes identified by the researchers include (a) constructivism, (b) thematic approach, (c) assessment and evaluation, (d) equity, (e) science–technology–society (STS), (f) educational technology, (g) cooperative learning, (h) hands-on activities, and (i) the nature of science (Ellis & Backe, 1995). It is emphasized that to improve science education these themes must be handled and explored. There are also many instruments developed in light of these themes to get perceptions of teachers about their science teaching and their needs in the field to apply the suggested science program of their country (Haney, Czerniak & Lumpe, 1996; Czerniak, Lumpe & Haney, 1999).

The scientific method which is considered as the way of learning science by many science educators and teachers have also been addressed by most historians of science, philosophers of science, and science educators. They all accept that there is no such thing as 'the scientific method'. Feyerabend (1988) even goes so far and argue that: 'the events, procedures and results that constitute the sciences have no common structure' and that: There can be many different kinds of science. People starting from different social backgrounds will perceive the world in different ways and learn different things about it which are all consistent with the MI theory (Feyerabend, 1988).

Fensham (1987) stated that “While science courses have been the part of general education of most children over the last couple of decades, the effectiveness of traditional science courses has become under increasing criticism. The studies revealed that there is a need for change in traditional science courses that would more appropriately fill the role of science for all” (p. 18-23). For this issue, there have been many reviews and reform proposals. Reforms include demands that the content of science courses should be made more interesting and relevant to children's lives, or that ways of teaching science should be more sensitive to the way children learn, to the children's gender, interests or to their cultural background. In other words students must be in the center of our education (Longbottom & Butler, 1998). Teaching for understanding meaning that there is more than one way to solve a problem or to learn a scientific concept is getting importance in science classrooms. To teach for understanding it is suggested that teacher centered classrooms must be shifted to student centered classrooms. By this way the emphasis will be on students and their groups other than on the lecturing and textbooks. To achieve this purpose and put the students at the center of education, many new approaches for science teaching was developed. With these approaches, it is also possible to take into account the students' differences and to organize the lessons based on the students' interest and skills. In these lessons, teachers provide students with hands-on experiences, not just paper and pencil assignments. Students are introduced with the problems related to real life, not with the knowledge formulated in the book. Such a curriculum enables students to make sense of science in their daily lives and engage in science practice as well. In this sense, it brings science into the everyday life of the student and the real world. Therefore, it would be essential to know how students learn and examine the learning theories for meaningful learning of science by the students (Anderson & Mitchener, 1994; Eisenhart, Finkel & Marion, 1996).

2.2.2 Learning Theories based on the TAMBID

In the literature there are some points of views regarding the use of the TAMBID in the education. As each individual in the universe is genetically unique, their brains are also unique. The relationship between brain and learning is explained in a manner that, the more complex the learning, the greater the total brain interaction and the complexity of the learning differs among individuals which constitute the basis of the differences among individuals (Thies, 2000). In spite of this fact, most schools still use the same curriculum, instructional methods, and assessment methods for all students regardless of differences in their learning and processing styles (Kutay, 2006). There are many learning theories including theories of Piaget, Ausebel and Vygotsky. Although all of these theories of learning emphasize how individuals learn, some of the learning theories gives more emphasis on individual differences. One of the clearest and most important revelations stemming from brain researches is that there are no "regular" students. The notion of broad categories of learners-smart, not smart, disabled, not disabled, regular, not regular-is a gross oversimplification that does not reflect reality. By categorizing students in this way, we miss many subtle and important qualities and focus instead on a single characteristic (Rose & Meyer, 2002). These theories are mostly brain-based theories as also suggested by Güneysu, Çağlayan and Kaygısız, 2005). She claimed in her book *The Reflection of Brain Based Studies on Education* is that results of the studies on brain have an affect on teaching and learning environments. Findings of the experimental studies on brain change our view of looking into individuals and so individual differences are being more emphasized in schools with the extensize researches on brain studies. By this way, the educators with the teachers are trying to find new ways and strategies of handling with the individual differences of the students in the classroom. A classification of learning theories based on brain-based studies and individual differences are shown in Figure 2. 2a (Güneysu et al., 2005). Also, what brain research tells about individual differences is summarized in Figure 2.2b.

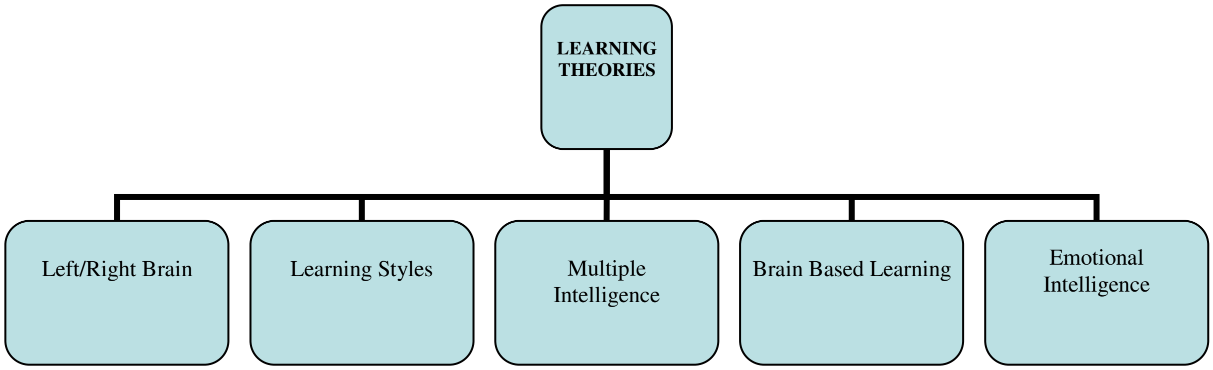


Figure 2. 2a Learning Theories Based on Individual Differences

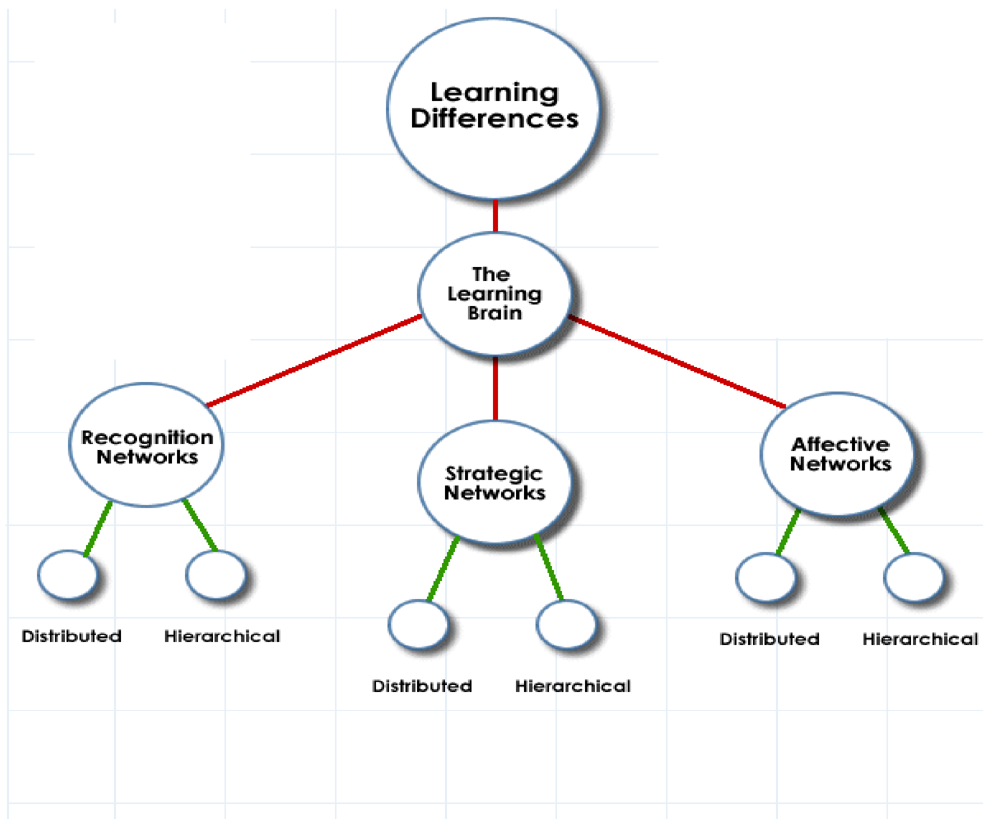


Figure 2.2b. What Brain Researches Tells Us About Individual Differences (from Hall, 2002, http://old.cast.org/tesmm/example2_3/brain.htm)

There are three networks processing in the brain. Figure 2.2b demonstrated the organization of three (recognition, strategic, and affective) learning networks in the brain. These networks with the highly specialized subprocesses within networks demonstrated that each student brings a unique assortment of strengths, weaknesses, and preferences to school. To focus on one network alone for any given student is not suggested by brain research studies. Rather it is emphasized that patterns of strength and weakness across all three networks interact with the teaching and learning environment in ways that can either bring about progress or frustration. Sometimes a problem in one area can receive so much attention that other issues are missed. For example, students with learning disabilities are often mistakenly thought to have problems only with recognizing words. Furthermore, understanding affective issues can help teachers support all learners more appropriately. Of the three learning networks, affective networks are perhaps intuitively the most essential for learning, yet they are given the least formal emphasis in the curriculum. All teachers know how important it is to engage students in the learning process, to help them to love learning, to enjoy challenges, to connect with subject matter, and to persist when things get tough. When students withdraw their effort and engagement, it is tempting to consider this a problem outside the core enterprise of teaching which is not true. Attending to affective issues when considering students' needs is an integral component of instruction, and it can increase teaching effectiveness significantly. Lastly, it can be concluded that most learning occurs in students by interaction of these networks which explain the relation between brain based studies and individual differences. (Rose & Meyer, 2002).

The classification of learning theories in Figure 2.2a based on brain based studies are directly related to the differences among the individuals. A teacher can determine their students' LS, multiple intelligences or emotional intelligences by using various inventories in the literature and might select the teaching strategies that will be used in the lesson based on the TAMBID. As the number of researches about brain structure and functioning, the nature of the teaching and learning strategies may also change (Güneysu et al., 2005). The terms neuroscience, science of learning, brain-based studies and learning styles are often used as if they are interchangeable but they have a distinct meaning, research lineage and references. The followings are short explanations of each learning theories summarized in light of the relation with individual differences of the students.

2.2.2.1 Left/Right Brain

In this learning theory, which is also known as brain-lateralization theory, individual differences of the students are related to the hemisphere of the brain. According to this theory, learning is achieved by using whole brain. Teachers taking into account this issue should know that which hemisphere of the brain their students use. Some of the individuals may use their one of the hemisphere more than the other suprisingly two hemisphere are indeed participated in all of the processess not in the same manner but in different way.

The concept of right brain and left brain thinking developed from the research in the late 1960s of an American psychobiologist Roger W Sperry. He discovered that the human brain has two very different ways of thinking. One (the right brain) is visual and responsible from emotions by processesing information in an intuitive and simultaneous way, looking first at the whole picture then the details. The other (the left brain) is verbal and processes information in an analytical and sequential way, looking first at the pieces then putting them together to get the whole (Dunn & Griggs, 2000).

2.2.2.2 Learning Styles

Learning styles is defined and classified with a variety of different definitions and classifications in the literature. A well- known definition of LS used by many researchers is “a biologically and developmentally imposed set of personal characteristics that make the same teaching method effective for some students and ineffective for others." (Dunn & Griggs, 2000, p. 3; Dunn, Beaudry & Klavas, 1989, p. 51). The other definition by Lee and Lodewijks (1995) is "the tendencey to use certain processing and regulation activities spontaneously when learning." (p. 320).

The differences in environment constitute the learning in individuals. Each individual have different LS in this environment. Two children having the same parent may have different LS since their perceptions might be different causing them to have different needs and interests. These constitute the individual differences. If individual differences are taken into account in the educational settings, individuals will be happy and the knowledge acquired in this environment will be permenant (Güneysu et al., 2005). Furthermore, learning styles are helpful for teachers and provide the means of understanding their own students' learning styles. There are numerous quantitative studies in the literature demonstrating that teaching based on students' learning styles improves both classroom success and satisfaction (Dunn, Beaudry & Klavas, 1989; Smith, 1997; Dunn & Griggs, 2000; Kutay, 2006).

LS were one of the most significant individual differences for teaching and learning process about which many researches were carried out, and many classification system was constructed for the teachers to take individual differences of their students into account. LS is also one of the unique approach in which the individual differences of the students is more emphasized than any other approaches in the literature (Kolb, 1984; McCarthy, 1996). Therefore it would be helpful for the scope of this study to explain different LS models, and their use in education. There are various learning styles model in the literature. One of the reasons why there are so many approaches is the diversity of views in the literature about how individuals learn. Table 2.5 summarized the different learning styles models.

Table 2.5 Learning Styles Models

	GENERAL INFORMATION	THEORETICAL ASSUMPTIONS	LEARNER CLASSIFICATION	MODEL
Dunn and Dunn Learning Style Model	Based on -cognitive style theory (the idea that, individuals process information differently based on either learned or inherent traits) and -brain lateralization theory (the idea that the left and right hemispheres of the brain have different functions.	1. Most individuals can learn. 2. Instructional environments, resources, and approaches can respond to diverse learner style strengths. 3. Everyone has strengths, but different people have many different strengths. 4. Individual instructional preferences exist and can be measured using an instrument with excellent published reliability and validity. 5. Given responsive environments, resources, and approaches, students attain statistically higher achievement and attitude scores in matched, rather than mismatched learning styles treatment. 6. Most teachers can learn to use learning styles as a cornerstone of their instruction. (Dunn & Griggs, 2000).	-Environmental, -Emotional, -Sociological, -Physiological -Psychological	Table 2.6

Table 2.5 (cont'd)

Kolb Learning Style Model	Students are classified as having a preference for (a) concrete experience or abstract conceptualization (how they take information in) and (b) active experimentation or reflective observation (how they process information). The four types of learners in this classification scheme are: • *Type 1* (concrete, reflective) the *diverger*. • *Type 2* (abstract, reflective)—the *assimilator*. • *Type 3* (abstract, active)—the *converger*. • *Type 4* (concrete, active)—the *accommodator*. (Kolb, 1984).	-Students are different in how they take information and how they process the information -Learning has a continuum cycle	-Concrete experience, -Reflective observation -Abstract conceptualization -Active experimentation	Table 2.6

Table 2.5 (cont’d)

McCarthy’s 4MAT Learning Style Model	Based on a "wheel" for the development of lessons which will lead students from concrete experience to reflective observation to abstract conceptualization and finally to active experimentation (from Kolb's model) Four different types of learners in a classroom: 1. Innovative learners who are mainly interested in personal meaning. 2. Analytic Learners are essentially interested in having facts directly without going deeply into details and concepts. 3. Commom sense learners are interested in how things work. They want to involve and check it out personally.	-Different students have different understanding and way of processing knowledge -Flexible to change the style from one to another for a student -Dynamic learners are interested in self directed findings. They trust their feelings and also like to teach others.	-Innovative learners -Analytic Learners -Commom sense learners -Dynamic learners	Figure 2.3

In Table 2.5, three learning theories with their brief explanations were tabulated. In general, these three learning style models have some common features. For instance, they are similar in that, all supports the idea that students have different understanding or strength for learning. Among three models, the well-known and frequently used ones are the Kolb learning style model and Dunn and Dunn learning styles model. Although it is popular, McCarthy LS model has never been evaluated using either experimental or correlational research (Kutay, 2006). The three LS models are supporting the same idea in different ways. The main difference among them is the elements of individual differences of the students. In Dunn and Dunn model, learners are classified based on their achievement in different sitauations according to the environmental, emotional, sociological, physiological and psychological factors. Searson and Dunn (2001) in their research has identified factors which assist or hinder individuals in the classroom in achieving as optimally as possible. They stated that the teachers need to consider the LS theory when evaluating under which conditions students do best in achieving objectives in science instruction which also includes individual differences of the students. Dunn & Dunn learning style model is summarized in Table 2.6 by considering the elements of the model (Searson & Dunn, 2001).

Table 2.6 Dunn and Dunn Learning Styles Model

STIMULI	***ELEMENTS***			
Environmental	Sound	Light	Temperature	Design
Emotional	Motivation	Persistence	Responsibiliy	Structure
Sociological	Self Pair	Peers	Team	Adult Varied
Physiological	Perceptual	Intake	Time	Mobility
Psychological	Global Analytic		Hemisphericity	Impulsive Reflective
← **Simultaneous or Successive Processing** →				

As tabulated in Table 2.6, The Dunn and Dunn model includes five strands (i.e, environmental, emotional, sociological, physiological and psychological). These factors or stimuli affecting students' learning in different levels of elements originally stated by Dunn (1999) are as follows:

1. Environmental factors such as acceptable noise levels, temperature readings, as well as formal versus informal seating arrangements.
2. Emotional elements such as conformity versus nonconformity, as well as preferences for choices as to what to learn.
3. Sociological factors such as studying alone or with others as well as well as preferring collegial relations versus structure with a more authoritative teacher.
4. Physiological factors such using auditory, tactual, and/or kinesthetic ways of learning. Included too are moving around or sitting still as well as eating versus not eating while concentrating on the task at hand.
5. Psychological factors such as being an analytic learner who focuses on a step by step fashion which leads to an understanding, as compared to global learners who desire to understand what is learned and how it relates to themselves before focusing on facts.

Analytic students respond best to printed words whereas global learners respond better to illustrations and pictures. The Dunn research indicates, ‘If students cannot learn the way we teach them, then we must teach them the way they learn’ (Dunn, 1999).

The other learning style system proposed by Kolb (1984) is different from the Dunn and Dunn model in that the classification of the learners is different. Kolb is one of the researchers who has many studies on LS. Before defining the LS, he try to explain the learning process calling it as learning cycle. He claimed that, to achieve learning, an individual have to experience four stage; concrete experience, reflective observation, abstract conceptualization and active experimentation. This cycle is shown in Figure 2.3.

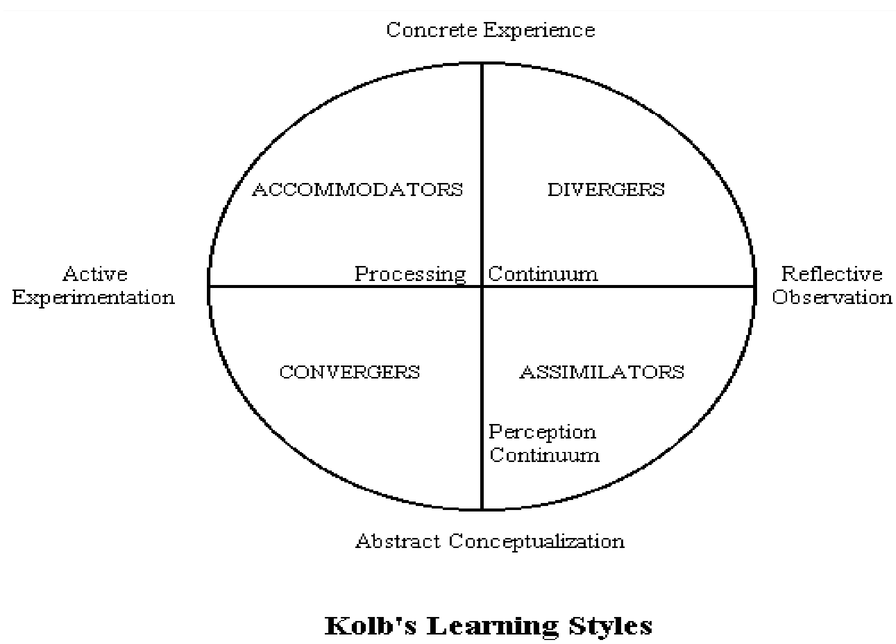


Figure 2.3 Kolb’s Learning Style Model

Type 1 (divergers) learners respond well to explanations of how course material relates to their experience, interests, and future careers. Their characteristic question is "*Why*?" To be effective with Type 1 students, the instructor should function as a *motivator*. Type 2 (assimilators) learners respond to information presented in an organized, logical fashion and benefit if they are given time for reflection. Their characteristic question is "*What*?" To be effective, the instructor should function as an *expert*. Type 3 (convergers) learners respond to having opportunities to work actively on well defined tasks and to learn by trial-and-error in an environment that allows them to fail safely. Their characteristic question is "*How?*" To be effective, the instructor should function as a *coach*, providing guided practice and feedback in the methods being taught. Type 4 (accomodators) learners like applying course material in new situations to solve real problems. Their characteristic question is "*What if ?*" To be effective, the instructor should pose open-ended questions and then get out of the way, maximizing opportunities for the students to discover things for themselves. Problem-based learning is an ideal pedagogical strategy for these students (Kolb, 1984).

McCarthy (1996) is the other researcher attempting to explain the basis of LS. The 4MAT system model is derived from Kolb's model so it is similar to this model. The 4MAT wheel (McCarthy, 1987; shown in Figure 2.4) is divided into four which represent four different types of learners in a classroom: Innovative learners, analytic learners, commom sense learners, dynamic learners.

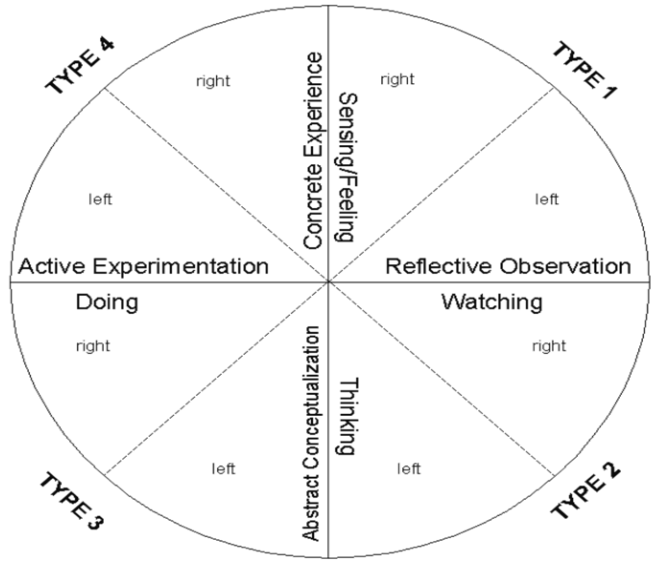


Figure 2.4 4MAT System, Teaching to Learning Styles with left/right brain systems

McCarthy (1987) also suggested appropriate teaching strategies for her different learning style formats. The suggested activities with her correspoing learner type in McCarthy learning style model is given in Table 2.7.

Table 2.7 Suggested McCarthy Learning Style Model Teaching Strategies for Learners

Type of Learner	Suggested Teaching Strategy
Innovative Learners	Cooperative learning, brain storming and integration of different contents such as science with writing models
Analytic Learners	Traditional lectures, independent research and listening to experts in the subject matter
Common Sense Learners	Concrete style, experimental activities, hands-on tasks and kinesthetic experience
Dynamic Learners	Independent studies, role playing and games

McCarthy (1987) stated that the most prevalent teaching strategies in public schools are instructional techniques like lecturing. McCarthy suggested that to include the whole brain in learning teachers should use four styles which serve to both left brain and right brain in their lessons.

2.2.2.3 Multiple Intelligences

Since the theory of multiple intelligences proposed by Howard Gardner in 1983, educators and researchers have become very interested in the theory as a means to improve teaching and learning in a multiplicity of ways. Although multiple intelligences is not a learning theory, it affects the learning in students and have a profound impact on the way teachers teach, the way children learn and are assessed, and the manner in which children are considered to be smart or intelligent (Toth, 2002). Individual differences of the students differs with respect to their talents or intelligences. Seven main intelligences proposed by Gardner (1983) are verbal-linguistic, logical-mathematical, visual-spatial, musical-rhythmic, bodily-kinesthetic, interpersonal and intrapersonal. Then Gardner added eight and even ninth intelligences to the list-the naturalist and existentialist intelligences. (Also the tenth is on the road-sexual intelligence). Multiple intelligences suggested teaching strategies for students differing in their LS. Learning is enhanced when a classroom environment is created that provides students with opportunities to learn in several ways (Gardner, 1983). The role of teacher in this theory was to guide and help the students. MI is related with the TAMBID in that teachers can implement numerous teaching methods according to different intelligence types that their students possess. Table 2.8 (adapted from Armstrong, 1994) summarized the intelligences areas with its features and suggested teaching activities for specific intelligences that teachers might use in their classroom.

As theory of multiple intelligences have been applied in many educational setting, one of the important issue to consider is to assess the teachers' perception and knowledge related to the theory of multiple intelligences and how the teachers apply and implement the multiple intelligences in the classroom must be considered. There are a number of studies in this issue supplying guidance to the shape and rationale of this present study.

Table 2.8 Multiple Intelligences Areas and Suggested Teaching Strategies (Armstrong, 1994)

Children who are strongly:	**Think**	**Love**	**Need**
Linguistic	in words	reading, writing, telling stories, playing word games, etc.	books, tapes, writing tools paper diaries, dialogues, discussion, debate stories
Logical-Mathematical	by reasoning	experimenting, questioning, figuring out puzzles, calculating, etc.	things to explore and think about, science materials, manipulatives, trips to the planetarium and science museum
Spatial	in images and pictures	designing, drawing, visualizing, doodling, etc.	art, LEGOs, video, movies, slides, imagination games, mazes, puzzles, illustrated books, trips to art museums
Bodily-Kinesthetic	through somatic sensations	dancing, running, jumping, building, touching, gesturing, etc.	role play, drama, movement, things to build, sports and physical games, tactile experiences, hands-on learning
Musical	via rhythms and melodies	singing, whistling, humming, tapping feet and hands, listening, etc..	sing-along time, trips to concerts, music playing at home and school, musical instruments
Interpersonal	by bouncing ideas off other people	leading, organizing, relating, manipulating, mediating, partying, etc.	friends, group games, social gatherings, community events, clubs, mentors/apprenticeships
Intrapersonal	deeply inside themselves	setting goals, meditating, dreaming, being quiet,	secret places, time alone, self-paced projects, choices

2.2.2.4 Brain Based Learning

Humans have a marvelous brain, whose possibilities appear endless. So when we refer to brain-based learning, we are concerned about maximizing learning, understanding how the brain works best. Some of the researchers argued the concept of brain based learning as they claimed that all learning is brain based. Twelve learning principles that emphasize the connections and patterns our brains make are as follows (Caine & Caine, 1997).

1. The brain is a complex, dynamic system.
2. The brain is social.
3. The search for meaning is innate.
4. The search for meaning occurs through "patterning."
5. Emotions are critical to patterning.
6. Every brain simultaneously perceives and creates parts and wholes.
7. Learning involves both focused attention and peripheral perception.
8. Learning always involves conscious and unconscious processes.
9. We have at least two ways of organizing memory.
10. Learning is developmental.
11. Complex learning is enhanced by challenge and inhibited by threat.
12. Every brain is uniquely organized.

2.2.2.5 Emotional Intelligence

The roots of emotional intelligence come from the studies of Thorndike. Thorndike (1920) defined the social intelligence as the ability to understand and direct the woman, man, girls and boys and also to behave logically in relation with individuals. Emotional intelligence has five basic elements; self awareness, directing the emotions, self motivation, empathy and handling with the relations (Goleman, 1995). Teachers considering the emotional intelligences of the students pay attention to arrange the learning environment in a way where fear is removed and provide struggle. Also students should be ready for the lesson emotionally in such an environment. There are four branch model of emotional intelligence describing four areas of capacities or skills that collectively describe many of areas of emotional intelligence (Mayer & Salovey, 1997). This model is shown in Figure 2.5. More specifically, this model defines emotional intelligence as involving the abilities to: (a) accurately perceive emotions in oneself and others, (b) use emotions to facilitate thinking (c) understand emotional meanings, and (d) manage emotions.

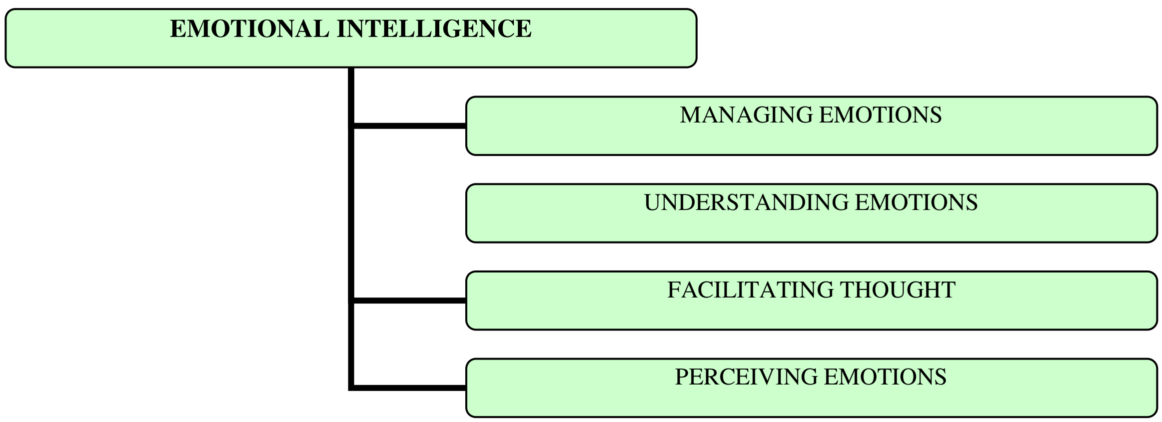


Figure 2.5 Four Branched Model of Emotional Intelligence

Including the emotional intelligence, all brain-based learning theories give opportunities for teachers with respect to the teaching and assessment of science by considering the individual differences of the students in the classroom. At that point, it is important to know how a teacher can deal with these individual differences of the students in the classroom.

2.2.3 Different Lessons to Different Students

When individuals come across with new information, their way of selecting, perceiving and processing that information is different from each other because of their background knowledge, unique qualities, likes and dislikes, cultural environments and style of learning (Stronk, 1980; Rossman, 1983). Analysis of the literature demonstrated that (a) there is a devolution in student interest and achievement in science, (b) students needs' are increasing, as students are different, the need for different kinds of science instruction emerged (c) Student learning and their attitudes in science can be im provedd by using science instruction and (d) teachers should now more about individualized instruction by taking their students' needs into acoount and they can be taught about the teaching and assessment strategies to incorporate individualized instruction into science classrooms (O' Toole, 1968; Hewitt, 1974; DeRose et al., 1979; Roach & Hommond, 1981; Green, 1982; Yager & Penick, 1984).

The effectiveness of the TAMBID has been examined for many years. Many researchers emphasized the importance of the approaches taking into account the student differences. For example one of the suggestions of Clark (1996) is to create a positive science classroom climate was 'making provisions for as much individualization as possible' (p. 65). Also he stated that teachers must *provide every* student, regardless of learning modality strength in different areas. Knowledge of learning theory, an understanding of how learning occurs and is facilitated, is an important component of the TAMBID which are all student-centered teaching. Teachers of science who know that learning is an active process by which students individually and collectively achieve understanding use their pedagogical content knowledge to make effective decisions about learning, teaching strategies, and assessment. Effective teachers of science continuously develop a broad repertoire of instructional strategies to engage all students in a variety of ways. These decisions are impacted directly by the needs, interests, and abilities of their students (National Research Council, 1996). The key issue emerged here is that how teachers handle the diversity in their science and technology classroom and how they organize and plan their lesson by considering students' differences. There are some approaches to solve this conflict and to engage all of the students into the lesson. One of the solution to this issue is proposed by Watts (2003) who suggested three approaches for teachers to use in science lessons to address this issue. These three approaches are;

- Differentiation at a very broad level, which treats the students in the classroom as a homogeneous group and entails managing the class as a unified whole and that makes little allowance for significant individual difference.
- Partial differentiation, where groups of learners in the classroom are recognized as having particular and different requirement, for example ability, gender, preferences or special educational need.
- Full differentiation, where an attempt is made to track the individual learning patterns and trajectories of each member of the class and, in that way, to manage and support each person's specific learning needs (Watts, 2003; p.452).

He also stated that trends are towards the second and third approaches other than first one by employing interactive teaching methods and promoting active learning enabling students to plan and manage their own learning.

Research has also been conducted on the TAMBID by Dunn and Dunn (1989) by using Dunn's learning style model at more than 115 universities worldwide. Studies have been carried out on students who are considered as gifted and talented, learning disabled, emotionally disabled, at risk, low achieving or average. According to the results of this research, it can be stated that using and considering an individual's learning style can help increase concentration, processing and retention of new and difficult subject.

There are also other researchers who examined individualized teaching (Klopfer, 1971; James, 1972; Newport, 1973; Marchese, 1977; Repicky, 1978;

Gettinger, 1983; Willett, et al, 1983). Results of their studies demonstrated that, students learned more effectively and showed increased motivation and retention when allowed to pace themselves. They reported that individualized instruction produced significantly greater achievement gains than the traditionally taught groups and conventional These researchers discussed about the issue that, since there are many instructional approaches available to the science teacher, then the question should not be "Which one to use today?" but "Which approach is best for this particular student? The stated that teachers need to start tailoring science instruction into a more personal approach which is individualized instruction.

Some of the studies demonstrated that there are no significant difference between the individualized instruction and any other type of instruction (Bangert, et al., 1983). For example, Anderson and Butts (1980) compared 40 sixth grade students' preference for different instructions to see whether there will be any difference in achievement and attitude toward the instruction of the students., One class was taught by group instruction and the other class was taught by individualized instruction on the unit electricity. The results of the study revealed that there were no differences in either achievement or attitude between the two groups based on their scores on achievement and attitude tests. Bangert, et al., (1983) analyzed 51 individualized instruction studies carried out on grades 6-12. They reported that individualization of the instruction had a little effect on achievement and attitudes. Also there are studies demonstrating that there is no effect of individualized instruction on student achievement in science. For example Gallagher (1970), Humphreys, et al. (1982), and Okebukola and Ogunniyi (1984) carried out studies to compare cooperatively grouped students and individualistic grouping in science laboratory. The results showed that cooperatively grouped students have significantly higher scores on science achievement test than students studied individually.

One of the study conducted by a primary school teacher in a science lesson. Pool (1997) investigated the effectiveness of three distinct instructional approaches on selection of the styles by the teachers and on the attitudes of 5th grade students toward instruction. In the first instructional approach, in which the teacher is in charge, traditional strategies like lecturing, and memorization were used. In the second approach, the teacher is comfortable with many innovative learning strategies and sees new possibilities for defining discipline, but still largely directs student learning. It is observed that more teachers are moving to the second approach, though most teachers still operate from the mental model of the traditional approach to education, because that was the way they were taught. In the third instructional approach, which is actually brain-based teaching, learning becomes collaborative and teachers and students have much more mutual responsibility. Here, students know what they want to do, time parameters are flexible, and orderliness and coherence prevail. Teachers have an extensive repertoire of strategies. These classrooms are characterized by ongoing questioning and analysis. Students and teachers ask experts, they get on the Internet, they learn together. The results of the study demonstrated that although students are often much more comfortable with the third instructional approach, the teachers are not.

2.2.4 How Can a Science Class be Individualized

Results of various studies revealed that there is no one best way to individualize science instruction in terms of teaching and assessment methods. Therefore, a teacher might use any kinds of methods to take into individual differences among their students into consideration. There are also some decisions to be used in planning and implementation of individualized or differentiated instruction since several key elements guide differentiation in the education environment. Tomlinson (2002) identifies three elements of the curriculum that can be differentiated: Content, Process, and Products. Figure 2.6 illustrated the learning cycle and decision factors used in planning and implementing differentiated instruction. Several elements and materials are used to support instructional content. These include acts, concepts, generalizations or principles, attitudes, and skills. Teacher plans what to teach to determine the content. For the process, flexible grouping is consistently used. Strategies for flexible grouping are essential. Learners are expected to interact and work together as they develop knowledge of new content. Teachers may conduct whole-class introductory discussions of content big ideas followed by small group or pair work. Student groups may be coached from within or by the teacher to complete assigned tasks. Grouping of students is not fixed. Based on the content, project, and on-going evaluations, grouping and regrouping must be a dynamic process as one of the foundations of differentiated instruction. There are many strategies that teachers can implement in a science classroom. Among instructional strategies that can help teachers manage differentiation to teach science and individualize the instruction by helping students find a good learning "fit" are the followings: use of multiple texts and supplementary materials, use of computer programs, interest centers, learning contracts, compacting, tiered sense-making activities and tiered products, tasks and products designed with a multiple intelligence orientation, independent learning contracts, complex instruction, group investigation, independent study, group work, science learning centers, peer teaching, activity kits and individualized reading materials., there are many teaching and assessment methods like cooperative learning or portfolio. For the assessment of the content, authentic assessment strategies were suggested dor individualized instruction. Basically,and shortly, what it means is that students are tested on what they have been taught and hopefully, what they have learned. The greatest implications are that: curriculum is aligned with what is expected to be learned; strategies used to teach are according to students' needs; and assessment instruments used are flexible and adequately and appropriately used to measure on-going performance (Clark, 1996; Hall, 2002; Tomlinson, 2005). Most of these methods were suggested to use for individualized instruction or differentiated instruction by many author in the literature. Among these methods, the teachers are expected to select the ones that is most appropriate for her/his particular situation. He/she should not be depend on and use only one methods of teaching. It is known that the best method for maximizing learning for the students is the eclectic approach to teaching science that ensure flexibility and variety in both science content and science teaching methods (Silberman, 1971; Jones, 1977; Plimmer & Hartshorn, 1989; Roach & Hammond, 1981; Clark, 1996). In science classrooms, teachers applying the TAMBID provide specific ways for each individual to learn as deeply and quickly as possible, without assuming one *student's* road map for learning is identical to the other students.

Three ways by which the teachers who are taking into account the students' differences in classes are listed by Tomlison and Dockterman (2002):

1. ***Teachers*** in differentiated classes use time flexibly, call upon a range of instructional strategies, and become partners with their ***students*** to see that both what is learned and the learning environment are shaped to the learner. They do not force-fit learners into a standard mold.
2. ***Teachers*** in differentiated ***classrooms*** begin with a clear and solid sense of what constitutes powerful curriculum and engaging instruction. Then they ask what it will take to modify that instruction so that each learner comes away with understandings and skills that offer guidance to the next phase of learning.
3. Essentially, ***teachers*** in differentiated ***classrooms*** accept, embrace, and plan for the fact that learners bring many commonalities to school, but that they also bring the essential ***differences*** that make them individual. ***Teachers*** can allow for this reality in many ways to make ***classrooms*** a good fit for each individual.

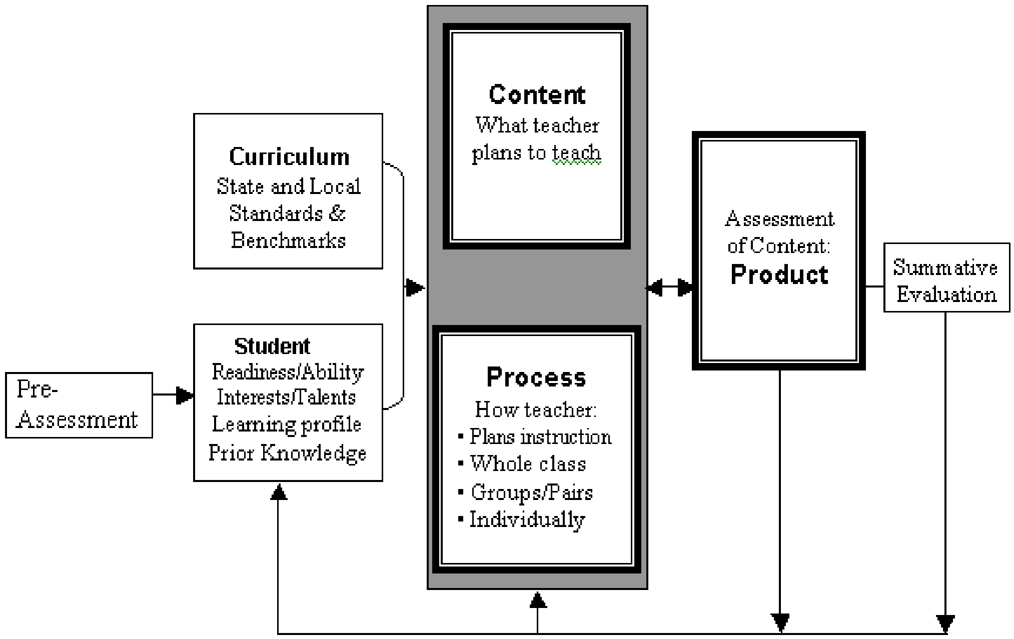


Figure 2.6 Learning Cycle and Decision Factors Used in Planning and Implementing Differentiated Instruction (Hall, 2002; http://www.cast.org/publications/ncac/ncac_diffinstruc.html)

Identifying the various needs of the learners and then differentiating instruction to create multiple instructional paths can be a challenging task as can be seen from the studies carried out on this issue (Tomlison & Dockterman, 2002). Knowledge of how individuals learn may offer various teaching strategies to be used in a science and technology classes. Figure 2.7 demonstrated how teachers' knowledge of how individual learn allows for purposeful choice of instructional methods (Bransford et al., 1999).

In the literature there are also technology integrated solutions. Specifically, some recommended software titles to solve this issue:

- **Thinking Reader,** a product in development at the Center for Applied Special Technologies (CAST), embeds reading and comprehension scaffolds into a digital version of a piece of core literature that the entire class is reading. The program uses text-to-speech to make the content accessible to struggling readers, and built-in strategy prompts help build comprehension. The program can be leveled to reflect growing abilities (www.cast.org).
- **Inspiration,** a wonderful and easy-to-use graphic organizing tool, can help you review book content in a variety of modes that can support multiple LS. An outline of events or ideas, for instance, can also be displayed graphically. Relationships can be shown in text or with boxes and circles. ***Students***, too, can use this flexible tool as a support for organizing their own thoughts and understanding (www.inspiration.com).
- **TimeLiner** takes any sequenced information, puts it in the right order, and displays or prints it as a banner time line, a poster, a scrolling HTML document, or a multimedia slide show. The same data can be viewed in different ways, which, like Inspiration, gives students many avenues by which to reach your *students* at the touch of a button. The ability to annotate events in a time line with notes, images, movies, voice, and links to Web pages offers *students* multiple ways to express themselves. Some in your class may write paragraphs to display their understanding, while others may record their thoughts as attachments to the sequence of events in a chapter.

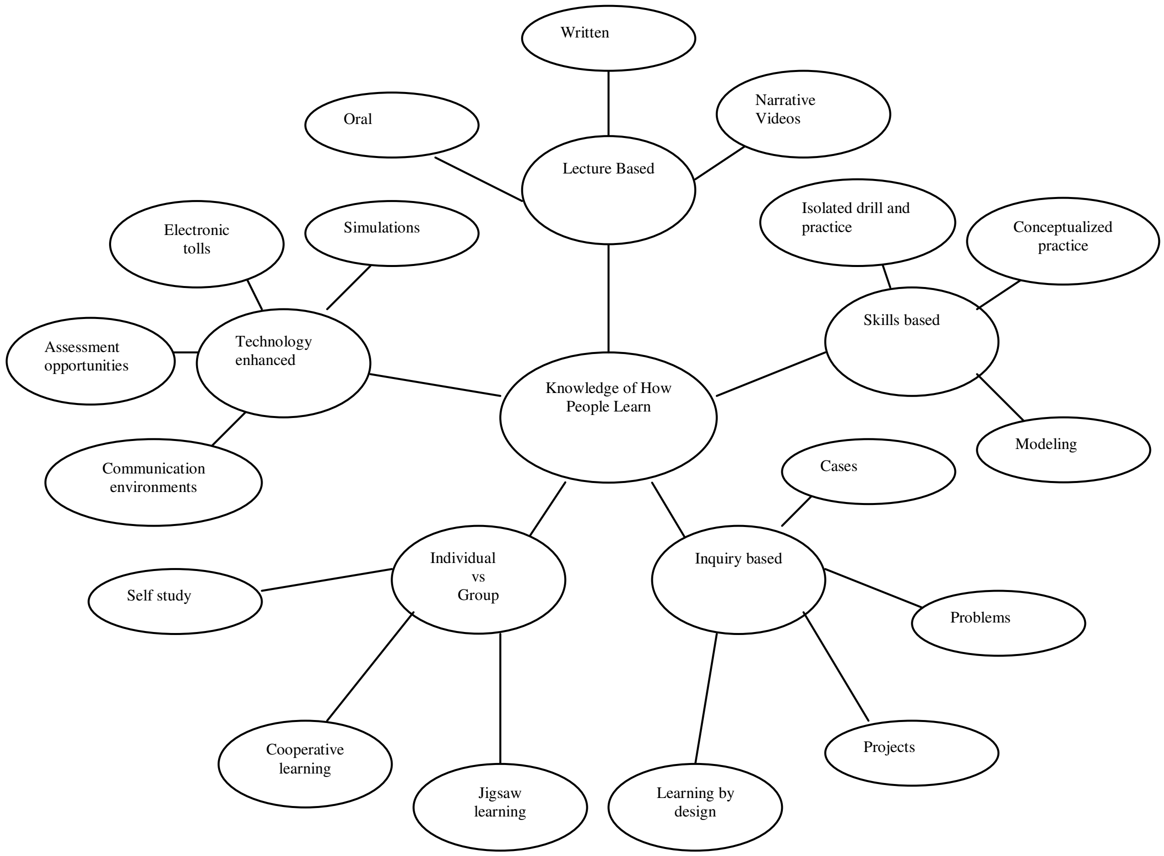


Figure 2.7 How Teachers' Knowledge of How People Learn Allows for Purposeful Choice of Instructional Methods (Bransford et al., 1999).

2.2.5 Teachers` Perceptions and Practices on the TAMBID

Studies investigating students' differences in learning generally indicated that teachers do not use individualized instruction in their lesson (Pool, 1997). For example, Brunkhorst et al., (1993) reported that, only a small number of elementary teachers regularly incorporated innovative strategies in their science lessons. Therefore they pointed out that, for these and other reasons, preparation of teachers to teach science is recognized as the focal point in science education reform and more reseach studies are needed in this area.

In another study, Baney (1998) describe the experiences and perspectives of four 5thgrade teachers as they worked together as a team to implement strategies based on Howard Gardner's Theory of Multiple Intelligences (MI). An observational case study design from a qualitative research approach was used as the teachers planned and began to incorporate teaching strategies based on MI Theory into an interdisciplinary social studies unit on power and responsibility. Throughout the process, participants enhanced their knowledge of MI Theory and gained insights into their own teaching practices through personal reflection and through interaction with each other. By gaining a deeper understanding of the process of MI implementation, as well as the driving and restraining forces associated with it, other teachers can make their own decisions and choices about utilizing MI strategies in their classrooms. The experiences of the teachers in the study also provide insights and implications for education regarding educational change and putting research theory into practice. The results of the study related with the implementation of multiple intelligences in classroom carried out by Baney (1998) were so similar to that of Borrego (1998) in that both emphasized the need for educational change and the importance of multiple intelligences in this reform.

Another study was carried out by MacLeod (2002) to investigate teachers' perceptions of Howard Gardner's Theory of Multiple Intelligences and related practices. The results of the study are encouraging with regard to teachers' perceptions of Gardner's theory (e.g., familiarity, training, applicability, and comparison with other theories of intelligence). Results suggested that this sample of teachers use a variety of different teaching strategies and assessment techniques within their classrooms, reflecting Gardner's eight different intelligences. The teaching strategy that was most frequently practiced was related to Interpersonal Intelligence and the assessment technique that was most frequently practiced was related to Verbal-Linguistic Intelligence. The two teaching strategies and assessment techniques that were least frequently practiced were related to Musical-Rhythmic and Naturalistic Intelligences. The other study conducted by Toth (2002) also aimed at determining teachers' perceptions and implementation of multiple intelligences centered instruction. The research methods included in this study were teacher interviews and surveys. The results yielded similar findings of previous studies in that teachers varied in their implementation of MI centered teaching, but tended to focus their instruction toward the linguistic and logical-mathematical intelligences. Generally, the participating teachers' definition of MI-centered teaching was consistent with the definition of Gardner and they indicated that the use of MI-centered teaching strategies was helpful in their classroom. Maddox (2002) also suggested that teachers could be trained to get a clearer understanding of the multiple intelligences. The authors of the articles carrying out studies related with the perceptions of teachers about MI theory and MI applications in educational setting did not give any information related with the effect size, power or practical significance of their studies. Therefore the results are not trustworthy and need to be replicated to get more accurate results. Besides intelligences of the students, gender of the students is also a research area for individual differences in learning science.

Related to the gender differences in students, Stark and Gray (1999) investigated and analyzed the male and female students' preferences of selecting learning activities to see whether there would be any difference in selecting the learning strategies by the students of different gender to examine the gender factor on strategies used in the lesson. To achive their purpose, first they chose a list of science-based activities including, discussion in groups, teacher explanation to the class, working with apparatus and materials, teacher demonstration to the class, completing a science work-card or worksheet, solving a problem in science, following up on a student's own science question, watching television video about science in the classroom, using textbooks about science in the classroom, writing about some activity undertaken in science and learning about famous scientists (p. 642). The researchers then gave a survey to the students to determine their preferences by gender and analyzed the data. Results showed that there are differences in selection of strategies based on gender differences. However much selected activities were the same by all students. For example, most of the students prefered working with apparatus and materials, watching television videos, discussing science in groups or solving problems but it was observed that girls tended to be more tolerant of seat-bound activities than were boys, in that they enjoyed writing about science and learning about scientists. This study revealed that individual differences in selecting teaching methods and assessment also include gender factor.

The study carried out by Borrego (1998) explored the use of the seven multiple intelligences within the classroom and the teachers' background knowledge in the multiple intelligences. Pre and post surveys were administered to 20 special education teacher interns. Survey questions were based on a 1-6 point Likert scale, in addition to open-ended questions. Pre and post survey percentages were calculated and compared. Pre and post test comparisons indicated a marked increase (85%) in the number of books and articles read by interns regarding multiple intelligences (MI). No differences between pre and post data were shown in self-reflection on multiple intelligence methodology, or reflection of instruction with a colleague or other adult. Finally, analyses of interviews and surveys exemplified that all of the teacher interns utilized some form of student portfolio. Results indicated that training provided in the multiple intelligences enhanced their ability to implement this strategy effectively in the classroom.

Also the results of the some researches in literature demonstrated that reform efforts often ignore teacher beliefs. Additionally, Haney, et al (1996) reported that teachers feel isolated in their efforts to implement science recommendations. They do not believe that the school community supports them in reform implementation. Therefore, investigations examining the belief structures of teachers and other members of the school community are needed to guide the existent science reform efforts.

Reviewing the literature about science education, learning theories and their applications in classrooms revealed that many schools started to integrate the new teaching strategies into their classrooms and even whole curriculum and many researchers have carried out studies to investigate the effect of these strategies on many discipline apart from science. There is one important belief that there is a dependence of Western education on linguistic and mathematic-logical way of teaching and so it is important for the teachers to address the other ways of teaching in science curriculum and reach all of the students by using various teaching strategies (Stenberg, 1994).

National School Public Relations Association (NSPRA, 1971) reported on individualized instruction in USA that teachers which have once adopted individualized instruction techniques will never return to the traditional classroom. And most of the teachers prefer to use individualized instruction. However, teachers who have never used the individualized instruction will have negative feelings and attitudes toward individualized instruction. Primary school teachers' perceptions on individual differences and their needs to include individual differences of the students into science and technology classes are in the scope of this study.

2.2.6 Need and Need Assessment

2.2.6.1 Definition and Levels of Need

It is possible to come across with different definitions of needs in the literature. Reviere, et al (1996) defines need as a gap between real and ideal conditions- that is both acknowledged by community values and potentially amenable to change. This definition has three parts. First, a gap must exist between the real and the ideal conditions in a community. Differences will always exist, and individuals will always be arranged on a continuum from more to less needy. Nonetheless, narrowing the gap is a positive goal. Second, this gap must be perceived and acknowledged as a need by a community.

Berwick (1996) considers need as a gap or measurable discrepancy in what learners need and what they receive in language programs. He defines gap as the inconsistency between the target situation and the present situation. Majority of need assessment (N.A) studies have been based on a variation of one of the three definition of the need:

- Need defined as a discrepancy
- Need defined as a deficit
- Need defined in terms of want or preference (Suarez, 1992).

Levels of need are explained in different categories by various researchers. To clarify the idea that 'NA should be focused on the people in the system', Witkin and Altschuld (1995) proposed levels of needs, each of which also represent a target group for NA. The components of three levels of needs are summarized in Table 2.9.

Table 2.9 Components at the Levels of Needs

LEVEL	**COMPONENTS**	**EXAMPLE**
Level 1 Primary	Service receivers	Students, clients, patients, information users, potential customers
Level 2 Secondary	Service providers and policymakers	Teachers, parents, social workers, administrators, managers
Level 3 Tertiary	Resources or solutions	Buildings, facilities, supplies, technology, programs, class size, transportation, programs

Witkin and Altschuld (1995) stated that many NAs are conducted at Level 2 and they stated that it can be used to determine inservice needs of elemantary teachers where a new program is being instituted. In this study, needs of primary school teachers were assessed by taking their perceptions into consideration in one of the subproblems of the study so the level of need considered in the study was level 2.

There are other classifications of the need. For example, Kaufman's Organizational Elements Model (OEM) proposed that there are three basic levels of needs or discrepancies (Kaufman et al., 1993). The first of them is the external or

Mega level defined as the needs of society and the larger environment. These needs must be assessed first and concern outcomes delivered within the society in which we all live and in which we make our contributions. In the other level named as the Macro level needs should be addressed relating to the nature of outputs which are the products of the institutions and organizations. At the Macro level, we could think of how well organizations are delivering results of benefit to the organization itself and to its partners. The other level is the Micro level. It deals with the results accomplished by individual performers and teams that organizations use to achieve the Macro level and, in turn, the Mega level. Each level depends on each other and at each level, the discrepancy between "what is" and "what should be" must be determined.

2.2.6.2 Prioritizing Needs

Needs assessment process results in the identification of many needs, while the needs of people are infinite, resources required to solve need problems are finite. Therefore the identified needs should be placed in order from most crucial to least crucial so that attention can be given to the most critical needs first. In needs assessment studies, when the needs are identified for a particular situation, priorities of needs can be listed. There are some methodologies to set the priorities. The most common approach for this is the quantitative approach. Witkin and Altschuld (1995) suggested to use quantitative procedures for setting priorities for the ease of application and the ability to defend the procedure. Quantitative approach of ordering needs depend on the strength of their importance, and extent of the discrepancy between targeted and actual status. There are basically two procedures to order needs quantitavely; discrepancy index and the need index. Discrepancy index proposed by Rokey (1975) involves current and targeted state of need on a likert scale. Then the importance of needs are ranked according to the discrepancy that exists between current and targeted state of need. The current state refers to the present perceptions that respondents have in performing their duties, while the targeted state of need refers to the perceptions that respondents should have in order to perform their duties better. The difference between the current rating and the targeted rating constitute the discrepancy. The greater the difference, the greater the discrepancy would be and the greater the negative value, the greater the discrepancy would be and so the greater need (Rokey, 1975). Need index was proposed by Hanson (1978). This approach involves a democratic process where target groups rank order their needs. In this approach, a need index for each item rated on a likert-scale format is calculated. Then the calculated need indices are arranged in order of magnitude. The higher index corresponding to the topmost priority need is listed first, and the lowest priority need is listed at the bottom.

The data collecting instrument for this study was constructed to account for the current state and targeted state and therefore the discrepancy approach to prioritizing needs was appropriate to use in this study.

2.2.7 Conducting Needs Assessment

Determining the learners' needs in order to achieve the desired target situation is seen as the target of any N.A process. There are many different definitions of needs assessment in the literature**.** Also the terms "needs analysis, front-end analysis, goal analysis, task analysis and strategic planning" (Csete, 1996, p. 2) might be used as synonyms for needs assessment. Identification of the needs calls for a systematic way. This systematic way is defined as needs assessment. York (1982) defines needs assessment as "the ordering and prioritization of community needs". Needs Assessment is a process that determines gaps between current outputs or outcomes and required or desired outcomes, and placing these gaps in priority order, and selecting the most important for resolution (Kaufman, Rojas & Mayer, 1993). Another definition of needs assessment was done by Gupta (1999). He defined needs assessment as "a process for pinpointing reasons for gaps in performance or a method for identifying new and future performance needs" (p. 4).

The major purpose of needs assessment is to gather information for setting priorities on needs of people in relation to a system of interest. Review of the literature has identified various rationales for carrying out the needs assessment process. These rationales are (a) Needs assessment used as a decision-making tool, (b) Needs assessment as an empowerment tool.

Soriano (1995) stated that needs assessments are frequently confused with program evaluation efforts. He clarified that a needs assessment may indeed be considered a form of evaluation, because it may suggest that some of the current services are not needed or are lacking. However he added that needs assessment and program evaluation are different as their purposes are different in that needs assessments are used to collect data to assess the need or current use of information or services. The final information from NAs can then be used to make decisions about the allocation of program resources and services. Program evaluations, on the other hand, are mostly designed to evaluate the effectiveness or impact of an agency or program, they may also suggest unmet needs, but this is not their primary purpose.

2.2.8 Philosophies of Needs Analysis

According to Stufflebeam, et al (1985), four divergent philosophies can arise in a needs analysis: the democratic, the analytic, the diagnostic and the discrepancy. The importance of such philosophies lies in the fact that they will affect the types of information that will be gathered.

The democratic philosophy is one in which a need is defined as any change that is desired by a majority of the group involved. Whether this group consisted of the students themselves, their teachers, program administrators, or the owners of a private school, the democratic philosophy would lead to a needs analysis that would gather information about the learning most desired by the chosen groups (Brown, 1995). In the analytic philosophy a need is whatever the students will naturally learn next based on what is known about them and the learning processes involved. A diagnostic philosophy proposes that a need is anything that would prove harmful if it was missing (Brown,1995). Finally, the discrepancy philosophy which constitutes the base of this study, is one in which needs are viewed as differences or discrepancies, between a desired performance from the students and what they are actually doing. The discrepancy or gap model is the most straightforward and widely used, especially in education (McKillip, 1987). The model emphasizes normative expectations and involves three phases:

(1) goal setting, identifying what ought to be;

(2) performance measurement, determining what is;

(3) discrepancy identification, ordering differences between what ought to be and what is (McKillip,1987, p.20).

Other ways of characterizing needs and NA have also been proposed. For example, Cohen (1981) divided NA into two categories-procedures for mobilizing support across various constituency groups and procedures for resource allocation. Our study held discrepancy philosophy by referring to perceptions of different teachers. By revealing the discrepancy between the teachers' needs and their self-rating with respect to their competence, discrepancy philosophy has been assumed.

2.2.9 Benefits of Conducting a Needs Assessment

The most common reasons for needs assessments to be conducted according to Soriano (1995) are justification for funding, regulations or laws that mandate needs assessments, resource allocation and decision-making –determining the best use of the limited resources and as part of program evaluations. He describes the needs assessment in a way that reflects complexity. They call it a tool which leads to determining valid and useful problems which are philosophically as well as practically sound. It is possible to conclude that needs assessment enables us to obtain valid and reliable information which help us to better target our services and efforts. He stated that if a needs assessment is done well, it should lead to actions that will directly benefit those with the needs.

According to Reviere, et al (1996) a needs assessment assures a flexible, responsive curriculum rather than fixed, linear curriculum determined ahead of time by instructors and it provides information to the instructor and learner about what the learner brings to the course (if done at the beginning), what has been accomplished (if done during the course), and what the learner wants and needs to know next. Reviere, et al (1996) stated that needs assessments are tools designed to identify what a particular group of persons lacks to achieve more satisfactory lives. Formal organizations must know what services and programs will adequately remediate or solve problems. Along these same lines, agencies must know if and how well their programs are working. In addition, because today's population is increasingly diverse, service providers and social scientists can no longer assume what they have done in the past remains appropriate for their present constituency. Data acquired from needs assessment are decisions in planning programs and allocating resources.

2.2.10 Needs Assessment Methodologies

There are many approaches available for needs assessment (McKillip, 1987). These approaches take into consideration who will use the information about needs to be developed, resources available (including time), to assess and analyze needs, and the various indicators of need that may be employed that are relevant. For example, there are three models suggested by Smith and Ragan (1992) for needs assessment studies; discrepancy model, problem finding-solving method, and innovation model (Smith & Ragan, 1992, p. 36). Many sources must be considered to obtain an adequate picture of the issues identified in the three models just mentioned. Rosett (1988) suggested that these data can be acquired through a variety of techniques; analysis of subject matter, interviewing, observing, focus groups and questionnaires and surveys.

Witkin and Altschuld (1995) proposed a model for needs assessment including three phases. These phases are:

Phase 1-Pre-assessment. This phase is exploratory. It involves getting organized and focusing on potential areas of concern, finding out what is already known or available about the foci, and deciding to collect in-depth information in a formal NA (Phase 2). Other decisions that could result from pre-assessment are stopping the NA process because the need is not there or concluding that enough is known about needs to proceed to Phase 3 (planning actions to resolve inherent problems).

Phase 2-Needs assessment. Conducting an extensive, formal NA predicated on what is and what is not learned in Phase 1, determining the relative priorities of needs, and conducting causal analyses of needs to identify possible solution strategies are all tasks involved in the actual NA.

Phase 3-Post-assessment. Phase 3 involves moving from knowledge of high-priority needs and their causal factors into designing and implementing solutions within organizational frameworks and evaluating the results of the solution(s) as well as the overall NA process itself.

Even some of the problems in the field have been categorized and documented. Witkin and Altschuld (1995) described difficulties in defining or establishing the "what should be" condition, measuring the "what is" status, determining discrepancies from the two states based on measurements that tend to be flawed, and using multiple methods in the NA studies (1999). At the same time, more recent writings show slow but noticeable changes in perceptions of the NA, concepts related to it, and how the NA efforts are being implemented. They are almost imperceptible, slowly mutating features of the landscape, and they foretell what might happen over time with regard to the practice of the NA.

Witkin and Altschuld (1995) have identified two types of secondary information (i.e., information collected and archived by others) for needs assessments: social indicators and existing agency or institution records. Of these, social indicators are often the most useful for educational needs assessments. Typical sources of educational social indicators are (a) multi-level assessment program results, (b) data from existing needs assessments, (c) related program evaluations, (d) accreditation records, (e) records of student and teacher absences, (h) demographic data, (i) district level census data, and (j) classroom observations (Witkin & Altschuld, 1995). Three basic survey methods for collecting needs assessment data include: questionnaires, interviews, and the critical incident technique. Of these, the written questionnaire is the most common method of collecting needs assessment data (Witkin & Altschuld, 1995). The following questions should be asked by assessors when designing a questionnaire:

1. How does the survey fit with other NA data collection methods?
2. What kinds of questions need to be asked, based on the preassessment?
3. What types of decisions will be made from the collected data?
4. What kinds of questions or items will elicit usable data?
5. How will the data be analyzed and collated with other NA data to establish priorities? (p. 134)

Generally Witkin and Altschuld (1995) classified the data gathering methods for needs assessment into three groups; archival, communication processes, and analytic processes. Table 2.10 summarized the data gathering methods for needs assessment studies (Witkin & Altschuld, 1995, p. 48).

Table 2.10 An Overview of Data Gathering Methods for Needs Assessment

Data Sources	*Description*	*Information Produced*
ARCHIVAL		
Records, logs, social indicators, demographic data, census data, epidemiological studies, data from assessment programs.	Existing data usually found in records of organizations or agencies; some are statistical or other demographic indicators of subgroups in the population.	Quantitative data that help determine the status factors of a target group in regard to a need area
COMMUNICATION		
• Noninteractive Written questionnaires, key informant interviews, critical incident technique, mailed delphi technique	• These techniques use structured forms or protocols that employ a variety of scales and response modes	• Mainly qualitative values, perceptions, opinions, judgements of importance, observations,
• Interactive Public hearings, community forum groups, nominal group technique, focus group interview, DACUM process.	• These techniques involve large or small groups of stakeholders in varying degrees of interaction.	• Mainly qualitative-opinions, expert judgments, group perceptions and perspectives-values, information on causes, decision on priorities.
ANALYTIC		
Fishboning, cause and consequence analysis, success mapping, fault tree analysis, task analysis, trend analysis, force field analysis.	These use various kinds of group processes to examine archival or other data, apply analytic techniques, and produce graphic displays for decision making in NA	Causal and contributing factors, consequences if a need is not met, data can be combined with other information.

In terms of Witkin and Altschuld's classification of needs assessment study, since a questionnaire and interviews were used to collect data from the teachers, the second type, which is the communication method with noninteractive method was used in this study which were conducted to assess the perceptions of teachers on using the TAMBID in science and technology classess.

Soriano (1995) stated that there are three main factors that helps us decide which NA method is the best; (a) Time, (b) Resources, and (c) Knowledge. He added that each needs assessment method differs in the time needed for implementation, the number of people involved, the funding resources required, and the technical knowledge needed so no method is perfect or inherently better than others. Steadham (1980) suggested to use multiple methods of Needs Assessment and not relying on one. The easiest way of obtaining needs assessment information is to interview people, but interviews have limitations as well. The ideal procedure is to "triangulate" the information by collecting it via two or more ways. It is important to get a complete picture from many sources and viewpoints.

- direct observation
- questionnaires
- consultation with persons in key positions, and/or with specific knowledge
- review of relevant literature
- interviews (In-depth or key informant): qualitative method of conducting in-depth interviews with a small number of individuals carefully selected for their personal experiences and knowledge
- focus groups**;** qualitative method involving a small group of people whose discussion is carefully planned and led by an experienced moderator
- records & report studies
- Surveys which are quantitative method involving systematic data collection from a sample of individuals selected from target population; information is used to generate group-level summary statistics; results may be
- work samples

Each of these techniques has its' own advantages and limitations. The advantages and disadvantages of each data collection method were shown in Table 2.11. For example, the questionnaire and survey, which was also be used in this study can gather a lot of information from a lot of people. However, the information reported on these instruments can be highly influenced by what participants think is the desirable response.

Table 2.11 Data Collection Methods in Needs Assessment Studies

Method	**Advantages**	**Disadvantages**
Questionnaire	• May yield large amount of information. • Restricts respondents to specific areas. • Does not require trained interviewers. • Time effective for a large number of participants.	• Requires explicit instructions. • Return rates tend to be low. Try building in an incentive to motivate people to completion. • Requires a significant sample size for an acceptable confidence level.
Observation	• Establishes what people actually *do*, not what they *say* they do. • May be accomplished via trained observers or automatic cameras.	• Requires skilled observers. • May be expensive and time-consuming. • Data not easily quantifiable.
Face-to-Face Interview	• Yields a high response rate. • Provides most information for time spent and most accurate detail. • Provides opportunity to pursue responses for more detail.	• May be costly in both time and money. • May provide extraneous information. • Requires trained interviewers.
Telephone Interview	• Less costly than face-to-face interviews. • Less time-consuming that face-to-face interview.	• Provides no non-verbal feedback. • Respondent may cut interview short.
Group Data Collection 1. A panel of experts or master performers. 2. A focus group of target population.	• Yields a high response rate. • Provides significant amount of information for time spent. • Experts can identify *what is* and *what needs to be*.	• May be difficult to schedule. • Requires some degree of structure. • Dominant participant may bias group response.

2.2.11 Steps in Designing Needs Assessment

There are certain kinds of models with different steps suggested for needs assessment. To begin with, Soriano (1995) summarized the preliminary sequential steps used to design a needs assessment in Figure 2.8 (p. 7).

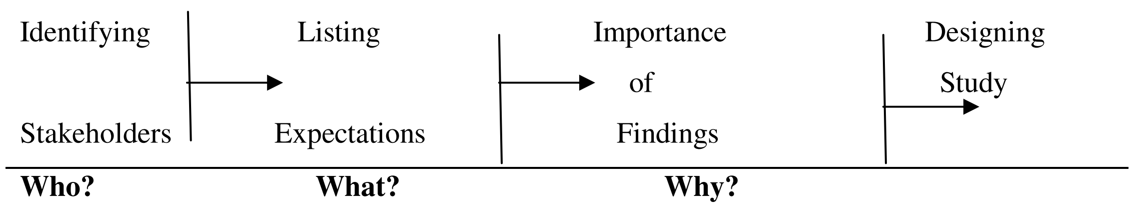


Figure 2.8 Preliminary Sequential Steps Used to Design a Needs Assessment

The steps suggested by McKillip (1987) in needs assessment studies are stated as the following:

1. Identify users and the uses of the needs assessment
2. Describe the target population and the service environment
3. Identify needs
- Describe problems
- Describe solutions
4. Assess the importance of the needs
5. Communicate results

Witkin and Altschuld (1995) also suggested general steps of needs assessment for different data gathering methods which are summarized below:

1. Determine the purpose of the needs assessment
2. Selecting the target population
3. Selecting the level of need

4. Selecting the sample
5. Determining appropriate content and types of items
6. Designing the questionnaire and constructing the interview schedule
7. Designing item formats and scales
8. Applying the questionnaires and conducting the interviews
9. Determining the method or data processing and analysis

To sum up, N.A studies have some general steps to follow and the researchers might select the basic steps based on their purpose of research. The general steps followed in this study are consistent with the suggestions of Witkin and Altschuld (1995) to conduct needs assessment part of this study, using a survey and interview as data collection methods.

2.2.12 Needs of Teachers to Teach Science

There are many needs assessment studies carried out in different institutions in different countries especially on needs of teachers in teaching science. Analysis of the literature about in-service needs of teachers to teach science revealed that, there have been a significant difference between the needs of teachers to teach science from developed countries such as the United States or England compared to the needs of those from developing countries such as Malaysia and Turkey. It has been shown that the needs of teachers to teach science from the developed countries (Baird & Rowsey, 1989) focused more on the development of students such as teachers have difficulties in 'motivating students', 'developing strategies to promote analytical thinking and problem-solving skills' and 'developing strategies on developing conceptual understanding' which are to improve students' higher order thinking skills. Also in developed countries, teachers' the least needed in-service courses was 'the use of internet and the use of computers' (Germann & Barrow 1995) On the other hand, the priority needs perceived by Malaysian science teachers (Abu Bakar & Tarmizi, 1995; Idris, 2002) were focused more of self-improvement of the teachers such as 'being creative in science instruction', 'updating knowledge of science innovations in science instruction' and 'understanding the goals of the syllabus'. Needs assessment studies in other developing countries such as in Philippines (Beasley, 1999) revealed that concerns are in areas such as 'upgrading teachers' competencies in hands-on operation of modern technologies such as computers and laboratory equipments'.

Many research studies revealed that teachers have some specific needs to teach science effectively in any grade in various countries (German & Barrow, 1995; Weiss, 1987; Moore & Blankenship, 1977; Baird et al., 1993; 1994). In the literature, it was observed that the needs assessment studies were mostly carried for secondary stage science teachers. However there are some studies comparing the needs of teachers in different grades. For example, in his study, Stronck (1974) compared the needs of primary, elementary, junior high school and senior high school science teachers by surveying totally 50 teachers. The aim of his study was to demonstrate whether there is a significant difference in needs of teachers in different grades. His results revealed that there are no differences in needs of teachers to teach science. All groups in his study expressed the need to learn how to coordinate the sequence of scientific concepts and process for students to be knowledgeable about recent scientific and technological advances. Differently, only secondary school science teachers have more needs than the primary and elementary school teachers especially about how a scientist works and the identification of values related to citizenship (Stronck, 1974).

Moore (1978) is the other researcher who carried out a study on science teachers to assess their needs. In this study, Moore assessment profile instrument was used. This instrument was administered on 130 science teachers and the results were analyzed by using inferential statistics. The results of the study demonstrated that teachers have some common needs in six areas: (a) Developing basic science teaching skills, (b) Motivating students to learn science, (c) Obtaining and utilizing science materials, (d) Guiding students to set up and achieve realistic goals, (e)

Training in science teaching methods, (f) Providing appropriate and meaningful science experience to students (Moore, 1978, p. 342).

The results of the study carried out by Enochs, Oliver and Wright (1990) by using Kansas science teaching need inventory and application of the inventory on 300 elementary school teachers are also relevant to the previous study. The results revealed that common needs of science teachers in Kansas are related to the lack of interests in science, inadequate student reading abilities, using microcomputers in science instruction, learning new teaching methods and obtaining information about instructional materials (Enochs, Oliver & Wright, 1990, p. 75). The needs assessment study carried out by Gyamfi (2003) on 12 science teachers using Moore Assessment Profile survey instrument to identify the priority needs common to science teachers in Kumasi also demonstrated that teachers have common needs as the teachers in other countries such as more effective use of instructional materials, science books, and in-service training programs.

Baird et al. (1994) administered a multistate survey to science teachers to determine the needs of teachers to teach science. Results of his study demonstrated that teachers have difficulties in updating their teaching skills and hands-on teaching strategies and also in motivating their students to learn, to identify sources of inexpensive materials and to use computers to facilitate instruction. Also the data collected by Baird et al. (1994) using national science foundation survey demonstrated that secondary school science teachers have the common needs of developing instructional materials, learning new teaching methods, implementing discovery/inquiry method to teach science and using hands on approach to teaching (Weiss, 1987).

The results of the needs assessment studies indicated that teachers have some common needs to teach science in many countries. Thus, systematic needs assessments are necessary in order to examine the skills which are needed by a group of learners through different data collection instruments from different sources. Such studies lead to useful decisions regarding the improvement of basic curricular elements. The results of the studies demonstrated that the use of science teaching methods and strategies are among the needs of many science teachers as can be seen from the results of the studies which is one of the concern of this study. In spite of the fact that teachers have some common needs to teach science, in the literature it is proved that there are some teacher variables like sex, grade level, and years of experience have an effect on teachers in service needs (Conkle, 1995; Baird et al.,1993; Moore & Blankenship, 1977). The last subproblem of this study is related with the needs of teachers with their demographic informations.

2.2.13 Studies on Needs of Teachers and the TAMBID in Turkey

In recent years, with such a changing face of the science education in Turkey, there has been an increasing interest among Turkish researchers on teacher perceptions and needs relating to teaching and assessment methods in science lessons. Teacher's practices in classes are getting more importance in educational settings.

For example, Dindar and Yaman (2002) carried out a survey study to determine how efficiently use teaching methods that are conducted by teacher in science course at 4th and 5th class primary school and to determine agents that have negative influence at using teaching methods required in science course. They demonstrated that most frequently used strategies by teachers are expository and questioning methods, mid-frequently used methods are experiment and demonstration methods, and least frequently strategies used by teachers are drama and project methods.

In another study, Karatepe et al, (2004) examined the science curriculum of primary school according to its appropriateness for acquiring the aims of science education and investigated depending on the views of teachers who applied this curriculum. The study was done through making an inquiry to 100 teachers who have been teaching science through 4thand 8th grade in 46 primary schools in Çorum. At the end of the this study, it was concluded that teachers found appropriate the new primary science curriculum for acquiring the aims of teachers' in science teaching at primary schools.

Ogan (2002) carried out a study in Istanbul to identify the in-service needs of high school science teachers according to the subgroups such as school type and gender. About 422 science teachers were surveyed from 75 high school by using Turkish translation of modified version of Science Teacher Inventory of Need (STIN). It was concluded from the data analysis of the results that although there are differences in subgroups, science teachers in İstanbul have the top 10 needs in the areas of: (1) selection of supportive materials for science instruction such as books and films; (2) using audiovisual equipment to improve science instruction; (3) selection and order of science software for microcomputers in the schools; (4) using an inquiry teaching strategy in teaching science; (5) employment of simulation techniques in teaching science; (6) using computers to deliver science instruction; (7) selection and order of science laboratory equipment; (8) directing a field trip; (9) identification of sources for free/inexpensive instructional materials; (10) using the library/media center to support science instruction.

In Turkey, many researchers have also emphasized the importance of student differences in selection of teaching and assessment methods the classrooms. For example, Çavuş (2004) stated that the selection of appropriate teaching and assessment methods based on objectives, content and the environment increases the students' interest, participation and achievement in the classroom. To achieve these, teachers have to use different teaching and assessment strategies. Furthermore he clarified that teaching can be seen as a process in which learning is aimed and the teachers help their students. At that point it is essential to take into account the students' differences and to select the teaching methods based on the differences among students to help the students in this learning process.

More recently, Özbek (2005) also emphasized the importance of individual differences in education. In his descriptive paper based on individualized education curriculum by the method of data scanning, he stated that in a learning unit, there are many factors that affect the learning of students. These factors can be external such as development and growth and internal such as materials, and learning environment. Individual differences, he said, is one of the internal factors and these differences make teachers have to use individualized education curriculum. These individual differences, as he listed, might be maturity, motivation, sense organs, intelligence level, age, attention, stimulus, and prior knowledge. A teacher must take all of these factor into consideration.

Another example of attempt to consider individual differences in Turkey is one by Erden and Altun (2006). They proposed some teaching strategies for students having different LS. For example, recently, in their book Erden and Altun (2006) stated that the basis of individual differences are the heritage and the social environment. They also emphasized the importance of the TAMBID. Furthermore, they summarized all of the LS models mentioned in the literature. They classified the LS under five major topics; LS according to the perceiving and processing the knowledge, the LS according to the preference for receiving the knowledge, LS according to innate personality features, the LS based on skills, and LS according to the preference for working environment. All of these topics have also a long list of components. Importantly, they suggested some teaching strategies for different personality character students. Considering the personality of the students, their proposed teaching activities are shown in Table 2.12. Therefore, if teachers know their students' personality, then they can select the activities according to the students' personality. By this way, they integrate the TAMBID into their lesson.

Table 2.12 Suggested Teaching Methods and Strategies Appropriate for Different Personality Characters

Teaching methods and Strategies	Personality Features				
	Performance based	Production based	Discovery based	Interaction based	Thinking based
Expository Teaching		X	X		
Dramatization	X		X	X	
Demonstration	X	X	X		
Discussion			X	X	X
Individual Project		X	X		
Group Project	X			X	
Cooperative Teaching	X		X	X	X

In the literature, the researcher did not come across a study in which science teacher's needs are explored in terms of the TAMBID.

2.2.14 Summary of Related Literature

Summary of the conceptual framework and review of related literature mentioned in this chapter is given below.

1. Educators have been writing about individual differences among learners for a long period of time. The differences among students are great so that each student needs a specially designed curriculum and yet at the same time it is necessary for learners to be able to work together with others harmoniously (Stahl & Anzalone, 1970; NSPRA, 1971; O' Toole, 1968; Zeitler, 1975; Roach & Hammond, 1981).

2. Planning is essential to provide opportunities for all students to learn science. Therefore, planning is heavily dependent on the teacher's awareness and understanding of diverse abilities, interests, and cultural backgrounds of students in the classroom. A wise balance of content and learning and instructional strategies

provides a foundation for effective science instruction (Gallagher, 1970; Klopfer, 1971; Repicky, 1978; Good & Stipek, 1983; Green, 1982).

3. Student diversity in education usually refers to the effects of gender and ethnicity on student performance. However there are many areas in which the student are so diverse other than these two issue. Four categories of students' differences that have been shown to have important implications for teaching and learning in the literature are differences in students' LS (characteristic ways of taking in and processing information), approaches to learning (surface, deep, and strategic), and intellectual development levels (attitudes about the nature of knowledge and how it should be acquired and evaluated) and multiple intelligences (differences in skills and abilities) (Gardner & Hatch, 1989; Felder & Brent, 2005).

4. There are many patterns of learning and no one teaching method meets the varied needs of all children. It is vitally important to provide alternatives in the educational program. The teacher cannot tell a child how to think. Students come to school with widely different properties like LS, attitudes about teaching and learning, responses to specific classroom environments and instructional practices, skills and motivation. The more thoroughly instructors understand the differences, the better chance they have of meeting the diverse learning needs of all of their students (Stahl & Anzalone, 1970, p. 24).

5. LS theory has much to offer in thinking about the learning environment for students in the classroom. It gives advantage to the teachers to take students differences into consideration. Since 1970s, various types of LS and learning strategies have been reported in the literature (Riding & Douglas, 1993, Smith, 1997; Oxford & Anderson, 1995).

6. Effective teachers must consider student differences in their teaching and learning process. For this purpose, teachers need knowledge of child development, multiple teaching strategies, a variety of assessment strategies, as well as insight into children's LS. The use of a variety of instructional strategies is the key to promoting maximum learning in classroom and while selecting the appropriate instructional

strategies, the needs and interest of diverse groups of learners must be addressed (Dadydov, 1995).

7. Need Assessment (NA) can be defined as “the process of determining the things that are necessary or useful for the fulfillment of a defensible purpose” (Stufflebeam, et al, 1985, p.16). NA is a basic process for humans and organizations. Discrepancy assessment or NA, though often called by different names, is a common activity that is similar in structure across fields such as education, health care, and engineering (Hansen, 1991).

8. There are many methodologies to conduct a needs assessment study. Based on the literature, general steps for conducting the needs assessment part of this study are the (a) literature survey, (b) analysis of wide range of survey questionnaires, (c) contact with others who had conducted similar surveys, (d) interviews with teachers to determine goals, (e) review of the questionnaires by colleagues, (f) piloting of the questionnaires, (g)selection of staff and student subjects, (h) developing a schedule for collecting data, (i) administration of questionnaires, (j) follow-up interviews with selected participants, (k) tabulation of responses, (l) analysis of responses, and (m) writing up of report and recommendations (McKillip, 1987; Witkin & Altschuld, 1995).

9. Teachers have some common needs to teach science in many countries. Among the needs are more effective use of instructional materials, science books, and in-service training programs, developing basic science teaching skills, motivating students to learn science, obtaining and utilizing science materials, guiding students to set up and achieve realistic goals, and training in science teaching methods (Moore, 1978; Enochs, Oliver & Wright, 1990; German & Barrow, 1995; Weiss, 1987; Moore & Blankenship, 1977; Baird et al., 1993; 1994).

CHAPTER 3

METHODOLOGY

In this chapter, the overall research design of the study, data sources, data collection instruments, data collection procedures were explored. Also addressed were procedures for searching databases, ethical considerations, validity and reliability issues, analyses of the data, assumptions and limitations of the study.

3.1. Research Method and Overall Research Design

Table of specification for the overall study containing the subproblems of the study with their corresponding research type, data collection method and the data collection instrument are given in Table 3.1.

Table 3.1 Table of Specification for the Overall Study

Research Questions	*Research Type*	*Data Collection Method*	*Instrument/ Item number*
1. Which teaching and assessment strategies do primary school teachers use in science and technology classes?	Quantitative/ Descriptive Research Qualitative/ Ethnographic and Case Study	Questionnaire Interview Observation	• Questionnaire Section 2- Question 1 a, b, c • Interview Questions 3, 4, 5, 6 • Observation
2. What are teachers' practices related to teaching and assessment methods based on individual differences in science and technology classes? Do they use teaching and assessment strategies focusing on individual differences like learning styles or multiple intelligences?	Quantitative/ Descriptive Research	Questionnaire Interview	• Questionnaire Section 3 • Interview Questions 10, 11 & 12

Table 3.1 (cont'd)

3. What are teachers' perceptions related to new science and technology curriculum in Turkey in terms of teaching and assessment methods?	Quantitative/ Descriptive Research Qualitative Etnographic study	Questionnaire Interview	• Questionnaire Section 2- Questions 2 a,b; 3 • Interview Question 2
4. What are teachers' perceptions related to individual differences of the students?	Qualitative Etnographic study	Interview	• Interview Questions 7, 8 & 9
5. What are the needs of primary school teachers to apply the teaching methods based on individual differences in science and technology classes?	Quantitative/ Descriptive Research	Questionnaire Interview	• Questionnaire Section 4 • Interview Question 13, a, b, c, d, e
6. Do teachers' top priority needs related to teaching methods based on individual differences differ with regard to their gender, grade level, and years of experience?	Quantitative/ Descriptive Research -Causal Comparative	Questionnaire	• Questionnaire Section 1& 4

The research type of this study include survey, causal-comparative, and also qualitative research in nature which are non-experimental research methods because the study describes conditions that already exist and to determine specific characteristics and needs of a group of primary school teachers based on the TAMBID.

3.2 Population and Sample

Target population of this study was identified as all primary school teachers (PST) in the public schools in Ankara. Since it is not possible to reach this target population, accessible population was determined as all primary school teachers who teach science in the public schools in Yenimahalle and Çankaya district in Ankara. This is the population to which the results of the study will be generalized. The number of primary school teachers (PST) in Yenimahalle and Cankaya districts are approximately 430 and 560, respectively. There are about 187 primary schools distributed in Yenimahalle and Cankaya districts. The school names, and the number of 4th and 5th grade classrooms, in Yenimahalle and Çankaya districts are given in Table 3.2.

Table 3.2 Public Primary Schools in Yenimahalle and Çankaya district with respect to Fourth and Fifth Grade Classroom Distributions

School names	Number of 4th and 5th grade PST	School names	Number of 4th and 5th grade PST
Yenimahalle		Çankaya	
Afet İnan İÖO	5	Yeşilkent İÖO	4
Metin Emiroğlu İÖO	4	Yusuf Karaman İÖO	5
Kardelen İÖO	4	Özbirlik İÖO	6
Göktürk İÖO	6	Cebesoy İÖO	4
Atakent İÖO	5	Karataş İÖO	4
Ziya Gökalp İÖO	4	Aşağı İmrahor İÖO	5
Yahya Çavuş İÖO	5	Abdurrahman Şengel İÖO	4
Osman Ülkümen İÖO	4	Gökçe Karataş İÖO	5
Anadolu İÖO	5	Ayten-Şaban Diri İÖO	7
Batıkent İÖO	4	Beytepe İÖO	7
Harzemşahlar İÖO	4	İncesu İÖO	5

Table 3.2 (cont'd)

Afşin Bey İÖO	5	Türkan Yamantürk İÖO	6
Şüküfe Nihal İÖO	5	Dr.Reşit Galip İÖO	5
Susuz Köyü İÖO	4	Maltepe İÖO	6
Oğuzlar İÖO	4	Kemal Atatürk İÖO	6
Şentepe İÖO	4	Or-An Perihan İnan İÖO	5
Prof.Dr.Mehmet Sağlam İÖO	5	27 Aralık Lions İÖO	5
Orhan Cemal Fersoy İÖO	5	Sarar İÖO	6
Refika Aksoy İÖO	6	Fahri Çaldağ İÖO	5
Batıkent İlkyerleşim İÖO	4	Akpınar İÖO	7
Mesa Koru Sitesi İÖO	5	Mohaç İÖO	5
Abay İÖO	4	İzciler İÖO	6
M Ali Durak İ.Ö.O	6	Ulubatlı Hasan İÖO	5
Kooperatifler İÖO	4	Nenehatun İÖO	6
.İbrahim Çoban İÖO	4	Salih Alptekin İÖO	6
G.U Tıp Fakültesi Hastanesi İ.Ö.O	5	Dikmen Necla Kızılbağ İÖO	7
Çalışanlar İÖO	6	Timur İÖO	5
Yahyalar Durali Bezci İÖO	4	Mimar Sinan İÖO	4
Ümit İÖO	5	Misak-ı Milli İÖO	6
Hazar İÖO	5	İl Genel Meclisi İÖO	5
Celayir İÖO	4	Hamdullah Suphi İÖO	3
Gazi İÖO	5	İzzet Latif Aras İÖO	5
Atatürk İÖO	5	Şahinbey İÖO	5
Batıkent Orhan Eren İÖO	4	Ahmet Yesevi İÖO	6
Yunus Emre İÖO	5	İffet Güneşoğlu İÖO	5
İstiklal İÖO	6	Muazzez Karaçay İÖO	5
Kürşad Bey İÖO	4	Nurçin Sayan İÖO	6
Mehmet Ulucan İÖO	5	Sokullu Mehmet Paşa İÖO	4
Avni Akyol İÖO	6	Reşatbey İÖO	6
Mehmet Emin Yurdakul İÖO	5	Yenilik İÖO	5
Ahmet Hamdi Tanpınar İÖO	5	Kavaklıdere İÖO	5
Aşağıyurtçu Köyü İÖO	3	Ahmet Barındırır İÖO	6
Yeşilevler İÖO	5	Yasemin Karakaya İÖO	7
Zehra Önder İÖO	4	Büyükhanlı Kardeşler İÖO	5
Necdet Seçkinöz İÖO	7	Ülkü Akın İÖO	6
Kent Koop İÖO	6	Metin Oktay Mah. İÖO	5
Kayalar İÖO	5	Fatma-Yaşar Önen İÖO	5
Türkan Azmi Köksoy İÖO	4	Süleyman Uyar İÖO	6
Ayşe Tokur İÖO	6	Özcan Torunoğlu İÖO	5
Ostim İÖO	7	Teğmen Kalmaz İÖO	4
M.E.Vakfı Batıkent İÖO	5	Türkiye Noterler Birliği İÖO	6
Faruk Verimer İÖO	6	Yücetepe İÖO	7
Konutkent İÖO	7	Mehmet İçkale İÖO	6
Abdi İpekçi İÖO	5	Köy Hizmetleri İÖO	5
Müjgan Karaçalı İÖO	4	İltekin İÖO	4
Dede Korkut İÖO	6	Muharrem Pakoğlu İÖO	6

Table 3.2 cont’d

Barbaros İÖO	7	Kütükçü Alibey İÖO	5
Demetevler İÖO	6	Eşref Bitlis İÖO	7
Ergazi İÖO	6	Ahmet Bahadır İlhan İÖO	5
Orhangazi İÖO	5	Gökay İÖO	4
İsmail Erez İÖO	6	Ahmet Vefik Paşa İÖO	5
Öğretmen Kubilay İÖO	5	Kurtuluş İÖO	5
Necmi Şahin İÖO	6	Tevfik İleri İÖO	6
Türkkonut İÖO	6	Dedeman İÖO	4
Emin Sağlamer İÖO	7	Turhan Feyzioğlu İÖO	6
Ali Rıza Bey İÖO	6	Ahmet Haşim İÖO	7
Dr.Ümit Yaşar Akyol İÖO	6	Akşemsettin İÖO	7
Onuncu Yıl İÖO	5	Pakize Erdoğu İÖO	5
Mevlana İÖO	5	Kılıçali Paşa İÖO	6
Münevver Öztürk İÖO	4	Ahmet Andiçen İÖO	6
Gazi Osman Paşa İÖO	5	Gülten Kösemen İÖO	6
Mimar Sinan İÖO	6	Seyranbağları İÖO	6
Yuva İÖO	5	Talatpaşa İÖO	6
İvedik İÖO	5	Rauf Orbay İÖO	5
Aselsan İÖO	6	Mithatpaşa İÖO	6
Alacaatlı Köyü İÖO	5	Anıttepe İÖO	7
Sofuoğlu İÖO	6	Mimar Kemal İÖO	4
Ballı Kuyumcu İÖO	5	Atasülün İÖO	5
Memlik Köyü İÖO	5	Milli Egemenlik İÖO	5
Fatih İÖO	6	Çankaya İÖO	6
Çeşme İÖO	4	Boztepe İÖO	5
Çayyolu İbrahim Aydın İÖO	6	Bademlidere İÖO	7
Emniyetçiler İÖO	5	Halide Edip Adıvar İÖO	4
Ayten Şaban Diri İÖO	7	Necla-İlhan İpekçi İ.Ö.O	5
		Nebahat Keskin İOO	6
		Ayten Tekışık İOO	6
		Namık Kemal İOO	7
		Milli Eğitim Vakfı İOO	5
		Kıymet Necip Tesal İOO	4
		Mustafa Kemal İOO	5
		Hüsnü Tekışık İOO	6
		Bilgi İOO	7
		T Emlak Bankası İOO	4
		DSİ. İOO	5
		Arjantin İOO	6
		Ertuğrulgazi İOO	7
		Hasan Özbay İOO	5
		Hürriyet İOO	4
		Özyurt İOO	6

Table 3.2 (cont'd)

		Ziraat Mühendisleri İOO	7
		Erdoğan Şahinoğlu İOO	6
		M. Hikmet Ayberk İOO	5
		Alparslan İOO	4
84	~430	103	~560

Of the 990 primary school teachers, 155 participated in the survey part of this study, which approximately 16% of whole population. Number of schools included was 31 and 38 for Yenimahalle and Çankaya, respectively. Three groups of teachers were involved in this study; for the questionnaire, for the interviews and for the observation. Furthermore, there are two parts in this study; quantitative and qualitative part. The quantitative part of this study includes questionnaire administration and qualitative part includes interviews and the observations. For the questionnaire administration which constitutes the quantitative part of the study, instead of randomly selecting a sample of teachers from every school, because of the time and budget, all teachers in selected schools formed a sample. First, the district was identified and the names of the schools in this district were obtained. The teachers, in each school, then constituted a cluster. The study sample chosen from the accessible population is a sample of convenience. The sample was selected from a group of people available. First, the researcher based on distance, time and budget selected the schools. From the cluster of these schools, the primary school teachers currently teaching science in these schools constituted the sample of the survey study. While determining the sample size, the researcher examined the related literature. As Schumacher and McMillan (2001) suggested, the determination of sample size should take into consideration several factors; the type of research, research hypotheses, financial constraints, the importance of the results, the number of variables studied, the methods of data collection and the degree of accuracy needed. Based on these suggestions, the researcher decided to include 200 teachers to complete the survey. For the interview part of the study, the researcher selected five schools randomly from the ones that questionnaire was administered and then interview with 4^{th} and 5^{th} grade teachers who are voluntarily participated to the interview. The teachers were different from the questionnaire part of the study. For the observation part, the method of selecting the two classrooms was convenient sampling, which is one of the nonrandom sampling methods. It was convenient for the part of the researcher to select a convenient sample however there might be some disadvantages of using a convenient sample which may affect the reliability of the study. Since convenience samples were used in this study, it will not be a good representative of the population. Therefore to minimize the negative effects of convenient sampling, it will be important to include information on demographic and many other characteristics of the sample studied. In this study, many demographic information of the sample consisting of gender, grade level, years of experience, and program graduated were included in the study.

3.3 Overall Design of the Study

The purpose of this study was to identify the perceptions and the needs of primary school teachers in Ankara to apply the teaching and assessment methods based on individual differences in science and technology classes. Both qualitative and quantitative data were collected through the data collection instruments for teachers. A needs assessment questionnaire were administered on 155 primary school teachers. Also the researcher carried out in depth interviews with 13 primary school teachers. Furthermore an observational case study which is participant observation including note taking and video typing in a 4^{th} and a 5^{th} grade science and technology classes was carried out. The general overall design of the study is shown in Figure 3.1.

LITERATURE AND CONTEXT ANALYSIS

DEVELOPMENT OF DATA COLLECTION INSTRUMENTS

SAMPLE	INSTRUMENTS
Primary school teachers (n=155)	Survey
Primary school teachers (different from teachers in questionnaire part) (n=13)	Interview schedule
Science and technology classrooms (n=2)	Observation schedule Video

ANALYSIS OF DATA

RECOMMENDATIONS

Figure 3.1 Overall Design of the Study

This study consisted of more than one data collection methods and each of the data collection methods is related to different research types. For the quantitative part of this study, among the three general types of research methodologies which are descriptive, associational, and intervention types (Fraenkel & Wallen, 1996, p. 13), the quantitative part of this study was a descriptive research study. The most common descriptive methodology in educational research which is the survey method was used in this study to collect data from the teachers. As a research design, survey research determines “the attitudes, opinions, and perceptions of persons of interest to the researcher” (Borg, et al, 1993; p. 21; as cited in Gyamfi, 2003; p. 66). A combined close-ended and open-ended questionnaire was used for this survey research. By use of the closed ended questionnaire, primary school teachers were requested to answer specified questions of interests to the researcher. However, in open-ended part of the questionnaire, there were no specified choices of responses, rather the teachers had the opportunity to express their practices and perceptions.

Three major characteristics of most survey studies are: (1) Information is collected from a large group of people in order to describe some aspects or characteristics of the population. (2) The main way in which the information is collected is through asking questions and the answers of these question constitute the data of the study. (3) Information is collected from a sample rather than from every member of the population (Fraenkel & Wallen, 1992, p. 367). The type of the instrument used in this survey research was the questionnaire. In this study data were collected by direct administration of the survey. A cover letter explaining the purpose of the study was also prepared and was given with the survey to the teachers (Appendix A). Since the survey was applied directly to the teachers, confidentiality and anonymity of the respondents were assured verbally before administrating the survey to the teachers.

According to the new classification of nonexperimental quantitative research (Johnson, 2001), the survey part of this study is descriptive nonexperimental research in terms of research objective because the researcher primarily describing the phenomenon. This study is also cross-sectional in terms of time dimension since the data are collected from the primary school teachers at a single point in time and the sample had been drawn from a pre-determined population. Therefore, the research type of this study based on the classification of Johnson (2001) is Type 2 which is cross-sectional and descriptive.

For the qualitative part of this study, the research type is a case study for the observation part, since only two classrooms were included in the study, and is an ethnographic study for the interview part which contains 13 primary school teachers which is more than a case study included. In the literature it is stated that case and ethnographic studies are powerful since the researcher could be the part of the research. Entirely observation and interviews of the study, and also the open ended questions in the questionnaire comprised the qualitative part of this study. To define qualitative research is not simple by the researchers and many have their own definition and classification. Most of the researchers also used different terms to refer to qualitative study. “Qualitative inquiry”, “field methods”, “descriptive research” and “inductive research” are among the names that various researchers use to call a qualitative study. In spite of these different terms used, qualitative research remains to be the umbrella term and interpreted as referring to the “meaning, concepts, definitions, symbols, and characteristics” (Berg, 1989, p. 2). Cassell and Simon (1994) defined the qualitative research as the methodological perspective of interpretive paradigm in sociology, which seeks to understand the world as it is.

Marshall and Rossman (1999) stated that qualitative research is pragmatic, interpretive, and grounded in the lived experiences of people and it is a broad approach to the study of social phenomena (p. 2). Also Bogdan and Biklen (1998) offer five characteristics of qualitative research; (a) being naturalistic, (b) being descriptive data, (c) concern with the process, (d) being inductive and, (e) meaning. These five characteristics of the qualitative research appear to be common in all studies and a discussion of some of these features with their relation to the qualitative part of this study is explained below.

The first feature is stated as qualitative research is naturalistic meaning that qualitative studies are based on naturalistic inquiry where naturalistic setting is the direct data source. It means that naturally occurring activities and processes were studied in the qualitative studies. The activities are natural when they are not planned and manipulated by the researcher as is in the case in an experiment (Patton, 1987, p. 13). Also the situations are typical or normal ones, reflective of the everyday life of individuals, groups, societies, and organization (Miles & Huberman, 1994, p. 6). This study is appropriate for being naturalistic because the data collected from the teachers through the experiences of them in their science classes. The qualitative data of this study consists of detailed description in the form of words rather than number so it is descriptive in nature. It is in-depth with direct words if teachers’ personal perspectives and experiences. Qualitative researchers are concerned with process rather than sheer outcomes or products. The focus is on the description of dynamic systems and processes and their holistic affects on participants (Patton, 1987, p. 18). In this study, the researcher's major interest is on the processes and their effects on the teachers' perceptions. Qualitative researchers tend to analyse data inductively, that is they construct a picture which is shaped when parts are connected (Bogdan & Biklen, 1992). This study is based on discovery as all research questions are based on the exploration, there is no attempt to prove or disprove anything. Therefore, the research study has an inductive nature. The researcher tried to analyse the data with all its richness as closely as possible in the form of recorded and transcribed format as stated in Bogdan and Biklen (1998). Qualitative research design has some major steps. The design of qualitative research is shown in Figure 3.2 which has major steps also followed in this study as suggested by Yıldırım and Şimşek (2000, p. 51).

\

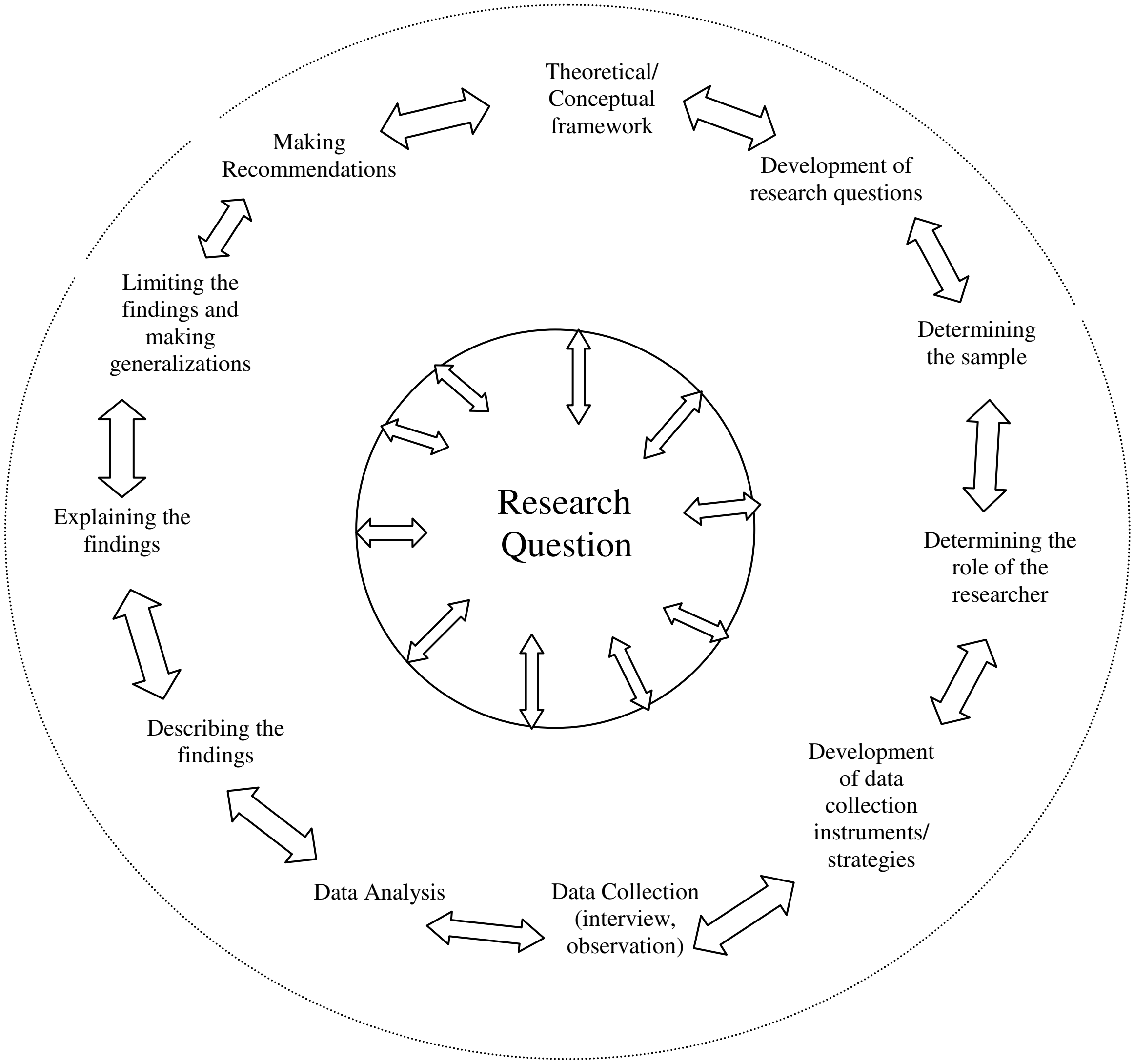


Figure 3.2 Qualiative Research Design (Yıldırım & Şimşek, 2000, p. 51)

Interviewing and observation was the best ways to collect data for the qualitative studies. Rubin and Rubin (1995) see the qualitative interviewing as an adventure into the experiences of others to identify what others think and feel about their worlds. The researcher designed an interview schedule and conducted interviews in their natural settings to gather data on teachers. Bogdan and Biklen

(1998) stated that interviews might be used in two ways. They may be the dominant strategy for data collection, or they may be employed in conjunction with participant observation, document analysis or other techniques. In this study interviewing and surveying were the dominant strategy to collect data, but participant observation was also used in conjunction with interviewing and the questionnaire. Interviewing is regarded as one of the most widely used qualitative method in organizational research (King, 1994) because it is considered as a highly flexible method which provides in-depth data production while the participants feel comfortable. Furthermore, interviewing helps a researcher learn about one's experiences, thoughts, feelings and perceptions. It is an adventure into the experience of others to identify what others think and feel about their worlds (Rubin & Rubin, 1995).

As Marshall and Rossman (1999) emphasized, if the interview is conducted with more than one person, the interview process gathers a wide variety of information across a larger number of subjects than if there were fewer participants. Also in the interviews immediate follow-up and clarification are possible. Combined with observation, interviews allow the researcher to understand the meaning that people hold their everyday activities. However, interviewing has also limitations. For example, interviews involve personal interaction, and cooperation is essential during the process. Interviewees may be unwilling or may be uncomfortable sharing all, which the interviewer may hope to explore, or they may be unaware of recurring patterns in their lives (Marshall & Rossman, 1999, p.110).

Observation is a fundamental and highly important method in all qualitative inquiry. Observation entails the systematic noting and recording of events, behaviors and objects in the social setting chosen for study. The observational record is generally referred to as field notes which are detailed, nonjudgmental, concrete descriptions of what has been observed. There are two types of observations mentioned in the literature, each type having two subcategories. The types of observational studies are summarized in Table 3.4 (Bailey, 1982). Based on this classification, the observational type of this study is Type 1 since the researcher was a participant during the observation and a natural setting which is classroom was observed in this study. The field notes of this study include observer notes and video camera transcripts. This method requires a great deal of the researcher (Marshall & Rossman, 1999; Bogdan & Biklen, 1998).

Table 3.3 Types of Observations in Qualitative Studies

Types of Observational Studies		
	Natural Setting (Fieldwork)	**Artificial Setting (Laboratory work)**
Structured	Type 1 (participant)	Type 3 (non participant)
Unstructured	Type 2 (participant)	Type 4 (non participant)

There are many advantages of conducting a participant observation including; fostering face to face interactions with the participants; usefulness for uncovering participants' perspectives; collection of data in natural setting; facilitating immediate follow-up for clarification; good for documenting major events, crises, and social conflicts; collecting data on unconscious thoughts and actions; usefulness for describing complex interactions, good for obtaining data on nonverbal behavior and communication; facilitating discovery of nuances in culture, providing for flexibility in formulating hypothesis; providing context information; facilitating analysis, validity checks, and triangulation; facilitating cooperation; and allowing wide range of data and participants. Therefore, participant observation is a powerful method if can be used in correct manner. There are also some disadvantages of the method which are; might leading the researcher to miss the forest while observing trees; data to be open to multiple interpretations due to cultural differences; dependency on cooperation of small group of key individuals; difficult to replicate; data often subject to observer effects; dependency on the goodness of research questions;

dependency on openness and honesty of participants; and highly dependent on the ability of the researcher to be resourceful, systematic, and honest (Marshall & Rossman, 1999, p. 135). In this study, as a participant observer, the researcher tried not to miss anything and tried to observe everything that can be useful for the research questions. Also she tried to be systematic, planned, honest and resourceful in all of the session of the observation.

Furthermore, with respect to the aims of the study, the research type of this study is a needs assessment (NA) study as the needs of primary school teachers to apply the teaching and assessment methods based on the TAMBID were explored in sub-problems 5 and 6. As Witkin and Altschuld (1995) stated, there is no one correct way to conduct a needs assessment. There are different approaches for conducting needs assessment such as conducting surveys, conducting interviews, using existing data, employing observation techniques, processes that involve community forum, and focus groups to identify needs. In this study survey and interviews were selected to determine the needs of teachers. Usually, the data collected from a NA study such as survey and interviews yield two categories of data: qualitative and quantitave data (Gupta, 1999). Similarly, in this study, the research method is both qualitative and quantitative in nature as both survey and interviews were used in the study.

In this study, the focus is on the perceptions, practices and the needs of primary school teachers in science and technology classes in applying the TAMBID. Participant observation in this study was aimed to support the findings of other sources of information which are questionnaire and the interview results. Two classrooms were observed by the researcher as a participant observer by taking notes and by recording whole lessons using a video camera for four weeks. The aims of the observation in this study were to determine the teaching and assessment strategies used by the 4^{th} and 5^{th} grade primary school teachers (sub-problem 1), and their practices regarding the TAMBID (sub-problem 2).

Table 3.4 summarizes the data collection methods of the study with corresponding research type and data analysis method.

Table 3.4 Data Collection Methods with Corresponding Research Type and Analysis Method

Data Collection Instruments	Research Type	Data Analysis Method
Survey	Descriptive Research Causal comparative Research Needs Assessment Study	Descriptive Analysis
Interview	Qualitative Research Ethnographic Study Needs Assessment Study	Content Analysis
Observation	Qualitative Research Case Study	Content Analysis

3.4 Procedures

After the research problem of this study is defined, to gain insight about which studies are conducted in the area of interest and the results of these relevant studies, appropriate data sources that would provide a large number of studies related to the basis of individual differences, teaching and assessment methods based on the TAMBID were first determined. The literature search included two phases; in Turkey and outside of Turkey. First secondary sources including textbooks written related to the TAMBID and needs assessment from libraries and Internet-base sources (like amazon.com) had been searched. Then, to find the sources and where to locate these sources that deal directly with the research question, general references had been searched for relevant primary sources. The data sources used are the computerized databases of;

- The Educational Resources Information Center (ERIC)
- Dissertation Abstracts International
- Social Science Citation Index (SSCI)
- Wilson Select Plus
- Springer
- Ebscohost

These indexes have been searched by using the keywords pertinent to the question of interest. The keywords used were “individual differences”, “individualized instruction”, “science education”, “needs assessment’, “primary school teachers”, “teaching science”, “teaching methods”, “assessment methods” and “science teaching strategies”. As there are many numbers of researches carried out in science education in different grade levels, units, subjects and purpose, these databases when searched by the keywords resulted in a large number of journals and articles in this area. The number of the studies declined when search for the combination of the keywords, for instance with the needs assessment and individual differences. For example “dissertation abstract international” yielded 21 doctoral theses when searched for “needs assessment” and 2 theses when searched for both “needs assessment” and “individual differences”. Then the relevant primary sources are obtained from journals in the libraries or from the full text article given in the databases search results. Some of the journals including the relevant articles are journal of educational research, journal of science education, journal of research in science teaching, educational leadership, childhood education, school science and mathematics and so on.

To reach the studies carried out in Turkey, thesis in the library of Turkish Higher Education System (YÖK), Turkish journals including Education and Science, Hacettepe University Journal of Education, Ministry of Education Journal, European Journal of Educational Research, Internet (from search engines), Congress proceeding books published in different cities in Turkey are searched for relevant resources. Totally 31 articles and 6 books were obtained from the sources in Turkey related to needs assessment or individual differences.

3.5 Data Collection Procedures

The purpose of this study was to evaluate primary school teachers’ knowledge, perceptions and needs in implementing teaching and assessment methods based on individual differences in their science and technology classes. For this purpose, 3 different data collection instruments were used in the study as mentioned before: questionnaire, interview schedule and observation schedule.

3.5.1 Perceptions and Needs Assessment Questionnaire for Primary School Teachers to Teach Science based on the TAMBID (PNAQ)

In the first phase of this study, a questionnaire was used, to determine the teaching and assessment strategies used by the 4^{th} and 5^{th} grade primary school teachers (sub-problem 1), their practices regarding the TAMBID (sub-problem 2), teacher's perceptions related to NSTC of Turkey in terms of teaching and assessment methods (sub-problem 3), their needs to apply the teaching methods based on individual differences of students in science and technology classes (sub-problem 5), and whether teachers' needs related to the TAMBID differ with regard to their gender, grade level, the program graduated and years of experience (sub-problem 6). This questionnaire (Appendix A) was designed in a form that both qualitative and quantitative data were collected.

There are 4 sections in the questionnaire of this study. Section 1 is demographic information part. There are questions regarding teachers' gender, years of teaching, level of their teaching and so on. This section of the survey was used to determine whether teachers' needs related to teaching methods based on individual differences differ with regard to their gender, grade level, the program graduated and years of experience (sub-problem 6).

Section 2 includes questions related to teacher's perceptions on NSTC of Turkey in terms of teaching and assessment methods. The questions in this section were open-ended questions and prepared to determine the teaching and assessment methods used by primary school teachers, and also teachers' perceptions and experiences in terms of teaching and assessment methods in NSTC of Turkey. In this respect, this section of the questionnaire was used to answer the 1^{st} and 3^{rd} subproblems of the study.

Section 3 of the questionnaire included questions regarding to teachers' practices in the TAMBID. In this section, teachers were given 60 items related to daily classroom teaching and assessment practices based on the TAMBID and they were asked to place the number (From 5 meaning "Frequently" to 1 meaning "Never") that best describes their perception of how much they use the given strategies in their daily classroom teaching and assessment practices. This section of the survey was used to give answers to 2nd subproblem of the study.

Section 4 of the survey involves current and targeted state of need on a likert scale. The current state assess the teacher's present perceptions that they have in terms of the TAMBID, while the targeted state of need was to assess teacher's perceptions that they should have in order to integrate the TAMBID into their science and technology lesson. This section of the survey was used to give answers to 5th and the 6th subproblems of the study.

3.5.2 Administration of the PNAQ for Data Collection

Before starting to collect data in this study, permissions for administering the questionnaire was obtained from MEB. To request for the permission, a cover letter introducing the researcher and the advisor of the study, purpose of the study, the voluntary participations of the subjects and the assurance of the confidentiality of the study was sent to the MEB. A copy of the correspondence and the cover letter sent to MEB for permission by the researcher to conduct the study was included in the Appendix I. It takes about 6 months since there were some regulations in MEB about getting permissions to conduct a study at that time. The cover letter was re-written in that period based on the new requirements of MEB. To satisfy the requirements, a detailed summary of the research study (Problem, purpose, significant, method, and the practical significance of the study), the list of the schools in Yenimahalle and Çankaya district, and the questionnaire that would be administered were added to the cover letter for the study permission. The permission letter from MEB to apply the questionnaire was included in Appendix J.

After taking all requisite permissions to apply the survey, the researcher and ten preservice science teachers visited most of the primary schools in Yenimahalle and Çankaya district and handed out the questionnaires. The questionnaires were accompanied by cover letters to the participating teachers explaining the purpose of the survey and assuring them for the confidentiality of their responses, and requesting their cooperation. The teachers were given three weeks to respond the questionnaire. At the end of the specified time period, the questionnaire instruments were collected from the schools. The data collection procedure for the survey took about seven weeks. The number of the survey distributed to the schools was 200. The researcher collected 162 questionnaires from the schools. Therefore the return rate was %81. The researcher examined the questionnaire instruments before starting to data analysis. Among 162 questionnaires, 7 of them were not included in the analysis as there were many missing data in the items especially to test the dependent variable and so listwise deletion of the items was carried out. Therefore totally 155 survey instruments were included in the analysis of data. In this phase, because the subjects provided the infromation in the survey, the survey type used in this study was a subject-completed instrument. The research measure for this study was a questionnaire, which is a written response type instrument.

3.5.3 Interview Protocol

In the second phase of the study, the researcher carried out in-depth interviews with selected 13 participants from the sample. 13 primary school teachers were selected from Yenimahalle and Çankaya district mostly by taking willingness of teachers into consideration. The profiles of the interviewees were tabulated in Table 3.5. The purposes of the interviews were to determine the teaching and assessment strategies used by the 4^{th} and 5^{th} grade primary school teachers (sub-problem 1), their background knowledge and practices regarding the TAMBID (sub-problem 2), teachers' perceptions related to NSTC of Turkey in terms of teaching and assessment methods (sub-problem 3), teachers' perceptions on individual differences of the students (sub-problem 4), and teachers needs to use the TAMBID (sub-problem 5).

After determining the teaching and assessment methods used by the teachers, their practices based on the TAMBID and their perceptions on NSATC in the first phase of the study, interviews provided detailed information about teachers' perceptions, practices and needs in applying the TAMBID. In the interviews, participants were asked questions to explain their teaching practices on the TAMBID, their perceptions about individual differences and to describe any barriers that they are experiencing (or that they experienced) that would affect their capability to practice the TAMBID in the science and technology classroom. The interview protocol of this study was also summarized in Appendix B.

Table 3.5 Demographic Distributions of the Interviewees

	INTERVIEWEES												
	1	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*	*11*	*12*	*13*
Gender	*F*	*M*	*F*	*F*	*M*	*F*	*F*	*M*	*F*	*F*	*F*	*F*	*F*
Grade Level	*5*	*5*	*4*	*5*	*4*	*5*	*5*	*4*	*4*	*5*	*5*	*4*	*5*
District	*2*	*1*	*1*	*2*	*2*	*2*	*1*	*1*	*2*	*1*	*1*	*1*	*2*
Program Graduated	*T.T*	*P.B.*	*T.T*	*T.T*	*P.B*	*P.B*	*P.B*	*P.B*	*P.B*	*P.B*	*T.T*	*T.T*	*T.T*
Years of Experience	*34*	*26*	*30*	*30*	*26*	*27*	*19*	*25*	*30*	*27*	*36*	*16*	*17*

F:Female, M: Male;1;Yenimahalle, 2; Cankaya B: Bachelor, PB: Pre-Bachelor, T.T: Teacher Training School

3.5.4 Framing and Conducting the Interview

After selecting a sample of the interviewees from 4th and 5th grade primary school teachers, the researcher had made appointments with all 13 interviewees. The number of interviewee was determined by the subjective judgment of the researcher. Indeed qualitative interviews do not attempt to gain high numbers of subjects to allow hypothesis to be tested for statistical significance, the appropriate number of participants is determined by the researcher (Doyle, 2004). As she suggested, the researcher stop interviewing when, in her opinion, she had obtained a complete understanding of her chosen topic.

Each of the interviews lasted approximately 45 minutes. Three of the teachers did not want to continue to the interview if their voice was recorded, so their answers were written by the researcher instead of using a recorder. Before the interview started, first the researcher informed the interviewees on the purpose of the interview, permission for audio recording, confidentiality of data, estimated time for the interview period and if the interviewee had any questions to ask. After brief explanation of these statements, the interview had started with each interviewee and the researcher prompted a question and listened to the reply intensively. The researcher also tried to keep the interviewees at ease and talk freely about their points of view. Some of the interviewees produced rich data filled with words. Transcripts of them are filled with examples and details. In a few of the conversations with the interviewee, the interviewer asked some questions for clarification when the topic seemed unfamiliar to them. They asked questions like, 'What do you mean?" or "Can you repeat the question?'. This occurred for example while asking the question in the first draft of the interview schedule, What is your opinion about individual differences? (Question 7)'. After the researcher repeat the question or used the alternative question "In what respects do you think that your students are different?", the interviewee gave answer to these questions in a relaxed mode. The interviews were all conducted in a silence place; in a teachers' room or in a meeting room in the school where the interviewee is a teacher. To conduct the interviews in a silence place is an important issue for interviewing. Besides all these factors, there are many minor but important factors the researcher was aware of during and after the interview. For example, the interviewer asked only one question at a time and waited until that question had been answered before asking the other question, alternative question or probes. Sometimes the participants did not give related answers to the questions or they gave too long answers. To handle this issue, the researcher followed the suggestions of the researchers in the related area. For instance, Bogdan and Biklen (1998) stated that silences can enable subjects to get their thoughts together and to direct some of the conversation. Also as they suggested if the interviewees were talking at length about a topic the researchers had no interest, the researcher did not interrupt the interviewee and did not try to change the direction of the conversation.

Also, the interviewer tried to encourage responses with gestures or verbal cues and gave full attention to the teachers at all times during the interviews. Furthermore, when making transitions between topics, the researcher made it clear that one topic was over and a new topic is beginning. The researcher digitally recorded most of the interviews and transcribed the interview short after the interview to give them to the interviewee to ensure the accuracy of transcriptions and additional comments. The researcher took these points into consideration during all interviews. In this study, the interview process including all details like transcriptions and making corrections on the final documents lasted about 4 months.

3.5.5 Observation Protocol

In the literature it is clarified that a few researchers rely extensively on still and video footage, even employing visual recording as the prime data collecting approach. It is stated that although cameras have significant potential as a data collecting aid, most of the qualitative researchers do not use cameras or other visual recording equipments as they shy away from cameras or just do not feel competent with a camera as they have not mastered the technical aspects of the equipment. However, it is suggested that a camera can be used in any manner in a setting. It is known that objects and settings contain more information than it is in a written form (Bogdan & Biklen, 1998). At the very beginning of the study, the researcher thought to have an experienced photographer who understand qualitative researcher but she could not find such a person. Indeed, (Bogdan & Biklen, 1998) declared that “a good photographer may not be a good observer” (p. 103). The other issue is that the researcher is more knowledgeable than a photographer about the purpose of the study and about what to be observed in the classroom. The researcher and the photographer might have studied collaboratively but in that case there will be two participants observer in the classroom which may affect the behaviors of the students and the teacher (Bogdan & Biklen, 1998). Therefore the researcher educated herself to learn the every aspects of being a participant observer and to use a video camera technically. By using a video camera, as Yıldırım and Şimşek, (2000) stated, the researcher did not feel herself to take short and quick notes and the observation was more productive for the part of the researcher. Since the researcher used a video camera to record whole lessons during the observations, she took short notes that might be overlooked or might not been noted with a video camera, and can be useful for answering the research questions. Note taking process was carried out by using a classroom observation note taking form (Appendix G). The notes taken in the lessons and the video transcripts were then compared and unified to comprise the observation records based on the research questions to prepare for the data analysis.

In this study, the researcher observed 24 hours of science and technology lessons as a participant observer in two classrooms for four weeks to answer the 1st sub-problem of the study. Table 3.6 summarizes the profile of the observation process. By filling the checklist, taking notes and using a video camera 24 hours of science and technology lessons were recorded. Permission of the teachers and the parents of the students in the classroom to record the lessons with a video camera were taken with a consent letter (Appendix H). In qualitative studies, it is not possible to observe everything in an observation process. Therefore before starting an observation, the researcher revealed clearly what and in which content to be observed, meaning that the researcher had a direction or tendency so it was useful to prepare an observation schedule before starting to the observation process. In this study, before the observation process was started, the researcher clarified the purpose of the observation. In light of the purpose of the observation, the dimensions of the observation were determined and an observation schedule was prepared. To decide and determine what, how and how much will be observed, the researcher observed two hours of the classroom where the observation would take place as a trial.

The observation schedule of this study was prepared based on the suggestions of Yıldırım and Şimşek (2000) (see Appendix F). The observation protocol of this study was summarized in Appendix E.

Table 3.6 Observation Process Profile

OBSERVATION	**Class 1**	**Class 2**
Grade Level	4	5
Class Size	32	28
Unit Covered	Living Organisms	Light and Sound Electricity
Duration of the Observation	4 weeks	4 weeks
Hours of Observation	12	12

3.5.6 Participant Observation

In this study, the researcher carried out observation as a participant observer. As Patton (1987) stated, to be a participant observer (or complete participant, covert participant observation) has some advantages over nonparticipant observation such as (a) the researcher participates in activities of the community, observes how people behave and interact with each other and outside organizations, (b) the observer tries to become accepted as a participant rather than as an outsider. The purpose of such participation is not only to see what is happening but to feel what it is like to be part of the group, (c) the extent to which this is possible depends on the characteristics of program participants, the type of questions being studied and the socio-political context of the setting, (d) the strength of this approach is that the researcher is able to experience and presumably better understand any project impacts. However, the main weakness of being a paricipant observer is that it is likely to alter the behavior that is being observed.

Patton (1987) defines five dimensions to describe major variations in field observations and they can be used to help make decisions about the parameters of a particular observation session. The first observational strategies concern the extent to which the observer is also a participant in the activities in the group being studied. Second concern is the extent to which fieldwork is overt or covert. Explicitness about research purpose is the third concern about the extent to which the purpose of the observation is made explicit. That is, it is related with the concern of whether or not informing the people about your aim, and if so to what extent**.** Another dimension along which observational studies vary is the length of time devoted to data gathering. Lastly, the major factor that affects other dimensions is the scope or focus of the study. These dimensions are graphically summarized in Figure 3.3.

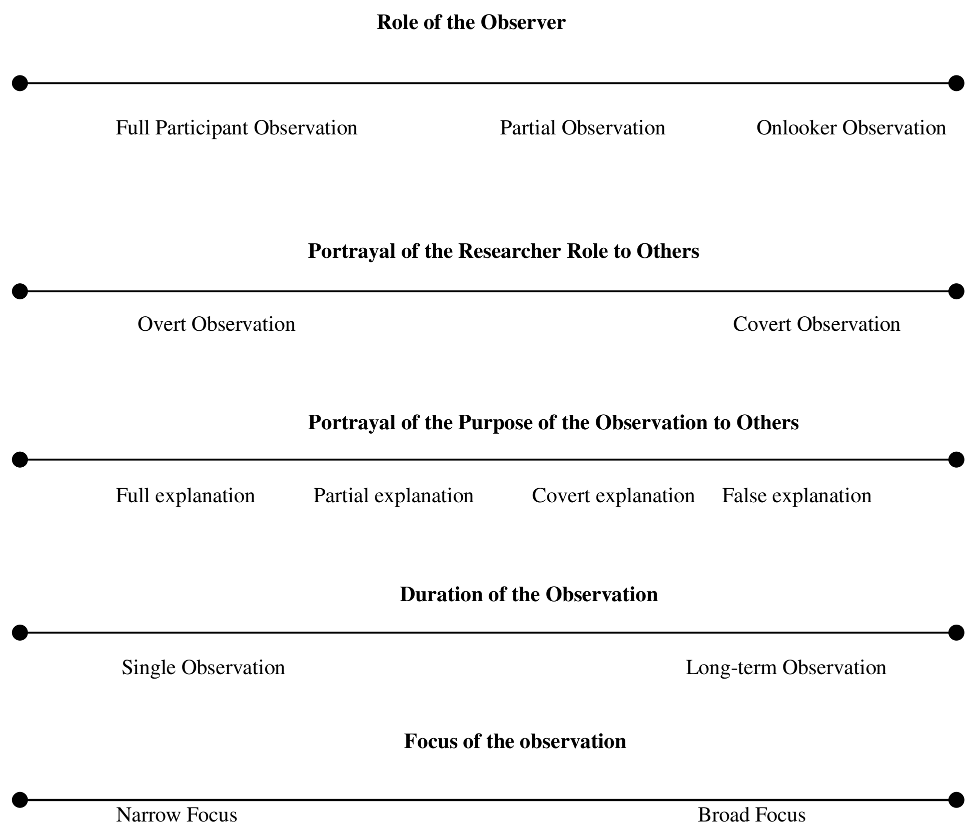


Figure 3.3 Five Dimensions Along Which a Fieldwork Varies (Patton, 1987)

For this sudy, based on the dimensions of the fieldwork proposed by Patton (1987) as shown in Figure 3.3, it can be said that, in terms of the role of the observer, the observation was onlooker observation since observer observed the whole process by taking notes and recording with a video camera not by participating the class activities as a researcher or as a teacher. Observer carried out overt observation since all subjects including the teacher and the students were aware of the presence of the observer. As for purpose of the observation, it was full explanation because the teacher and the students in the classroom were informed about the purpose and every aspects of the study. Duration of the observation in this study was four weeks, so in terms of duration, it was a long term observation. Lastly, focus of this observation can be considered as a narrow focus because there are hundreds of areas that can be observed in a classroom but the focus of observation in this study was generally on teaching and assessment methods.

3.6 Development of the Questionnaire, Interview and Observation Schedule

In this section a detailed description of the procedures to develop the questionnaire, interview schedule and observation schedule of the study were explained.

3.6.1 Development of the PNAQ Questionnaire

The questionnaire "Perceptions and Needs Assessment Questionnaire for Primary School Teachers to Teach Science based on the TAMBID" (See Appendix A) was designed in a form that both qualitative and quantitative data were collected. The questionnaire was developed by the researcher. Before developing the questionnaire, the researchers searched the instruments that can be appropriate to be used for this study. Based on the new science and technology program of Turkey and the questionnaires found in the literature, the researchers developed a new questionnaire to be used in this study, by satisfying the purpose of the study. In an effort to ensure the validity and reliability of the questionnaire used in this study, different questionnaires were searched. Most of the questions in the questionnaire of this study were added from General Qualified Teaching Profession Questionnaire (MEB, 2004) prepared based on aims of the new science and technology curriculum of Turkey. Some of the questions were also added based on the literature. There are a number of survey instruments to be used in the literature on determining teachers' concerns and needs to teach science and on their use of various teaching and assessment methods. On choosing a needs assessment instrument, several criteria such as using a simple and an understandable language, relation to the purposes of this study, proven validity and reliability, and relation to the teachers' professional needs based on the TAMBID were considered. Among the questionnaires in the literature, Teacher's perceptions and practices of Gardner's theory of multiple intelligences developed by MacLeod (2002), Science Teacher Inventory of Need (STIN) developed by Zurub and Rubba (1983) and Moore assessment profile developed by Moore (1978) were selected by the researcher. None of these questionnaires were used exactly the same in this study but a few of the items of these questionnaires were used after translating into Turkish and some modifications were made on the items based on the purpose of the study. The final form of the questionnaire which is the Perceptions and Needs Assessment Questionnaire for 4th and 5th grade Primary school teachers to Teach Science based on the TAMBID was used in this study as a data collection instrument.

There are 4 sections in this questionnaire. As explained in detail in Chapter 3, Section 1 is demographic information part, the questions are related to the teachers' gender, years of teaching, level of their teaching and so on. Section 2 includes questions related to teacher's perceptions on new science and technology program in Turkey in terms of teaching and assessment methods. The questions in this section were mostly open-ended questions and mostly related to teachers' knowledge and experiences in terms of teaching and assessment methods in new science and technology program in Turkey.

Section 3 of the questionnaire included questions regarding to teachers' practices on the TAMBID. The item format of this scale was the five-point Likert scale. Teachers were asked to rate the statements by marking a five-point Likert scale with the possible responses from “Frequently used strategy” to “Unknown strategy” that best describes their perception of how much they use the given strategies in their daily classroom teaching and assessment practices.

Since teachers’ practices on the TAMBID may contain many domains; such as teaching methods, assessment methods, perceptions on the TAMBID, application of the TAMBID, general approaches of the TAMBID, first of all 63 items were written for Section 3 of the questionnaire to capture thoughts and practices related to these domains. These items were prepared based on the publications on teaching and assesment methods, individual differences and science and technology education (Açıkgöz, 96; Güneysu, Çağlayan & Kaygısız, 2005; Harlen, 1998; Hoerr, 1996; McAnarney, 1997; MEB, 2005; Newport, 1973; Orlich, 2004, Özdemir, Güneysu & Tekkaya, 2006). At the beginning, three domains were decided for the questionnaire; general approaches on the TAMBID, teaching methods, and assessment methods. It is hypothesized that the items 1, 2, 3, 6, 7, 8, 9, 10, 11, 12, 13, 14, 18, 19, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 37, 40, 43, 44, and 45 were belonging to general approaches on the TAMBID domain; items 4, 5, 15, 16, 17, 20, 21, 22, 23, 36, 38, 39, 41, and 42 were belonging to teaching methods domain; and items 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58, 59, 60, 61, 62 and 63 were belonging to assessment methods domains. After preparing the first draft of the questionnaire with hypothesized three domains, it was piloted on 8, 4th and 5th grade primary school teachers from public schools. After pilot study and based on two expert opinions, questions 9, 13, 20, 31 were dropped for several reasons which will be explained in detail in “Validity and Reliability” part.

3.6.1.1 Discrepancy Needs Model

The design of the section 4 of the instrument was based on the discrepancy needs model. As stated in Chapter 2, discrepancy is defined to mean a difference between current and targeted status. The four components in a discrepancy needs assessment procedure were considered to prepare this section of the questionnaire; (1) determining desired conditions, (2) determining existing conditions, (3) determining discrepancies between current and targeted state of conditions, and (4) analyzing and assigning priorities to the discrepancies. The discrepancies constitute indices of need. In this discrepancies needs format, teachers rate specific statements on two column five point Likert scale; (1) perception of the degree to which the situation actually exists and so the current state assess the teacher's present perceptions that they have in terms of the TAMBID, and (2) perception of the extent to which the situation is desired to exist so that assess teacher's perceptions that they should have in order to integrate the TAMBID into their science and technology lesson.. By this way, it would be possible to determine the discrepancy between the two scale values for a specific item and to calculate a need index.

Needs assessment instrument for this study was developed by the reseacher to obtain information regarding self-perceptions of primary school teachers for using various teaching strategies and their desire for training in these areas. The items for needs analysis in the questionnaire were selected from General Qualified Teaching Profession Questionnaire (MEB, 2004) and also some items were added based on suggestions of National Science and Techology Curriculum related to the TAMBID (MEB, 2005). Based on the literature, five domains of needs of clasroom teachers were determined to assess needs by using section 4 of the questionnaire; "Needs related to knowing student's developmental characteristics", "Needs related to considering student's needs and interest", "Needs related to competency for the arrangement of learning environments", "Needs related to differentiation of teaching and assessment considering individual differences", and "Needs related to effects of possible exterior factors". This section have 26 items based on categories of the primary school teachers' needs. There are 6 items related to the category A, 5 items related to category B, 5 items related to category C, 5 items related to category D and 6 items related to category E. The items in this section including the needs with their related categories are tabulated in Table 3.7. Corresponding categories were designated with the related item number in the table.

Table 3.7 Needs Assessment Items in the PNAQ with the Subcategories

Needs	
Item	Correspondin g Category
1. Öğrenci farklılıklarını göz önünde bulunduran yeni öğretim yaklaşımları ile ilgili yeterli bilgiye sahibim.	C1
2. Ders planlarımı öğrenciyi merkeze alarak hazırlarım.	B1
3. Öğrencilerin gelişim düzeylerini ve bireysel farklılıklarını belirlemek için çeşitli teknikler (gözlem, karşılıklı görüşme, ölçek, bireysel ve grup projeleri vb.) kullanırım.	A1
4. Uygulamalarımda öğrencilerimin gelişim düzeylerini ve ilgi alanlarını dikkate alırım.	A2
5. Öğrencilere onların gelişim düzeyi, öğrenme biçimi, ilgi ve gereksinimlerine uygun ödev ve sorumluluklar veririm.	A3
6. Öğrenciye ait bilgileri sınıf içi ve dışı çalışmaları çeşitlendirmekte kullanırım.	A4
7. Öğrenciye ait bilgileri öğrenme-öğretme sürecini planlama, uygulama ve değerlendirmede kullanırım.	A5
8. Öğretme-öğrenme sürecinde öğrencinin ilgi ve ihtiyaçları doğrultusunda değişiklikler yaparım.	B2
9. Bilgi ve iletişim teknolojilerini kullanarak, farklı deneyimlere, özelliklere ve yeteneklere sahip öğrencilere uygun öğrenme ortamları hazırlarım.	B3
10.Öğrencinin farklı ihtiyaçlarını dikkate alarak öğrenci merkezli stratejileri destekleyen teknolojiler kullanırım.	D1
11.Öğrencilerin farklı ön yaşantılarını öğrenme ortamlarını düzenlerken dikkate alırım.	C2
12. Öğrenme ortamlarını etkinlik türüne göre düzenlerim.	C3
13. Fen ve teknoloji dersi ile ilgili materyal kullanmada yeterli donanıma sahibim.	C4
14. Derslerimde kullanmak üzere kolay bulunur ve ucuz materyallere ulaşabilirim.	C5
15. Materyalleri hazırlarken ve seçerken bireysel farklılıkları dikkate alırım.	B4
16. Farklı ihtiyaçları dikkate alarak öğrenme etkinlikleri düzenlerim.	D2
17. Öğrencilerimin öğrenme stilleri ve zekaları ile ilgili bilgi toplarım.	A6
18. Öğrencinin ilgi ve ihtiyaçları doğrultusunda değerlendirme yöntemlerini çeşitlendiririm.	B5
19. Ölçme ve değerlendirme yaklaşımlarını çeşitlendirirken bireysel farklılıkları dikkate alırım.	D3
20. Çok yönlü değerlendirme için alternatif ölçme araçlarını belirlerim (portfolyo, kavram haritaları, gezi, gözlem, görüşme vb.)	D4
21. Ölçme sonuçlarına göre hedefleri, öğrenme ortamını ve ölçme araçlarını yeniden gözden geçiririm ve kayıtlar tutarım.	D5
22. Bütün bunları (1-21 arası şıkları) uygulayabilirim çünkü bu sistem okul yönetimi tarafından benimsenmiştir.	E1
23. Bütün bunları (1-21 arası şıkları) uygulayabilirim çünkü bu sistem diğer öğretmenler tarafından da uygulanmaktadır.	E2
24. Yeni yaklaşımları uygularken veliler tarafından destekleniyorum.	E3
25. Sınıfım çok kalabalık olduğu halde öğretim-öğrenim sürecimde bireysel farklılıkları göz önüne alan yöntemleri kullanırım.	E4
26. Bireysel farklılıkları göz önüne alan yöntemleri kullandığımda öğretim programı yetiştirebiliyorum.	E5
27. Bireysel farklılıkları göz önüne alarak dersimi işlediğimde öğrencilerimi disiplin etmekte sorun çıkmıyor..	E6

A
Needs related to knowing student's developmental characteristics

B
Needs related to considering student's needs and interest

C
Needs related to competency for the arrangement of learning environments

D
Needs related to differentiation of teaching and assessment considering individual differences

E
Needs related to effects of possible exterior factors

3.6.1.2 Reliability and Validity of Questionnaire Instrument

Most of the questions were selected from the published instruments of the other researchers including General Qualified Teaching Profession Questionnaire (MEB, 2004), MacLeod, 2002, Zurub and Rubba (1983), and Moore (1978) and it can be considered as a test validity of the questionnaire instrument. Face validity of the questionnaire was established by two methods. First, five experts consisting of faculty members from different universities reviewed the questionnaire for its content. The researcher prepared a table of content for the instrument for the faculty members including a short knowledge about the purpose of the study and the instrument. Then experts read through the questions in the questionnaire by relating them with the problems of the study. They reviewed the items in the questionnaire according to the given table of specification by for example evaluating the representativeness of the content by the selected items, comprehensiveness of the items, and formatting. The revisions on the questionnaire were made based on their suggestions. Second, the questionnaire was field tested as to its content and response format with eight fourth and fifth grade primary school teachers. Among them three have taught science in primary school for more than 10 years and the other teachers have teaching experience ranging between 2 to 6 years. All members were working at different schools other than the sample of this study in Yenimahalle and Çankaya district. These teachers were chosen because they showed interest in the study and they were voluntarily involved in the pilot study. Actually the purpose of the pilot study was to test the applicability of the questionnaire for the primary school teachers to the primary school context. A cover letter including, the purpose of the questionnaire, table of specification and also additional page that contained the following questions and statements was attached with the questionnaire.

1. Are there any items on the questionnaire that you do not understand?
2. Are there any items that do not consistent with the new science and technology curriculum?
3. Are there any items that overlap with each other?

4. Write down any comments or suggestions that you think to improve the questionnaire.
5. Could you note the time to complete the questionnaire?

Teachers made valuable comments on the questionnaire. The response rate was about 85%. After the primary school teachers reviewed the questionnaire, they were mostly in agreement with the use of the questionnaire to assess the perceptions and needs of primary school teachers. Most of the teachers said that it was a useful questionnaire since they stated that they learn many things while they were reading the items, and thay had opportunity to assess themselves. They also wrote that it was a useful research since they had many difficulties in applying the new teaching and assessment methods in the curriculum and so identification of the needs will be a step to a better situation. All of the teachers agreed that the items were related to the NSTC. Some of the teachers wrote that they had difficulty in understanding some of the questions in Section 3 of the questionnaire and also two teachers stated that there were some overlaps in the questions in section 3 by writing the number of questions. Approximate time for completing the questionnaire was 20 minutes for the primary school teachers. The changes mostly was done on Section 3 of the questionnaire, the second draft of the items in Section 3 of the questionnaire with the dropped items and the related domains (28 statements for domain A, 13 statements for domain B, 19 statements for domain C) was given in Table 3.8. (A: First domain "General approaches on the TAMBID"; B: Second domain "Teaching Methods"; C: Third domain "Assessment methods"). There were a few changes on the other sections of the questionnaire. The feedbacks from both processes were reviewed and revisions were made on PNAQ. The agreement between the ideas of primary school teachers and the experts on PNAQ was assumed as a judgment of the reliability and the validity of the questionnaire.

Table 3.8 Items in Section 4 of the PNAQ with the domains

	DOMAIN	DROPPED	REASON FOR DROPPING
1. Fen ve Teknoloji derslerinde öğrenci farklılıklarını göz önüne alarak derslerimi işlerim.	A1		
2. Öğrencilerime rehberlik yaparak öğrenmelerini kolaylaştırırım.	A2		
3. Öğrencilerime bireysel olarak yapacakları etkinlikler vererek onlarda bağımsız çalışma alışkanlığını geliştiririm.	A3		
4. Fen ve Teknoloji dersimde küçük grup tartışmaları düzenlerim.	B1		
5. Fen ve Teknoloji derslerimde gerektiğinde okul gezilerine (müze, kütüphane, alan gezisi vb.) yer veririm.	B2		
6. Öğrencilerimi kütüphanede araştırma yapmaları için yönlendiririm.	A4		
7. Öğrencilerimin işlenen konu ile ilgili ön bilgi ve inançlarını açığa çıkarırım.	A5		
8. Öğrencilerime öğrendikleri yeni kavramları farklı durumlarda kullanmaları için fırsatı veririm.	A6		
9. Öğrencilerimi bir olguyu açıklamak için alternatif yorumlar yapmalarına fırsat tanırım.	X	√	Not clear
10. Öğrenme merkezleri oluşturarak dersimi işlerim.	A7		
11. Öğrencilerimi ileri sürülen alternatif düşünceler üzerinde düşünmeleri için teşvik ederim.	A8		
12. Fen ve teknoloji derslerinde laboratuarda gruplar oluşturarak öğrenme ortamını düzenlerim.	A9		
13. Öğrencilerimi grup yaparken grupların heterojen olmasını sağlarım.	X	√	Not related with the purpose
14. Öğrencilerimi fen konularında yazılar yazmaya teşvik ederek onların fen günlükleri tutmasını sağlarım.	A10		
15. Öğrencilerimi fen konularında poster hazırlamaları için teşvik ederim.	B3		
16. Fen derslerinde öğrencilerime konu ile ilgili kavram haritaları hazırlamalarını sağlarım	B4		
17. Öğrencilerime konuyu okurum ya da anlatırım.	B5		
18. Öğrencilerime kendi kişisel isteklerini belirlemede fırsat tanırım.	A11		
19. Öğrencilerimi bilimsel düşünmeleri için teşvik ederim.	A12		
20. Derslerde görsel sunumlar kullanırım.	X	√	Overlap with 36.question
21. Öğrencilerimi grupla beyin fırtınası yapmaları için teşvik ederim.	B6		
22.Öğrencilerime nesneleri değiştirmeleri ya da elleriyle bir şeyler üretebilmeleri için fırsat tanırım.	B7		

Table 3.8 (cont'd)

23. Öğrencilerime sınıf içerisinde konularla ilgili grup projeleri yapıp sunmalarına imkan tanırım.	B8		
24. Öğrencilerime araştırma yapmaları için yeterli zamanı tanırım.	A13		
25. Öğrencilerimi kavramları mantık çerçevesinde düzenlemeleri ve organize edebilmeleri için teşvik ederim.	A14		
26. Öğrencilerime tartışılan ya da öğretilen konuyu görsel olarak ifade etmelerine fırsat tanırım.	A15		
27. Öğrencilerime duyuları ile hissedebilecekleri materyaller ve deneyimler sağlarım.	A16		
28. Öğrencilerime düşüncelerini müzik yardımıyla ifade etmelerine fırsat tanırım.	A17		
29. Öğrencilerim nesneleri, olayları ve yaşayan organizmaları onların belirli özelliklerine dayanarak sınıflandırmaları için fırsat tanırım.	A18		
30. Öğrencilerimi sınıfta öğrendikleri ile günlük hayatlarında yaşadıkları arasında ilişki kurabilmeleri için teşvik ederim.	A19		
31. Öğrencilerimi sınıfta okuduklarını ve duyduklarını görselleştirmeleri için teşvik ederim.	X	√	Overlap with 26.question
32. Öğrencilerimi sınıfta birbirlerine yardımcı olmaları için teşvik ederim.	A20		
33. Öğrencilerime doğa olayları ile ilgili olarak çalışmaları için fırsat tanırım.	A21		
34. Öğrencilerimi sözel becerilerini iletişim kurmada, problem çözmede ve düşüncelerini ifade etmede kullanabilmeleri için teşvik ederim.	A22		
35. Öğretim- öğrenim sürecinde gerektiğinde matematiksel problem çözmeyi kullanırım.	A23		
36. Sınıfta harita, poster, şema gibi görsel materyalleri kullanırım.	B9		
37. Sınıf içi iletişimlerinde öğrencilerimi vücut dillerini kullanabilmeleri için teşvik ederim	A24		
38. Sınıf içi öğretimimde ritmi, şarkıları ve müziği kullanırım	B10		
39. Öğrencilerim sınıf içerisinde okuma faaliyetlerinde bulunmaları için fırsat tanırım.	B11		
40. Öğrencilerime sınıf içerisinde ne hissettiklerini söyleyebilmeleri için fırsat tanırım	A25		
41. Öğrencilerime bilimsel deneyler yapabilmeleri için fırsat tanırım	B12		
42. Öğrencilerime sınıf içerisinde video, film ya da asetat gösteririm	B13		
43. Öğrencilerime birbirleri ile paylaşımda bulunmaları için fırsat tanırım	A26		
44. Öğrencilerim öğrenme sürecinde drama, dans ve fiziksel aktivitelerini kullanmaları için fırsat tanırım.	A27		
45. Öğrencilerime farklı bitkiler ve hayvanlarla ilgili çalışabilmeleri için fırsat tanırım.	A28		

Table 3.8 (cont'd)

Öğrencilerimin başarılarını değerlendirirken	
46. Onlara ait yazılı materyallerin örneklerini (düz yazı, kısa cevap gibi) değerlendirmeme katarım.	C1
47. Hazırladıkları yansıtıcı yazımlarını (öz değerlendirme ve günlük tutma gibi) kullanırım.	C2
48. Onlara ait akıl yürütme ve problem çözme becerileri örneklerini kullanırım.	C3
49. Yaptıkları çizim, resim ya da her türlü sanatsal çalışmalarını kullanırım.	C4
50. Drama etkinliklerini kullanırım.	C5
51. Hazırladıkları grup raporlarını kullanırım.	C6
52. Elleriyle geliştirdikleri bir ürünü sergilemelerini (model gibi) değerlendirmeme katarım.	C7
53. Onların geliştirdiği şarkı ya da ritm sözlerini kullanırım.	C8
54. Çalışmalarındaki doğa gözlemlerinin sentezini kullanırım.	C9
55. Onların iletişim kurmadaki becerilerini dikkate alırım.	C10
56. Kendi değerlendirmelerinin dönütlerini kullanırım.	C11
57. Arkadaşlarının değerlendirmelerinin dönütlerini kullanırım.	C12
58. Kendi hazırladıkları bulmaca, kavram haritası gibi örnekleri değerlendirmeme katarım.	C13
59. Kendi çalışmalarının görsel sunumlarını kullanırım.	C14
60. Onlarla yapılan görüşmelerde sağlanan dönütleri kullanırım.	C15
61. Rol oynama ya da diğer fiziksel ifadeleri kullanırım.	C16
62. Onların müziksel performanslarını ya da bestelerini kullanırım.	C17
63. Çevre ile ilgili yaptıkları deneyleri ya da projelerini kullanırım.	C18
64. Hazırladıkları ürün dosyalarını (portfolyo) dikkate alırım.	C19

3.6.2 Development of the Interview Schedule

Before preparing the interview schedule, the researcher first carried out a literature review on teaching and assessment methods, individual differences, and needs assessment studies to build a theoretical framework for the interview process and to prepare the interview schedule. Based on the literature, she built an interview framework for the purpose of the study as to constuct interview questions and also to analyze data. Figure 3.4 provides an interview framework with all its constituents which also specify the areas of the research study and the serve as a basis to answer the subproblems of the research study.

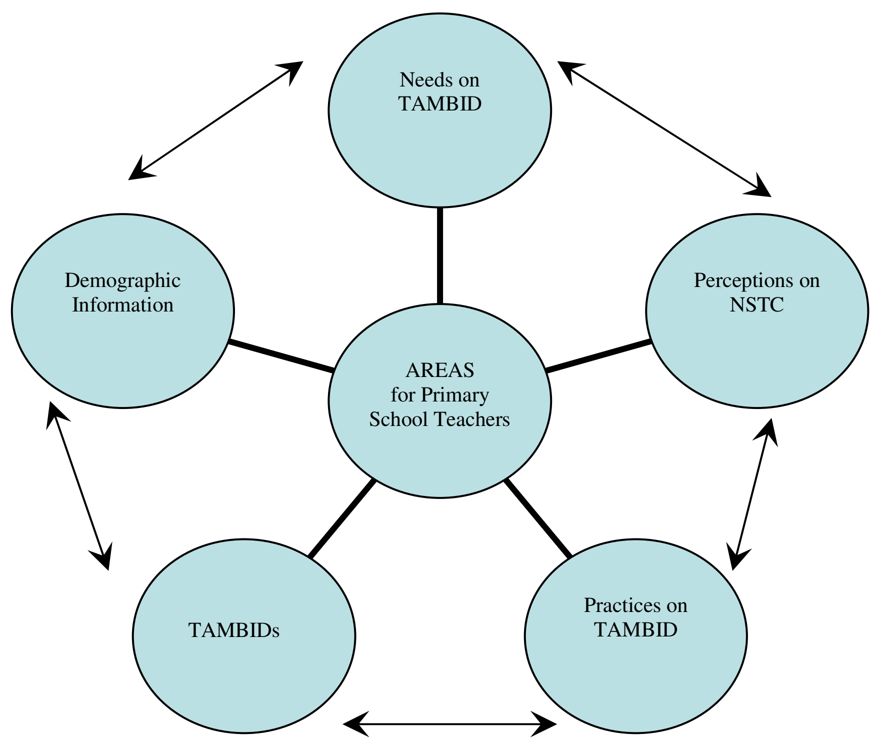


Figure 3.4 Interview framework of the Study Based on Research Questions

The next step for the interview process was to select an interview type and questioning. As open-ended questions would yield information which answer the research quedtion, the researcher decided to design semi-structured interview format with open ended questions. The main advantage of a semi-structured interview is that while allowing questioning with specific topics, it is possible to pose these questions in a more open-ended manner (Rubbin & Rubbin, 1995). Therefore, the type of the in-depth interviews was standardized open ended because the exact wording and sequence of questions were predetermined and questions were open ended so that more questions could be asked on specific subproblems of the study giving emphasis on exploration rather than hypothesis testing. While preparing the questions of the interview schedule the following points were considered as suggested by Patton (1990), Bogdan and Biklen (1998) and Marshall and Rossman (1999).

- Relevance to the research questions of the study
- Specifying the context
- What questions to ask
- Asking open-ended questions rather than short answer
- Making people to talk
- Writing alternative questions
- Writing probes to get detail answer
- How to sequence questions
- How much detail to solicit
- How long to make the interview
- How to word the actual questions

Interview questions focused on teachers' experience, opinions, background, and needs on THE TAMBID and NSTC.

3.6.2.1 Journey from First to the Second Draft of the Interview Schedule

It was a long journey to prepare the actual draft of the interview schedule. To form interview questions was not a simple and straightforward process. It is not a relatively easy data collection method to use as most people think. It requires special training and practice to improve skills in preparing interview schedules. Luckily, the researcher of this study had opportunities to improve herself before carrying out this study during a qualitative design lecture. There are some suggested steps of interviewing process after deciding on the topic that would be studied. These steps are preparing the interview schedules, testing the interview schedule, setting up the interviews, carrying out the interviews and writing up the interviews. These steps were followed in this study to conduct the interview process. The guidelines to prepare an interview are not suggested as strict rules but rather certain points to consider in the literature (Yıldırım & Şimsek, 2000).

When the researcher prepared the first draft of the interview questions, one of the qualitative research experts said that some of the questions were too general, some were unnecessary and some were not related with the research questions of the study. Furthermore, in the first draft of the interview schedule, the researcher did not ask any alternative questions in case the teachers do not understand the original questions. Also there are a few probes for the questions that need to get details of a question so experts examining the first draft, suggested to add more probes. Therefore, the probes were written for some of the questions to get deeper answers from the interviewee. Probes were used to deepen the response to a question, to increase the richness of the data, and to give cues to the subject about the level of response desired. Probes were used to follow-up initial responses.

Some of the questions were removed from the original interview schedule based on the suggestions of the experts. For instance, in the first draft (Appendix C), the researcher asked a question like “How many courses did you take about teaching and assessment methods at university?”. Such a question was a short-answer question and not necessarily to be asked in the interview. Another question in the first draft was “Do you use constructivism in your classroom?”. The expert suggested that being a short answer question, this question was also a knowledge question and if not asked properly, it can be a threatening question and the teachers might hesitate to answer such questions. The suggestion of the expert was to use more general question to learn which teaching and assessment methods teachers use and then to give names by the researchers. Because the teachers might not know the name of the teaching and assessment methods but they might use this method in their classrooms. Another question in the first draft was “Which teaching and assessment methods do you use in your science and technology classess?”. Although this question was directly related with the research problem of the study, it did not specify the context and it required knowledge to answer. Therefore the question was replaced by asking “How do you teach in science and technology classes?”. This question was more open-ended in nature and did not ask any specific knowledge. Based on the answer, given to this question, the researcher can figure out the teaching and assessment methods that teachers use in their classes. This change made the question more specific and more understandable by the interviewees. Furthermore an unclear question in the first draft “Did you experience any the TAMBID in your classroom?”(question 10) was removed in the original second draft since the question is a yes or no question and did not give any idea about whether the teacher know about the TAMBID or how she/he apply the TAMBID in the class. The other question in the first draft was “What do you think about new approaches in science and technology education?” (question 12). This question was also too general question and not related with the research question. The expert suggested not asking such a question. Also after the recommendations of the experts, some new questions have been added into the original draft of the interview schedule, some of the questions were combined as the alternative of each other, and some probes were added to some of the questions. One of them was the “Do you think that you know your students well” with a probe, “in what respects”. The other question added was “Do you collect any data from your students to know them better” with a probe “How do you collect?”. These questions were directly related to the research questions, non-threatening and easily understandable questions for the teachers.

Some of the background questions in the first draft of the interview schedule were also changed. These questions are simple to respond questions and are significant for the rest of the interview. To build background questions, the researcher tried to ask factual questions as warm-up questions. Before building up opinions, the researcher tried to build a general framework by asking such questions like “Can you briefly summarize your teaching profession?”, or “How long have you been a teacher?”. These types of questions provided confidence and establish rapport between the interviewer and the subject. Based on the suggestions of the experts, the order of some of the questions in the first interview schedule had also been changed. In both first and second draft of the interview schedule, the questions easy to answer had been placed before the questions that can be difficult to answer, and the needs assessment part for the interview was placed at the end of the interview since the experts suggested that it will be more useful to ask the needs after getting opinions and creating a friendly and relaxed environment.

In general important points taken into account based on the literature and on the opinions of the experts while preparing the questions and revising the questions in the first draft of the interview schedule. For preparing the final form of the interview schedule in this study as suggested by (Yıldırım, 2001) are summarized in Table 3.9.

Table 3.9 Suggestions Considered to Prepare the Questions of Interview Schedule (Yıldırım, 2001)

What?	**How?**
1. Asking easily understandable questions	**Using a non technical and clear language* ** Considering subject's cognitive level and background* **Avoid concepts, phrases or sentences that might be unfamiliar or misunderstood*
2. Asking specific questions wherever possible	**Starting from subjects experience* **Avoid confusing the subject and causing difficulty in answering the question* **Addressing general themes in the context of research questionst*

Table 3.9 (cont'd)

3. Asking truly open-ended questions	**Minimizing the imposition of predetermined responses* **Being aware that avoiding is, are, do and using how, why, what are not enough to ask open ended questions*
4. Not leading respondents with assumptions	** Not trying to confirm the assumptions of the study* ** Stating the questions in a neutral way*
5. Asking singular questions	** Not throwing several questions together* ** Not confusing and places an unnecessary burden of interpretation on the respondent*
6. Having Probes and Follow-up Questions	** Using different types of probes* *Detail-oriented probes: to get a complete and detailed picture through who, where, what, when and how questions* *Elaboration probes to keep the respondent talking more about the subject* *Clarification probes: to clarify unclear, ambiguous responses.*
7. Mixing Several Different Styles of Questioning	** Non-threatening, easily understandable and leads to a revealing and full response.* ** Avoid the rigidity of scales or questionnaires* ** Having alternative questions for each question for people with different thinking styles* ** Using different styles of questions* *closed questions: requiring respondent to choose one of several possible answers* *open-ended questions: subjects reply however they like* *indirect questions: explore a theme without referring directly to it.* *direct questions: ask for a direct response* projective questions: asks the subject to imagine himself in hypothetical situations and describe their reactions

Table 3.9 (cont'd)

8. Sequence the Questions Carefully	* *Beginning with warm-up questions* * *Working from particular to general - grounding a general theme within the context of a research question* * *Not forgetting that the people are more comfortable with questions regarding the details of individual incidents.* * *After establishing the context, asking about interpretations, opinions and feelings* * *Not asking questions about hot topics before establishing a rapport that allows respondents to be open and expansive* * *Asking knowledge and skill questions properly in relation to a context, specific activities or experiences* * *Using present tense questions before past and future tense questions.* * *Keeping the background questions at minimum if ask them at the beginning*
9. Always Looking for Ways to Improve Interview Questions	* *Considering grammar, clarity, question-topic fit, adding questions* * *Asking respondents to reflect critically on the usability of the questions* * *Being critical of the questions and looking for ways to improve the quality of writing*

Having prepared 13 questions for the interview, the researcher piloted them with two primary school teachers from Yenimahalle and Çankaya districts. She piloted the questions of interview schedule to ensure that there are no overlaps and they focus on the sub research questions. The outcome of the trial period provided that some questions were still irrelevant or too general, since the teacher gave answer to the specific question in another question before asking this question. This shows the researcher that some of the questions were repetitive and they were changed in the original draft, some of the questions were combined. The pilot study demonstrated that because most of the questions were open- ended in nature, the follow up questions or probes provided detailed information and the detailed data made it very difficult to analyse the data collected. The other advantage of pilot study of interview schedule with two teachers is that it gave as opportunity to manage time and limit it to 45 minutes to an hour.

The interview questions consisting of both perception and fact questions were ready to use having made recommended changes and piloted the questions. Final form of the interview schedule of the study was given in Appendix D.

3.6.3 Development of the Observation Schedule

In this study, to prepare the observation schedule, first the researcher clarified the purpose of the observation. Then the dimensions of the observation were determined. To decide on this issue and to determine what, how and how much will be observed, the researcher observed two hours of the classroom where the observation would take place as a trial. While doing this, some suggestions of Patton (1987) were considered to prepare an observation schedule. These dimensions are explaining the physical setting, observing the social dimension of the setting, observing the activities occurring in the setting and observing the language formed in the setting. Patton (1987) stated that some of these dimensions must be included in any of an observational study such as defining the physical setting but some are not depending on the event that is observed. The observation schedule of this study was given in Appendix F.

In this schedule, the purpose of the research and the problems of the study that are waiting answers from the observation process were presented. Then where and when the observation would take place was explained. Then, the dimensions that will be observed were presented, which are; the physical setting of the classroom, teaching and assessment methods used in the classroom, and individual differences. Also teacher and student roles were added to the list which might form a clue for the research problem. Lastly coding list was presented including possible events that might occur during the observation procedure. The aim of preparing such a list was to make the observer sensitive to the variables in the coding list during the observation. This coding list were changed and revised during the observation process, and also during the data analysis process (Yıldırım & Şimşek, 2000). During observations, observation checklist was also used. Observation checklist was derived from the section 3 of the PNAQ instrument (see Appendix H).

3.7 Triangulation

In this study, since the researcher used more than one data collection method, to answer the sub-problems of the study, triangulation was carried out by using different kinds of data collection methods; survey, interviews and observation. Triangulation is a strategy that allows reducing in bias and making acceptable explanations about some social facts. Triangulation was used to obtain research data with different methods and to test the persuasiveness of the findings (Mathison, 1998). According to Denzin (1978), there are four categories of triangulation; data triangulation, researcher triangulation, theory triangulation, and method triangulation. In this study, the triangulation methods were basically method and data triangulation. In method triangulation, there are three different types of data collection methods; questionnaire, interviews and observation for answering the research problem. In data triangulation, the findings of the each data collection methods would support the findings of the other data collection methods in this study. Each sub-problem was triangulated by at least two data collection methods.

Indeed 1st, 2nd, 3rd and 5th sub-problems of the study were triangulated by all three data collection methods. Triangulation in this study by means of subjects, data collection methods, and data collection instruments were summarized in Figure 3.5 (adapted from Collins, 1999).

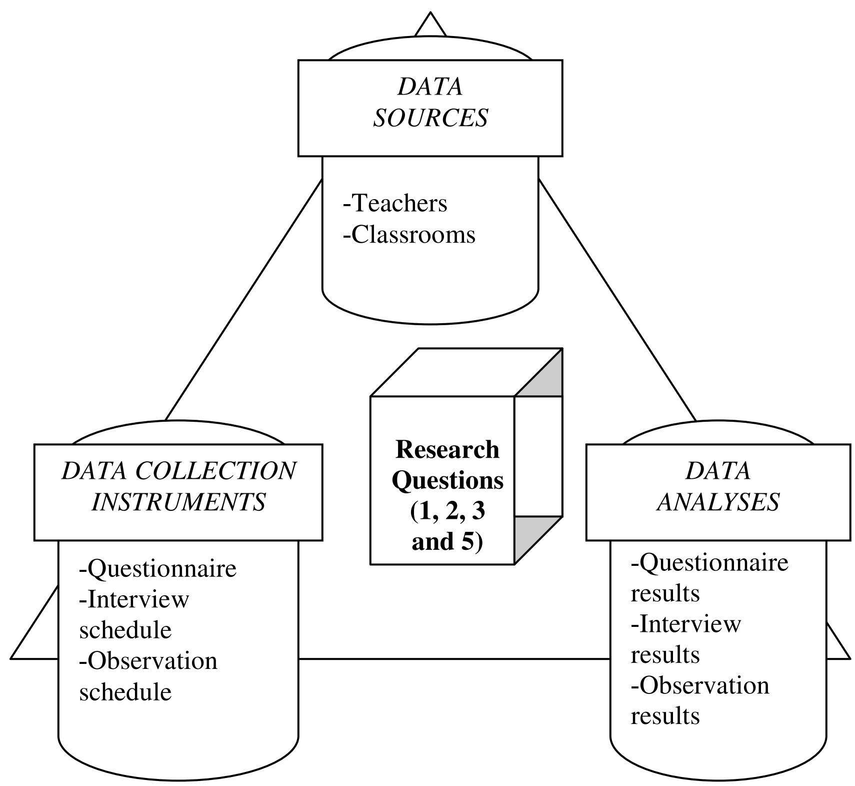


Figure 3.5 Triangulation Process in the Study

3.8 Analyses of Data

The participant's responses to the questionnaire and data obtained from interviews and observations will comprise the data set used for analysis. There are two parts in the analyses of data of the study; quantitative part and qualitative part. In survey phase of the study (sub-problems 1-2), data were analyzed by using both quantitative and qualitative analysis. In interview and observation part, data were analyzed by using qualitative data analysis methods.

3.8.1 Quantitative Analyses of Data

In quantitative part, data were analyzed by using Statistical Package for Social Sciences 11.5. Descriptive statistics (e.g., frequencies, percentage analysis, pie charts, bar graph) to describe the data and summarizing the responses in order to draw some conclusions from the results to answer the first two research problem. For analyzing the data obtained from the questionnaire, descriptive statistics were used both for presenting the results in detail and to check the assumptions of the inferential statistics. Inferential statistics were used to generalize our results from sample to population. Frequencies of responses reported by descriptive statistics were used to calculate the discrepancy index of the identified needs of the primary school teachers. Priority needs were identified and the needs were arranged in a hierarchical order according to the magnitude of the discrepancy index. By this way, top priority needs of the teachers were determined. The needs assessment part of the questionnaire of this study was constructed to account for the current state and targeted state and so the discrepancy index was used to prioritizing needs by ranking the importance of needs according to the discrepancy that exists between current and targeted state of need proposed by Rokey (1975) and McKillip, (1987). To analyze section 4 of the questionnaire, following information was computed; Mean and standard deviation of the perceived column, mean and standard deviation of the desired column, the difference between two means, and the t value between the two means. The paired t-test procedure was used since the respondent in the two measures (current and targeted state) is the same person. The t-value for each statement shows whether the probability of the observed difference between the current and targeted means occur just by chance or if there is a true difference. A negative t-value indicated there is no perceived need for training, while a positive t-value means there is a preceived training need. Also, the higher positive t-value, the greater perceived need for training.

Furthermore, analyses of variance (ANOVA) procedure was employed to answer the last research problem. The ANOVA is a statistical technique that measures the effect of independent variable(s) on dependent variable. In the causal comparative phase of this study (sub-problem 6), There were many characteristics of the teachers including their years of experience, gender and grade level as the independent variables of the study, their effects on the dependent variable which is the perceptions of the teachers.

3.8.2 Qualitative Analyses of Data

In this study, qualitative data analyses was used for open ended questions in the survey, for interviews and for observations transcripts. Open ended questions of the survey was analyzed by using one of the qualitative analysis methods, which is frequency counts technique followed by coding, generating the categories and explaining the results.

The data obtained from the interviews and also observations were summarized and coded descriptively to assess the teachers' knowledge and experience related to the use of the TAMBID, to identify the perceptions of teachers with respect to individual differences of the students and to determine the needs of teachers to apply the TAMBID in science and technology classrooms. The coding procedure was carried out based on the literature and experts opinions. The researcher went through the data looking for things pertinent to answering the research question. Then coded data was sorted into piles according to topics. Coding procedure were explained below in detail.

In qualitative studies, qualitative data tend to be analyzed inductively by the researchers meaning that they construct a picture which is shaped when parts are collected (Bogdan & Biklen, 1998). There is no claim or a foreseen hypothesis, and naturally there is no attempt to approve it. In qualitative research, a theory emerges bottom up and therefore is called as 'grounded theory'. Since all research questions of this study are not written to prove or disprove nothing, it is inductive in nature and there is no correct way to analyze the data. In this study, the issue stated by (Bogdan & Biklen, 1998) was considered in that, "nothing is trivial but everything has the potential of being a clue that might unlock a more comprehensive understanding of what is being studied". Overall process of transcribing the qualitative data of this study took about 7 months. Based on the conceptual and theoretical bases of in qualitative data qualitative analysis procedures, general steps followed in analyzing the qualitative part of this study are as follows;

Step 1: Transcribing the Qualitative Data

The interviews recorded by audiotape and observations recorded by videotape were first transcribed by the researcher. Interviews recorded during the interviews each took about an hour were transcribed word by word from the cassettes by using word processing program. Through this process, 125 pages of raw data were generated from the interviews. As for observations, 24 hours of video recordings of the observations were transcribed and written in word processing program based on the scope of the study. Totally 90 pages of raw data were generated from the observations. This step of data analysis was the longest part of the data analysis process.

Step 2: Reading, Shortening and Formatting the Transcriptions

After transcribing the interviews and observations data and prepared the raw data for the qualitative part, the researcher read the transcriptions based on relevance to the research questions and shortened the transcripts by deleting the irrelevant parts. After shortening process, 110 pages of interview transcripts and 90 pages of observation transcripts were obtained. Then transcriptions were formatted based on spelling and grammar. Furthermore, in order to allow easy coding, each page of the transcripts was designed by leaving the right margin wide (see Appendix N). Also the hard copy of each interview was numbered as t1, t2, t3…… T stands for teacher and the number is corresponding to the related interview. While explaining the interviews and observations, and giving quotes for the teachers, these designations (t1, t2, t3. or O1, O2) was used in the text. The hard copy of each observation was numbered as O1 and O2 referring to the first (at 4th grade classroom) and the second observation (at 5th grade classroom) respectively. Hard copy of interview and observation transcripts took their final form for further data analysis.

Step 3 Identifying Meaningful Data Units and Coding the Data

In this step, before coding, the researcher read the interviews and observations, and tried to get general ideas about what can be done with different parts of the data. This step was carried out with one of the colleague who is knowledgeable on qualitative data analysis. This step was useful in order to overview data. The researcher and her colleague wrote comments and their interpretations of the data in the margin. Although the interview was conducted in Turkish, this step was carried out in English in order to be familiar with the terminology within two languages.

After identifying meaningful data units, the researcher coded (labeled) the interviews and observations data by writing in the right margins. The codes of the data were related with the research study and as Dey (1993) stated codes are emerged from prior review on the relevant literature; the focus of the research and the research questions; interferences from the actual data; substantive, policy, and theoretical issues; and also researcher's imagination, and previous knowledge and experiences (p. 100). An example of coding process was presented in Table 3.10 for the t1, question 2 (see Appendix N for sample of interview data transcripts).

Table 3.10 An Example of Coding the Data

Part of the Data	Sample Coding
Yeni Fen ve Teknoloji programında aslında bilgiyi öğretmekten ziyade kişilik üzerinde çok duruluyor, yani nedir, sorumluluğunu bilecek, iyi bir vatandaş olacak, kişilikli olacak, dürüst olacak, araştıracak, sorgulayacak, bir şeyi hemen kabul etmeyecek, ben bunu çocuklara veriyorum ama herkes böyle değil. Fakat bunların dışında öğretmen değil, nitelikli öğretmen, iyi öğretmen, mesleğini seven öğretmen yetiştirmek önemli. Ondan sonra eğer öğretmen mesleğini seviyorsa, ona bir ideal olarak yaklaşıyorsa, ve eline verilen öğrencilerin ileride Türkiye'yi yöneteceklerini biliyorsa ve bunun bilincinde ise özveriyle çalışıyor, yoksa olmuyor……..Bir de genelde bayan öğretmenlerin maddi sıkıntıları yok, eşlerinden dolayı, o yüzden hobi olarak yapıyoruz, çok severek yapıyoruz, belki erkek öğretmen olsaydım,maddi sıkıntım çok fazla olsaydı veya ailevi sorunlarım olsaydı kendimi mesleğime bu kadar veremezdim..Yani sınıfa giren bir öğretmen mutlu olmalı, on anda öğrencilerden başka bir şey düşünmemeli….	Emphasis on personality rather than information • Knowing responsibility • Good citizen • Good personality • Honest • Researcher • Examiner Features about teachers Gender of teachers Liking the teaching profession • Income • Concentration • Happiness
Fen ve Teknoloji kitabını çok beğendim, çok güzel yazılmıştı, yalnız bu kitabın uygulanması için çok güzel laboratuarlar gerekiyor, laboratuar eksikliğimiz var bizim bu okulda. Eğer bir laboratuarımız olsaydı ve başında özellikle söylüyorum bir laboratuar öğretmeni olsaydı çok iyi olurdu. Eskiden bu da vardı, küçümsedikleri eski fen programında bu da vardı, laboratuarımız vardı ve laboratuar öğretmenimiz vardı	Well written science book Lack of laboratories Lack of lab teacher In OSC • Having lab • Having a lab teacher

Step 4 Generating Initial Categories

After coding data, the codes are compiled into more general themes or categories. With this step, organization of the coded data into topics had started. Table 3.11 presented the categories emerged from the first interview for question 2 (t1).

Table 3.11 Initial Categories Emerged from the First Interview

Categories Emerged from t1
1. Positive perspectives on NSTC
2. Negative perspectives on NSTC
3. Factors affecting the application of NSTC
4. Basic Features on NSTC
5.Comparison of new and old science curriculum

Step 5 Organization of Codes Based on Initial Categories

After the initial categories were generated in the previous step, the codes were organized under initial categories to get used to the coding and categorizing process. Based on the initial categories, codes were placed at the related categories. An example of this step was shown in Table 3.12.

Table 3.12 Example for the Organization of the Codes under Categories

An Example for the Organization of Codes Based on Categories from t1
1. Positive Features of NSTC • Emphasis on personality rather than information • Expectations from students • Being science an experiment and observation lesson • Student centered • Learning by doing • Constructivist approach • Based on investigations • Long lasting knowledge • Teacher is a guider
2. Factors Affecting Application OF NSTC • Beliefs of teachers • Gender of teachers • Perspectives of teachers • Family life of teachers • Family life of stds • Structure of the School • Guidance of teachers • Background of teachers • Presence of examinations in Turkey (OKS&OSS) • Cooperative workings of persons in school • Comfortable and relax working conditions

Step 6 Indexing the Data

While carrying out the coding and categorizing process, there were many codes and categories emerged from data. Also there were subcategories under the categories. Some of the codes were the same for the responses of the teachers and for the observations. Therefore, the researcher decided to index the data for facilitating the process of coding.

When necessary during the writing stage in the text, the researcher used the indexed data. For this purpose, the researcher used numbers, letters and abbreviations. Along the interviews, if the same issue was repeated by any of the interviewees, corresponding indexes was inserted by indexing the related sub-problem with which the specific data was related, the participant number and page number. For instance, indexing data as 2.5.1.2, 2 means that the data related with the sub-problem 3 as it started with 2 (If it started with 3, this refers to the sub-problem 1, 4 refers to the sub-problem 4, 5 refers to the sub-problem 5 and 6 refers to the sub-problem 2), the second number 5 refers to the fifth category generated for this sub-problem and 1 and 2 refers to the subcategories for related category. Furthermore, t (n;2) refers to the teacher and 'n' in the parentheses refers to the related interviewee and 2 refers to the page number for that teacher. Similarly q (n) is the quotation mentioned in the text with the 'n' corresponding teacher. The Table 3.13 demonstrated an example of indexing data by numbers from t (7).

Table 3.13 An Example of Indexing Data by Numbers

DATA	INDEXING DATA
Fen ve Teknoloji kitapları geçen senelere göre çok güzeldi. Etkinlik kitapları çok güzeldi, yalnız eksiklikleri vardı. Çünkü bunlar hazırlanırken okullar buna hazırlanmamıştı, sadece program hazırlanmış, ama öğretmen hazırlanmamış. Öğretmene detaylı bilgi verilmedi, kılavuzlarımız 2 ay sonra geldi ve fen ve teknolojiye uygun okullar yapılmadı, altyapısı oluşturulmadı. Örneğin laboratuar malzemeleri. Ben Çankayada çalışıyorum, Çankayanın en gözde okullarında da çalıştım, laboratuar malzemelerimiz eksik. Bunu Türkiye geneline yaydığınız zaman ben üzülüyorum, bunlara dikkat edilmesi gerekir. Teknik alt yapının hazırlanması ve teknik eğitimin verilmesi gerekir. Ama programı uygulanabilir buluyorum, eksikliklerimiz olmasına rağmen uygulayabildik. Eski programla karşılaştırdığımda, şimdi deneylere daha çok ağırlık verilmiş, çocukları düşündürme yönü var. Eskiden daha fazla bilgi vardı, detay vardı. Ama şimdiki araştırmaya yönelik ve çocukların etkin olduğu bir program. Konular azaltılacaktı ama malefef gene sayısı fazla, ünite sayısı çok fazla, bazı konulara yüzeysel olarak değinilmiş, biz elektrik konusunu yetiştiremedik, yüzeysel olarak değindik.	2.5.1 2.4.10 2.3.7 2.1.1 2.1.1.2 2.1.8 2.1.3.4 2.1.1.3 2.4.8 2.4.11 2.4.5 2.2.4 • 2.1.4.6 • 2.1.4.7 • 2.1.36

Step 7 Refining, Re-reading and Generating Additional Categories

After indexing the data, the researcher read all the transcripts again to validate the appropriateness and the accuracy of codes and categories generated. This process went on through all of the interview and observation transcripts. This step generated some additional codes and categories for the data.

Step 8 Re-reading, Controlling and Determining Relationships among Categories

After the completion of generating additional categories by reading all of the transcripts and going through the codes and categories, the researcher read the transcripts for the last time to control the codes and categories. The researcher also looked for the meaning and relationship among the categories and tried to extract meaning from the data set. After identifying the interconnections between the codes and categories, the researcher outlined the categories under the research questions of the study.

Step 9 Organizations of Categories under Research Questions

At this stage, the categories (themes) emerged from the data set were organized under the five research questions by using tables. The research questions with the related categories emerged from the study was presented in Table 3.14 (for sub-problem 1), and Table 3.15 for the interview and observation data respectively.

Table 3.14 Research Questions Matched with the Categories for the Interviews

	Categories	**Categories**
Research Question-1	TEACHING METHODS • Presentations by stds • Homeworks • Experiment in class • Group works • Observations • Equipments • Investigations • Poem • Song • Plays • Dramatization • Discussions • Questioning • Visual materials • Student prepared materials • Expository teaching • Cooperative learning • Peer teaching • Projects • Daily life examples • Giving examples from teacher experiences • Drama, Role playing • Outdoor activities • Laboratory • Puzzles • Summary • Individualized teaching • Preparing posters • Explaining • Establishing relations with other lessons • Preparing an index about concepts in unit • Materials • Learning by doing • Using models	ASSESSMENT METHODS • Testing • Performance • Honesty • Interest • Achievement in the past • Relationship with friends • Peer teaching forms • Process assessment • Self assessment • Portfolios • Assessment at the beginning • Questioning • Family involvement • Project assessment • Formative evaluation • Oral examination • Homeworks

Table 3.15 Research Questions Matched with the Categories for the Observations

Research Question-1 **Categories**	• Questioning • Lecturing • Daily life examples • Explaining • Summary • Analogy • Demonstration • Drama • Presentations by the students • Discussion • Activity based teaching • Independent Study • Experiments • Discovery • Brain storming • Group works • Projects

Step 10 Compiling Data Booklet, and Pre-writing Stage

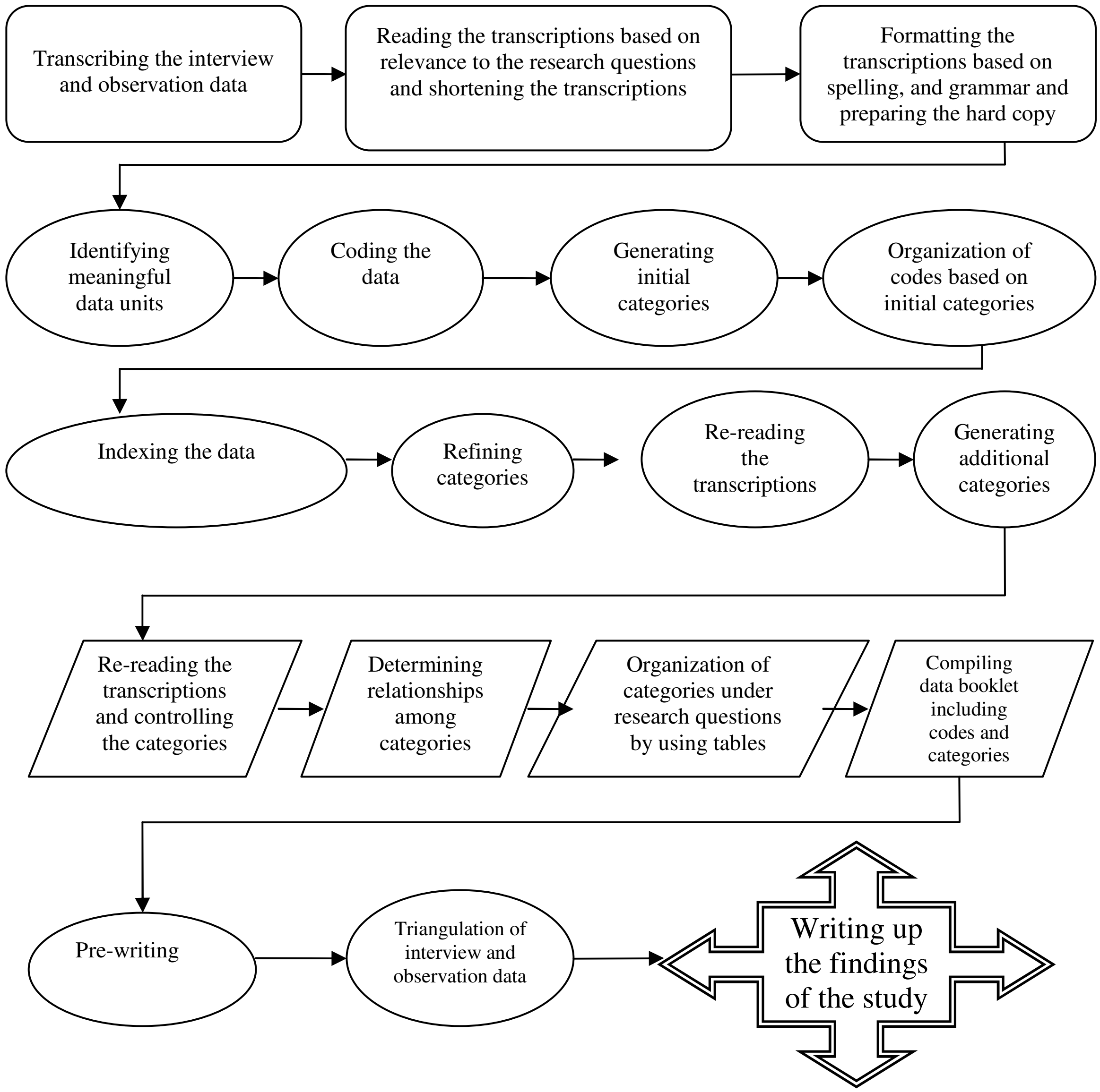
After all of the processes were completed, 195 pages of data for the interviews and observations were organized and compiled in a booklet in order for facilitating the writing the findings of the study by the researcher. At the pre-writing step, the researcher searched for the ways to construct, understand, exemplify, describe, verify, display and summarize the data. The quotes were also selected before passing along the writing step.

Step 11 Triangulation and Writing Up the Findings of the Study

After completed all of the steps of data analysis, the findings of the study were written based on the research problems. The profiles of the all interviewees were presented. Also, for presenting the results of some of the research questions, the categories emerged from the data for the related research questions were presented as sub-headings. While writing the findings of the study, triangulation allowed the researcher to present the results in a comprehensive frame. The data obtained from the interviews, observations and the questionnaire were triangulated.

To sum up, data analysis step of the qualitative part of the study included extensive analysis following the general steps of data analysis. The researcher tried to be smooth and well-organized through the data analysis process. Since thirteen teachers were participated in the interviews, the term "majority" will be used while writing the results to indicate that seven or more expressed a similar opinion or view. General steps followed in analyzing the qualitative part of this study including interviews and observation were summarized in Figure 3.6 adapted from Collins (1999).

Figure 3.6 Overall Qualitative Data Analysis Steps of the Study



3.9 Validity and Reliability Issues

Validity is the adequacy, appropriateness, meaningfulness, and usefulness of the inferences researchers make based on the data they collect, while reliability is the consistency of these inferences overtime. There are many threats in both quantitative and qualitative studies that must be controlled. For example, potentially confounding variables that will not be controlled in this study can be educational policy of school, economical conditions of schools, learning styles of teachers, teaching experiences of teachers and their socioeconomic status. The science teachers may have negative attitudes toward using the new teaching approaches like the TAMBID. Teachers' educational backgrounds may be also important. They may use different strategies in their science classrooms. School may have no enough economical conditions to supply seminars to teachers related with the use of MI theory in science classrooms. These can be the potential variables that cannot be controlled during the study. It will be useful to examine these threats and their control in this study seperately for quantitative and qualitative part.

3.9.1 Internal Validity of the Quantitative Study

There might be some main threats to internal validity in the research. They can be subject characteristics, mortality, location, instrumentation and instrument decay for the survey part of this study (sub-problem 1, 2, 3, 5, and 6) and similarly subject characteristics, instrumentation, mortality and location for the causal comparative phase of the study (sub-problem 6). The teachers' perception of the study can create a subject attitude threat to internal validity. Instrument decay might also affect interview surveys as the participants in this study might also get tired or get bored affecting the validity of information obtained. A location might be a threat in this study if the collection of data is carried out in places that may affect responses. Location was held constant that is tried to keep the same for each teacher including the room, silence and lightening. Teachers were recommended to fill the questionnaires in a silent and calm environment in their free hours in order to control this threat. Fatigue of the scorers can be instrument decay if she becomes tired and scores tests differently. This threat will try to overcome by schedule data collection and scoring so as to minimize the any changes in any of instruments and scoring procedures by different scorers. For the Internal validity of the causal comparative part of this study, subject characteristics is the major threat. For this sub-problem (6), many subject characteristics of teachers including gender, years of experience in teaching, grade level they teach and program they graduated were assessed with the questionnaire by taking them into consideration during analysis by looking at the effects each independent variable on each top priority needs of the teachers.

The design and implementation of the survey was also subject to threats. For example, teachers may not have self-reported with a high degree of accuracy. To overcome this effect for data validity, a uniform method of data collection was implemented. Furthermore, the survey was developed in a manner that did not cause teachers' beliefs to be captured. To reduce the effect of this issue, piloting of the survey helped the researcher to design questions that were not complex and based on experiences of primary school teachers increasing the likelihood of the teachers' information represented what they believed.

3.9.2 Population and Ecological (External) Validity of the Quantitative Study

The population validity refers to the extent to which the results of a study can be generalized from a specific sample of a larger group of subjects. In this study, the accessible population was the primary school teachers in Yenimahalle and Çankaya district. The subjects of the study for the quantitative part were 155 primary school teachers. As the non-random sampling method was used to select the sample, this leads to limited generalization of the research results. However, the generalization of similar population of teachers at public schools might still be acceptable.

3.9.3 Validity and Reliability for the Qualitative Study

In this research, for checking or enhancing the validity and reliability of the qualitative study, the procedures suggested by Fraenkel and Wallen (1996) and, Lincoln and Guba (1985) were used.

As much depends on the perspective of the researcher in a qualitative study, the researchers might have certain biases. In this study to reduce these biases, the researcher uses some procedures. For example, to establish the validity and the reliability of the data collection and analysis, the researcher used a variety of instruments to collect data and so research findings from different data collection instruments were compared by using triangulation technique. This triangulation included survey, interviews with teachers and observation in two science and technology classroom. During interviews, several threats to the validity of the instrumentation process might cause individuals to respond differently than they might be otherwise. Also the characteristics of the data collector like offensive language might affect how individuals respond, causing them to react in part to the data collector rather than to the questions. There is also the possibility of an unconscious bias on the part of the data collector, as when she or he asks leading questions of some individuals but not others. All of these issues were considered throughout the data collection procedures. In this study, the descriptions of informants were compared with the others' descriptions and as a result no discrepancies were found. The interview questions had been written down to reduce distortions attributed to selective forgetting. Interview guide was designed and its framework was established based on the literature review. This enabled the researcher to keep focus on the research questions of the study. Interview questions were piloted with primary school teachers and revised interview questions were also sent to experts to get opinion. An expert from the department of Educational Sciences reviewed and evaluated the interview and observation process of this study.

The researcher designed the interview process and made necessary changes on the schedule. This process enabled content and construct validity of the questions. To increase validity, audiotapes for the interviews, and videotape for the classroom observation were used. The results of the interviews and observation were discussed and shared with the primary school teachers to ensure the accuracy of research results. Also the data of interviews and observation were read and coded by two educators different from the researcher. By checking coding definitions become sharper when two or more researchers code the same data set and discuss difficulties and issue arising. More coders mean a good reliability check for the qualitative studies. Inter-coder reliability was also calculated by dividing the number of agreements to the total number of agreements and disagreements. For this study, the final interview and observation transcripts were read and coded by three different raters: one is a doctoral student in Educational Sciences and the other is a assistant professor in the department of Education, both having knowledge and experience in the area of qualitative data analysis.

The results of the coding and generating categories of this study were compared between three coders and inter-coder reliability was calculated as approximately 82%. It is acceptable for checking the reliability in qualitative studies since it is larger than 70% (Yıldırım & Şimşek, 2001). This procedure also increases the reliability of the results of this study.

3.9.4 Trustworthiness

The term trustworthiness was used by some researchers to refer to validity and reliability issues in qualitative studies. Different from other researchers, Lincoln and Guba (1985) and Merriam (1998) proposed another terms and classification for the quality of qualitative researches. They suggested that the rigor and the quality of an interpretive qualitative research project can be examined by four criteria: credibility, transferability, dependability and confirmability.

To summarize briefly, credibility which is known as internal validity refer to the degree the findings match what is really occurring. The recommended strategies for credibility of a qualitative study were triangulation, member checking, repeated observations, peer debriefing, and researcher bias. In this study all of these issues were considered. To ensure the suggestions, as mentioned earlier, triangulation was carried out to ensure validity. Participants examined the data and share their perspective to see whether the results were reasonable. Repeated observations were carried out in a science and technology classes and so the data were gathered over a period of time, a month. Furthermore, two peers read, examined and reviewed the study's findings as they emerged. The researcher, as all qualitative researchers tried to control her bias to be objective and overlook the observer expectations. Interpretation of data would also be biased by the researcher background knowledge about science teaching and individual differences. Therefore, the researcher constantly worked hard to keep personal biases and opinions under control trying to focus only on science teaching and the TAMBID.

Hawthorne effect may also be a threat for the observation part of the study. To avoid this problem, the researcher remained at a separate place while in the classroom, away from the students, and did not change her place often. She made no connection with the teacher and the students. Also, the researcher entered the classroom before the students and exited after the students and set her equipments including observation schedule and video cam in her place to interact very little with the students and the teacher during all observation process.

To establish transferability which is known as external validity, for whether the findings would generalize, the researcher described the study's research context, and the procedures followed in detail and provided rich and thick descriptions of events and data analysis so that reader would be able to determine how qualitative research procedures match the research situation of this study. Transferability is seen as a weakness in qualitative studies so the researcher tried to explain the every detail of the research design stating the parameters of the research. Then those who design research studies within those same parameters can determine whether or not the cases described can be generalized for new research policy and transferred to other settings.

To ensure dependability which is different from reliability, emphasizing the need for the researcher to be sure that whether the findings are consistent with the data, the researcher employed multiple methods of data collection methods, gave details of data collection methods, and included interview transcripts, observation transcripts in the study by explaining how analysis codes and categories were determined and carried out.

To establish confirmability, referring to the extent to which the results could be confirmed by others, the researcher employed the detailed procedures mentioned for dependability to be a representative of a guide for others to see clearly how findings and conclusions of this study were derived from the data collected. Confirmability is subject to be effected by convenience sampling method which is used in this study. Therefore the researcher tried to establish confirmability as much as possible. It is also important to cite previous researchers who have written about bias, and data quality and suggested ways to handle these issues. It is why the researcher of this study searched, and mentioned many references about trustworthiness of qualitative studies.

3.10 Ethical Considerations

"Ethics has to do with the application of a system of moral principles to prevent harming or wronging others, to promote the good, to be respectful, and to be fair" (Sieber, 1985, p. 14). Ethics related to how the researcher treats other research participants and how the relationships formed may depart from some conception of the ideal. In all the studies and in this study, ethical considerations need to be considered by the researcher at the initial stages of the research, as well as throughout the entire project. Fraenkel and Wallen (1996) listed three important issues that every researcher should address; the protection of participants, the ensuring of confidentiality of research data and the question of deception of subjects (p. 39). In this study to consider these issues, first research participants were informed of the nature, content, purpose of the research and its' benefits. At the outset of the study a consent form was prepared including an explanation of the procedures used and their purposes, a description of any benefits that would reasonably be expected and an offer to answer any questions concerning the procedures. In addition to getting informed consent, all participants were given confidentiality and anonymity. All subjects were assured that any data collected from them would be held in confidence. They were informed that identifying information of the participants written on the questionnaires would not be used in the text and data will be stored in a secure, private place. Actually one of the primary school teachers did not want the CD's watched by others. Deception also is not the concern of this study since the every thing was clearly explained to the subjects of the study. Institutional approval was also granted by the permission from MEB and the schools in which the questionnaire, interviews and the observation were carried out.

3.11 Limitations of the Study

1. This study is limited to the population with similar characteristics.
2. Literature consists of a large volume of studies related to the needs assessment and science education. Therefore it may not be possible for the researcher to review such an extensive literature and some of the important keywords or concepts may have been overlooked. However it is the researcher's assertion that these limitations do not in any way affect or minimize the importance of the study.
3. To answer the research questions of the study and to identify the needs of primary school teachers, various approaches were used to conduct needs assessment. Although there is no one way of conducting needs assessment and teachers` needs

can be identified by variety of ways, the steps followed in this study were relevant to the previous researches carried out in the same topics. In this study one of the data collection instruments was a questionnaire. Questionnaire approach has also some limitations which are:

a. Questionnaire approach may restrict the teacher's responses and may have missed some important data which was handled in this study as much as possible.

b. Since the survey questionnaire tends to be impersonal (Cummings and Worley, 1997), respondents may not answer the questions honestly in the survey which may have skewed the study results. Teachers' written responses might reflect what should be done rather than what was actually done in class.

4. Accuracy of self-reported data and the interpretation of the data might be uncertain.

5. Lack of research related to individual differences and needs assessment at the primary school level to guide future research and make comparisons.

CHAPTER 4

RESULTS

The purpose of this study was to identify the perceptions and the needs of primary school teachers in Ankara to apply the teaching and assessment methods based on individual differences in science and technology classes. In this study, both qualitative and quantitative research methods were utilized to find answers to the research questions. Data collection was held in three phases; in the first phase, data were collected by using a questionnaire from 155 primary school teachers; in the second phase data were collected by interviewing with 13 primary school teachers; and in the last phase data were collected by observing two science and technology classes, during spring semester in 2005-2006 education years. In line with the research questions, the results of qualitative and quantitative procedures are presented according to how they relate to the research questions by explaining the findings of each sub-problem separately. Six sub-problems were answered with the related data collection instruments. To answer the research sub-problem 1, the data obtained from the PNAQ, interviews and the observation were presented. The PNAQ result was presented to interview results were presented. Sub-problem 5 was answered by using the interview data. The emerging themes and patterns in the open-ended PNAQ were linked to the interview data, the research questions and the literature. By this way, triangulation was carried out for the related sub-problems containing two or more data collection instruments including sub-problem 1, 2, 3, and 5. Therefore, data obtained from multiple sources were compared to reach meaningful conclusions. At the end of the chapter, all findings are summarized.

4.1 Missing Data Analysis

In this study, missing data analysis was carried out before inferential statistics. Some members of the sample did not write the information about them or did not respond to the questions in the PNAQ. It may due to a number of reasons but it is a major problem recently as more people seem to be unwilling to participate in surveys. This situation leads to the presence of missing data in the part of researcher. Actually, during the application of the PNAQ, at least 40 teachers were unwilling to complete the questionnaire and the PNAQ was not given to these teachers at the beginning of the study.

Among 162 questionnaires, 7 of them were not included in the data analysis because either approximately %40 of the data was missing in different sections of the PNAQ or the teachers did not write their gender on the paper. Among the rest 155 survey, there were a few missing data which exceeded %10 of all data. The researcher handled this problem by replacing the data with the mode since the missing data was on independent variable and on the nominal scale which was teaching experience of the teachers. Also, some of the teachers did not give answers to the open ended questions in the PNAQ. The results of the study were presented with the available data for those questions.

4.2. Demographic Information of Primary School Teachers (Section 1 of the PNAQ Instrument)

The descriptive statistics of the PNAQ for the demographic informations of all primary school teachers (gender, grade level, program graduated, years of teaching experience, whether they participated in pre-service education and in-service education on new methods in science and technology education) in this study are given in Table 4.1.

Table 4.1 Demographic Distribution of All Primary School Teachers in the Study

Teacher Variable	**Category**	**Frequency**	**Valid Percent %**
Districts	Yenimahalle	66	42.6
	Çankaya	89	57.4
Gender	Female	97	62.6
	Male	58	37.4
Grade Level	4th	111	71.6
	5th	44	28.4
Program Graduated	Onlisans	62	40
	Teacher Training School	38	24.5
	Bachelor degree	47	30.3
	Master's degree	8	5.2
Type of Graduation Program	Education	126	81.3
	Other	29	18.7
Years of Teaching Experience	1-5 years	12	7.7
	6-10 years	42	27.1
	11-15 years	20	12.9
	16-20 years	16	10.3
	21-25 years	12	7.7
	26 + years	53	34.6
Pre-service Education	Yes	49	31.6
	No	106	68.4
In-service Education	Yes	111	71.6
	No	44	28.4

To summarize Table 4.1, of the 155 participants who completed the PNAQ, 66 (42.6%) of them were from Yenimahalle and 89 (57.4%) were from Çankaya districts. Also, 97 of the primary school teachers were female (62.6%) and 58 were male (37.4%). Among them, 4^{th} grade primary school teachers constitute 71.6% of the sample, while 5th grade primary school teachers constitute 28.4% of the sample Among 155 primary school teachers, 40% had pre bachelor degree, 24.5% had graduated from teacher training school, 30.3% had bachelor degree and 5.2% had master's degree. When their teaching experiences were compared, 12 had 1 to 5 years of teaching experience (7.7%); 42 had 6 to 10 years of experience (27.1%); 20 had 11 to 15 years of experience (12.9%); 16 had 16 to 20 years of experience (10.3%); 12 had 21 to 25 years of experience (7.7%); and 53 had 26 or more years of experience in teaching (34.6%). Therefore, it can be stated that the sample of this study constituted mostly experienced teachers since 52.6% of the participants had more than 15 years of experience.

During their pre-service education, most of the teachers (68.4%) stated that either they did not take any course about new approaches in science education or they graduated from a department other than education. Indeed, of the 155 participants, 29 (18.7%) graduated from faculties other than education such as chemistry, social sciences, engineering, and agriculture departments. Also some of the teachers whose graduation was related to education stated that they took some courses on science education but they were not effective since they learned only theoretical knowledge. As for teachers' in-service education, 71.6% had participated an in-service education program and 28.4% did not. Teachers were also asked why, if they did not participate in-service education program since they were expected to do. Among 44 primary school teachers, the reason why did not participate to an in-service education varies. For instance, they said that they did not any chance to participate because of time or location of the program or they did not need such an education. Two of them did not attend because of their family life. One of them stated that they will be retired in a short time and so he did not attend to an in-service education program. Similarly, two of them stated that the teacher book was enough for them. Also some of the teachers stated that they were not informed about such an-inservice program or no in-service education program was held in their district.

Among 111 primary school teachers who participated in an in-service education, most of them stated that it was not effective for them and they did not learn anything from these in service education program. The duration of in-service education was about 5 days. Teachers also mentioned that they participated in some courses and seminers related to science education, the duration of these courses and seminars ranged between 3 weeks and 2 months for the teachers. Most of them stated that the inservice education that they participated was not adequte and effective.

4.3 Results Related to Sub-problem 1

The first sub-problem (Sp1) of this study was "Which teaching and assessment strategies do primary school teachers use in science and technology classes?". The findings are from three data sources; the PNAQ, interviews and observations.

4.3.1 Results of the PNAQ for Sp1 (Section 2; Questions 1, a, b)

The responses of the primary school teachers were useful for the research study, they were cooperative, and they expressed positive feelings about the PNAQ and thanked to the researcher to study such a topic at the end of the PNAQ in the question that they were asked to state anything they want to add. Some of them indicated that they were interested in the research topic and wanted to share the results of the study and some stated that they learn many things while they filling out the survey.

To explore the teaching and assessment methods that primary school teachers implement in science and technology classess in response to sub-problem 1 of the study, section 2 of the PNAQ was used. This section included short answer open ended questions exploring the teaching and assessment methods that primary school teachers' use in science and technology classess. In this section of the PNAQ, teachers were asked the following questions: "Which teaching and assessment methods do you use in science and technology classess, could you give examples?", "How do you assess your students learning in science and technology classes, what are the factors that you consider while you give grades to your students at the end of the semester?", "Do you assess all of your students similarly? "Do you use seperate assessment methods for each of your students.

To answer the first question "Which teaching and assessment methods do you use in science and technology classess, could you give examples?", the teachers stated variety of teaching and assessment methods that they use in science and technology classes. Among 155 teachers, 19 teachers did not answer this open ended question in the PNAQ. Also only 40 teachers gave examples for the related teaching and assessment method. To analyze the responses of teachers, the open-ended PNAQ questions were analyzed by the use of qualitative analysis technique by counting the words and phrases related to teaching and assessment methods. Therefore the analysis unit was the words and the phrases. Analysis of the responses was carried out in some major steps suggested by Fraenkel and Wallen (1996), and Cummings and Worley (1996). First, the responses to questions were read to gain familiarity with the range of comments made. Second, based on the responses, the words and phrases were counted and then coding cateories and themes were generated. Finally, the frequency of responses for each category was tabulated. Also the categories were ranked in descending order of magnitude. In this respect, the type of the qualitative analysis frequency counts and coding. Table 4.2 demonstrated the frequency counts of teachers' responses related to the teaching and assessment methods. Based on the frequencies, categories were generated. Table 4.3 and 4.4 summarizes the categories based on teaching and assessment methods that primary school teachers use as they stated with the frequency counts (f) and with some examples from teachers' responses.

Table 4.2 Frequency Counts List of Teaching and Assessment Methods from the PNAQ Results

Teaching Methods and Learning Activities		*Assessment Methods*	
Word or phrase	Frequency	Word or phrase	Frequency
Projects	136	Achievement Tests	143
New approaches	132	Performance	124
Group works	120	New approaches	94
Science and Technology Curriculum	98	Portfolio	56
Simple experiments in class	97	Participation in activities	46
Student centered	95	Group works	26
Explanations	85	Peer assessment	21
Laboratory	75	Observation	16
Brain storming	52	Behavior	15
Questioning	51	Performance during experiments	14
Researches	47	Problem solving skills	13
Homeworks	44	Verbal exam	12
Individual Presentations	43	Attitude	12
Group Discussion	39	Project assessment	11
Expository teaching	38	Reasoning ability	9
Discussion	37	Preparation	7
Demonstration	35	Self assessment	7
Textbooks	33	Effort	5
Reading	30	Creative thinking	3
Role playing	28	Scientific process skills	2
Concept maps	25	Individualized assessment	2
Additional books	23	Intention	1
Visual activities	22	Interviews	1
Inquiry	21		
Field trips (museum, zoo, library, garden)	20		
Relating with everyday life	19		
Constructivism	19		
Drama	18		
Poster	16		
Learning by doing	14		
Active teaching	13		
CDs	10		
Discovery method	8		
Multiple intelligence based instruction	7		
Library	6		
Computers	6		
Competitions	3		
Cooperative	3		
Individual studies	2		
Whole group discussion	1		
Predict-Observe Explain	1		

As tabulated in Table 4.2, most of the teachers stated that they used strategies based on new approaches (132 teachers) and according to the NSTC (98 teachers).

They listed their strategies that they implement in science and technology lessons. The answers of the teachers ranged from projects to the predict-observe-explain method for teaching methods. Similarly for the assessment, most of the teachers (94 teachers) stated that they implement new approaches of assessment while they are assessing their students. Their responses for the assessment question ranged from achievement tests to interviews with the students. As tabulated in Table 4.3, when the responses of the teachers are categorized for teaching and assessment methods, primary school teachers implement mostly projects including individual presentations in science and technology classes (20.6%). They also use experiments (19.8%), group works (13.9%), discussions (8.8%), questioning (8.3%), brain storming (7%), demonstration (6.6%), role playing and drama (5.3%), expository teaching (4.4%), concept mapping (2.9%), field trips (2.3%), and POE (0.1%). As for the teachers' responses for the assessment methods, as shown in Table 4.4, teachers most frequently used assessment method is achievement tests (38%) including multiple choice, true-false, matching, fill in the blank, short answer, and essay type questions which are traditional assessment methods or strategies (MEB, 2005). Performance assessment strategies are also used by the teachers frequently (26.3%) including performance of the students on group works, participation in activities, preparation of the students to the lesson, attitude of the students toward lesson, in-class performance of the students, performance during experiments, behavior in classroom, observations, scientific process skills, intention and effort of students, conviction, and interviews. The other assessment methods used by the primary school teachers are portfolio (14.2%), individualized assessment (7.2%), peer assessment (5.6%), verbal exam (3.2%), project assessment (2.9%), and self assessment (1.9%). These methods are among the alternative assessment strategies suggested by MEB (2005). From these results, it is obvious that teachers implement traditional strategies more frequently than alternative strategies. Indeed, some of the alternative strategies suggested by MEB (2005) such as structured grids, diagnostic branching tree, and concept mapping were not stated by any of the teachers as an assessment method that teachers implement in science and technology lessons. Furthermore, one of the teachers stated that they did not have any time to assess their students individually and so she assessed her students in the same manner by using achievement tests. Some of the teachers also stated that they implement individualized assessment methods for only their handicapped or gifted students.

Table 4.3 The PNAQ Results for Categories of Teaching Methods Used by Primary School Teachers

Teaching Methods or Strategies	*f*	*%*	*Examples from teachers*
Projects -Individual presentations	179	20.6	-A project explaining the harmfulness of alcohol -Student presentations related to a topic
Experiments -in class -in laboratory -group experiments -observations	172	19.8	-An experiment carried out with fungus, with a microscope, comparing yeast and mould -Carried out in the class as no opportunity to use the laboratory
Group works	120	13.8	-Researches by groups, presentations, new inventor competition, poster preparation - Group projects on electric circuit
Discussions	76	8.8	- Having made students search on topics at home or in the library and discussion of the students in the class
Questioning	72	8.3	-In blood circulation topic
Brain-storming	61	7	-Assessing students' previous knowledge
Demonstration -Visual activities	57	6.6	-CDs on organisms
Role playing and drama	46	5.3	-Related to animals
Expository teaching	38	4.4	-After students' presentations
Concept mapping	25	2.9	-Teachers constructed on living organisms -Using samples from curriculum
Field trips	20	2,3	-to a zoo, library, museum
Predict-Observe-Explain approach (POE)	1	0.1	-During experiments especially before starting to a new experiments

Table 4.4 The PNAQ Results of for Categories of Assessment Methods Used by Primary School Teachers

Assessment Methods	***f***	***%***	***Examples from teachers***
Achievement tests	143	38	-Multiple choice, true-false, matching, fill in the blank, short answer
Performance assessment	99	26.3	-Group works -Participation in activities -Preparation to the lesson -Attitude toward lesson -In-class performance -Performance during experiments -Behavior in classroom -Scientific process skills -Intention and effort of students -Individualized assessment based on learning styles -Conviction -Observation forms used from curriculum
Portfolios	56	14.9	-Collection of experiment reports -Constructing and assessing concept maps
Individualized assessment (Individualized assessment based on learning styles, creative thinking, problem solving skills, and reasoning ability of the students)	27	7.2	-Teacher did not state any examples of individualized assessment -Most of them stated that they use individualized assessment along with the other assessment methods.
Peer Assessment	21	5.6	-It is effective as they take responsibilities
Verbal exam	12	3.2	-Once in a term
Project Assessment	11	2.9	-Based on student projects
Self Assessment	7	1.9	-Sometimes my students assess themselves

4.3.2 Results of Interviews for Sp1

Based on the responses of the teachers during the interviews, it can be stated that primary school teachers use a wide range of teaching and assessment methods in science and technology classes. The categories that emerged through thematic analysis of the interviews clustered under 40 themes for the teaching methods and 17 themes for the assessment methods, the results were also parallel to the results of the open-ended questionnaire dimensions. Two basic category determined to display the result of related interview questions were teaching methods “before starting to a topic” and “while teaching science topics”. These two categories were analyzed based on student and teacher centered approaches. The themes generated based on the results were complied under these two categories. According to the results, teachers implement variety of teaching methods before starting to a topic and while teaching science topics.

The themes generated for teaching and assessment methods were summarized in Table 4.5. Categorization of the teaching and assessment methods were organized based on MEB (2005). Entire coding list for the interviews related to all subproblems was presented in Appendix K. As appeared in Table 4.5 primary school teachers implement a variety of both student centered and teacher centered teaching methods in science and technology classess from lecturing to presentations by the students.

Table 4.5 Interview Results of Teaching Methods Used by Primary School Teachers

Before Starting to a Topic			
Preparation of questions by students	Arousing curiosity and attention	Questioning	Handing out questions to students
Outside investigations by students	Preparation of the teacher	Back to past topics	Knowing students knowledge from their background
Observations of students from daily life	Bringing students to the same level	Forming corners or centers in class	Brain storming

While Teaching Science Topics

Teacher Centered Strategies			Student Centered Strategies		
Lecturing -Summary -Daily life examples -Explaining	Demonstration (visual materials) -Observations -Preparing posters -Using models	Whole Class -Discussions	Role Playing	Projects -In class -At home -Individual -Group	Independent Study - Individualized teaching - Investigations -Poem -Song -Plays Preparing an index
	Story telling	Video	Peer Teaching	Library Search	Learning Centers - Student prepared materials
	Questioning	Simulations	Outdoor activities -Field Trips	Questioning	Presentations by students
	Giving examples from teacher experiences	Drills and Practice	Cooperative learning -Group works	Discovery -Learning by doing	
	Establishing relations with other lessons		Drama Dramatizaton	Problem based learning	
	Analogy		Games	Homeworks	

As for the assessment methods, teachers use various kind of assessment methods to assess their students' learning. The results were the same obtained in the PNAQ part of the study presented in Table 4.4. The assessment methods used by the primary school teachers are testing (Open-ended, multiple choice, fill in the blank, essay exams), performance assessment (Preparation for lesson, effort, performance during presentations, experiments, projects, and activities, also involvement to lesson, investigations), honesty of the students, interest of the students, students' achievement in the past, relationship of the students with their friends, process assessment, self assessment of the students, project assessment, peer assessment by using peer teaching forms, questioning, family involvement (Feedbacks for families, feedbacks from families), verbal examination and assessment of students' homeworks. Among these assessment methods, majority of the teachers (about 8 teachers) stated that they use achievement tests and performance tests to assess their students' learning that is to give a grade for the students at the end of the semester. The number of teachers using self assessment, peer assessment, verbal exam or project assessment was low (4 teachers).

4.3.3 Results of Observation for Sp1

Observation carried out in two classess supported the findings of the PNAQ and the interview results. The coding list for the observation results including teaching methods used by the teachers, materials used in the class, teachers' interactive activities, and students' interactive activities was given in Appendix L. Teaching methods used by the teachers are tabulated in Table 4.6. Furthermore, general profile of the two science and technology classess is given in Table 4.7. Based on the observations, teachers mostly implement questioning, presentation of the students, reading from the science book, group works and projects in their science and technology classes. Entire coding list for the observations related to the first subproblem was presented in Appendix L.

Table 4.6 Observation Results for Teaching and Assessment Methods

Teaching Methods	Assessment Methods
Questioning	Achievement tests
Lecturing	Performance assessment
Daily life examples	Peer Assessment
Explaining	Verbal exam
Summary	Project Assessment
Analogy	Self Assessment
Demonstration	
Using models	
Model construction	
Observations	
Drama	
Dramatization	
Role playing	
Special possession	
Presentations by the students	
Group presentations	
Individual presentations	
Discussion	
Whole class discussion	
Activity based teaching	
Investigation	
Investigations	
Experiments	
Discovery	
Learning by doing	
Brain storming	
Group works	
Projects	
Homeworks	

Table 4.7 General Profile of Two Science and Technology Classes

Class 1	**Class 2**
-Teacher of the class (T1) has a 15 years of experience -Use more traditional strategies -Spent a large percentage of classroom time on presentation of the students and reading from a book -At least 15 minutes of the lesson spent for establishing students' discipline and dealing with outside interrupts -T1 presents students with opportunities to learn the same concepts in different ways; reading assignments, projects, power points etc. -T1 encourages students to consult other materials while learning including real materials and different texts	-Teacher of the class (T2) has a 26 years of experience -Use more student-centered approaches -T2 relates science instruction with real-life, content is never presented as abstract information -T2 explicitly helps students make connections from abstract information to real world -T2 encourages students to consult other materials while learning including real materials and different texts -T2 explain students why each assignment is important, how they may use it later in life -Better guidance during the presentation of the students

Presentation by the students was the dominant strategy used in both classess. Teachers' guidance was different in two classess. In one of them, teacher only listened the students' presentations but in the other class, better teacher guidance was observed. It can also be stated that in both classess, presentation by the students seemed to be very useful for the students.

4. 4 Results Related to Sub-problem 2

4.4.1 Results of the PNAQ for Sp2 (Section 3)

The second sub-problem of the study was “What are teachers’ practices related to teaching and assessment methods based on individual differences in science and technology classes? Do they use teaching and assessment strategies focusing on individual differences like learning styles or multiple intelligences?”. To answer this question, section 3 of the PNAQ was used. Teachers’ responses to the questions were analyzed seperately for the three domains of the PNAQ by using descriptive statistics and frequency charts.

As can be seen from Table 4.8 and Figure 4.1, related to the general approaches on the TAMBID, teachers use A2 most frequently which is, to facilitate students’ learning by being a quidance. They also encourage their students to think scientifically and to be able to establish relations with the information learned in the class and daily life which are labeled as A12 and A19, respectively. The results of the descriptive statistics of mean distribution of practices of teachers demonstrated that the least frequently used approach by the teachers is to give opportunities for the students for expressing their ideas with the help of music (A17). Teachers also do not encourage their students to write about science topics to keep a science diary as much as other approaches (A10).

Table 4.8 Practices of Primary Teachers Based on General Approaches for the TAMBID

	Unknown strategy		Known but not applied		Rarely		Sometimes		Frequently		**SUM**			
	f	**%**	**f**	**%**	**f**	**%**	**f**	**%**	**f**	**%**	**f**	**%**	X_{ort}	**SD**
A1	-	-	17	11	20	12.9	43	27.7	75	48.4	155	100	4.14	1.02
A2	-	-	2	1.3	11	7.1	26	16.8	116	74.8	155	100	4.65	0.67
A3	1	0.6	1	0.6	19	12.3	53	34.2	81	52.3	155	100	4.37	0.77
A4	-	-	4	2.6	21	13.5	39	25.2	91	58.7	155	100	4.40	0.82
A5	1	0.6	2	1.3	10	6.5	45	29	97	62.6	155	100	4.52	0.73
A6	-	-	3	1.9	14	9	40	25.8	98	63.2	155	100	4.50	0.74
A7	7	4.5	26	16.8	41	26.5	41	26.5	40	25.8	155	100	3.52	1.18
A8	1	0.6	2	1.3	18	11.6	33	21.3	101	65.2	155	100	4.49	0.80
A9	1	0.6	19	12.3	32	20.6	68	43.9	35	22.6	155	100	3.75	0.96
A10	5	3.2	36	23.2	44	28.4	47	30.3	23	14.8	155	100	3.30	1.08
A11	-	-	7	4.5	22	14.2	46	29.7	80	51.6	155	100	4.28	0.87
A12	1	0.6	2	1.3	10	6.5	33	21.3	109	70.3	155	100	4.59	0.73
A13	1	0.6	1	0.6	17	11	37	23.9	99	63.9	155	100	4.50	0.77
A14	-	-	8	5.2	20	12.9	50	32.3	77	49.7	155	100	4.26	0.88
A15	1	0.6	5	3.2	20	12.9	46	29.7	83	53.5	155	100	4.32	0.87
A16	1	0.6	5	3.2	24	15.5	67	43.2	58	37.4	155	100	4.14	0.84
A17	13	8.4	30	19.4	44	28.4	43	27.7	25	16.1	155	100	3.24	1.18
A18	-	-	11	7.1	32	20.6	49	31.6	63	40.6	155	100	4.06	0.95
A19	2	1.3	1	0.6	13	8.4	37	23.9	102	65.8	155	100	4.52	0.78
A20	1	0.6	11	7.1	20	12.9	46	29.7	77	49.7	155	100	4.21	0.96
A21	1	0.6	2	1.3	29	18.7	56	36.1	67	43.2	155	100	4.20	0.83
A22	-	-	5	3.2	16	10.3	45	29	89	57.4	155	100	4.41	0.80
A23	3	1.9	3	1.9	19	12.3	57	36.8	73	47.1	155	100	4.25	0.89
A24	3	1.9	13	8.4	42	27.1	32	20.6	65	41.9	155	100	3.92	1.10
A25	-	-	2	1.3	17	11	37	23.9	99	63.9	155	100	4.50	0.74
A26	-	-	3	1.9	16	10.3	33	21.3	103	66.5	155	100	4.52	0.76
A27	1	0.6	11	7.1	36	23.2	54	34.8	53	34.2	155	100	3.95	0.96
A28	-	-	10	6.5	29	18.7	38	24.5	78	50.3	155	100	4.19	0.96

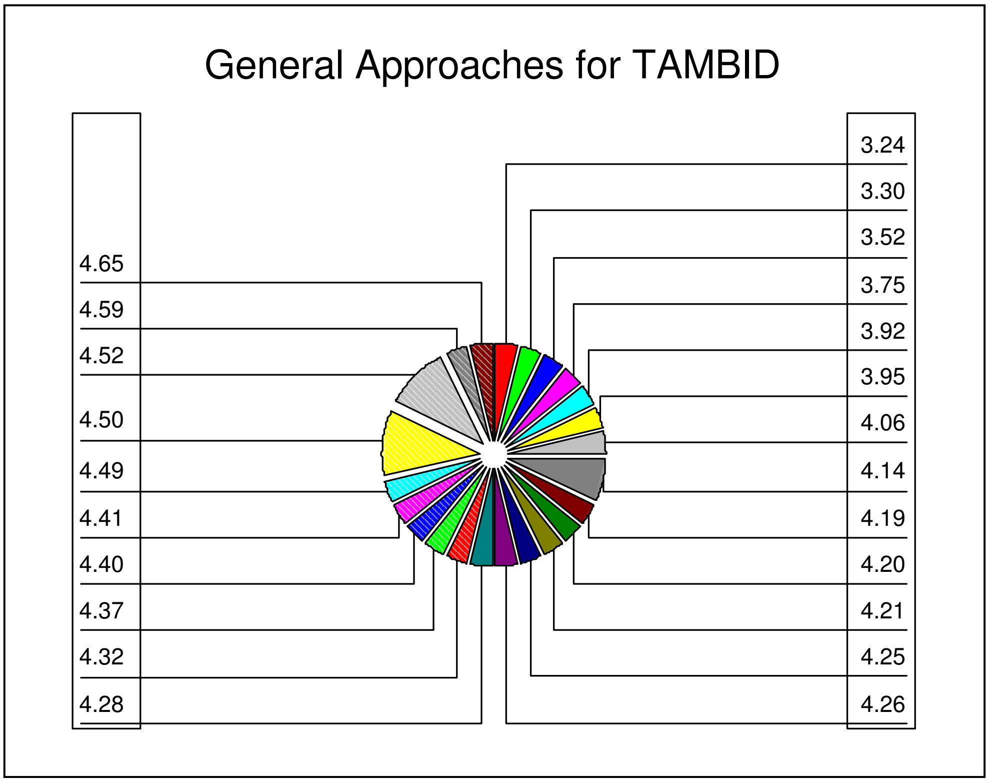


Figure 4.1 Mean Distribution of Practices of Teachers Based on the TAMBID

Table 4.9 and Figure 4.2 display the teaching methods used by the primary school teachers. The mean of each item demonstrated that teachers implement each of the teaching method in this section in their classess. As appeared in Figure 4.2, tearchers implement B9 which is using visual materials such as maps, shema, and posters, B8 which is giving opportunities for the students to prepare and present a group projects related to the topics in class and B6 which is to encouarage students for brain storming more frequently than the other teaching methods stated in section 3 of the PNAQ. Based on the results, least frequently used methods by primary school teachers are B2, B5, B10 which are, to include outside activities (museum, library and field trips) into the lessons, to read and explain the topic for the students, and to use rhythm, songs and music in science teaching.

Table 4.9 Practices of Primary School Teachers on Teaching Methods based on Individual Differences

	Unknown strategy		Known but not applied		Rarely		Sometimes		Frequently		SUM			
	f	%	f	%	f	%	f	%	f	%	f	%	X_{ort}	SS
B1	1	0.6	9	5.8	27	17.4	76	49	42	27.1	155	100	3.96	0.86
B2	1	0.6	36	23.2	42	27.1	53	34.2	23	14.8	155	100	3.39	1.02
B3	1	0.6	10	6.5	34	21.9	57	36.8	53	34.2	155	100	3.97	0.94
B4	3	1.9	13	8.4	27	17.4	46	29.7	66	42.6	155	100	4.03	1.06
B5	3	1.9	15	9.7	36	23.2	55	35.5	46	29.7	155	100	3.81	1.03
B6	2	1.3	3	1.9	21	13.5	54	34.8	75	48.4	155	100	4.27	0.86
B7	1	0.6	8	5.2	21	13.5	53	34.2	72	46.5	155	100	4.21	0.91
B8	2	1.3	1	0.6	20	12.9	40	25.8	92	59.4	155	100	4.41	0.84
B9	-	-	1	0.6	16	10.3	31	20	107	69	155	100	4.57	0.70
B10	3	1.9	22	14.2	41	26.5	50	32.3	39	25.2	155	100	3.65	1.07
B11	-	-	5	3.2	17	11	49	31.6	84	54.2	155	100	4.37	0.81
B12	-	-	12	7.7	20	12.9	52	33.5	71	45.8	155	100	4.17	0.93
B13	1	0.6	6	3.9	28	18.1	54	34.8	66	42.6	155	100	4.15	0.90

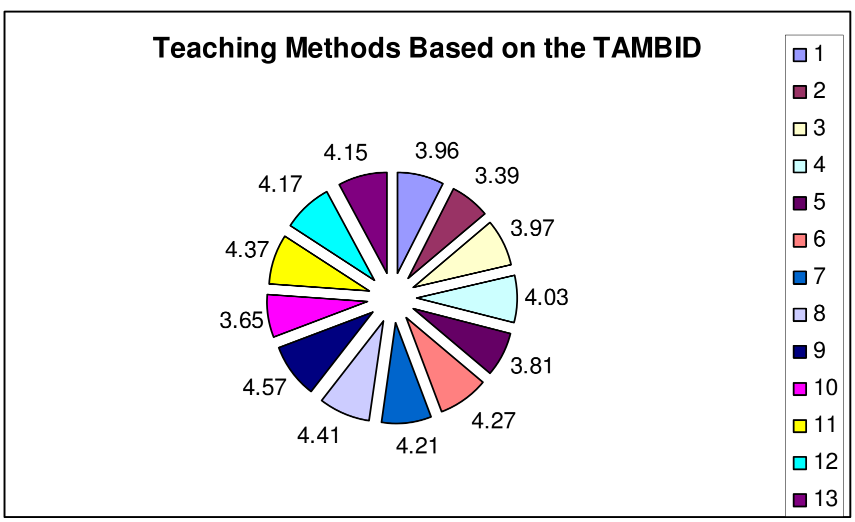


Figure 4.2 Mean Distribution of Practices of Primary School Teachers on Teaching Methods

Table 4.10 and Figure 4.3 present the assessment methods used by the primary school teachers. As appeared in the Table, the mean of the C10 (X_{ort}=4.37), C3 (X_{ort}=4.37), C7 (X_{ort}=4.29), C14 (X_{ort}=4.29) were the highest among the other assessment methods. These items were (Table 3.8) to take students' skills in communication into consideration, to use samples for reasoning and problem solving ability of the students, to include a display of a product like a model that students develop by hand in assessment, and visual presentations of students' studies for C10, C3, C7, and C14 respectively. However, according to the means, teachers include C17 (X_{ort}=3.26), C19 (X_{ort}=3.39), and C12 (X_{ort}=3.56), into their assessment least frequently. These items were to include students' musical performrmance and their compositions, to take their portfolios into consideration and to include peer assessment in assessment for C17, C19, and C12, respectively.

Table 4.10 Practices of Primary Teachers on Assessment Methods based on Individual Differences

	Unknown strategy		Known but not applied		Rarely		Sometimes		Frequently		SUM			
	f	**%**	**f**	**%**	**f**	**%**	**f**	**%**	**f**	**%**	**f**	**%**	X_{ort}	SS
C1	-	-	6	3.9	25	16.1	54	34.8	70	45.2	155	100	4.21	0.85
C2	2	1.3	20	12.9	35	22.6	54	34.8	44	28.4	155	100	3.76	1.04
C3	-	-	5	3.2	20	12.9	42	27.1	88	56.8	155	100	4.37	0.83
C4	2	1.3	15	9.7	33	21.3	42	27.1	63	40.6	155	100	3.96	1.06
C5	5	3.2	15	9.7	30	19.4	48	31	57	36.8	155	100	3.88	1.11
C6	-	-	8	5.2	30	19.4	51	32.9	66	42.6	155	100	4.13	0.90
C7	-	-	2	1.3	31	20	42	27.1	80	51.6	155	100	4.29	0.83
C8	7	4.5	22	14.2	36	23.2	52	33.5	38	24.5	155	100	3.59	1.14
C9	3	1.9	13	8.4	38	24.5	48	31	53	34.2	155	100	3.87	1.04
C10	-	-	7	4.5	20	12.9	37	23.9	91	58.7	155	100	4.37	0.88
C11	2	1.3	8	5.2	24	15.5	47	30.3	74	47.7	155	100	4.18	0.96
C12	2	1.3	25	16.1	51	32.9	38	22.5	39	25.2	155	100	3.56	1.08
C13	1	0.6	14	9	18	11.6	48	31	74	47.7	155	100	4.16	1.00
C14	2	1.3	5	3.2	26	16.8	35	22.6	87	56.1	155	100	4.29	0.95
C15	2	1.3	11	7.1	14	9	64	41.3	64	41.3	155	100	4.14	0.94
C16	1	0.6	11	7.1	32	20.6	55	35.5	56	36.1	155	100	3.99	0.96
C17	12	7.7	36	23.2	36	23.2	42	27.1	29	18.7	155	100	3.26	1.23
C18	3	1.9	7	4.5	35	22.6	42	27.1	68	43.9	155	100	4.06	1.01
C19	9	5.8	27	17.4	44	28.4	44	28.4	31	20	155	100	3.39	1.16

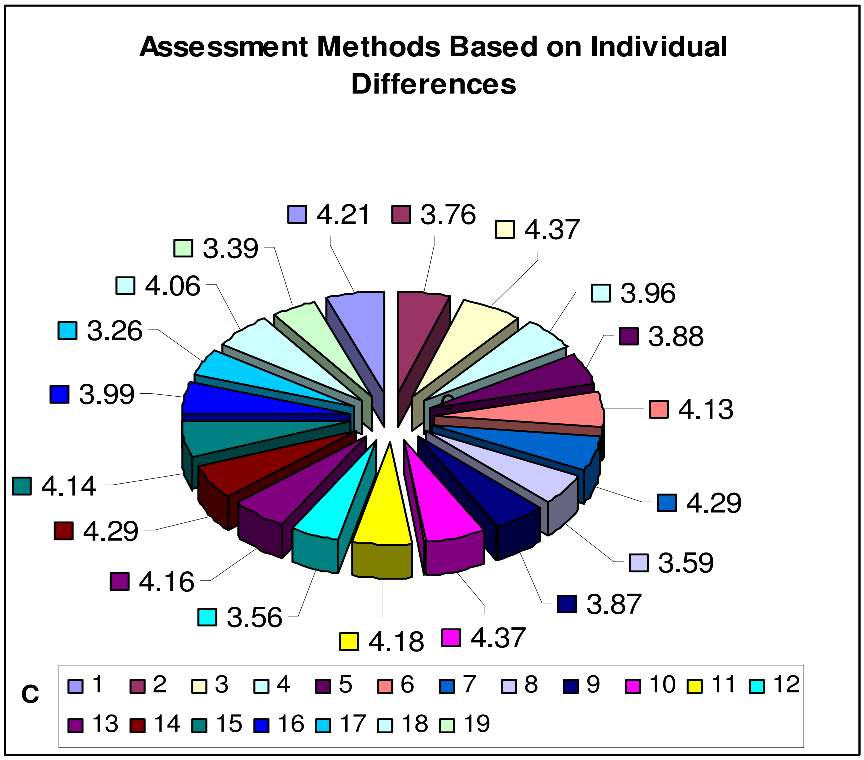


Figure 4.3 Mean Distribution of Practices of Primary School Teachers on Assessment Methods

4.4.2 Results of Interviews for Sp2

Interview questions 10, 11, and 12 in Appendix D were analyzed qualitatively to answer the second sub-problem "What are teachers' practices related to teaching and assessment methods based on individual differences in science and technology classes? Do they use teaching and assessment strategies focusing on individual differences like learning styles or multiple intelligences?". The themes and codes generated for answering the second subproblem of the study were presented in Appendix K. Based on the results, majority of the teachers stated that they implement teaching and assessment strategies focusing on individual differences. Also they clarified that use of the TAMBID has some advantages in science and technology classess. The responses of the primary school teachers based on the interview questions were compiled in three main categories; Teaching Methods based on the TAMBID, assessment methods based on the TAMBID, and importance and positive features of using the TAMBID. Among 13 teachers, 7 of them mentioned that they use variety of teaching and assessment methods to minimize the individual differences of their students. Teaching methods implemented by primary school teachers to consider individual differences of the students are; simple schemes, pictures, plays, drama (dramatization and role playing), watching films, drawing, hands-on activities, peer teaching, sport activities, group works, reading activities, writing poems, presentations, music, individual studies, projects, activities considering 5 senses, and giving responsibilities based on level of the students. Two of the teachers stated that implementation of NSTC is enough to satisfy the TAMBID, by teaching ways to reach knowledge for the students and arousing attention for students. Another teacher stated that she motivated low achievers in class during the lesson to equate the levels of the students. Selection of methods based on grade level is another statement made by another teacher. One of the teachers having a handicapped student in his class mentioned that he used individualized teaching for the handicapped student.

Teachers also talked about various assessment methods that they implement to consider individual differences of the students. Among them are; verbal exam, effort of students, performance assessments, essay exams, compositions, individualized assessment for handicapped students, peer assessment, portfolio assessment, evaluating the exams based on learning abilities of the students, giving high grades for low achievers to motivate them, self assessment of the students, objective assessment by taking curve and considering interest area of the students while assessing them. Two of the teachers stated that they implemented the same exam for all of the students since there is no chance to prepare different exams for the students. One of the teachers also stated that she assess their students based on approaches on old curriculum.

Teachers also specified the importance and advantages of using the TAMBID. Their perceptions are as follows; Use of the TAMBID results in better learning for students especially in their own interest area, sharing knowledge among students, developments of students in time, developing self confidence in students, preparing students for the life and future, developing verbal expression of students, supporting the efforts of students to reach high achievers, acquisition of long lasting knowledge in students, useful for the students with respect to knowing their responsibility and increasing interaction among students. One of the teacher also stated that she learned many methods from their students. Majority of the teachers think that to reach and gain each student, use of the TAMBID is important.

4.5 Results Related to Sub-problem 3

The third sub-problem of the study was **"**What are teachers' perceptions related to new science and technology curriculum in Turkey in terms of teaching and assessment methods?". This question was answered by using the data in Section 2 of the PNAQ related to the teaching practices of primary school teachers based on the TAMBID.

4.5.1 Results of the PNAQ for Sp3 (Section 2; Question 2; a, b, 3)

The questions in Section 2 of the PNAQ related to this subproblem were "Are you familiar with the improvements in science and technology curriculum?, What do you think which approaches these improvements are based on?", "Do you feel yourself adequate in terms of theoretical knowledge and application of the new approaches in science and technology lessons?".

To show their familiarity with the improvements in science and technology lessons, teachers gave their responses on a 5 point scale from 1 meaning less familiarity to 5 meaning most familiarity. Teacher's responses to this question was summarized in Table 4.11. The mean of the responses was 4.37 as shown in Table.

Therefore, it can be stated that teachers are familiar with the improvements in science and technology lessons. For the next question "What do you think which approaches these improvements are based on?", teachers' responses were summarized in Table 4.12.

Table 4.11 Familiarity of the Primary School Teachers with Improvements in Science and Technology Lessons

The question	1 least f / %	2 f / %	3 f / %	4 f / %	5 most f / %	Mean
Are you familiar with the improvements in science and technology lessons?	-	3 / 1.9	30 / 19.4	28 / 18.1	94 / 60.6	4.37

Table 4.12 Frequency Counts of Perceptions of Teachers on Improvements in Science and Technology Lessons

Improvements in science and technology lessons are based on		
Statements by teachers	*f*	%
Learning by Doing	36	14.1
Student centered approach	29	11.4
Investigation	26	10.2
Constructivist Approach	24	9.4
Experiments and observation	23	9
Multiple Intelligence	19	7.5
Relation with daily life	12	4.7
Avoiding from Rote learning	12	4.7
Developing creative and critical thinking	9	3.5
Approaches on developing skills to reach knowledge	9	3.5
Discovery learning	7	2.7
Projects	7	2.7
Activities	6	2.4
Emphasis on visual learning	6	2.4
Permanent learning	5	2

Table 4.2 (cont'd)

Drama based instruction	4	1.6
Spiral Approach	3	1.2
Individualized Instruction	3	1.2
Discussions	3	1.2
Process based	2	0.8
Developing scientific process skills	2	0.8
Developing problem solving skills	2	0.8
Integrated curriculum (relation with other lessons)	2	0.8
Using developments in technology	2	0.8
Questioning	2	0.8
Total	255	-
Having no idea (stating "I do not know" or "I can not give any example of approaches")	16	-
Stating that NSTC is "Not applicable"	4	-

The last question in Section 2 was "Do you feel yourself adequate in terms of theoretical knowledge and application of the new approaches in science and technology lessons?". Teachers answered the question by marking the "yes" or "no". They were also asked to write the reason if their answers were "yes" or "no". Among teachers, 153 of them answered this question and most of the teachers explained the reason of their answer for this question. The results of the answers of the primary school teachers for this question was shown in Table 4.13.

Table 4.13 Perceptions of Teachers to Feel Adequate in terms of Theoretical Knowledge or Application of New Approaches in Science and Technology Lessons

	ANSWER	
	YES	**NO**
f	71	82
%	46.4	53.6

Explanations (The reason of stating "yes" or "no")			
Yes	f	No (or yes but)	f
Because of		Because of	
-Getting in-service education on NSTC	6	-Inexperience in teaching profession -Need of more years in teaching science and technology	3
-Having enough theoretical knowledge for 5th grade science	1	-Not reading or searching to renew herself	2
-Having skills and ability for interacting with the students	1	-Inadequacy of the materials -Need of abundance of materials -Difficulties in obtaining materials	36
-Richness of the activities in NSTC	2	-Immediate change of the curriculum -Not proper with the pysical conditions in schools	2
-Easiness of application	1	-Need of in-service education about new curriculum -Inadequacy of the teacher education -Irrelevancy of content of the seminars with the curriculum -Inadequacy of educators giving the seminars -Shorthess of in-service educations -Theoretical content of in-service educations	38

Table 4.3 (cont'd)

-Detailed explanations in science and technology teacher book	4	-Difficulties while carrying out the experiments -Most of the time, failing during experiments -Not knowing how to carry out -Inadequacy of the laboratories in the school -Not using the laboratory for each experiment -Having no equipped laboratory -Need of science teacher in the laboratory lessons	25
-Presence of enough materials in the school such as data projector and computer	3	-Need of time to be used to the curiculum -Hardness in adapting to the new curriculum	9
-Feeling adequate in knowledge but not in application	8	-Not giving importance for developing herself because of family life	1
-Following up every development related to science education	1	-Need of technology such as computers and internet connection in the school or in the class	4
-Reading many books and articles on science education	2	-High number of students in the class	14
-Learning the application of new approaches during pre-service education	8	-Not knowing how to reach application examples about new approaches	6
-Personal effort to adapt to the curriculum	2	-Need of more time to carrying out all activities in the book	4
-Experience in teaching profession for many years -Being at least 20 years of teaching experience -Having ability to solve the problems for many years	6	-Hardness to understand the science and technology teacher book -Full of unknown words -A few examples on application of the new approaches -Objectıves are not clearly stated	2

Table 4.3 (cont'd)

-Necessity of adapting to the knowledge age -Being compulsory to apply new approaches to catch the developed countries	1	-Inconvenience of using the approaches in new curriculum -Not appropriate approaches for Turkish students	2
-Doing preparation before science and technology lesson	3	-Thinking that the new curriculum is not properly prepared -Not appropriate for students' thinking level -Many changes at a time	5
-Having positive attitude toward science and technology	2	-Being not appropriate for physical structure of the class -Not proper arrangement of the desks -Small class size -Not having enough visual materials in the classroom	3
		-Being not familiar with the equipments written in NSTC -Need of in-service education on using equipments in Science	3
		-Presence of examinations in Turkey affect the quality of the education that the teacher give	5
		-Science book is unproper -The main topics are not clearly stated	4
		-General sturucture and perspectives of Turkish people affect the application of NSTC	1
		-Graduating from irrelevant department in university	8

To sum up the Table 4.13, among 153 primary school teachers, 71 of them (46.4%) stated that they feel adequate and 82 of them stated that they did not feel adequate (53.6%) in terms of theoretical knowledge or application of new approachers in science and technology lessons. The results of this question revealed that most of the teachers did not feel themselves be adequate for applying NSTC. Teachers explained the reason of their perception in variety of ways. For the teachers whose responses are in favor of feeling adequate in terms of NSTC, their perceptions were various. For example, 6 teachers stated that they feel adequate since they got in-service education about the application of the NSTC. These teachers had enough theoretical and application knowledge related to the NSTC. However most of the teachers had negative perceptions on NSTC in terms of having not adequate theoretical knowledge and needing in service education. The notable majority of teachers (n=38) stated that they need in-service education on new approaches and on NSTC. There are many other reasons that teachers stated in that they feel negative about the NSTC. For instance, one of the teacher stated that "if I apply the curriculum as it is, I am afraid to be uncessfull teacher since my students would not be successfull in the examinations (OKS, LGS) in Turkey. Therefore, I would have to emphasize the memorization of knowledge, facts and concepts while teaching science and technology which affect the aplication of NSTC".

The results of this section of the PNAQ might demonstrate an important issue in terms of teacher education and application of NSTC that will be one of the concerns of this study in the discussion of the results part in Chapter 5.

4.5.2 Result of Interviews for Sp3

Thematic analysis of interview questions (Question 2 in the interview schedule) yielded 5 categories for the third subproblem relating to the perceptions of teachers on NSTC as shown in Figure 4.4. Categories emerged from the responses of the teachers were explained seperately each having additional sub-categories and codes. Entire coding list for the interviews related to third subproblem was presented in Appendix K.

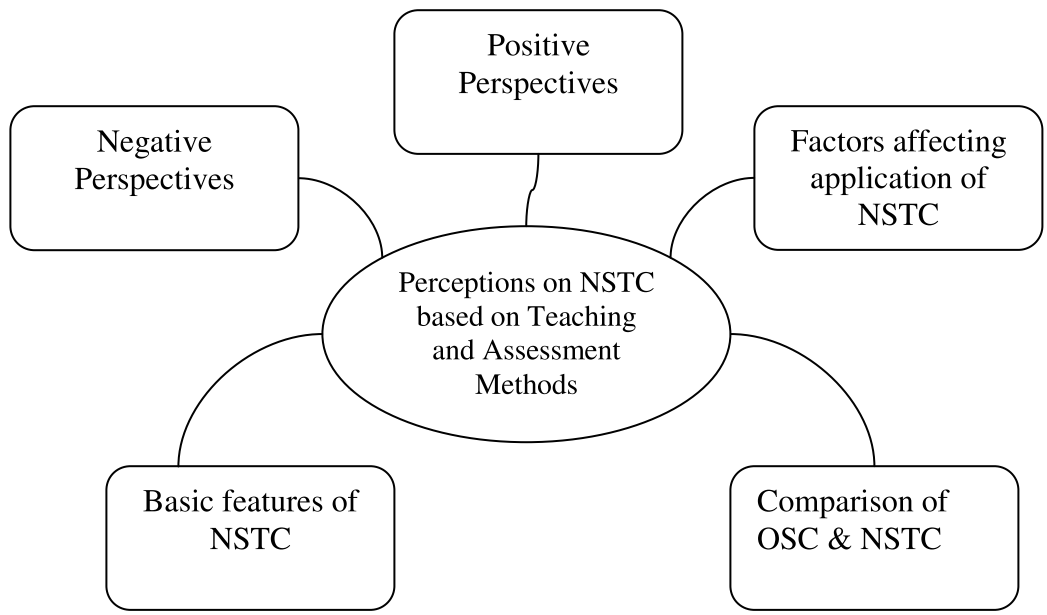


Figure 4.4 Categories Emerged from the Perceptions of Primary School Teachers on NSTC

4.5.2.1 Basic Features of the NSTC

Some of the primary school teachers basically mentioned about the general features of NSTC. They were not stated much about the NSTC in general since the interview questions were basically on teaching and assessment methods in NSTC. However, as teachers stated these features, the researcher decided to categorize these themes additionally. Responses of 13 teachers were gathered in ten categories. These categories were as listed in Appendix K. According to the teachers, basic features of NSTC were; emphasis of NSTC on personality rather than information as every child is valuable according to NSTC, expectations from students (having responsibility, being a good citizen, having good personality, to be honest, to be researcher, to be examiner, not accepting everything as it is, doing analysis, doing synthesis), being science an experiment and observation lesson, being student centered, learning by doing, based on constructivist approach, based on investigations, long lasting knowledge, teacher being a guider. These themes were so similar with the categories generated for the open ended questions in the PNAQ presented in the former part. Therefore, the results of the different data collection instruments were consistent with each other for this section.

4.5.2.2 Comparison of the OSC and the NSTC

In this study, most of the primary school teachers also compared OSC and NSTC in many respects. This might be bacause most of the teachers were experienced teachers in their years of teaching. As shown in Appendix K, there were thirteen sub-themes emerged from the analysis based on comparison of OSC and NSTC. Differences between the two curriculum based on teachers' statements were summarized in Figure 4.5. Based on the teaching and assessment methods, teachers stated that NSTC was better than OSC in many respects such as having more group projects, less theoretical knowledge, better adaptation of the students, having better books and so on. However, one of the teacher (T1) stated that OSC was better in terms of laboratory activities by having laboratory teachers, laboratory notebooks for each child and application of more laboratory.

	OSC			NSTC	
	More laboratory application			Less laboratory application	
	Lab teachers			No lab teachers	
	Lab notebooks for each child			No notebooks	
	Innovative			More innovative	
	Less group work activity			Emphasis on group works	
	More theoretical knowledge			Less theoretical knowledge	
	More details			Less details	
	More Questioning			Product based	
	Difficulty in adaptation of stds			Better adaptation of stds	
	Less applicable			More applicable	
	Standard books			Better books	
	Teacher centered			Student centered	
	Less projects			More projects	
	Less experiment			More experiments	

Figure 4.5 Comparison of the OSC and the NSTC Based on Teaching and Assessment Methods

4.5.2.3 Factors Affecting Application of the NSTC

Most of the teachers during interviews stated the factors that affects the application of the NSTC. Their comments were valuable and contribute to the results of needs of teachers to implement the TAMBID which will be discussed in the last chapter. According to the teachers, there are many factors that affect the implementation of NSTC. There were thirteen sub-themes generated based on teachers' perceptions. Teachers stated that teachers properties were the most significant factor that affects the implementation of NSTC. For instance, they believed that personality, beliefs, perspectives, family life and gender of the teachers might affect the teachers' teaching skills by affecting the application of NSTC. One of the teachers, expressed her perspectives related to this factor as in the following sentences:

> “Female teachers generally do not have any economic problems because our husbands earn money at home. Therefore we teach as a hobby and so we love our profession. If I were a male, and if I had economic problems, I would not be successful as I am. It is very important. A teacher entering a class should be happy. She/he should not think anything other than students. However, these kinds of problems were so common in our country q (1), t (1,3)”.

Her statements demonstrated that teachers have many external variables to affect their teaching. One of them is the gender that affects the income, concentration and happiness of the teachers. The other is the family life of the teachers as stated by the teacher in the following statement.

> “One of my students’ parent asked me about the teacher that teach instead of me as I changed my school at that time. I said that she is a good teacher, she asked the age and family of the teacher. I replied, she had two children. They were in high school. She said that ‘oh my good’ now is the most problematic time of that teacher, she can not concentrate on the class. Yes, this parents’ conclusion was true. Curriculum changes continuously but if teachers’ income and family problems continue nothing will change….q (2), t (1,3)”.

The other factors affecting the application of NSTC according to the teachers were family life of the students including cultural level of family, income and their styles of studying. Furthermore structure of the school in terms of presence of equipments and materials, number of students in the classroom and the size of the classroom was an important issue in the application of NSTC. The other factors emerged were guidance of teachers, presence of knowledge based examinations in Turkey (OKS & OSS) affecting the full application of NSTC. One of the teachers (T5) who was teaching at a school which is the first in OKS examination in Turkey stated that cooperative workings of persons in school was so beneficial for the achievement. He explained the keys of their school achievement in his own words:

> "Our achievement in the school was not achieved by the teachers alone. There was a team work in our school. Principal, my colleagues to be successful. If you work as a team, then achievement comes. We always worked with my colleagues. Whatever I did, the other teachers did the same and vice versa. To work as a team is so important. We do not work alone. We are not jealous. Our tests and questions were the same. We share our knowledge. We get help from the science teachers in the school. We are a family in school. Comfortable, relax and harmony were the key elements of the achievement q(4), t(5, 2)".

The categories and codes of harmony with other teachers including same applications, same types of assessment, sharing knowledge among teachers, getting help from science teachers, and comfortable and relax working conditions emerged from the sayings of the T5 above.

4.5.2.4 Positive Perspectives on the NSTC

Primary school teachers' responses demonstrated that teachers have some positive perceptions on NSTC. There were twenty sub-categories emerged related to the positive aspects of the NSTC according to teachers' perceptions (see Appendix 0). First of all, they think that NSTC have a well written science book. There are many good activities with their simple explanations. They think that NSTC was prepared based on student centered approaches and it is rich in content. They had some difficulties at the beginning of the curriculum but they applied the NSTC better in time. Also they stated that NSTC gives flexibility to teachers to apply the subjects in the curriculum. Their perceptions on NSTC related to students are also obvious as majority of them stated that NSTC was helpful for the students in many respects. For example, one of the teachers (T3) stated that by using the NSTC, achievement of the students increases. She expressed her feelings with the following statement;

> "I am very happy to apply this program. It was so useful for me and for my class. My students' achievements increased so much. Mathematics curriculum was also changed but I especially like the NSTC. The book were very good, activities were excellent. As our general examinations revealed, students' achievement in science was better than other lessons (q3), t (3, 1)".

Majority of the teachers said that their students have positive feelings about NSTC. They think that NSTC develops self confidence in students and useful for students' development. Examples are from daily life and investigative nature of the experiments was so useful for the students. By this way, students reach conclusions by themselves and it gives opportunities for students to know themselves. NSTC also increase group interactions among students and involvement of each student to the lesson was achieved by use of activities and multiple intelligences strategies as stated by the teachers. One of the teachers (T13) also said that NSTC gives opportunities to reveal individual differences of the students and also the use of multiple assessment methods was useful to assess the students. Three of the teachers also stated that knowledge acquired through the methods in NSTC would be more permanent for the students.

4.5.2.5 Negative Perspectives on the NSTC

Besides the other categories emerged so far, teachers also stated many negative perspectives on the implementation of NSTC. There were twelve sub-categories related to this category as can be seen in Appendix K. The sub-categories generated were lack of teacher training, feeling unfair about old science curriculum, problems related to laboratory, problems related to science book, number of students in class, size of the class, students being used to the system in OSC, inappropriate features of schools, assessment of students still by examinations, lack of assessment tools, lack of teacher knowledge on assessment, and lack of specialist on assessment in school.

Majority of the teachers stated that teacher training was not adequate to apply NSTC based on the TAMBID. For instance, they think that they took seminars from unqualified persons, they had their teachers' book late and so had difficulties in adapting to the curriculum. Also they experienced many technical inadequacies. Most of them stated that they were unqualified in laboratories. Their problems related to the laboratory included the absence of laboratory lesson and a laboratory teacher in school, having no lab notebooks, lack of equipments, lack of time, inappropriateness of the experiments with levels of students, difficulties in searching and reaching materials and difficulties in preparation for the experiments. Related to the science book they clarified that the books were inappropriate with levels of the students and sources available. Also two of them stated that explanations were so long in the book. One of the teachers stated that the book gives no emphasis on Turkish Scientists. Three of the teachers had also problems related to working books of students in terms of inappropriateness with the level of students and the separateness of the lesson book and the work book. One of them stated that they must be unified to be more effectively used and to avoid forgetting of the workbook at home. Lastly, most of the teachers said that there were many units and subjects in the book and the number must be decreased. Also one of the teachers stated that there must be more knowledge in the book related to the topics.

4.6 Results Related to Sub-problem 4

The fourth question of the study was "What are teachers' perceptions related to individual differences of the students?" This question was answered by using the interview data of the study including the questions 7, 8, and 9 (see Appendix D for the questions).

4.6.1 Results of Interviews for Sp 4

Teachers' perceptions about individual differences of the students clustered into two main themes. The first theme emerged from the perceptions of the teacher is the individual differences of the students. The second theme emerged is the ways used by the primary school teachers to know their students.

4.6.1.1 Perceptions on Individual Differences of the Students

According to the teachers, students are different with respect to various characteristics. Teachers had similar opinions about the individual differences of their students. All of them thought that their students are different from each other in many respects. There were many areas listed by the teachers by which students might have differences. Majority of the teachers stated that their students are different in their perception differences, interest, imagination, personality, skills, family structure, family characteristics and achievement. Also three of the teachers stated that students are different in their development level, curiosity and behaviors. Two of the teachers mentioned that their students are different with respect to emotions, learning stles and intelligences including multiple intelligences. One of the teachers categorized her students as low achievers and high achievers. Another teacher grouped her students as easy and difficult learners. One of the teacher has a student with behavioral disorder, another teacher has a hipercative student and the other teacher has a student having learning difficulties in her class. These teachers stated that these students are different from the others and they tended to give responses to the interview questions related to the individual differences based on these students. The other characteristics of the students perceived by the teachers leading to differences among students were approaches of the students to deal with a topic, being students to be honest or not, differences in taking responsibilities, performance, investigation styles of the students, and creativity of the students.

4.6.1.2 Perceptions on the Ways Used by the Teachers to Know Their Students

Teachers were asked questions about whether they collect information about their students and what are the ways that they use to know their students better. Teachers responses demonstrated that they use variety of strategies to know their students. Frequently used strategies by the teachers are talking to child and talking to family of the students to get information about students' life. Nearly all of the primary school teachers believe that it is impossible for a primary school teacher not to know their students as they are with the same students for five years. They stated that few of the students were coming from other schools and if this is the case, they get information from previous teacher of the student. Teachers' observations on students also is beneficial for them to know their students. The meetings between the teacher and parents and the cooperative workings of students, teacher, administration, parents and guidance teacher is the other way that teachers collect information on their students. Three of the teachers stated that there is a guidance teacher at school and this would facilitate to get information on students' inner world. Four of the teachers use data collection forms including survey, information forms, observation notebooks for each child, autobiographies written by students and drawing graphics for physical development of the students. One of the teacher clarified that it important to know and understand students and the teacher each other and sharing experiences among teachers in school. She emphasized the importance of presence of the school, family, and teacher triangle in the class. One of the teachers mentioned about the BEP (Individualized education program) for students having perception difficulties. She stated that they tried to use this program but it is not applicable in many respects especially because of lack of time. Furthermore one of the teachers said that objectiveness for giving each student equal chances is important but it is not possible in our country. She stated she changed the method if not appropriate for the specific child but most of the time, it would not be possible as she deal with all of the students in the classroom. One of the teachers also added that the principal and the parent interaction might affect the teacher and student interaction by affecting the student's behavior. Therefore the teacher tried to avoid facing parents with the administrator. As teachers had to deal with all of these issues, two of them stated that they tried to be equipped in many respects to minimize students' differences.

4.7 Results Related to Sub-problem 5

The fifth sub-problems of the study was "What are the needs of primary school teachers to apply the teaching methods based on individual differences in science and technology classes?". The results were from two data sources; the PNAQ and interviews.

4.7.1 Results of the PNAQ for Sp5 (Section 4)

To identify the needs of primary school teachers to apply the TAMBID in science and technology classes, section 4 of the survey was used. This section of the survey consisted of current (what is) and targeted (what should be) state of needs. Therefore, the design of the instrument was based on the discrepancy needs model using a two-column five-point Likert scale format. The identified statements were listed between the two columns (scale). Then the discrepancy between the two scale values for each item was computed. To analyze the responses of the teachers, based on the discrepancy between the two columns, need index was calculated for each item by computing the difference between the means of the two columns and calculating a correlated t-value. The higher the needs index, the greater the discrepancy and need for training for the specified item. The approach used to calculate the discrepancy index as formulated by Houston et al, 1977 (as cited in Gyamfi, 2003, p. 18) was;

"What is desired MINUS What is current EQUALS Needs Discrepancy"

(Ideal or future conditions) (Prevailing conditions)

By computing discrepancy indices (d), needs of all the primary school teachers in the study were identified from the Need Categories A-E and ranked. After calculating the needs discrepancy, needs were prioritized by ranking the importance of needs according to the discrepancy that exists between current and targeted state of need in a descending order of magnitude in a frequency distribution table. The avarage discrepancy index of the needs of primary school teachers was computed and ranked. Furthermore, the top-priority needs of teachers were identified from all needs. All needs with discrepancy index greater than that the avarage discrepancy index were considered as top-priority needs. The identified top-priority needs were ranked by their need indices. In light of discrepancy definition of the need, the suggestions in the literature related to the calculation of the needs were taken into account while determining the needs of teachers. These were (a) “if there is no difference between where we are now and where should be, then we have no need” and” (b) “if the difference between the current and the desired situations equals to a negative value, we conclude that there is a need of the situation (Kaufman, 1972; p. 49).

Table 4.14 presents a rank order list of needs of the primary school teachers as listed from 27 items in section 4 of the PNAQ. The (-) values designated by *..* showed that there is a need for the specific situation. As can be seen from Table 4.14, primary school teachers have needs for all of the items in the PNAQ. There were no zero or positive (+) values for discrepances showing that there is no need for the specified item. Therefore, there were no identified items in the PNAQ for which teachers did not have any need. The discrepancy indices of the identified needs range between 0.90 and 1.93. The narrow range of discrepancy indices is an indication that majority of primary school teachers in public schools in Ankara require needs in the identified items.

The needs of the primary school teachers included five Need Category A-E which were identified at the beginning of the study. Needs from Category A comprises needs related to “Knowing Student’s Developmental Characteristics” which induded six items. These items emphasize the needs for using strategies (observation, interviews, individual or group projects) to identify students’ developmental levels and individual differences (A1), taking students’ developmental levels and interests into consideration in teaching process (A2), assigning homeworks and responsibilities appropriate for students' developmental level, learning styles, and interests (A3), using informations related to students for diversifying in and out of classes (A4), using informations related to students for planning, application and assessment in teaching-learning process (A5), and collecting informations on studens' learning styles and intelligences (A6).

Needs from Category B comprises five needs related to "Considering Students' Needs and Interests". This category included the following items; Preparing lesson plans based on individual differences (B1), Making changesduring teaching-learning process based on the students' needs and interests (B2), Designing appropriate learning environments for the students having different experiences, characteristics and skills by using information and communication technologies (B3), taking individual differences into account while preparing and selecting materials (B4), and using various assessment methods based on students' needs and interests (B5).

Five of the needs which came from Category C related to the "Competency for the Arrangement of Learning Environments". These needs were namely; Having adequate information about new approaches based on individual differences, taking different background of the students into account while designing learning environment (C2), designing learning environments based on the types of activities (individual, group etc.) (C3), having adequate skills and knowledge to use materials related to science and technology (C4), Reaching materials which are cheap and easily available to use in lessons (C5).

For Category D, the needs were related to the "Differentiation of Teaching and Assessment by Considering Individual Differences" which emphasize; using technologies supporting student centered strategies by taking into account the different needs of the students (D1), designing learning activities based on individual differences (D2), taking individual differences into account while selecting assessment and evaluation methods (D3), identfying alternative assessment tools (portfolios, concept-maps, trips, observation, interviews etc.) for multiple ways of assessment (D4), going over and recording objectives, learning environment and assessment tools based on the results of assessment of the student (D5).

Lastly, for Category E there were six related need items for identifying the needs of the teachers. These items were related to “Effects of Possible Exterior Factors” and namely; Support of school administration on new approaches (E1), implementation of new approaches by the other teachers in the classroom (E2), support of parents while trying to use new approaches (E3), minimizing the number of students in the classroom to use strategies based on individual differences (E4), and catching up the curriculum when using strategies based on individual differences (E5).

Top priority of needs based on the responses of primary school teachers were summarized in Table 4.14. Twelve needs from all needs of primary school teachers based on the TAMBID were identified as top-priority needs. The top-priority needs were identified by chosing and ranking the discrepancy indices which were grater than avarage discrepancy index (d_{avg}=1.23). Highest discrepancy index which accounts for the highest need was for A6 which emphasizes for collecting informations on studens’ learning styles and intelligences (d=1.93). Also the discrepancy index of 1.85 which was the second most intense need identified by the primary school teachers was related to the minimizing the number of students in the classroom to use strategies based on individual differences (E4). These two high discpreancy indices were indication that primary school teachers have much need in these two area. The need to use various assessment methods based on students’ needs and interests (B5), with a discrepancy index of 1.48 ranked third on the list of top-priority needs of primary school teachers. The other top-priority needs listed in Table 4.15 related to Category A-E includes in order of magnitude of the discrepancy indices; Support of parents while trying to use new approaches (E3), taking individual differences into account while selecting assessment and evaluation methods (D3), catching up the curriculum when using strategies based on individual differences (E5), implementation of new approaches by the other teachers in the school (E2), making changesduring teaching-learning process based on the students' needs and interests (B2), support of school administration on new approaches (E1), designing appropriate learning environments for the students having different experiences, characteristics and skills by using information and communication technologies (B3), having adequate skills and knowledge to use materials related to science and technology (C4), and taking different background of the students while designing learning environment (C2). The table also shows that most of the top-priority needs of primary school teachers are from Category E needs, these needs related to the effects of possible exterior factors. This category included exterior factors such as the number of the students in the classroom (d=1.85) the effect of school administration (d=1.32), parents (d=1.46), time (d=1.44), colleagues (d=1.38), school administration (d=1.32) discipline (d=1.17) on selection of teaching and assessment methods by teachers.

Finally, the needs of the teachers based on the categories of the needs were tabulated in Table 4.16. The findings from teachers' responses reveal that most of the teachers identified Category E needs as statements that they would require help in this area (d_{mean}=1.44). Needs related to knowing student's developmental characteristics (Category A) was the second category for which teachers have needs having a discrepancy index of 1.40. The other categories that teachers have need were Category B (Needs related to considering student's needs and interest Category D (Needs related to differentiation of teaching considering individual differences and Category C (Needs related to the arrangement of learning environments) which have discrepancy indices 1.24, 1.18, and 1.10 respectively.

Table 4.14 Needs of Primary School Teachers in Public Schools in Yenimahalle and Çankaya, in Ankara

Needs						
Category	Statements	N	Mean of the Difference (D)	SD	t	Rank
C1	1. Öğrenci farklılıklarını göz önünde bulunduran yeni öğretim yaklaşımları ile ilgili yeterli bilgiye sahibim.	155	*-1.07*	1.06	12.54	18
B1	2. Ders planlarımı öğrenciyi merkeze alarak hazırlarım.	155	*-0.99*	1.14	10.83	22
A1	3. Öğrencilerin gelişim düzeylerini ve bireysel farklılıklarını belirlemek için çeşitli teknikler (gözlem, karşılıklı görüşme, ölçek, bireysel ve grup projeleri vb.) kullanırım.	155	*-1.03*	1.08	11.86	21
A2	4. Uygulamalarımda öğrencilerimin gelişim düzeylerini ve ilgi alanlarını dikkate alırım.	155	*-0.95*	1.09	10.81	24
A3	5. Öğrencilere onların gelişim düzeyi, öğrenme biçimi, ilgi ve gereksinimlerine uygun ödev ve sorumluluklar veririm.	155	*-0.98*	1.04	11.73	23
A4	6. Öğrenciye ait bilgileri sınıf içi ve dışı çalışmaları çeşitlendirmekte kullanırım.	155	*-1.08*	0.98	13.63	17
A5	7. Öğrenciye ait bilgileri öğrenme-öğretme sürecini planlama, uygulama ve değerlendirmede kullanırım.	155	*-1.04*	1.08	11.97	20
B2	8. Öğretme-öğrenme sürecinde öğrencinin ilgi ve ihtiyaçları doğrultusunda değişiklikler yaparım.	155	*-1.37*	1.42	11.99	8
B3	9. Bilgi ve iletişim teknolojilerini kullanarak, farklı deneyimlere, özelliklere ve yeteneklere sahip öğrencilere uygun öğrenme ortamları hazırlarım.	155	*-1.30*	1.18	13.74	10
D1	10.Öğrencinin farklı ihtiyaçlarını dikkate alarak öğrenci merkezli stratejileri destekleyen teknolojiler kullanırım.	155	*-1.14*	1.16	12.27	15
C2	11.Öğrencilerin farklı ön yaşantılarını öğrenme ortamlarını düzenlerken dikkate alırım.	155	*-1.23*	1.21	12.73	12
C3	12. Öğrenme ortamlarını etkinlik türüne göre (bireysel, işbirlikli vb.) düzenlerim.	155	*-1.03*	1.04	12.35	21

195

Table 4.14 (cont'd)

C4	13. Fen ve teknoloji dersi ile ilgili materyal kullanmada yeterli donanıma sahibim.	155	*-1.25*	1.18	13.13	11
C5	14. Derslerimde kullanmak üzere kolay bulunur ve ucuz materyallere ulaşabilirim.	155	*-0.90*	1.09	10.36	25
B4	15. Materyalleri hazırlarken ve seçerken bireysel farklılıkları dikkate alırım.	155	*-1.07*	1.14	11.70	18
D2	16. Farklı ihtiyaçları dikkate alarak öğrenme etkinlikleri düzenlerim.	155	*-1.12*	1.12	12.43	16
A6	17. Öğrencilerimin öğrenme stilleri ve zekaları ile ilgili bilgi toplarım.	155	*-1.93*	1.16	20.75	1
B5	18. Öğrencinin ilgi ve ihtiyaçları doğrultusunda değerlendirme yöntemlerini çeşitlendiririm.	155	*-1.48*	1.16	15.80	3
D3	19. Ölçme ve değerlendirme yaklaşımlarını çeşitlendirirken bireysel farklılıkları dikkate alırım.	155	*-1.45*	1.41	12.86	5
D4	20. Çok yönlü değerlendirme için alternatif ölçme araçlarını belirlerim (portfolyo, kavram haritaları, gezi, gözlem, görüşme vb.)	155	*-1.05*	1.09	11.95	19
D5	21. Ölçme sonuçlarına göre hedefleri, öğrenme ortamını ve ölçme araçlarını yeniden gözden geçiririm ve kayıtlar tutarım.	155	*-1.15*	1.09	13.07	14
E1	22. Bütün bunları (1-21 arası şıkları) uygulayabilirim çünkü bu sistem okul yönetimi tarafından benimsenmiştir.	155	*-1.32*	1.20	13.60	9
E2	23. Bütün bunları (1-21 arası şıkları) uygulayabilirim çünkü bu sistem diğer öğretmenler tarafından da uygulanmaktadır.	155	*-1.38*	1.17	14.63	7
E3	24. Yeni yaklaşımları uygulamaya çalışırken veliler tarafından destekleniyorum.	155	*-1.46*	1.31	13.85	4
E4	25. Sınıfım çok kalabalık olduğu halde öğretim-öğrenim sürecimde bireysel farklılıkları göz önüne alan yöntemleri kullanırım.	155	*-1.85*	1.32	17.42	2
E5	26. Bireysel farklılıkları göz önüne alan yöntemleri kullandığımda öğretim programı yetiştirebiliyorum.	155	*-1.44*	1.33	13.47	6
E6	27. Bireysel farklılıkları göz önüne alarak dersimi işlediğimde öğrencilerimi disiplin etmekte sorun çıkmıyor.	155	*-1.17*	1.32	10.99	13
	Avarage discrepancy index (d_{avg})		1.23			
	Standard Deviation		0.26			

Table 4.15 Top Priority Needs of Primary School Teachers in Public Schools in Yenimahalle and Çankaya, in Ankara (d >1.23)

Category	Need	Discrepancy	Rank
A6	Collecting informations on studens' learning styles and intelligences	1.93	1
E4	Minimizing the number of students in the classroom to use strategies based on individual differences	1.85	2
B5	Using various assessment methods based on students' needs and interests	1.48	3
E3	Support of parents while trying to use new approaches	1.46	4
D3	Taking individual differences into account while selecting assessment and evaluation methods	1.45	5
E5	Catching up the curriculum when using strategies based on individual differences	1.44	6
E2	Implementation of new approaches by the other teachers in the school	1.38	7
B2	Making changes during teaching-learning process based on the students' needs and interests	1.37	8
E1	Support of school administration on new approaches	1.32	9
B3	Designing appropriate learning environments for the students having different experiences, characteristics and skills by using information and communication technologies	1.30	10
C4	Having adequate skills and knowledge to use materials related to science and technology	1.25	11
C2	Taking different background of the students while designing learning environment	1.23	12

Table 4.16 Top Priority Needs Categories of Primary School Teachers in Public Schools in Yenimahalle and Çankaya, in Ankara

Code	Need Category	d (Mean)	Rank
E	Needs related to effects of possible exterior factors	1.44	1st
A	Needs related to knowing student's developmental characteristics	1.40	2nd
B	Needs related to considering student's needs and interest	1.24	3rd
D	Needs related to differentiation of teaching considering individual differences	1.18	4th
C	Needs related to the arrangement of learning environments	1.10	5th

4.7.2 Results of Interviews for Sp5

Teacher responses to identify their needs on applying the TAMBID in science and technology classess yielded many themes and codes. Response themes under each need category were summarized in Figure 4.6, 4.7, and 4.8. Basically, teacher have needs related to resources, opportunities, students, administrators, parents, knowledge and experience, science book, time, and many other exterior factors like Turkish educational system, dialog among teachers, desrhane, and examinations in Turkey such as OKS and LSS. Related to the science book, teachers stated that the science book is not appropriate with students' level, not taking individual differences of the students and, not appropriate with environmental conditions. Teachers' needs and their suggestions will be discussed in detail in Chapter 5.

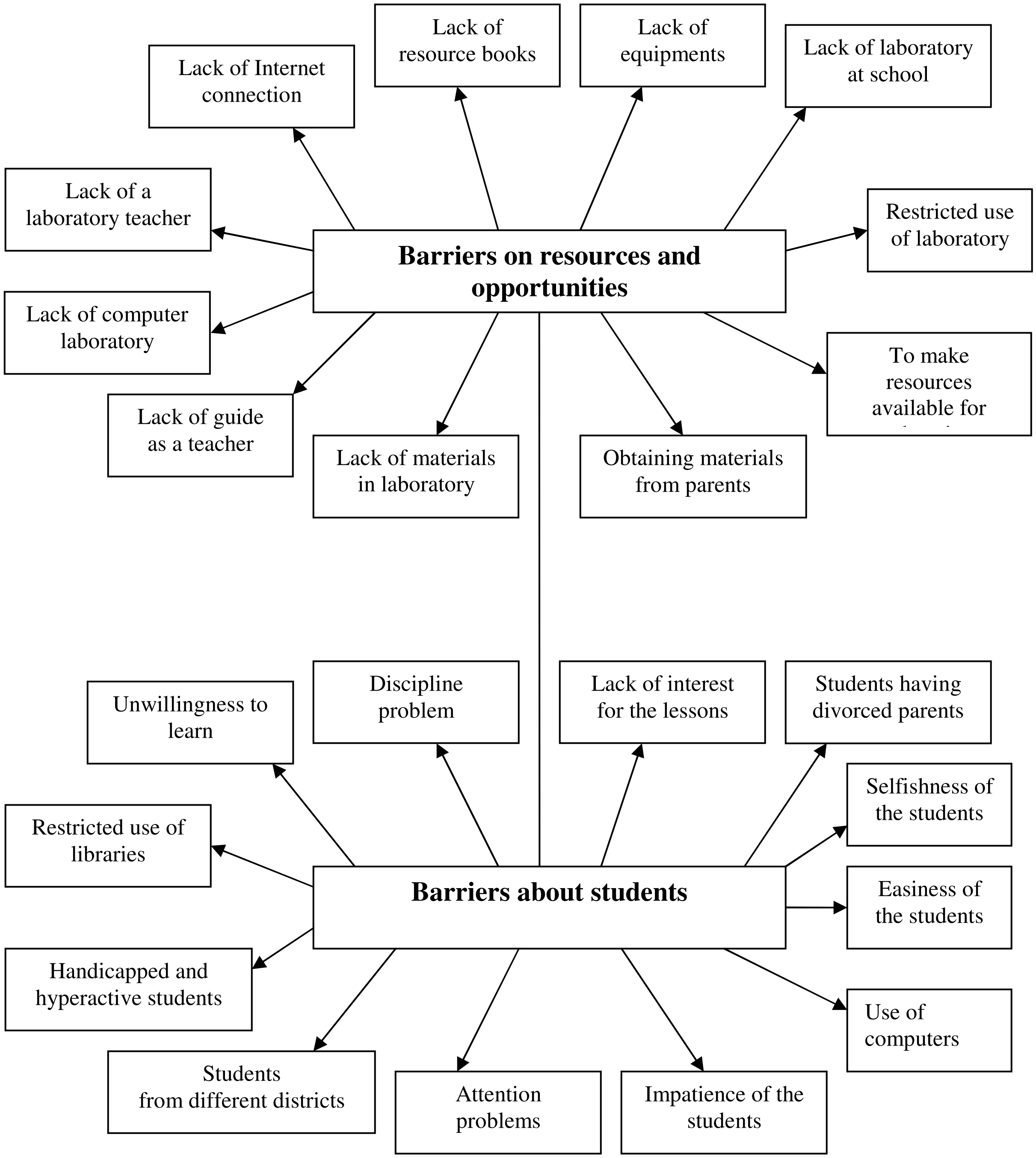


Figure 4.6 Primary School Teachers' Needs on Resources, Opportunities and Students

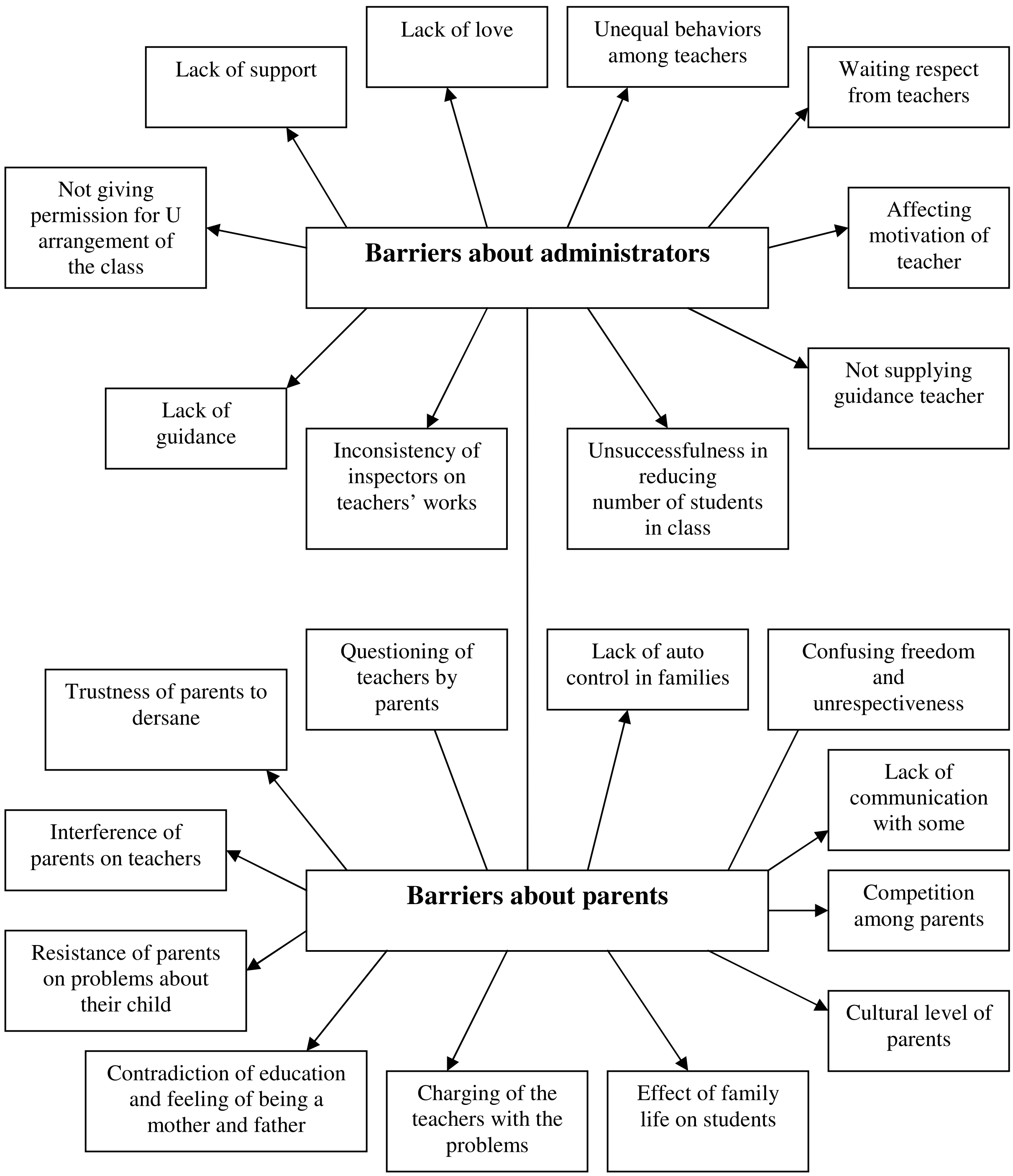


Figure 4.7 Primary School Teachers' Needs on Administrators and Parents

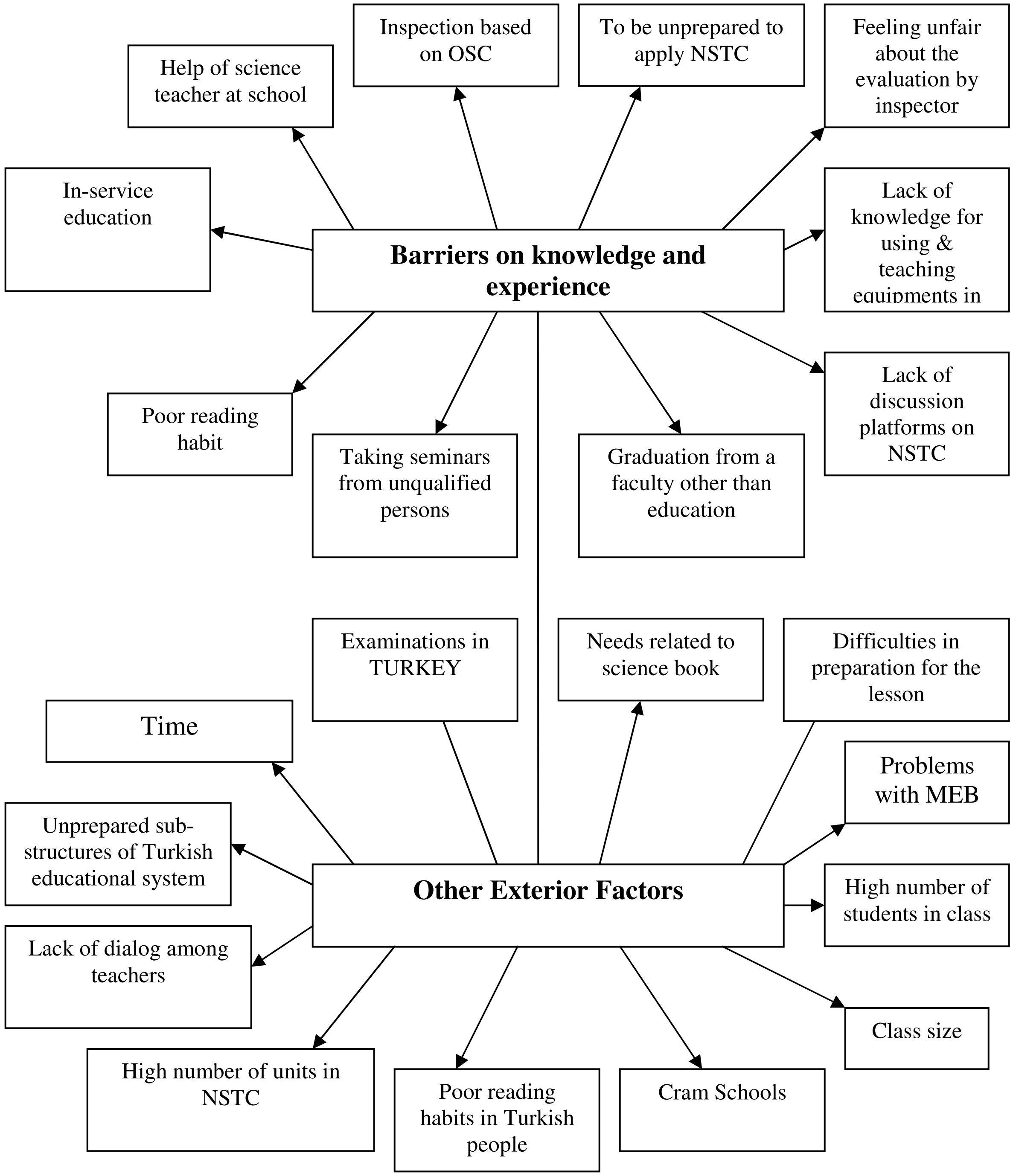


Figure 4.8 Primary School Teachers' Needs on Knowledge, Experience and Exterior Factors

4.8 Results Related to Sub-problem 6

The sixth sub-problem of the study was **"**Do teachers' needs related to teaching methods based on individual differences differ with regard to their gender, grade level, the program graduated and years of experience?". This question was answered by using the data in section 1 including the demographic information of the teachers and section 4 of the question the PNAQ are related to the needs of primary school teachers based on the TAMBID. For this purpose, responses to the PNAQ items under the Need categories A-E were analyzed by using the teacher demographic variable. The data to answer this question was from the PNAQ instrument results.

4.8.1 Results of the PNAQ for Sp6

To answer the question "Do teachers' top priority needs related to teaching methods based on individual differences differ with regard to the districts, gender, grade level, and years of experience?" which is causal comparative in nature since the variable in the group membership is categorical, inferential statistical test was carried out by using analysis of variance (ANOVA) for each independent variable. The analysis was also reported for each of the 15 ıdentıfıed top priority needs and the teacher variables (factors) in the PNAQ. The level of significance (p level) set at 0.05 to mean that the possibility of the result obtained occurring by chance is 5%.

For this sub-problem, the dependent variable is the teachers' top priority needs on the TAMBID and independent variables are districts, gender, grade level and years of experience.

Since there are many demographic information related to teachers' background in the study, six potential confounding factors (program graduated (PG), type of school graduated whether education faculty or not (TSG), whether any inservice education (IE) taken, gender (G), years of experience (YOE) and grade level that teachers currently teaching (GL) were pre-determined that might have effect on the analysis. Therefore, these factors were pre-determined as potential covarites in the analysis to statistically equalize the difference among the groups. These pre-determined covariates were correlated with the dependent variable (top priority needs of teachers). Table 4.19 demonstrated the results of the correlations and their level of significance. According to the results appear in Table 4.19, none of the potential covariates except a few of them, had no significant correlation with all the specific items in the PNAQ. Therefore, none of them were considered as covariates and the analysis went further with one way ANOVA instead of ANCOVA by comparing the means of top priority needs with teachers' demographic information.

Before conducting inferential statistics, the assumptions of ANOVA were tested namely, normality and equality of variances. Also it was assumed that the cases represent random samples from the populations and the scores on the test variable are independent of each other as cited by Green, Salkind and Akey (2000; p. 159).

For normality assumption, skewness and kurtsosis values were calculated. As appeared in Table 4.17 skewness and kurtosis values were in the acceptable range for a normal distribution.

Table 4.17 Skewness and Kurtosis Values for Top Priority Needs

	Top Priority Needs														
	1 A6	2 E4	3 B5	4 E3	5 D3	6 E5	7 E2	8 B2	9 E1	10 B3	11 C4	12 C2	13 E6	14 D5	15 D1
Skewness	-0.22	0.12	-0.32	-0.21	-0.35	-0.28	-0.36	-0.46	-0.27	-0.25	-0.26	0.03	0.06	-0.34	0.01
Kurtosis	-0.94	-1.2	-0.73	-0.84	-0.86	-1.01	-0.95	-0.86	-1.10	1.62	-0.22	0.05	0.41	0.07	1.05

Levene’s Test of Equality was used for determination of the equality of variance assumption to check whether the two populations from which the samples are selected have equal variances. Results were given in Table 4.18 for each group. As seen from the table, the error variances of the dependent variable across groups were equal for the D, representing the district ($F(1, 24)=1.476$, $p= .236$), for GL representing for grade level ($F(1, 24)=0.244$, $p= .626$), for YOE representing years of experience ($F(5, 20)=1.748$, $p= .170$), and for G representing gender ($F(1, 24)=0.70$, $p= .794$). This means that we fail to reject the null hypothesis of ‘equality of error variances’. This indicates that the equality of variance assumption for each analyses was satisfied.

Table 4.18 Levene's Test of Equality of Error Variances

	Group			
	D	GL	YOE	G
F	1.476	.244	1.748	.070
df1	1	1	5	1
df2	24	24	20	24
Sig.	.236	.626	.170	.794

Table 4.19 Significance Test of Correlation between Dependent Variable and Covariates

	Top Priority Needs														
Variables	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**
PG	.164*	.136	.104	.002	.083	.184*	.120	.020	.141	.044	.040	.042	.043	.086	.084
TSG	.147	.097	.098	.034	.096	.016	.029	.030	.039	.017	.002	.073	.039	.023	.056
IE	.085	.038	.037	.053	.012	.144	.046	.001	.070	.053	.119	.038	.156	.102	.040
G	.056	.016	.031	.016	.049	.025	.092	.132	.093	.016	.059	.027	.068	.146	.072
YOE	.219*	.124	.087	.105	.086	.188*	.246*	.158	.212*	.034	.125	.091	.020	.105	.055
GL	.045	.023	.006	.029	.096	.013	.018	.217*	.053	.020	.031	.127	.012	.014	.057

*Correlation is significant at the 0.05 level (two-tailed)

After testing the assumption for ANOVA, The hypotheses were generated to be tested for seeking answer for the subproblem 6. The null hypotheses were tested on each of the 12 identified top-priority needs and the teacher variables. Four hypotheses of the subproblem and the related results are as follows.

Null Hypothesis 1:

$H_0 : \mu_1 - \mu_2 = 0$

1: There will be no significant effects of the district (Yenimahalle and Çankaya) on the mean difference of each top priority needs of primary school teachers based on the TAMBID in science and technology classes.

To answer the question, 15 analyses of varıance were performed on the factor "district" to compare top priority needs of primary school teachers in Yenimahalle and Çankaya to apply the TAMBID in science and technology classes. As appeared in Table 4.20, there are no significant differences among teachers in two districts related to their all top-priority needs. For all of the top priority needs $p>0.05$, which support the null hytpotheses that the top prioritty needs A6, E4, B5, E3, D3, E5, E2, B2, E1, B3, C4, and C2 (see Table 4.15 for the names of the priority needs) are not different for primary school teachers in Yenimahalle and Çankaya.

Table 4.20 Descriptive and ANOVA Test Results for Districts Effect

	District		Mean Difference	
Top Priority Needs	Yenimahalle Mean	Çankaya Mean	F Ratio	Sig.(p)
A6	1.899	1.929	0.141	0.708
E4	2.076	1.685	3.349	0.069
B5	1.379	1.551	0.824	0.365
E3	1.576	1.371	0.927	0.337
D3	1.424	1.472	0.043	0.835
E5	1.379	1.483	0.232	0.630
E2	1.424	1.348	0.157	0.692
B2	1.242	1.449	0.806	0.371
E1	1.349	1.292	0.082	0.774
B3	1.318	1.292	0.018	0.893
C4	1.227	1.258	0.026	0.872
C2	1.333	1.157	0.808	0.370

*Indicates significance at .05 level

Null Hypothesis 2:

$H_0 : \mu_1 - \mu_2 = 0$

2: There will be no significant effects of gender on the mean difference of each top priority needs of primary school teachers based on the TAMBID in science and technology classes.

The results of ANOVA for testing the second null hypothesis of this study are listed in Table 4.21. The results demonstrated that there are no significant differences between female and male teachers in their top priority needs to apply the TAMBID in science and technology classes.

Table 4.21 Descriptive and ANOVA Test Results for Gender Effect

	Gender		Mean Difference	
Top Priority Needs	Female Mean	Male Mean	F Ratio	Sig. (p)
A6	1.974	1.845	0.489	0.485
E4	1.835	1.879	0.040	0.841
B5	1.505	1.431	0.146	0.703
E3	1.474	1.431	0.039	0.843
D3	1.505	1.362	0.374	0.541
E5	1.464	1.397	0.093	0.761
E2	1.464	1.241	1.305	0.255
B2	1.505	1.121	2.697	0.103
E1	1.402	1.172	1.322	0.252
B3	1.289	1.328	0.039	0.843
C4	1.299	1.155	0.537	0.465
C2	1.258	1.190	0.115	0.735

*Indicates significance at .05 level

Null Hypothesis 3:

$H_0 : \mu_1 - \mu_2 = 0$

3: There will be no significant effects of grade level on mean difference of each top priority needs of primary school teachers based on the TAMBID in science and technology classes.

The results of ANOVA was shown in Table 4.22. According to the results, there are no significant differences between the all needs of 4^{th} and 5^{th} grade primary school teachers to apply the TAMBID in science and technology classes.

Table 4.22 Descriptive and ANOVA Test Results for Grade Level Effect

	Grade Level		Mean Difference	
Top Priority Needs	4th Grade Mean	5th Grade Mean	F Ratio	Sig. (p)
A6	1.871	1.977	0.315	0.576
E4	1.886	1.824	0.084	0.772
B5	1.486	1.471	0.006	0.936
E3	1.500	1.424	0.130	0.719
D3	1.600	1.330	1.426	0.234
E5	1.457	1.424	0.024	0.876
E2	1.357	1.400	0.051	0.822
B2	1.700	1.682	1.592	0.702
E1	1.386	1.259	0.424	0.516
B3	1.329	1.282	0.058	0.809
C4	1.286	1.212	0.150	0.699
C2	1.400	1.094	2.497	0.116

*Indicates significance at .05 level

Null Hypothesis 4:

$H_0 : \mu_1 - \mu_2 = 0$

4: There will be no significant effects of years of experience of teachers currently teaching on the mean difference of each top priority needs of primary school teachers based on the TAMBID in science and technology classes.

The analyses of variance on each identified priority need by "Years of experience" is demonstrated in Table 4.23 below. The ANOVA results revelaed that fourth null hypothesis was rejected for two of the top priority needs; E2 ($F(5, 20)=3.653$, $p= 0.004$) which is the the need for implementation of new approaches by the other teachers in the school, E1 ($F(5,20)=2.712$, $p=0.022$ which is the need for the support of school administration on new approaches. Because the overall F test is significant for these needs, follow up tests were conducted to evaluate pairwise differences among the means; Dunnett's C post hoc analysis which does not assume equal variances. In fact, there are no differences in the population variances as appeared in Table 4.24 for E2 and E1 for years of experiences of the teachers ($p=0.616$, $p=0.063$, for E2 and E1 respectively). Results of post hoc analysis accompanying with Table 4.24 revealed that needs of teacher with 6-10 years of experience are more than those with 21-25 years of experience for implementation of new approaches by the other teachers in the school (E2) and for the support of school administration on new approaches.

However, the ANOVA results of for the other top priority needs showed that there are no significant differences between the top priority needs for the teachers having different years of experience in their teaching profession.

Table 4.23 Descriptive and ANOVA Test Results for Years of Experience Effect

	YOE						Mean Difference	
Top Priority Needs	1-5 years Mean	6-10 years Mean	11-15 years Mean	16-20 years Mean	21-25 years Mean	26 + years Mean	F Ratio	Sig. (p)
A6	1.333	1.619	2.000	2.313	1.917	2.170	2.141	0.064
E4	2.583	1.976	1.750	1.500	1.750	1.755	1.134	0.345
B5	1.750	1.714	1.350	0.875	1.417	1.471	1.410	0.224
E3	1.417	1.833	1.150	1.563	0.917	1.377	1.400	0.227
D3	1.833	1.643	1.300	1.313	0.833	1.453	0.871	0.502
E5	1.583	1.833	1.350	1.563	1.167	1.151	1.431	0.216
E2	1.667	1.881	1.150	1.500	0.583	1.151	3.653	0.004*
B2	1.500	1.810	1.250	0.875	1.500	1.132	1.593	0.166
E1	1.833	1.714	1.100	1.188	0.583	1.170	2.712	0.022*
B3	1.250	1.381	1.350	1.250	1.333	1.245	0.079	0.995
C4	1.333	1.452	1.450	1.000	1.000	1.113	0.760	0.580
C2	1.333	1.452	1.100	1.125	1.167	1.132	0.443	0.818

*Indicates significance at .05 level

Table 4.24 Post Hoc Comparisons for Years of Experience

	6-10 years of experience	21-25 years of experience	Sig.	p for Levene's Test
E2	2	5	0.008	0.616
E1	2	5	0.043	0.063

4.9 Summary of Findings

Results obtained from the PNAQ and interviews were unified, simplified and presented in Table 4.25 to facilitate for addressing and discussing the each issue.

Table 4.25 Summary of Research Findings

Research Question	Data Colection	Data Anlysis	Findings
Teaching Methods (Sub-problem 1)	The PNAQ	Descriptive analysis (frequency counts)	Projects (136), group works (120), simple experiments (97), explanations (85), laboratory (75), brain storming (52), questioning (51), researches (47), homeworks (44), individual preseantations (43), group discussion (39), expository (38), demonstration (35), individual studies (2), whole group discussion (1), predict-observe-explain (1)

Table 4.25 (cont’d) Teaching Methods	Interviews	Qualitative Analysis	Projects, group works, explaning, role playing, peer teaching, laboratory, brain storming, questioning, researches, homeworks, individual preseantations, whole group discussion, expository, demonstration, individual studies, simulations, story-telling
Teaching Methods	Observation	Qualitative Analysis	Questioning, lecturing daily life examples, explaining summary, analogy demonstration, using models model construction, observations drama, presentations by the students, group presentations individual presentations, discussion, whole class discussion, activity based teaching, independent Study investigations, experiments discovery, learning by doing brain storming, group works projects, homeworks
Assessment Methods (Sub-problem 1)	The PNAQ	Descriptive analysis (frequency counts)	Achievement tests (143), performance assessment (124), portfolio (56), roup works (26), peer assessment (21), observations (16), verbal exam (12), project assessment (11), self assesment (7), effort (5), creative thinking (3), scientific process skills (2), individual studies (2), interviews with the students

Table 4.25 (cont'd)

Assessment Methods	Interviews	Qualitative Analysis	Achievement tests, performance assessment (Preparation for lesson, effort, performance during presentations, experiments, projects, and activities, also involvement to lesson, investigations), honesty of the students, interest of the students, students' achievement in the past, relationship of the students with their friends, process assessment, self assessment, project assessment , peer assessment by using peer teaching forms, questioning, family involvement (Feedbacks for families, feedbacks from families), verbal examination
Most frequently used general approaches on the TAMBID (Sub-problem 2)	The PNAQ	Descriptive Analysis	-to facilitate students' learning by being a quidance -to encourage their students to think scientifically -to be able to establish relations with the information learned in the class and daily life
Least frequently used general approaches on the TAMBID (Sub-problem 2)	The PNAQ	Descriptive Analysis	-to give opportunities for the students for expressing their ideas with the help of music -to encourage their students to write about science topics to keep a science diary

Table 4.25 (cont'd)

Mostly used teaching method based on the TAMBID (Sub-problem 2)	The PNAQ	Descriptive Analysis	-using visual materials such as maps, shema, and posters -giving opportunities for the students to prepare and present a group projects related to a topic in class -encourage students for brain storming
Least frequently used teaching methods based on the TAMBID (Sub-problem 2)	The PNAQ	Descriptive Analysis	-include outside activities (museum, library and field trips) into the lessons -to read and explain the topic for the students -to use rhythm, songs and music in science teaching
Mostly used assessment methods based on the TAMBID (Sub-problem 2)	The PNAQ	Descriptive Analysis	-take students' skills in communication into consideration -to use samples for reasoning and problem solving ability of the students -to include a display of a product like a model that students develop by hand in assessment, and visual presentations of students' studies
Least frequently used assessment methods based on the TAMBID (Sub-problem 2)	The PNAQ	Descriptive Analysis	-students' musical performmance and their compositions -portfolios -peer assessment

Table 4.25 (cont'd)

Use of teaching methods based on the TAMBID (Sub-problem 2)	Interviews	Qualitative Analysis	Simple schemes, pictures, plays, drama (dramatization and role playing), watching films, drawing, hands-on activities, peer teaching, sport activities, group works, reading activities, writing poems, presentations, music, individual studies, projects, activities considering 5 senses, and giving responsibilities based on level of the students
Use of assessment methods based on the TAMBID (Sub-problem 2)	Interviews	Qualitative Analysis	Verbal exam, effort of students, performance assessments, essay exams, individualized assessment for handicapped students, peer assessment, portfolio assessment, evaluating the exams based on learning abilities of the students, giving high grades for low achievers to motivate them, self assessment of the students, objective assessment by taking curve and considering interest area of the students while assessing them.
Perceptions on NSTC (Sub-problem 3)	The PNAQ	Qualitative Analysis	Table 4.11, 4.12, and Table 4.13

Table 4.25 (cont'd)

Perceptions on NSTC (Sub-problem 3)	Interviews	Qualitative Analysis	Positive and negative perspectives, factors affecting application of NSTC, comparison of OSC and NSTC, basic features of NSTC (Section 4.5.2)
Perceptions on individual differences (Sub-problem 4)	Interviews	Qualitative Analysis	Individual differences of the students and ways to consider individual differences Appendix K
Needs of Teachers (Sub-problem 5)	The PNAQ	Descriptive Analysis	-Collecting informations on studens' learning styles and intelligences -Minimizing the number of students in the classroom to use strategies based on individual differences - Using various assessment methods based on students' needs and interests - Support of parents while trying to use new approaches - Taking individual differences into account while selecting assessment and evaluation methods - Catching up the curriculum when using strategies based on individual differences - Implementation of new approaches by the other teachers in the school - Making changes during teaching-learning process based on the students' needs and interests - Support of school administration on new approaches

Table 4.25 (cont'd)

Needs of Teachers (Sub-problem 5)	Interviews	Qualitative Analysis	Resources, opportunities, students, administrators, parents, knowleldge and experience, science book, time Figure 4.6, 4.7, and 4.8.
Whether top priority needs related to the TAMBID differ with regard to *gender	The PNAQ	Descriptive Analysis (ANOVA)	No Difference
*district	The PNAQ	Descriptive Analysis (ANOVA)	No difference
*grade level	The PNAQ	Descriptive Analysis (ANOVA)	No difference
*years of experience	The PNAQ	Descriptive Analysis (ANOVA)	-Needs of teachers with 6-10 years of experience are more than those with 21-25 years of experience for implementation of new approaches by the other teachers in the school and for the support of school administration on new approaches

CHAPTER 5

DISCUSSION CONCLUSIONS AND IMPLICATIONS

5.1 Discussion and Conclusions

This study investigated the perceptions and needs of public schools 4th and 5th grade primary school teachers in Yenimahalle and Çankaya districts related to the teaching and assessment methods based on individual differences within the classroom in science and technology classes. Specifically, this research study used both quantitative and qualitative studies, including questionnaire, interviews and observation to answer the following research questions: (1) Which teaching and assessment methods do primary school teachers use in science and technology classes, (2) What are teachers' practices related to teaching and assessment methods based on individual differences within the classroom in science and technology classes? Do they use teaching and assessment methods focusing on individual differences like LS or multiple intelligences? (3) What are teachers' perceptions related to new science and technology curriculum in Turkey in terms of teaching and assessment methods?, (4) What are teachers' perceptions related to individual differences of the students?, (5) What are the needs of primary school teachers applying the teaching and assessment methods based on individual differences in science and technology classes?, and (6) Do teachers' top priority needs related to teaching and assessment methods based on individual differences of the students differ with regard to their gender, grade level they teach, the program they graduated and their years of experience.

Sub-problems of the study emerged based on the theoretical and conceptual framework of the study also formed the framework for the discussion of the findings.

5.1.1 Teaching and Assessment Methods (Sub-problem 1-2)

The results of the interviews and observation (for some parts) support the questionnaire findings. Data from these measures demonstrated that the primary school teachers implement a variety of teaching and assessment methods as presented in Table 4.2, 4.3, 4.4, 4.5 and 4.6. According to the results most frequently used teaching methods by the teachers were projects including the individual presentations of the students on topics. To assess their students, teachers mostly use achievement tests and performance assessment in science and technology classes. The results obtained were not the same with the study carried out by Dindar and Yaman (2002). Their study demonstrated that most frequently used strategies by teachers are expository and questioning methods, and least frequently strategies used by teachers are drama and project methods. The results of another study by Kazu and Yıldırım (2000) also demonstrated that classroom teachers only implement expository methods and questioning in their lessons. The application of the NSTC in 2005 might affect the selection of methods used by the teachers. According to the results, they prefer projects and drama over expository methods to present a science and technology topic. It is also important to notify that for the teachers, achievement tests are the most dominant method for the assessment of their students. It is worth to mention that some of the teachers stated that they do not know how to implement the new assessment methods in science and technology classes. However, it was good to hear that some of the teachers implement new approaches of assessment such as portfolios, peer assessment, or self assessment in science and technology classes.

Although teachers implement such a variety of teaching and assessment methods in science and technology classes, teachers' methods were not based on an unique teaching approach, neither constructivist as suggested in the NSTC nor individualized as suggested in conceptual framework of this study. Teachers seemed to be in a translational phase from teacher centered instruction to a student centered instruction by using mostly student presentations in class or using questioning or lecturing during explaining the topic. Also teachers still rely on achievement tests to assess their students as the basic assessment method. Therefore, many teachers' practices either remain traditional in scope or they confuse the student centered approaches with the presentation of the topic by the students. Some of the studies also support these findings. For example, Martens (1992) stated that, a teacher learning to transition from a lecturing approach to a more student centered approach usually held onto a traditional mode of teaching. This practice occurred even when the teacher was provided the necessary support materials and supplies to implement the new approach.

5.1.2 The NSTC (Sub-problem 3)

As discussed in Chapter 1 and 2, the NSTC was implemented in 2005-2006 education year at 4th and 5th grades. The major aim was to improve science education in Turkey. The main emphasis in the NSTC is the change of teaching and assessment methods based on constructivist approach for the use of teachers in science and technology classes. As the teachers' role was one of the most crucial one in our society, gauging teachers' familiarity, perspectives and ideas about their implementation of the NSTC is critical to the goal of science education for all students. Teachers acknowledged many perceptions on the NSTC. There were five themes generated based on the responses of the primary school teachers; negative perspectives, positive perspectives, comparison of the NSTC and the OSC, basic features of the NSTC, and factors affecting application of the NSTC. Results were presented in section 4.5.2 in Chapter 4. It can be said that teachers have mostly positive perspectives on the NSTC. They think that the NSTC is better than the OSC in many respects as discussed in Figure 4.5. Teachers stated that teachers' properties were the most significant factor that affects the implementation of the NSTC. For instance, they believed that personality, beliefs, perspectives, family life and gender of the teachers might affect the teachers' teaching skills by affecting the application of the NSTC. This result is consistent with the other studies. Teachers' personality characters might affect their science teaching in many respects (Gyamfi, 2003; Hodson, 1998).

Majority of the primary school teachers stated that their training was not adequate to apply the NSTC. One of the essential points to emphasize is that teachers think that they took seminars from unqualified persons. Also they experienced many technical difficulties especially in laboratory applications. Their problems related to the laboratory included the absence of laboratory lesson and a laboratory teacher in school, having no lab notebooks, lack of equipments, lack of time, inappropriateness of the experiments with levels of students, difficulties in searching and reaching materials and difficulties in preparation for the experiments. A research carried out by Çepni, Küçük and Ayvacı (2003) support the findings of this study. Results of their study included that most of the classroom teachers do not give science courses with pleasure, teachers had difficulties in implementing laboratory activities and especially believe that it is more convenient that these courses should be taught by science teachers. The importance of laboratories in science and technology lessons and the significance of the qualification of the teachers in terms of knowledge and experience is an accepted idea for better science teaching (Asoko, 2002). Teachers came to the reform with varying degrees of knowledge about and experience with the instructional approaches of the curriculum and not all teachers held a belief system that coincided with the reform. Some of the teachers came into the field test with a better understanding of these key concepts, strategies, and skills than did others. Previous to the reform, as noted earlier, some of these teachers had begun to make changes in their approaches to teaching by incorporating new approaches based on individualized instruction in their science and technology classroom and by working with university personnel to develop and adapt effective strategies for handson science activities. Therefore primary school teachers need training to teach science effectively.

Related to the science book teachers clarified that the books were inappropriate with levels of the students and sources available. Also two of them stated that explanations were so long in the book and it gives no emphasis on Turkish Scientists. Most of the teachers also said that there were many units and subjects in the book and the number must be decreased. The study carried out by Yıldırım and

Öztürk (2002) had similar findings related to the inappropriateness of the curriculum and students' level and so support the findings of this study. The abundance of the contexts in the curriculum is a common problem in Turkey. In Turkey, primary education programs include Turkish language, Turkish literature, mathematics, social studies, science and technology, civics and human rights, the history of the Turkish Republic and Atatürk's reforms, a foreign language (English, French, or German), individual and group activities, religious culture and ethics, art/handicraft, music, physical education, traffic safety and first aid, career guidance, and elective courses. In such a rich context, primary teachers are not able to achieve the purposes of the science and technology program effectively. There is a predetermined hours of each subject per week at Turkish schools by MEB and primary teachers try to manage their program to cover all of the subjects that must be taught. The MEB also prepares students' textbooks, teachers' textbooks, worksheets, and teaching aids. Any materials to be used in schools must be approved by the Ministry.

5.1.3 Individual Differences (Sub-problem 4)

Use of various kinds of activities based on individual differences of the students was one of the main concerns of the study. Teachers are expected to use visual, auditory, and hands on activities for serving different learning styles of their students to deliver a fruitful instruction for their students. Teachers to teach science can and should change their direction toward the individualized instruction and must be aware of the individual differences among their students. To know is not sufficient, they must integrate individual differences into their science lessons (Zeitler, 1965, Green, 1982). There are many theories that is related to human brain activities and meet most of the criteria important for all aspects of education. Every teacher entering a classroom needs to know that the students in the classroom have different learning styles and needs a comprehensive picture of the learning process of each student in his or her class. As the technology increases and new developments emerge about the human brain, it is found that former methods of teaching and assessment are not adequate anymore. To evaluate whether primary school teachers in Yenimahalle and Çankaya implement the TAMBID, teachers were intervieved to get their opinions on individual differences of their students and the degree of their perceptions on their implementations in science and technology classess. Teachers' perspectives on individual differences are summarized in Appendix K. Primary school teachers believe that students are different in many respects such as in their perception, intelligences, family life, and learning styles. Also a few of the teachers acknowledged that variety of instructional strategies should be used to reach each student and to attain maximum learning. Based on their responses on the PNAQ and interviews, teachers seemed to know and implement how very important it is for an instructor to know their students. However results of the interview and observations revelaed that teachers' did not encounter individual differences of the students as much as they stated. Their statements and their actions in the class revealed that they implemented only one method at a time for all of the students. As explained in detail in conceptual framework of the study in Chapter 2, one method does not provide learning for all students to apply the TAMBID. The results were more obvious during the observaton of science and technology classess by the researcher. In both classess, during observations, teachers provided opportunities for students to design their own projects with an emphasis on creativity. They tried to adapt to the new approaches in the NSTC. For example, during a individual presentation of one of the students on living organisms, the student explained the topic to the class. She was well prepared for the presentations and had a deep understanding of the content. She explained the concepts in several ways by using slight projector. She prepared slides based on the theoretical knowdge of the concepts with many pictures and self prepared schemas and figures. After presenting the topic to her friends, she asked the questions that she prepared before the lesson. Also she answered the questions from her peers. The student's self confidence was perfect. Although in both classess, a student centered environment was clearly observable, observation results verified the idea that there was less attention to individual student learning differences or differentiated learning. To some extent, teachers implement some strategies of individualized instruction but all students are instructed at the same pace with the same assignments and so it is not a right implementation of individualized or differentiated instruction. In spite of the fact that teachers stated in questionnaire and interviews that they consider individual differences of the students and implement the TAMBID in science and technology lessons, their practice as observed during observation did not reflect their statements. There was an inconsistency between their perceptions and their practice. This findings is common among other researchers. For instance, research by Eick and Reed (2002) revealed that many science teachers' perceptions and beliefs were inconsistent with practice regardless of years of teaching. The other research carried out by Southerland, Gess, and Johnsons (2003) also demonstrated the inconsistencies between perceptions and practices of the teachers.

In general, based on the results of this study, in can be stated in spite of the fact that they use some strategies of individualized instruction, primary school teachers did not implement individualized instruction as a whole in science and technology classes. As Gallagher (1970) and Green (1982) stated the proper introduction and administration of individualized instruction in the science classroom would possible only if there is an appropriate preservice and inservice teacher education. Therefore it is not suprising that most of the teachers in this study stated that inservice education programs are not sufficient for them and they stated that in their preservice education, they did not learn how to apply new approaches and teaching strategies in science classrooms but they stated that they learned only the theoretical backgroung of these strategies.

It is important that teachers learn content, as well as pedagogy, through engagement in learning activity that "mirrors" the kind of experiences that reformers hope teachers would provide their students. However, the science courses that teachers take often communicate a false image of the process of learning and scientific inquiry. Though science is a dynamic process, students and teachers often are not allowed to experience it this way (Weiss, 1987). They often see science learning as static, a great wealth of facts known only by scientists that students must learn. Thus, new and experienced teachers, as a result of their experiences as students in traditional classroom settings, hold beliefs and understandings about the nature of science, the disciplines, and how they are best taught and learned that are counter to the principles underlying the new instructional approaches they are being asked to put into practice. Research results indicates that teacher learning must take place within school and classroom settings (Anderson & Mitchener, 1994). Making strong links to personal learning and the classroom context are important for teacher change in beliefs and practice; this is true for both novice and experienced teachers. Finally, support from research and professional development teams is critical as teachers begin to incorporate new approaches (Anderson & Mitchener, 1994). Importantly, teachers must have ample time and support for reflection, interactions with other teachers, and further learning opportunities. In sum, as teachers are asked to revise their teaching, the following elements appear to be key in the development of new understandings and practice. Reform efforts must (1) enable teachers to reflect upon and make explicit their personal practical knowledge, including beliefs, attitudes, and concerns; (2) consider teachers' knowledge and practices as the starting point of change; (3) provide teachers with experience and training in reform based strategies; (4) provide teachers opportunities to see these approaches modeled and to reflect upon these models; (5) enable teachers to design individualized instruction and practice these approaches in the context of supportive classroom environments where feedback is provided; (6) provide teachers with collaborative settings with other educators; and (7) provide teachers access to experienced professionals as mentors and guides (Anderson & Mitchener, 1994).

5.1.4 Needs of the Teachers (Sub-problems 5-6)

After determining teachers' perceptions and practices on teaching and assessment methods and on the NSTC, the major concern and the aim of this study was to identify the needs of primary school teachers to implement the TAMBID and to consider individual differences of the students. Many research studies revealed that teachers have some specific needs to teach science effectively in any grade in various countries (German & Barrow, 1995; Weiss, 1987; Moore & Blankenship, 1977; Baird et al., 1993; 1994). Qualitative and quantitative data analysis of the results of this study demonstrated that primary school teachers in Yenimahalle and Çankaya in Ankara also have a wide range of needs in order for implementing the TAMBID in science and technology classes and for considering individual differences of their students.

One of the needs to be emphasized based on the results is the in-service education programs prepared for the teachers. Based on the requirements of the MEB, all of the teachers were expected to take part in in-service education. However, among 155 teachers, 44 of them specified that they did not take any in-service education about new approaches in science and technology lessons. Teachers stated various reasons to pretend them attending the in-service education programs. The reasons vary but the main reasons were inconvenient time or location of the programs, and the problems that teachers encountered in their family life. Furthermore, based on both questionnaire and interview results, most of the teachers who were attended to such in-service education programs questioned the quality of the programs. They stated that the programs failed to meet the teachers' needs and the people charged to give the seminars were not qualified enough. These all affect the teachers' motivation and achievement to apply the NSTC. The results related to the in-service education were also consistent with the study carried out by Ogan (2002). In her study, based on the responses of 476 science teachers in Istanbul, she tried to identify the possible barriers that affect the teachers' participation to an in-service education programs. At the end of her study, she found that teachers' did not attend in-service education programs because of various reasons such as poor quality of the programs, lack of information in the programs, the programs failing to meet teachers' needs and time or location problems which were the same reasons that the teachers in this study stated. Teachers stated that they need no time as they have to catch the curriculum and have no enough materials. Indeed, in the literateure it is stated that individualized instruction usually requires more time, effort and materials than does conventional teaching (Zeitler, 1975; Jones, 1977).

The results showed that except in one school, teachers often work in isolation from each other. In one of the teachers' school, as the teacher stated they work collaboratively. The achievement of the school in OKS might demonstrate the importance of this collaborative work of the teachers along with the principal and parents. Therefore, actions were needed to be taken to foster greater collaboration among teachers and principal.

The results of the study related to the effect of parents on teachers' using the TAMBID demonstrated that in some of the families have negative effects on teachers to use the TAMBID in the classrooms. In the Turkish culture, there is a proverb about how parents view the role of schools: "The kid's bones are mine, but the flesh is yours." Turkish parents want schools to not only educate, but to sculpt the values of their children in ways that assist their children in becoming productive citizens for Turkey and the Turkish Government. To become an educated person was one of the highest honors in Turkish culture. Parent effect seemed to affect the teachers' instruction in primary school.

Teachers also stated needs related to principal and administrators in the school. The study carried out by Yin (2003) indicated that principal is key in educational reform in science. Qualitative data of the study revealed that some of the teachers think that principal interfere with their ability to teach and did not support teachers' involvement in development opportunities and did not provide all the materials and environment they needed to teach. Most of the teachers also mentioned that inspectors are the main barrier for their personal development. Therefore it is important that inspectors should also be sent to the in-service training courses as the teachers are. By this way, they might be aware of the new developments and changes. The results of this study about the effect of inspector on teachers' works are consistent with the results of the study carried out by Collins (1999). The other need of the teachers is the lack of materials, equipments, and resources which is an universal finding. Doubtless, the resources used in class may shape the way the activities were undertaken in classes and so it must be handled to be solved. For instance teachers might be oriented to use more daily life materials in the science and technology classes. These result are also the same with Yıldırım and Öztürk (2002).

Furthermore, it is observed from the analysis of the study that most the primary school teachers stated that there is a need to reduce the number of students in classrooms to apply the TAMBID and to reach all of their students. Indeed there are 35,168 primary schools in Turkey. But, the number of schools is not adequate when compared to the number of students continuing their education in these schools. In the primary schools, approximately 38.6 children are present in classes (MEB, 2000), and the ratio for the teacher-student is 1:32 for primary schools (Ministry of National Education, 2001). Therefore as the results of the study revealed and as the primary school teachers stated the number of students in the classrooms must be reduced. This might be achieved by increasing the number of quota in universities for the related departments.

The other issue raised from the interview results of the study was the national examinations that students take after they have completed their elementary education. The effect of this issue for 4th and 5th grade primary school students is not as much as the past during which there was an examination for the Anatolian High School Examinations. Now students enter OKS examination after completing their 8 year compulsory primary education. For preparing this examination students study after school and on weekends at “Dershane” (cram schools) to raise their scores on the OKS and other school examinations. This situation places a tremendous amount of pressure on students, their families and their school which affect the students’ achievements in science and technology or in other subjects in schools as also stated by the teachers. Cram schools, attended in the evenings and on weekends, are the norm for seniors and emphasize rote learning through drills (Stevens, Sarigul & Deger, 2002).

In spite of the fact that teachers have some common needs to teach science, in the literature it is proved that there are some teacher variables like sex, districts, grade level, and years of experience have an effect on teachers in service needs (Conkle, 1995; Baird et al.,1993; Moore & Blankenship, 1977). The results of the

ANOVA in this study demonstrated that teachers' top priority needs related to teaching methods based on individual differences do not differ with regard to the districts, gender, and grade level. However, some changes were observed only for years of experience. Three of the top priority needs were; the need for implementation of new approaches by the other teachers in the school, the need for the support of school administration on new approaches, and the need for using technologies supporting student centered strategies by taking into account the different needs of the students. Needs of teachers with 6-10 years of experience are more than those with 21-25 years of experience for implementation of new approaches by the other teachers in the school and for the support of school administration on new approaches. Furthermore needs of primary school teachers having 26+ years of experience are more than those having 1-5 or 6-10 years of experiences for using technologies supporting student centered strategies by taking into account the different needs of the students. Gyamfi (2003) also observed a difference in need of teachers for varying years of experience.

The researcher thought that these are all valuable findings and results in terms of teacher education since the importance of in-service education is universally agreed on. In service education is also important for primary school teachers in Turkey in order for them to more easily adapt to the changes in the curriculum which in turn affect the quality of education they teach and the development of their students. Therefore, while preparing in-service education programs for teachers, it is important to take teachers' needs into considerations and the number of the studies related to the needs of teachers in Turkey was very low. Although Turkish Ministry of National Education has taken many strides to increase the quality of education in Turkey, it seems that there are many crucial points to be considered and waiting actions. Moving toward the TAMBID is a long-term change process but the teachers and the schools can prepare themselves by drawing on insights from researches about these issues and by experiences of others who are able to apply the strategies for students of varying preferences, skills, intelligences and abilities.

5.2 Implications and Recommendations for Futher Research

The results of this study outlines several areas on which additional research is needed on teachers' perceptions and needs at the primary school level in science and technology. First, this study revealed the need to develop better data collection instruments and methods to identify more information on teachers' perceptions and needs. Second, better instruments are needed to solve the conflict between teachers' perceptions and practices. Especially in Turkey, the number of valid and reliable instrument to assess teachers' needs was very limited. Third, researches that involves interviews followed by observations is particularly needed. In this research, the teachers taking part in interviews and observations were different. It would be extremely useful to study with the same teacher during interview and observation. This may yied valuable results. Similar research might be conducted with different teachers from different grade levels. Also similar research might be conducted in private or other types of schools and the results might be compared in different types of schools. It would be also helpful to conduct a study having a greater sample to obtain more reliable, accurate and generalizable results.

In this study, the practices related to the teaching methods based on individual differences in science and technology classes is selected because they have various teaching strategies serving the principles stated in the NSTC in Turkey and also the biggest advantage of adopting the strategies of these teaching methods in the classroom is that it gives every student a chance to succeed and leads to innovation in teaching. "It gives teachers more tools to build student success" Torff (1997, pp. 170).

Educational leaders must recognize the many factors that are critical to the success of reform, including the ways and practices that support teacher learning as well as the obstacles that can inhibit its progress. With such understanding, we can foster action that will support valued change and, importantly, address limiting factors. Keeping these points in mind and acknowledging that the process of learning to teach can take place across a variety of contexts (i.e., content courses, teacher preparation programs, professional development courses and workshops, and classroom settings), several actions can support teacher learning and the teacher change process. First of all, teachers should address preexisting knowledge and beliefs about teaching, learning, learners, and subject matter. It is valuable to assist teachers as they make their beliefs explicit and provide them with contexts to examine, critique, and weave new ideas into their existing constructs. Second, teachers must be given continued opportunities to deepen and expand their subject matter knowledge. Without necessary subject matter knowledge, it is hard for teachers to learn strategies and techniques needed to respond to students' thinking about the subject in ways that facilitate their learning. Whereas, in the past, accumulating a specified number of credit hours in a particular discipline was indicative of subject mastery, within recent years, researchers have come to see that a much deeper understanding of the discipline and its practices is imperative for good teaching (Anderson & Mitchener, 1994).

5.3 Recommendations for Practice

1. Results of this study highlight the importance of examining teachers' perceptions and needs in improving science education at the primary school level.
2. The data collected that identifying how science is taught at the primary school level might be crucial for curriculum development studies.
3. The needs of the primary school teachers in order to implement the TAMBID and the NSTC should be considered by MEB. Indeed, the results of this study was written as a report for MEB, there might be some remedies or solutions for the teachers to consider their needs.
4. Teachers need knowledge of how students learn. Teacher preparation programs might be organized to include more detailed information about how students learn to comprehend the basis of individual differences of the students. Knowledge of how students learn can influence quality of the instruction for teachers by encountering variuos types of teaching and assessment methods into the instruction. (Bransford, et al, 1999; Deiro, 2005; O' Toole, 1968).

5. The teachers should respect and nurture the diversity of the students. As one of the goal of education is to provide an equitable environment for all children and to represent knowledge in different ways is one of the way to accomplish this purpose, teachers must be educated on individualized instruction.
6. Schools planning professional development need to include more coursework or workshops in their program that helps teachers to develop their repertoire on teaching and assessment methods based on individual differences of the students. Teachers need knowledge of learning styles, brain-based learning, multiple intelligences, emotional intelligences, meaningful and authentic assessments.
7. Class sizes should be decreased in schools for the teachers to reach each child more easily and in order to be of the students' needs and development. By this way, the difficulty of controlling the students in classroom is considered.
8. In service education programs related to the NSTC and the TAMBID could be prepared by National Ministry of Education for the primary school teachers. The duration of the education should be long and it must be compulsory for the teachers. Also the in-service education shoul not be held in summer time but during the semester.
9. In service education programs should be given by qualified persons.
10. The teachers should be in close collaboration with their colleagues, parents and administrators.
11. Inspectors should be sent to the in-service training courses as the teachers are.
12. Curriculum developers should take the individualized and differentiated based instruction into consideration during curriculum development process. They could involve various teaching and assessment methods emphasizing individual differences of the students in new curricula.
13. Pre-service teacher training programs should involve a course to inform prospective teacher to assist them gaining knowledge and skills about individual differences of the students and implementation of the TAMBID.

14. As the teacher and students feel the pressure of examinations in Turkey like OKS, LGS and ÖSS, they do not apply the curriculum as expected. Therefore change in the structure of the examinations in Turkey is needed.
15. School administrators should help teachers on implementing the NSTC. They should deal with teachers in every respect. There might be some regulations to accomplish this issue like preparing seminars, meetings or workshops among teachers on needed topics.
16. National Ministry of Education should prepare information departments for the teachers so that any kinds of questions from the teachers are answered.
17. Each school should have a guidance teachers for the students having behavioral or phsychological problems.
18. A laboratory and the use of the laboratory by primary school teachers for science and technology lessons should be provided for each school.
19. Primary school teachers should get help during laboratory applications either from a laboratory teacher or science teacher at school.
20. The number of science and technology units at 4^{th} and 5^{th} grade should be decreased.
21. Principal and the administrators in schools shoul be informed related to the developments in science and technology lessons and should be tolareable for the changes that teachers make in their classrooms.
22. Science and technology lessons must be instructed by the science teachers at primary grades.
23. To apply a student centered curriculum, teachers need to be familiar with science content as well to become familiar with diverse student populations to make effective curricular decisions for inclusive science education to be effective.
24. Needs assessment of primary school teachers in Turkey should be carried out at regular intervals to identify emerging needs of teachers for inservice training and to satisfy the needs of them.

REFERENCES

Abu Bakar, K. & Tarmizi, R. A. (1995). *Teacher preparation concerns: Professional Needs of Malaysian Secondary School Science Teachers*, Paper presented at National Association of Research in Science Teaching Conference, April, San Franciso, USA.

Adıgüzel, H. Ö. (2002). Eğitimde Yeni bir yöntem ve disiplin: Yaratıcı drama. *Yaratıcı Drama 1985-1995 Yazılar*, Natürel Yayınevi Ankara.

Açıkgöz, K. Ü. (1996). *Etkili Öğrenme ve Öğretme,* Kanyılmaz Matbaası, İzmir.

American Association for the Advancement of Science. (1993). *Benchmarks for Science Literacy*: Project 2061 New York. Oxford University Press.

Anderson, C. & Butts, D. (1980). A Comparison of individualized and group instruction in a sixth grade electricity unit*, Journal of Research in Science Teaching,* 17 (3), 139-145.

Anderson, R. D., & Helms, J. V. (2001). The ideal of standards and the reality of schools: Needed research. *Journal of Research in Science Teaching*, 38 (1), 3–16.

Anderson, R. D., & Mitchener, C. P. (1994). Research on science teacher education. In D. L. Gabel (Ed.), *Handbook of research on science teaching and learning:* A project of the National Science Teachers Association. New York: Macmillan.

Armstrong, T. (1994). *Multiple Intelligences In The Classroom.* Alexandria, VA: Association for Supervision and Curriculum Development, USA.

Armstrong, T. (2000). *Multiple intelligences in the classroom.* Alexandra: Association of School Curriculum Development, Washington DC, USA.

Asoko, H. (2002). Developing Conceptual Understanding in Primary Science, *Cambridge Journal of Education*, 32 (2), 153-164.

Aşkar, P., & Akkoyunlu, B. (1994) Use of Information Technology in Schools and the Role of Principals, in M. Thomas, T. Sechwest & N. Estes (Eds.) *The Eleventh International Conference on Technology and Education,* London, 27-30 March, p. 1056-1058. Austin: Morgan Printing Company.

Ayas, A., Cepni, S., & Akdeniz, A., R. (1993). Development of Turkish Secondary Science Curriculum. *Science Education*, 77 (4), 433-440.

Bailey, K. D. (1982). *Methods of Social Research*, 2nd edition. New York: The Free Press, USA.

Baird, W & Rowsey, R. (1989) A survey of secondary science teachers' needs, *School Science and Mathematics*, 89 (4), 272-284.

Baird, W. E., et al. (1993). A comparison of Alabama Secondary Science and Mathematics Teachers: Demographics and Perceived Needs. *School Science and Mathematics,* 93 (4): 175-182.

Baird, W. E., et al. (1994). Comparison of Perceptions among Rural versus Nonrural Secondary Science Teachers: A multistate Survey. *Science Education*, 78 (6): 555-576.

Baney, M. E. (1998). An Examination of the Process of Implementing Multiple Intelligences Theory into Classroom Practice, *Dissertation Abstracts International*, 59 (6), 1900.

Bangert, R. L., Kulik, J. A., & Kulik, C. C. (1983). Individualized system of instruction in secondary schools. *Review of Educational Research*, 53(1), 143-158

Beasley, W. (1999) *Meeting the needs of science teachers and students: The Philippines experiment, in Ware, S.* (ed.) in Science and Environment Education: Views from Developing Countries, Secondary education series: World Bank.

Berg, B. (1989). *Qualitative Research methods for the social sciences*. Boston: Allyn & Bacon, USA.

Bilen, M. (1993). *Plandan Uygulamaya Öğretim*, Takav Matbaacılık, Ankara.

Black, P. (2003). *The importance of everyday assessment in the science classroom*, Arlington, VA: NSTA Press, USA.

Black, P. & William, D. (2004). *The formative purpose: Assessment must first promote learning*. In M. Wilson (Ed). Towards coherence between classroom assessment and accountability, the University of Chicago press, Chicago, USA.

Bogdan, R. C., and Biklen, S. K. (1998). *Qualitative Research for Education: An introduction to theory and methods*, Viacom Company, 3rd Ed., Boston: Allyn and Bacon, USA.

Borrego, I. M. (1998). The Application of Multiple Intelligences (MI) Principles by Special Education Teacher Interns in Classroom Environmental Adaptations. *Dissertation Abstracts International*, 59 (8), 2929.

Bransford, et al. (1999). *How people learn: Brain, mind, experience and school*, Washington, DC: National Academy Press, USA. Retrieved June 9, 2005, last accessed in May 8, 2005, from http://nap.edu/html/howpeople1/.

Brooks, J. G., & Brooks, M. G. (1999). A Look at School Environments**,** in search of understanding: The case for the constructivist classroom. Alexandria, VA: ASCD Publications, USA.

Brualdi, A. (1996). Multiple intelligences: Gardner's theory. *ERIC Clearinghouse on Assessment and Evaluation.* Retrieved May 5, 2005, from ERIC Digest (ED410226), last accessed in May 10, 2005 http://www.ericfacility.net/ericdigests.ed410226.html.

Brunkhorst, H. K., Brunkhorst, B. J., Yager, R.E., Andrews, D. M., & Apple, M. A. (1993). The Salish Consortium for the improvement of science teaching preparation and development, *Journal of Science Teacher Education*, 4 (7), 51-53.

Caine, R. N. & Caine, G. (1997). Education on the Edge of Possibility, Alexandria, Va.: ASCD, USA.

Carter, K. (1990). Teachers' knowledge and learning to teach. In W. R. Houston (Ed.), Handbook on research on teacher education (pp. 291–310). New York: Macmillan.

Cassel, C. & Simon, G. (1994). *Qualitative methods in organizational research*. London: Sage Publications, England.

Checkley, K. (1997). The first seven and the eighth. *Educational Leadership*, 55 (1), 8-13.

Clark, J. V. (1996). *Redirecting Science Education: Reform for a culturally diverse classroom*. Thousand Oaks, CA: Corwin Press, Inc.

Csete, J. M. (1996). Needs assessment: What difference does (and can) it make? Paper presented at the annual meeting of the American Educational Research Association, New York, NY. (ERIC Document Reproduction Service No. ED 396 002).

Cohen, B. J. (1981). *Do you really want to conduct a needs assessment?* Management and Behavioral Science Center, University of Pennsylvania, Philadelphia.

Collins, A. B. (1999). *A Case Study of Instructional Supervision at a Private School*, Unpublished PhD Dissertation, Middle East Technical University, Ankara.

Connelly, F. M., & Clandinin, D. J. (1988). Teachers as curriculum planners. New York: Teachers College Press, USA.

Council of Ministers of Education (1997). *Common Framework of Science Learning Outcomes K to 12*: Pan-Canadian Protocol for Collaboration on School, USA.

Cummings, T & Worley, C. (1996). *Organization Development and Change,* South-Western College Publishing, Cincinnati.

Czerniak, C. M., Lumpe, A.T., & Haney, J. J. (1999). Relationship between teacher beliefs and science education reform: What are teachers' beliefs about thematic units? *Journal of Science Teacher Education*, 10 (2), 123–145.

Çepni, S., Küçük, M. & Ayvacı, H. Ş. (2003). Ilköğretim Birinci Kademedeki Fen Bilgisi Programının Uygulaması Üzerine Bir Çalışma, Gazi Üniversitesi, *Gazi Eğitim Fakültesi Dergisi*, 23 (3), 131-145.

Dadydov, V. (1995). The Influence of L.S. Vygotsky on Education, Theory, Research, and Practice. *Educational Researcher*, 24 (3), 17.

Deiro, J. A. (2005). *Teachers do make a difference; The teacher's guide to connecting with students*, Corwin Press, A sage publication company, Thousand oaks, California, USA.

Denzin, N. K. (1978). *The Research Act: A theoretical introduction to sociological methods.* New York: McGraw-Hill, USA.

DeRose, J. V., Lockard, J. D., & Paldy, L.G. (1979). The teacher is the key: A report on three NSF studies. *Science and Children*, 4 (3), 35-41.

Dewey, J. (1983). Report on Turkey. "The Middle Works: Essays on Politics and Society, 1923-1924. Vol. 15 of Collected Works. Ed. Jo Ann Boydston. Carbondale: Southern Illinois Press.

Dey, I. 1993. *Qualitative Data Analysis: A User-Friendly Guide for Social Scientists*. London: Routledge and Kegan Paul.

Dindar, H. & Yaman, S. (2002). A Case of Using Teaching Methods by Teacher in Science Course at 4th and 5th Class in Primary School, *Gazi Üniversitesi Kastamonu Eğitim Dergisi*, 10 (1), 103-108.

Doyle J. K. (2004). Handbook for IQP Advisors and Students, Chapter 11: Introduction to Interviewing Techniques, Prepared for the Interdisciplinary and Global Studies Division, Worcester Polytechnic Institute. Retrieved October 23, 2005, from
http://www.wpi.edu/Academics/Depts/IGSD/IQPHbook/ch11.html.

Duman, A, & Williamson, B. (1996). Organization, Constrains and Opportunities: An Analysis of Adult Education in Turkey. *International Journal of Lifelong Education*, 15 (4), 286-302.

Dunn, R. (1999). How to implement and supervise a Learning Style.
Retrieved June 10, 2002 from
http://www.ascd.org/publications/books/1996dunn/1996dunntoc.html

Dunn, R., Beaudry, J. S., & Klavas, A. (1989). Survey of Research on Learning Styles. *Educational Leadership*, 46(6), 50-58.

Dunn, R. & Dunn K. (1989). *Learning Style Inventory*, Lawrence, KS, Price Systems, USA.

Dunn, R. & Griggs, S. A. (2000). *Practical Approaches to Using Learning Styles in Higher Education*, Wesport, Connecticut: Bergin & Garvev, USA.

Ediger, M. (2001), Assessment, Geography, and the Student, *Journal of Instructional Psychology*, 28 (3), 150-155.

Eick, C. J., & Reed, C. J. (2002). What makes an inquiry-oriented science teacher? The influence of learning histories on student teacher role identify and practice, Science Education, 86 (2), 401-416.

Eisenhart, M., Finkel, E., & Marion, S. F. (1996). Creating the conditions for scientific literacy: A re-examination. *American Educational Research Journal*, 33 (2), 261–295.

Ellis, J.D., & Backe, K.A. (1995, April). Using *video to evoke reflection on science teaching*. Paper presented at the annual meeting of the National Association for Research in Science Teaching, San Francisco, California, USA.

Enochs, L. G., Oliver, S., and Wright, E. L. (1990). An evaluation of the Perceived Needs of Secondary Science Teachers in Kansas. *Journal of Science Teacher Education*, 1 (4), 74-79.

Erden, M. & Altun, S. (2006). *Öğrenme Stilleri*, Yaylacılık Matbaası, Morpa, İstanbul.

Ersoy, Y. (2006). TIMSS-R Aynasından Yansıtmalar-I: Türkiye'de Fen Bilgisi Öğretmenlerinin Genel Görünüşü, *Journal of Turkish Science Education*, 3(1), 19-35.

Farrell, J. T. (1967). Dewey in Mexico. In Hook, S. (Eds.), J. Dewey: *Philosophy of Science and Freedom*, (pp. 351-377). New York: Barnes and Nobles.

Felder, R. M. & Brent R. (2005) Understanding Student Differences, *Journal of Engineering Education*, *94* (1), 57-72.

Fensham, P. J. (1987). Science for all. *Educational Leadership,* 44 (4), 18-23.

Feyerabend, P. (1988). *Against Method.* New York: Verso, USA.

Fraenkel, J. R., & Wallen, N. E. (1996). *How to Design and Evaluate Research in Education.* Mcgraw-Hill, Inc.

Gallagher, J. J. (1970). A comparison of individualized and group instruction in science: Effects on third grade pupils. *Journal of Research in Science Teaching*, 7(5), 236-253.

Gardner, H. (1983). *Frames of Mind: the Theory of Multiple Intelligences*. New York, NY: Basic Boks.

Gardner, H. (1995). Reflections on Multiple Intelligences: Myths and Messages. *Phi Delta Kappan*, 101 (76), 200-209.

Gardner, H., & Hatch, T. (1989). Multiple Intelligences Go to School: Educational Implications of the Theory of Multiple Intelligences. *Educational Researcher*,18 (8), 4-10.

Germann, P. J., and Barrow, L.H. (1995). In-service Needs of Teachers of Biology: A comparision between Veteran and Non-veteran Teachers. *American Biology Teacher,* 57 (5), 272-277.

Gettinger, M. (1983). Effects of learner ability and instructional modification. *Journal of Educational Research*, 16 (4), 362-369.

Goleman, D. P. (1995). *Emotional Intelligence: Why It Can Matter More Than IQ for Character, Health and Lifelong Achievement*. Bantam Books, New York.

Good, T. L. & Stipek, D.J. (1983). Individual Differences in the Classroom, A book chapter, part one, Individual differences and the common curriculum, Eighty-second yearbook of the national society for the study of education, p (9-43), University of Chicago Press, Chicago, USA.

Goodnough, K. (2001). Multiple intelligences theory: a framework personalizing science curricula, *School Science and Mathematics*, 101 (4), 180-193.

Green, E. L. (1982). Individualized learning in science. *School Science Review*, 64 (226), 16-22.

Green, S. B., Salkind N. J. & Akey, T.M. (2000). *Using SPSS for Windows, Analyzing and Understanding Data*, Prentice Hall, Upper Saddle River, New Jersey, USA.

Gupta, K. (1999). *A practical guide to Needs Assessment*, Jossey-Bass, Pfeiffer Publicatıon, San Francisco, USA.

Güneysu, S., Çağlayan, E., & Kaygısız, P. (2005). *Beyin Araştırmalarının Eğitime Yansıması,* SMG Yayıncılık, Ankara.

Gyamfi, A. (2003). *Needs Assessment of Science Teachers in Secondary Schools in Kumasi, Ghana*. Unpublished PhD Dissertation, State University of Newyork, Albany, USA.

Hall, T. (2002). *Differentiated instruction.* Wakefield, MA: National Center on Accessing the General Curriculum. Retrieved August 13, 2005, from http://www.cast.org/publications/ncac/ncac_diffinstruc.html

Haney, J. J., Czerniak, C. M., & Lumpe, A. T. (1996). Teacher beliefs and intentions regarding the implementation of science education reform strands. *Journal of Research in Science Teaching,* 33 (9), 971-993.

Hansen, D.J. (1991). An Empirical Study of the Structure of Needs Assessment. Unpublished doctoral dissertation, The Ohio State University, Columbus.

Hanson, G. R. (1978). *Assessing student characteristics: with whom are we dealing*. Proceedings of the 58th Annual Conference of the Association of College Unions International, USA.

Harlen, W. (1998). *The teaching of Science in Primary Schools*, second edition, David Fulton Publishers, London

Hein, G. E. & Price, S. (1994). *Active Assessment for Active Science: A guide for elementary school teachers,* Portsmouth, Heinemann, USA.

Hewitt, H. C. (1974). The Individual science journal. *Science and Children*, 11 (8), 30-31.

Hodson, D. (1998). *Teaching and learning science: Towards a Personalized Approach.* Philadelphia, Open University Press, USA.

Hoerr, T. R (1996). Introducing the theory of multiple intelligences. *NASSP Bulletin,* 80(583), 8-10.

Humphreys, B., Johnson, R. T. & Johnson, D. W. (1982). Effects of cooperative, competitive and individualistic learning on students' achievement in science class. *Journal of Research in Science Teaching*, 19(7), 351-356.

Idris, M.D. (2002) A study on the needs of Malaysian primary science teachers, Unpublished Master Thesis, Faculty of Education, University of Kebangsaan Malaysia, Malaysia.

James, R. K. (1972). A comparison of group and individualized instructional techniques in seventh grade science. *Journal of Research in Science Teaching*, 9(2), 91-96.

Jung, C. (1927). *The theory of psyhological type*, Princeton University Press, New Jersey, USA.

Jones, M. A. (1977). Advantages and disadvantages of individualized instruction. *Journal of College Science Teaching*, 6 (3), 232-233.

Johnson, B. (2001). Toward a New Classification of Nonexperimental Quantitative Research. *Educational Researcher*, 30 (2), 3-13.

Karagözoğlu, G., & Murray, K. B. (1988). Profile of New Teachers in the Turkish Educational System. *Contemporary Education*, 50 (3), 173-177.

Karatepe A., Yıldırım H. Y., Şensoy Ö., & Yalçın N. (2004). Fen Bilgisi Öğretimi Amaçlarının Gerçekleştirilmesinde Mevcut Fen Bilgisi Müfredat Programının Amaçlar Boyutunda Uygunluğu Konusunda Öğretmen Görüşleri, *Kastamonu Eğitim Dergisi*, 5 (2), 165-175.

Kaufman, R., Rojas, A.M., & Mayer, H. (1993). *Needs assessment: A user's guide*. Educational Technology, Englewood Cliffs, NJ. United States of America.

Kazu, İ. V. & Yıldırım, V. (2000). İlköğretim Sınıf Öğretmenlerinin Öğretim Yöntemleri Knusundaki Nitelikleri, *IX. Ulusal Eğitim Bilimleri Kongresi*, Eylül, Atatürk Üniversitesi Eğitim Fakültesi, Erzurum.

King, N. (1994). *The qualitative research interview*. In qualitative methods in organizational research. C.Cassell and G.Symon (Eds). London: Sage Publications, England.

Klopfer, L. E. (1971). Individualized science: Relevance for the 1970s. *Science Education*, 55(3), 441-448.

Kolb, D.A. (1984). *Experiential Learning: Experience as the Source of Learning and Development,* Englewood Cliffs, N.J.: Prentice-Hall Inc, USA.

Kutay, H. (2006). A Comparative Study about Learning Styles Preferences of Two Cultures, Unpublished PhD Dissertation, Ohio State University, USA.

Lee, K. & Lodewijks, H. G. L. C. (1995). The adaptation of international students' learning styles to different learning contexts. *College Student Journal*, 29 (3), 319-332.

Lincoln, Y., & Guba, E. (1985). *Qualitative Naturalistic Inquiry*, Sage Publication, New York, USA.

Longbottom, J. E. , & Butler, P. H. (1998). Why Teach Science? Setting Rational Goals for Science Education. *Science Education*, 83 (4), 473-492.

MacLeod, M. V. (2002), Teachers' perceptions and practices of Howard Gardner's Theory of Multiple Intelligences (Howard Gardner), Unpublished Doctoral Thesis. Ma Mount Saint Vincent University, Canada.

Maddox, J. V. (2002). Teacher training in multiple intelligences strategies and cooperative learning structures to effect a change in the classroom. *Dissertation Abstracts International.* Retrieved May 15, 2005, from http://wwwlib.umi.com/dissertations/

Marchese R. S. (1977). A literature search and review of the comparison of individualized and conventional modes of instruction in science. *School Science and Mathematics*, 8(8), 699-703.

Marshall, C., & Rossman, G. B. (1999). *Designing qualitative research.* Thousand Oaks: Sage Publications, USA.

Martens, M. (1992). Inhibitors to Implementing a Problem-Solving Approach to Teaching Elementary Science: Case Study of a Teacher in Change. *School Science and Mathematics*, 92 (2), 150-166.

Mathison, S. (1998). Why triangulate?, *Educational Researcher*, 17 (2), 13-17.

Mayer, J. D., & Salovey, P. (1997). What is Emotional Intelligence? In P. Salovey & D. J. Sluyter (Eds.) Emotional Development and Emotional Intelligence. New York: Basic Books, USA.

McCarthy, B. (1987). *The 4MAT system: Teaching to learning styles with right/left mode techniques*. Barrington, IL: Excel, Inc.

McCarthy, B. (1996). *About learning*. Barrington, Illinois; Excel, Inc.

McKillip, J. (1987). *Need analysis: Tools for the services and education.* California: Sage Publications, Inc, USA.

Merriam, S. (1998). *Qualitative Research applications in education*, CA: Jossey-Bass, San Francisco, USA.

MEB. (1992). *Ilköğretim Kurumlar Fen Bilgisi Dersi Öğretim Programları* (Science Education Programs of Primary Education), Istanbul, Turkey.

MEB. (2000). *2518 Sayılı Tebliğler Dergisi, Milli Eğitim Basımevi*, İstanbul.

MEB. (2001). National Educational at the beginning of 2002, MONE Research and Planning Coordination Committee. Ankara, Turkey.

MEB. (2004). Öğretmenlik Mesleği Genel Yeterlikleri Taslağı, Temel Eğitime Destek Programı, Öğretmen Eğitimi Bileşeni, Ankara

MEB. (2005). *Ilköğretim Fen ve Teknoloji Dersi 4-8. sınıflar Öğretim Programı Taslak Programı,* Ankara, Turkey.

Miles, B. M., & Huberman, A. M. (1994). *Qualitative Data Analysis*: An extended sourcebook. (2nd edition). Thousand Oaks, CA: Sage, England.

Miller, R. M. (1984). Science Teaching for the Citizen of the Future. *Science Education*, 68 (4), 403-410.

Moon, T. R. (2000). The Role of Assessment in Differentiation, *Theory into Practice*, 44 (3), 226–233.

Moore, K. D. (1978). An assessment of secondary school teacher needs. *Science Education*, 62 (3), 339-348.

Moore, K. D., & Blankenship, J. W. (1977). Teaching Basic Science Skills Through Realistic Science Experiences in the Elementary School. *Science Education*, 61 (3), 337-345.

Mutlu, M. & Aydoğdu, M. (2003). Fen Bilgisi Eğitiminde Kolb'un Yaşantısal Öğrenme Yaklaşımı, *Pamukkale Üniversitesi Eğitim Fakültesi Dergisi*, 13(1), 15-29.

National Science Teachers Association. (1998). The national science education standards: A vision for the improvement of science teaching and learning. Retrieved March 12, 2002, from http://www.nsta.org/handbook/nses.htm

National Research Council (1996). *National Science Education Standards*, Washington, DC. National Academy Press.

Newport, J. F. (1973). Alternative approaches in elementary school science. *School Science and Mathematics*, 73 (8), 619-626.

NSPRA (National School Public Relations Association). (1971). Individualization in schools: The challenge and the Options. Education USA Special Report. Washington, DC: National School Public Relations Association.

Ogan, F. (2002). *Determination of In-service Needs of Turkish High Schools Science Teachers in Istanbul,* Unpublished PhD Dissertation, Florida State University, Florida, USA.

Okebukola, P. A., & Ogunniyi, M. B. (1984). Cooperative, competitive and individualistic science laboratory interaction patterns, effects on students' achievement and acquisition of practical skills, *Journal of Research in Science Teaching*, 21 (3), 875-884.

Orlich, C. D., et. al. (2004). *Teaching Strategies: A Guide to Effective Instruction*, Boston, MA: Houghton Mifflin Co, USA.

O' Toole, R. J. (1968). The effectiveness of individualized elementary school science. *Science Education*, 52 (4), 381-384.

Oxford, R. L. & Anderson, N. J. (1995). A cross-cultural view of learning styles. *Language teaching*, 28 (15), 201-215.

Özbek, R. (2005). Eğitim programlarının bireyselleştirlmesinin sebepleri, *Elektronik Sosyal Bilimler Dergisi*, 3 (11), 66-83.

Özdemir, P., Akkuş, O. (2005). Use of Creative Drama in Science and Mathematics by Preservice Elementary Teachers. *Hacettepe Üniversitesi Eğitim Fakültesi Dergisi,* 29 (2), 157-166.

Özdemir P., Güneysu S. & Tekkaya C. (2006). Enhancing learning through multiple intelligences. *Journal of Biology Education.* 40 (2), 74.

Patton, M. G. (1987). *How to use qualitative methods in evaluation*. Newbury Park: Sage Publications, England.

Patton, M. G. (1990). *Qualitative evaluation and research methods*. Newbury Park: Sage Publications, England.

Penick, J. E. (1995). New goals for biology education, *Bioscience*, 45(6), 52-

58.

Plimmer, J. P., & Hartshorn, R. L. (1989). Evaluation of a model for reform of elementary science instruction in rural and small school systems. *Journal of Rural and Small Schools,* 3 (3), 6-13.

Pool, C. R. (1997). Maximizing Learning: A Conversation with Renate, *Educational Leadership,* 54 (2), 11-15.

Proctor, et al. (1995). Learning to Teach in the Primary Classroom, Routledge, London and New York.

Repicky, P. A. (1978). Another individualized science program? Yes, but. *School Science and Mathematics*, 78, 93-98.

Reviere, R., Berkowitz, S., Carter, C.C., & Ferguson, C.G. (1996). *Needs assessment: A creative and practical guide for social scientists.* Washington: Taylor & Francis.

Riding, R., & Douglas, G. (1993). The effect of cognitive style and mode of presentation on learning performance. *British Journal of Educational Psychology*, 63 (25), 297-307.

Roach, D. K., & Hammond, R. A. (1981). Individualized instruction in Great Britain: A survey and a case study. *Journal of College Science Teaching*, 11(1), 25-29.

Rokey, T. J. (1975). Needs Assessment Model: East Stroudsburg, Pennsylvania, Educational Development Center

Rose, C., & Nicholl, M. J. (1999). *Accelerated Learning for the 21st Century*, Dell Publishing. London: Piatkus.

Rose, D. & Meyer, A. (2002). *Teaching Every Student in the Digital Age: Universal Design for Learning*, ASCD, 2002. Retrieved December 15, 2005, last accessed in October 18, 2005, from http://www.cast.org/teachingeverystudent/ideas/tes/index.cfm

Rossett, A. (1988). *Training needs assessment*. Englewood Cliffs, NJ: Educational Technology Publications, Inc.

Rossman, M. (1983). Why kids fail to learn science and what to do about it. *Learning*, 12 (5), 76-80.

Rubin, H. J., & Rubin, I. S. (1995). *Qualitative Interviewing. The art of hearing data*. Thousand Oaks: Sage Publications, England.

Rutherford, J., & Ahlgren, A. (1989). American Association for the Advancement of Science. *Science for all Americans,* Project 2061. New York: Oxford University Press.

Schumacher, S and McMillan, J. H. 1993. Research in Education: A conceptual Introduction. New York: Harper Collins.

Searson, R., & Rita Dunn (2001). The Learning Style Teaching Model, *Science and Children*, 38 (5), 22-36.

Shirley, B. S. O., & Napsiah, M. (2004) The professional development needs of 'Ketua Panitia': A study of several secondary schools in Kuching, Sarawak, Paper presented at Seminar Kebangsaan Pendidikan Guru, Kuching, Sarawak.

Sieber, Joan E. (editor). 1985. *The Ethics of Social Research*: *Fieldwork, Regulation, and Publication*. New York: Springer-Verlag.

Siepmann, J., P. (1999). What is Science?, *Journal of Theoretics*. Vol. 1-3, Retrieved February 28, 2005, last accessed in January 15, 2005, from http://www.journaloftheoretics.com/Editorials/Vol-1/e1-3.htm.

Silberman, C. (1971). A critical view of individualization, individualized instruction in schools. School Public Relations Association, Washington, DC: Education USA National

Sizer, T. R. (1999). No two are quite alike. *Educational Leadership*, 59 (2), 6-10.

Smith, E. (1997). Learning styles. Framework and instruments. *Educational Psychology*, 17(1), 51-63.

Smith, P.L. & Ragan, T. (1992). *Instructional Design*. New York: Macmillian.

Soriano, F. I. (1995). *Conducting needs assessments: A multidisciplinary approach*. California: Sage Publications, Inc, USA.

Southerland, S. A. , Gess-Newsome, J., & Johnson, A. (2003). Portraying science in the classroom: The manisfestation of scientists' beliefs in classroom practice. Journal of Research in Science Teaching, 40 (2), 669-691.

Stahl, D. K. & Anzalone, P. M. (1970). *Individualized Teaching in Elementary Schools*, Parker Publishing Company, Inc. West Nyack, NY, USA.

Stark, R. and Gray, D. (1999). Gender preferences in learning science, *International Journal of Science Education*, 21 (6), 633-643.

State of Delaware High School Science Summary (2002). Research for Better Schools, Retrieved January 15, 2005, last accessed in February 13, 2005, from http://www.rbs.org/mathsci/states/de/needs_assessment/state/high_science_summer.htm

Steadham, S.V. (1980) Learning to Select a Needs Assessment Strategy, Training and Development Journal, American Society for Training and Development, 30 (2), 56-61.

Stenberg, R. J. (1994). Allowing for Thinking Styles. *Educational Leadership*, 52 (3), 42-45.

Stevens, D. D., Sarigul, S., & Deger, H. (2002). Turkish Student Teachers Early Experiences in Schools: Critical Incidents, Reflection, and a New Teacher Education Program. *An Online Journal for Teacher Research*, 5 (2). Retrieved December 13, 2004, last accessed in October 15, 2005, from http://education.ucsc.edu/faculty/gwells/networks/journal/Vol5(2).2002sept/Stevens.html

Stronck, D. R. (1980). The educational implications of human individuality. *American Biology Teacher*, 42(3), 146-151.

Stufflebeam, D. L., McCormick, C. H., Brinkerhoff, R. O., & Nelson, D.D.(1985). *Conducting educational needs assessments.* Boston: Klower, USA.

Suarez, J. M. (1992). Needs Assessment. In Husen Tortsen and Postlethwaite, Neville, The Encyclopedia of Education 2nd Edition. New York: Pergamon, Elsevier Science, USA.

Şahin, Ç. (2004). İlköğretim Okullarında Görev Yapan Öğretmenlerin Kullandıkları Öğretim Stratejileri, *İnönü Üniversitesi, Eğitim Fakültesi Dergisi*, 5 (8), 13-18.

Thies, A. P. (2000). The Neuropsychology of Learning Styles, *National Forum of Applied Educational Research Journal*, 13 (1), 50-62.

Thorndike, E. L. (1920). İntelligence and its uses. *Harper's Magazine*, 140(2), 227-235.

TIMSS (1999). International Mathematics Report and the TIMSS 1999 International Science Report. U.S. National Center for Education Statistics in Pursuing Excellence: Comparisons of International Eighth-Grade Mathematics and Science Achievement from a U.S. Perspective, 1995 and 1999.

Tomlinson, C. (1995). How *to differentiate instruction in mixed-ability classrooms.* Alexandria, VA: Association for Supervision and Curriculum Development.

Tomlison, C. A., & Dockterman, D. (2002). *Instructor*, Different Learners Different Lessons*,* 112(2), 21-26.

Torff, B. (1997). *Multiple Intelligences and Assessment*, IRI/ Skylight Training and Publishing, USA.

Toth , K. R. (2002). A study of teachers' perceptions and implementation of multiple intelligences-centered instruction in a Connecticut elementary school. *Dissertation Abstracts International*, 30(41), 347.

Turan, S. (2000). John Dewey's Reports of 1924 and his Recommendations on the Turkish Educational System Revisited. *History of Education*, 29(6), 543-555.

Van Driel, J. H., Beijaard, D., & Verloop, N. (2001). Professional development and reform in science education: The role of teachers' practical knowledge. *Journal of Research in Science Teaching*, 38(2), 137–158.

Watts, D. M. (2003). The Orchestration of Learning and Teaching Methods in Science Education, *Canadian Journal of Science, Mathematics and Technology Education*, 3(4), 451-464.

Weiss, I. R. (1987). Report of the 1985-86 national survey of science and mathematics education in USA. Research Triangle Park, NC: Research Triangle Institute, USA.

Welch, W. W. (1995). *Student assessment and curriculum evaluation: Improving science education*, The University of Chicago press, Chicago, USA.

Willett, J. B., Yamashita, J. J. M., & Anderson, R. D. (1983). A meta-analysis of instructional systems applied in science teaching. *Journal of Research in Science Teaching*, 20(5), 405-417.

Witkin, B. R., & Altschuld, J. W. (1995). *Planning and conducting needs assessments: A practical guide.* Thousand Oaks, CA: Sage Publishing, USA.

Witkin, H. A., Moore, C.A., Goodnough, D. R., & Cox, P. W. (1977). Field-dependent and field-independent cognitive styles and their educational implications. *Review of Educational Research*, 47(1), 1-64.

Wolf, E. (1996). John Dewey in Turkey: An Educational Mission. *Journal of American Studies of Turkey*, 3, 15-42.

Yager, R. E., & Penick, J. E. (1984). What students say about science teaching and science teachers, *Science Education*, 68, 143-152.

Yıldırım, A, & Şimşek, H. (1999) *Sosyal bilimlerde nitel araştırma yöntemleri*, Ankara: Seçkin Yayınevi.

Yıldırım, A. & Öztürk, E. (2002). Sınıf Öğretmenlerinin Günlük Planlarla İlgili Algıları: Öncelikler, Sorunlar ve Öneriler, *İlköğretim-Online*, 1(1), 17-27. Retrieved May 18, 2005 from
http: www.ilköğretim-online.org.tr

Yin, R. (2003). *Application of Case Study Research* (2nd ed.). Thousand Oaks, CA: Sage Publications, USA.

Zeitler, W. (1975). Individualized science. *Science and Children*, 12(5), 32-33.

Zurub, A. R., & Rubba, P. A. (1983). Development and validation of an inventory to assess science teacher needs in developing countries. *Journal of Research in Science Teaching,* 20 (9), 867–873.

APPENDIX A

PERCEPTIONS AND NEEDS ASSESSMENT QUESTIONNAIRE (PNAQ)

(FEN VE TEKNOLOJİ ÖĞRETMENLERİ ÖĞRETME-ÖĞRENME SÜRECİ GÖRÜŞ VE IHTİYAÇ ANALİZİ ANKETİ)

Öğretmenler öğrencilerin öğrenme ihtiyaçlarını karşılayabilmek için sınıf ortamında farklı öğrenme kuramlarına dayalı çok çeşitli yaklaşım, yöntem ve strateji kullanırlar. Bu anketi uygulamadaki amacımız öncelikle öğretmenlerimizin öğrenci farklılıklarını göz önüne alan günümüz çağdaş yaklaşım ve stratejileri ile ilgili olarak görüşlerini belirlemektir. Bunun yanı sıra bu yeni yaklaşımları uygulamalarına yansıtıp yansıtmadıkları ya da yansıtabilmek için nelere ihtiyaçları olduğunu saptamaktır. Yoğun programınız arasında bu anketi doldurduğunuz için şimdiden teşekkür ediyoruz.

Araş. Gör. Pınar ÖZDEMİR
Prof. Dr. Sibel GÜNEYSU

Bölüm 1: Demografik Özellikler

1. Cinsiyetiniz: Kadın ☐ Erkek ☐

2. Eğitim Durumunuz:

Ön-Lisans ☐ Lisans ☐ Yüksek Lisans ☐ Doktora ☐

Başka ☐ Lütfen yazınız……………………………………………

3. Lisans eğitiminiz öğretmenlikle ilgili değil ise daha sonra bu konuda eğitim aldınız mı? Ne kadar sürdü? Bu eğitimi nereden aldınız?
....
...........……………………………………………………………………………

4. Kaç yıldır öğretmenlik yapıyorsunuz?

1-5 yıl ☐	6-10 yıl ☐
11-15 yıl ☐	16-20 yıl ☐
21-25 yıl ☐	26-… yıl ☐

5. Şu an ders verdiğiniz sınıf düzeyi
....

Bölüm 2: Yeni Fen ve Teknoloji Programı Öğretim Yöntemi ve Değerlendirmeye İlişkin Öğretmen Görüşleri

1. a. Fen ve Teknoloji derslerinizi nasıl işliyorsunuz? Hangi yöntem veya stratejileri kullanıyorsunuz?

....
....
....

b. Fen ve Teknoloji derslerinde öğrencilerinizin başarılarını nasıl değerlendiriyorsunuz?
Onların dönem sonu notunu verirken göz önüne aldığınız faktörler nelerdir?

....
....
....

2) a. Fen ve Teknoloji dersinin içeriğindeki yeniliklerden haberdar mısınız?

Hayır		Biraz		Evet
1	2	3	4	5

b. Bu yeniliklerin hangi yaklaşımları temel aldığını düşünüyorsunuz? Birkaç örnek verebilir misiniz?

----

3) a. Öğretmenlik eğitiminizde (önlisans ya da lisans programınızda) Fen Eğitiminde yeni yaklaşımlar ile ilgili olarak herhangi bir eğitim aldınız mı?

Evet ☐ Eğer evet ise lütfen açıklayınız...
……………………………………….
……………………………….............

Hayır ☐ Eğer hayır ise nedenini açıklayınız……………………………………

b. Fen Eğitiminde yeni yaklaşımlar ile ilgili olarak hizmet içi eğitim seminerlerine katıldınız mı ?

Evet ☐ Eğer evet ise lütfen açıklayınız...
……………………………………….

Hayır ☐ Eğer hayır ise nedenini açıklayınız……………………………………
……………………………………….

c. Fen Eğitiminde yeni yaklaşımlar ile ilgili olarak teorik ve uygulama açısından kendinizi
yeterli hissediyor musunuz?

Evet ☐ Eğer evet ise lütfen açıklayınız...
……………………………………….
……..........…………………………..

Hayır ☐ Eğer hayır ise lütfen açıklayınız……………………………………
………………………………………
……………………………………

d. Tüm öğrencilerinizi aynı şekilde mi değerlendiriyorsunuz? Öğrencilerinizi değerlendirirken her bir öğrenciniz için ayrı bir değerlendirme yöntemi kullanıyor musunuz?

Evet ☐ Eğer evet ise lütfen açıklayınız...
……………………………………….

Hayır ☐ Eğer hayır ise lütfen açıklayınız……………………………………
………………………………………
………………………………………

Bölüm 3: Öğrenci Farklılıklarını Göz Önüne Alan Öğrenme ve Değerlendirme Yöntemlerine İlişkin Öğretmen Deneyimleri

Öğrenci farklılıklarını göz önüne alan öğretim yöntemleri hakkında yeterli bir bilgiye sahip olmasanız da, bu yöntemlere özgü öğretim ve değerlendirme stratejilerini günlük derslerinizde kullanıyor olabilirsiniz. Aşağıdaki öğretim ve değerlendirme stratejilerini fen ve teknoloji derslerinizde ne sıklıkta kullandığınızı belirtiniz.

5= Çok sık (her derste ya da haftada birçok kez)
4= Bazen (Ayda birkaç kez)
3= Nadiren (Ayda bir kez ya da daha az)
2= Haberdarım fakat daha uygulamadım
1= Bilmediğim bir strateji

	Bilmediğim bir strateji	Haberdarım fakat daha uygulamadım	Nadiren (Ayda bir kez ya da daha az)	Bazen (Ayda birkaç kez)	Çok sık (her derste ya da haftada birçok kez)
1. Fen ve Teknoloji derslerinde öğrenci farklılıklarını göz önüne alarak derslerimi işlerim.					
2. Öğrencilerime rehberlik yaparak öğrenmelerini kolaylaştırırım.					
3. Öğrencilerime bireysel olarak yapacakları etkinlikler vererek onlarda bağımsız çalışma alışkanlığını geliştiririm.					
4. Fen ve Teknoloji dersimde küçük grup tartışmaları düzenlerim.					
5. Fen ve Teknoloji derslerimde gerektiğinde okul gezilerine (müze, kütüphane, alan gezisi vb.) yer veririm.					
6. Öğrencilerimi kütüphanede araştırma yapmaları için yönlendiririm.					
7. Öğrencilerimin işlenen konu ile ilgili ön bilgi ve inançlarını açığa çıkarırım.					
8. Öğrencilerime öğrendikleri yeni kavramları farklı durumlarda kullanmaları için fırsat veririm.					
9. Öğrenme merkezleri oluşturarak dersimi işlerim.					

10. Öğrencilerimi ileri sürülen alternatif düşünceler üzerinde düşünmeleri için teşvik ederim.					
11. Fen ve teknoloji derslerinde laboratuarda gruplar oluşturarak öğrenme ortamını düzenlerim.					
12. Öğrencilerimi fen konularında yazılar yazmaya teşvik ederek onların fen günlükleri tutmasını sağlarım.					
13. Öğrencilerimi fen konularında poster hazırlamaları için teşvik ederim.					
14. Fen derslerinde öğrencilerime konu ile ilgili kavram haritaları hazırlamalarını sağlarım					
15. Öğrencilerime konuyu okurum ya da anlatırım.					
16. Öğrencilerime kendi kişisel isteklerini belirlemede fırsat tanırım.					
17. Öğrencilerimi bilimsel düşünmeleri için teşvik ederim.					
18. Öğrencilerimi grupla beyin fırtınası yapmaları için teşvik ederim.					
19.Öğrencilerime nesneleri değiştirmeleri ya da elleriyle bir şeyler üretebilmeleri için fırsat tanırım.					
20. Öğrencilerime sınıf içerisinde konularla ilgili grup projeleri yapıp sunmalarına imkan tanırım.					
21. Öğrencilerime araştırma yapmaları için yeterli zamanı tanırım.					
22. Öğrencilerimi kavramları mantık çerçevesinde düzenlemeleri ve organize edebilmeleri için teşvik ederim.					
23. Öğrencilerime tartışılan ya da öğretilen konuyu görsel olarak ifade etmelerine fırsat tanırım.					
24. Öğrencilerime duyuları ile hissedebilecekleri materyaller ve deneyimler sağlarım.					
25. Öğrencilerime düşüncelerini müzik yardımıyla ifade etmelerine fırsat tanırım.					
26. Öğrencilerim nesneleri, olayları ve yaşayan organizmaları onların belirli özelliklerine dayanarak sınıflandırabilirler.					

27. Öğrencilerimi sınıfta öğrendikleri ile günlük hayatlarında yaşadıkları arasında ilişki kurabilmeleri için teşvik ederim.					
28. Öğrencilerimi sınıfta birbirlerine yardımcı olmaları için teşvik ederim.					
29. Öğrencilerime doğa olayları ile ilgili olarak çalışmaları için fırsat tanırım.					
30. Öğrencilerimi sözel becerilerini iletişim kurmada, problem çözmede ve düşüncelerini ifade etmede kullanabilmeleri için teşvik ederim.					
31. Öğretim- öğrenim sürecinde gerektiğinde matematiksel problem çözmeyi kullanırım.					
32. Sınıfta harita, poster, şema gibi görsel materyalleri kullanırım.					
33. Sınıf içi iletişimlerinde öğrencilerimi vücut dillerini kullanabilmeleri için teşvik ederim					
34. Sınıf içi öğretimimde ritmi, şarkıları ve müziği kullanırım.					
35. Öğrencilerim sınıf içerisinde okuma faaliyetlerinde bulunmaları için fırsat tanırım.					
36. Öğrencilerime sınıf içerisinde ne hissettiklerini söyleyebilmeleri için fırsattanırım.					
37. Öğrencilerime bilimsel deneyler yapabilmeleri için fırsat tanırım.					
38. Öğrencilerime sınıf içerisinde video, film ya da asetat gösteririm.					
39. Öğrencilerime birbirleri ile paylaşımda bulunmaları için fırsat tanırım.					
40. Öğrencilerim öğrenme sürecinde drama, dans ve fiziksel aktivitelerini kullanmaları için fırsat tanırım.					
41. Öğrencilerime farklı bitkiler ve hayvanlarla ilgili çalışabilmeleri için fırsat tanırım.					
Öğrencilerimin başarılarını değerlendirirken					
42. Onlara ait yazılı materyallerin örneklerini (düz yazı, kısa cevap gibi) değerlendirmeme katarım.					
43. Hazırladıkları yansıtıcı yazımlarını (öz değerlendirme ve günlük tutma gibi) kullanırım.					
44. Onlara ait akıl yürütme ve problem çözme becerileri örneklerini kullanırım.					

45. Yaptıkları çizim, resim ya da her türlü sanatsal çalışmalarını kullanırım.					
46. Drama etkinliklerini kullanırım.					
47. Hazırladıkları grup raporlarını kullanırım.					
48. Elleriyle geliştirdikleri bir ürünü sergilemelerini (model gibi) değerlendirmeme katarım.					
49. Onların geliştirdiği şarkı ya da ritm sözlerini kullanırım.					
50. Çalışmalarındaki doğa gözlemlerinin sentezini kullanırım.					
51. Onların iletişim kurmadaki becerilerini dikkate alırım.					
52. Kendi değerlendirmelerinin dönütlerini kullanırım.					
53. Arkadaşlarının değerlendirmelerinin dönütlerini kullanırım.					
54. Kendi hazırladıkları bulmaca, kavram haritası gibi örnekleri değerlendirmeme katarım.					
55. Kendi çalışmalarının görsel sunumlarını kullanırım.					
56. Onlarla yapılan görüşmelerde sağlanan dönütleri kullanırım.					
57. Rol oynama ya da diğer fiziksel ifadeleri kullanırım.					
58. Onların müziksel performanslarını ya da bestelerini kullanırım.					
59. Çevre ile ilgili yaptıkları deneyleri ya da projelerini kullanırım.					
60. Hazırladıkları ürün dosyalarını (portfolyo) dikkate alırım.					

Bölüm 4: Sınıf Öğretmenlerinin Öğrenci farklılıklarını Göz Önüne alan Öğrenme ve Değerlendirme Yaklaşımlarının Kullanımına İlişkin İhtiyaç Analizi

Bu anketin amacı fen ve teknoloji derslerinde sınıf öğretmenlerinin öğrencilerini tanıması ve bu farkındalıktan öğretme-öğrenme sürecini planlamada, uygulamada ve değerlendirmede en üst düzeyde yararlanabilmesi için ihtiyaçlarını belirlemektir. Aşağıda verilen ifadeleri şu anki mevcut durumunuzu düşünerek soldaki kutucuğu ve olmasını istediğiniz durumu düşünerek sağdaki kutucuğu işaretleyiniz.

MEVCUT DURUM						**İSTENEN DURUM**				
5	4	3	2	1		5	4	3	2	1
Her Zaman	Bazen	Arasıra	Nadıren	Hiçbir Zman		Her Zaman	Bazen	Arasıra	Nadıren	Hiçbir Zman
					1. Öğrenci farklılıklarını göz önünde bulunduran yeni öğretim yaklaşımları ile ilgili yeterli bilgiye sahibim.					
					2. Ders planlarımı öğrenciyi merkeze alarak hazırlarım.					
					3. Öğrencilerin gelişim düzeylerini ve bireysel farklılıklarını belirlemek için çeşitli teknikler (gözlem, karşılıklı görüşme, ölçek, bireysel ve grup projeleri vb.) kullanırım.					
					4. Uygulamalarımda öğrencilerimin gelişim düzeylerini ve ilgi alanlarını dikkate alırım.					
					5. Öğrencilere onların gelişim düzeyi, öğrenme biçimi, ilgi ve gereksinimlerine uygun ödev ve sorumluluklar veririm.					
					6. Öğrenciye ait bilgileri sınıf içi ve dışı çalışmaları çeşitlendirmekte kullanırım.					
					7. Öğrenciye ait bilgileri öğrenme-öğretme sürecini planlama, uygulama ve değerlendirmede kullanırım.					
					8. Öğretme-öğrenme sürecinde öğrencinin ilgi ve ihtiyaçları doğrultusunda değişiklikler yaparım.					
					9. Bilgi ve iletişim teknolojilerini kullanarak, farklı deneyimlere, özelliklere ve yeteneklere sahip öğrencilere uygun öğrenme ortamları hazırlarım.					

MEVCUT DURUM						İSTENEN DURUM				
5	4	3	2	1		5	4	3	2	1
Her Zaman	Bazen	Arasıra	Nadıren	Hiçbir Zman		Her Zaman	Bazen	Arasıra	Nadıren	Hiçbir Zman
					10.Öğrencinin farklı ihtiyaçlarını dikkate alarak öğrenci merkezli stratejileri destekleyen teknolojiler kullanırım.					
					11.Öğrencilerin farklı ön yaşantılarını öğrenme ortamlarını düzenlerken dikkate alırım.					
					12. Öğrenme ortamlarını etkinlik türüne göre (bireysel, işbirlikli vb.) düzenlerim.					
					13. Fen ve teknoloji dersi ile ilgili materyal kullanmada yeterli donanıma sahibim.					
					14. Derslerimde kullanmak üzere kolay bulunur ve ucuz materyallere ulaşabilirim.					
					15. Materyalleri hazırlarken ve seçerken bireysel farklılıkları dikkate alırım.					
					16. Farklı ihtiyaçları dikkate alarak öğrenme etkinlikleri düzenlerim.					
					17. Öğrencilerimin öğrenme stilleri ve zekaları ile ilgili bilgi toplarım.					
					18. Öğrencinin ilgi ve ihtiyaçları doğrultusunda değerlendirme yöntemlerini çeşitlendiririm.					
					19. Ölçme ve değerlendirme yaklaşımlarını çeşitlendirirken bireysel farklılıkları dikkate alırım.					
					20. Çok yönlü değerlendirme için alternatif ölçme araçlarını belirlerim (portfolyo, kavram haritaları, gezi, gözlem, görüşme vb.)					
					21. Ölçme sonuçlarına göre hedefleri, öğrenme ortamını ve ölçme araçlarını yeniden gözden geçiririm ve kayıtlar tutarım.					
					22. Bütün bunları (1-21 arası şıkları) uygulayabilirim çünkü bu sistem okul yönetimi tarafından benimsenmiştir.					
					23. Bütün bunları (1-21 arası şıkları) uygulayabilirim çünkü bu sistem diğer öğretmenler tarafından da uygulanmaktadır.					

					24. Yeni yaklaşımları uygulamaya çalışırken veliler tarafından destekleniyorum.					
					25. Sınıfım çok kalabalık olduğu halde öğretim-öğrenim sürecimde bireysel farklılıkları göz önüne alan yöntemleri kullanırım.					
					26. Bireysel farklılıkları göz önüne alan yöntemleri kullandığımda da öğretim programını yetiştirebiliyorum.					
					27. Bireysel farklılıkları göz önüne alarak dersimi işlediğimde öğrencilerimi disiplin etmekte sorun çıkmıyor.					

Eklemek istediklerinizi lütfen belirtiniz

....
....
....
....
....
....
....

Araştırmamıza sağladığınız katkı için teşekkür ederiz.

APPENDIX B

INTERVIEW PROTOCOL

Interview Protocol				
Research Questions	Data Collection	Interview Questions	Possible Interview Prompts	Data Analysis
Which teaching and assessment strategies do classroom teachers use in science and technology classes? (sub-problem 1)	Tape record or writing down interviews based on the teachers' permission; take field notes and writing memos	How do you teach in your science and technology class? (Question 3) What kind of activities do you use in your science and technology class? (Question 4) What kind of assessment methods do you use for assessing your students? (Question 5) How do you learn your students' background knowledge before you start a new topic? (Question 6)	Teaching methods, assessment methods Multiple assessment methods, details about the use of portfolios, projects, open ended questions, individualized assessment (If any of them stated by the teacher)	Transcribing the data, identifying meaningful data units, coding the data, generating themes and categories, organization of categories under research questions

What are teachers' perceptions related to new science and technology program in Turkey in terms of teaching and assessment methods? (sub-problem 4)	Tape record or writing down interviews based on the teachers' permission; take field notes and writing memos	The new science and technology curriculum have started to be applied in 2005-2006 education year. Could you briefly explain you opinions about the new curriculum? (Question 2)	Teaching methods, assessment methods, individual differences, application of the curriculum, positive and negative features	
What are teachers' perceptions related to individual differences? (sub-problem 5)	Tape record or writing down interviews based on the teachers' permission; take field notes and writing memos	What is your opinion about individual differences? (Question 7) In what respects do you think that your students are different? Do you think that you know your students? In what ways do you think you know your students? (Question 8) Do you know your students' personality features? Do you gather information about your students to know them? (Question 9)	Intrapersonal and interpersonal features, background, family life Learning styles, skills, multiple intelligences	

What are teachers' practices related to teaching and assessment methods based on individual differences within the classroom in science and technology classes? Do they use teaching and assessment strategies focusing on individual differences like learning styles or multiple intelligences? (sub-problem 2)		Dou you teach according to the students who learn differently? How? (Question 10) Do you think that all of your students learn in same way? What do you do to solve this issue? Do you use teaching and assessment methods appropriate for your students' development level and learning styles? Do you take individual differences into account while you are assessing your students? (Question 11) What do you think that 'How individual differences affect your students' learning?' (Question 12) What do you think that 'What is the importance of knowing students in teaching and learning process?'		

What are the needs of classroom teachers to apply the teaching nd assessment methods based on individual differences in science and technology classes? (sub-problem 6)	Tape record or writing down interviews based on the teachers' permission; take field notes and writing memos	When you consider individual differences in your teaching process, do you have any difficulties? in terms of -knowledge, experience, and application; -principals; -parents; -materials and resources; -students (Question 17)	In-service education programs, lack of materials, time, classroom management, discipline, class size, school etc.	

APPENDIX C

FIRST DRAFT OF THE INTERVIEW SCHEDULE

GÖRÜŞME FORMU İLK HALİ

İlköğretim okullarında görevli fen ve teknoloji öğretmenlerinin öğrencilerini tanıması ve bu farkındalığı öğretme-öğrenme sürecini planlamada, uygulamada ve değerlendirmede en üst düzeyde yararlanabilmesi için ihtiyaçları nelerdir?

Merhaba, adım Pınar Özdemir. Hacettepe Üniversitesinde Araştırma Görevlisi olarak çalışmaktayım. Aynı zamanda Orta Doğu Teknik Üniversitesinde doktora yapıyorum. Yaptığım tez çalışması için fen ve teknoloji dersinin işlenişine ilişkin görüşlerinizi ve uygulamalarınızı öğrenmek istiyorum.

Görüşme sürecinde söyleyeceklerinizin tümü gizli tutulacak ve sadece bu araştırma için kullanılacaktır. Araştırma sonuçlarında adınız geçmeyecektir.

Sorularıma başlamadan önce söylediklerime ilişkin söylemek istedikleriniz ya da sormak istedikleriniz varsa sizi dinliyorum.

Görüşme Soruları

ÖZGECMİŞ/DEMOGRAFİK SORULAR

1. Öğretmenlik yaşantınızı kısaca özetleyebilir misiniz? Öğretmenlik eğitiminizde öğretim yöntem ve metotlarıyla ilgili kaç tane ders aldınız?

Kaç yıldır öğretmenlik yapıyorsunuz?

Mezun olduğunuz okul?

Okuttuğunuz sınıf düzeyi?

Universitede öğretim ve değerlendirme yöntemleri ile ilgili kaç ders aldınız?

ÖĞRETİM YÖNTEM VE TEKNİKLERİ

2. Yeni programlar 2005-2006 yılından itibaren ilköğretim birinci kademede uygulanmaya başlandı. Yeni programlara ilişkin görüşünüzü birkaç cümleyle açıklar mısınız?

Problem cümlesi 1. Which teaching strategies do classroom teachers use in science and technology classes? Do they use teaching strategies focusing on individual differences like learning styles or multiple intelligences?

(Fen ve Teknoloji derslerinde sınıf öğretmenleri hangi öğretim stratejilerini kullanmaktadırlar? Öğrenme stilleri ve çoklu zeka gibi öğrenci farklılaklarını göz önüne alan öğretim stratejilerini kullanıyorlar mı?)

3. Derslerinizin işlenişi sırasında hangi öğretim kuram ya da yaklaşımları temel alıyorsunuz? Yapısalcılık ya da çoklu zeka kuramı gibi öğrenme yaklaşımlarını derslerinizde uyguluyor musunuz?
4. Derslerinizin işlenişi sırasında hangi öğretim yöntem ve tekniklerini kullanıyorsunuz?

Sondalar: Buluş yoluyla öğrenme, beyin fırtınası tekniği, kavram haritaları, tartışma tekniği, problem çözme becerileri, proje çalışmaları, işbirlikli öğrenme, deney ve gözlem yapma, eğitsel oyunlar tekniği, bilgisayar destekli öğretim, soru cevap tekniği, drama tekniği, örnek olay tekniği vs.

Problem cümlesi 2. What are teachers' practices related to teaching methods based on individual differences within the classroom in terms of teaching strategies and assessment techniques in science and technology classes?

(Fen ve teknoloji derslerinde sınıf öğretmenlerinin sınıf içinde öğrenci farklılıklarını göz önüne alan öğretim yöntemlerine dayalı öğretim stratejileri ve değerlendirme yaklaşımlarına ilişkin olarak deneyimleri nelerdir?)

5. Öğrencilerinizin konu ile ilgili var olan bilgilerini nasıl öğreniyorsunuz?
6. Öğrencilerinizin öğrenme biçimleri veya zeka alanları ile ilgili bilgi topluyor musunuz? Nasıl?

Alternatif: Öğrencilerinizin hangi yolla öğrendikleri, hangi alanlarda yetenekli olduğu hakkında bilginiz var mı?

7. Öğrencilerinizin kişilik özeliklerini biliyor musunuz?

Sondalar: içe dönük dışa dönük olmaları, geçmiş yaşantıları, aile hayatları

8. Öğrencilerinizin nasıl öğrendikleri hakkında bilgi topluyor musunuz? Nasıl?
9. Sınıfınızdaki farklı şekillerde öğrenen öğrencilere göre dersinizi yönlendiriyor musunuz? Nasıl?
10. Bireysel farklılıkları göz önüne alan öğretim ve değerlendirme yaklaşımlarını sınıf içinde daha önce kullandınız mı?
11. Öğrencilerinizi değerlendirirken bireysel farklılıkları göz önüne alıyor musunuz? Nasıl?

Problem cümlesi 5. What are the needs of classroom teachers to apply the teaching methods based on individual differences in science and technology classes?

(Sınıf öğretmenlerinin öğrenci farklılıklarını göz önüne alan öğretim yöntemlerini kullanımlarına ilişkin ihtiyaçları nelerdir?)

12. Fen ve teknoloji eğitimindeki yeni öğretim ve değerlendirme yaklaşımları ile ilgili ne düşünüyorsunuz?

13. Bireysel farklılıkları göz önüne alarak öğretim sürecinizi planlamak, uygulamak ve değerlendirmek için yeterli bilgiye ve deneyime sahip olduğunuzu düşünüyor musunuz?

14. Öğrencileriniz arasındaki bireysel farklılıkların onların öğrenmelerini ne şekilde etkileyeceğini düşünüyorsunuz?

15. Öğrencilerinizi tanıyor musunuz? Hangi yönlerden onları tanıdığınızı düşünüyorsunuz?

16. Öğrencileri tanımanın öğretim öğrenme sürecindeki yeri ile ilgili ne düşünüyorsunuz?

17. Öğretim sürecinizde bireysel farklılıkları göz önüne alırken en çok sıkıntı çektiğiniz konular nelerdir?

18. Öğrenme stilleri kuramlarından herhangi birini derslerinizde kullandınız mı? Kaç kez kullandınız?

Kullanmadıysanız neden?

Kullandıysanız, hangi derslerde ve hangi sıklıkta kullandınız?

19. Çoklu zeka kuramını derslerinizde kullandınız mı? Kaç kez kullandınız?

Kullanmadıysanız neden?

Kullandıysanız, hangi derslerde ve hangi sıklıkta kullandınız?

20. Beyin temelli öğrenme kuramını derslerinizde kullandınız mı? Kaç kez kullandınız?

Kullanmadıysanız neden?

Kullandıysanız, hangi derslerde ve hangi sıklıkta kullandınız?

APPENDIX D

FINAL FORM OF THE INTERVIEW SCHEDULE

GÖRÜŞME FORMU

İlköğretim okullarında görevli sınıf öğretmenlerinin fen ve teknoloji derslerinde öğrencilerini tanıması ve bu farkındalığı öğretme-öğrenme sürecini planlamada, uygulamada ve değerlendirmede en üst düzeyde yararlanabilmesi için ihtiyaçları nelerdir?

Merhaba, adım Pınar Özdemir. Hacettepe Üniversitesinde araştırma görevlisi olarak çalışmaktayım. Aynı zamanda Orta Doğu Teknik Üniversitesinde doktora yapıyorum. Yaptığım tez çalışması için fen ve teknoloji dersinin işlenişine ilişkin görüşlerinizi ve uygulamalarınızı öğrenmek istiyorum. Ayrıca 4. ve 5. sınıflarda uygulanmaya başlayan yeni fen ve teknoloji öğretim programında yer alan öğretim ve değerlendirme yaklaşımları ile ilişkili olarak görüşlerinizi almak istiyorum.

Görüşme sürecinde söyleyeceklerinizin tümü gizli tutulacaktir ve sadece bu araştırma için kullanılacaktır. Araştırma sonuçlarında adınız geçmeyecektir.

Konuşmalarımızın kaydedilmesi konusunda ne düşünüyorsunuz?

Sorularıma başlamadan önce söylediklerime ilişkin söylemek istedikleriniz ya da sormak istedikleriniz varsa sizi dinliyorum.

Bu görüşmenin yaklaşık 1 saat süreceğini tahmin ediyorum. İzin verirseniz sorularimi sormaya başlamak istiyorum.

Görüşme Soruları

ÖZGECMİŞ/DEMOGRAFİK SORULAR

1: Öğretmenlik yaşantınızı kısaca özetleyebilir misiniz?
Sondalar: Hangi bölümden kaç yılında mezun oldunuz?, Kaç yıldır öğretmenlik yapıyorsunuz?, Mezun olduğunuz okul?, Okuttuğunuz sınıf düzeyi?
Could you briefly summarize your experience in teaching?
Probes: program graduated, years of experience, grade level that you teach

ÖĞRETİM YÖNTEM VE TEKNİKLERİ

Problem Cümlesi 4 Öğretmenlerin öğretim ve değerlendirme yöntemleriyle ilgili olarak yeni fen ve teknoloji öğretim programı ile ilgili görüşleri nelerdir?
What are teachers' perceptions related to new science and technology program in Turkey in terms of teaching and assessment methods?

2: Yeni fen ve teknoloji programı 2005-2006 yılından itibaren ilköğretim birinci kademede uygulanmaya başlandı. Yeni programlara ilişkin görüşünüzü kısaca özetleyebilir misiniz?
Sondalar: Olumlu yönler, olumsuz yönler, eksiklikler, öğretim ve değerlendirme yöntemleri
Probes: Positive and negative features, deficiencies, teaching and assessment methods.
The new science and technology curriculum have started to be applied in 2005-2006 education year. Could you briefly explain you opinions about the new curriculum?
Problem cümlesi 1 Fen ve Teknoloji derslerinde sınıf öğretmenleri hangi öğretim ve değerlendirme stratejilerini kullanmaktadırlar?
Which teaching and assessment strategies do classroom teachers use in science and technology classes?

3: Fen ve Teknoloji derslerinizi nasıl işliyorsunuz?

How do you teach in your science and technology class?

4: Fen ve Teknoloji derslerinizde ne tür etkinlikler kullanıyorsunuz?

What kind of activities do you use in your science and technology class?

5: Öğrencilerinizi değerlendirirken hangi değerlendirme yöntemlerini kullanıyorsunuz?

What kind of assessment methods do you use for assessing your students?

Sondalar: Başlangıç, dönüt verme, tanılama

Probes: Beginning, feedback, diagnosis

6. Konuya başlamadan önce öğrencilerinizin konu ile ilgili var olan bilgilerini nasıl öğreniyorsunuz?

How do you learn your students' background knowledge before you start a new topic?

BİREYSEL FARKLILIKLAR

Problem cümlesi 5 Öğretmenlerin bireysel farklılıklarla ilgili olarak görüşleri nelerdir?

What are teachers' perceptions related to individual differences?

7: Bireysel farklılıklar deyince aklınıza ne geliyor?

What is your opinion about individual differences?

Alternatif soru: Öğrencilerinizin hangi yönlerden birbirinden farklı olduğunu düşünüyorsunuz?

In what respects do you think that your students are different?

8: Öğrencilerinizi tanıdığınızı düşünüyor musunuz? Hangi yönlerden onları tanıdığınızı düşünüyorsunuz?

Do you think that you know your students? In what ways do you think you know your students?

Alternatif soru: Öğrencilerinizin kişilik özeliklerini biliyor musunuz?

Do you know your students' personality features?

Sondalar: içe dönük dışa dönük olmaları, geçmiş yaşantıları, aile hayatları

Prompts: intrapersonal and interpersonal features, background, family life

9: Öğrencilerinizi tanımaya yönelik onlarla ile ilgili bilgi topluyor musunuz? Nasıl?

Do you gather information about your students to know them?

Problem cümlesi 2 Fen ve teknoloji derslerinde sınıf öğretmenlerinin sınıf içinde öğrenci farklılıklarını göz önüne alan öğretim yöntemlerine dayalı öğretim stratejileri ve değerlendirme yaklaşımlarına ilişkin olarak deneyimleri nelerdir?

What are teachers' practices related to teaching and assessment methods based on individual differences within the classroom in science and technology classes? Do they use teaching and assessment strategies focusing on individual differences like learning styles or multiple intelligences?

10: Sınıfınızdaki farklı şekillerde öğrenen öğrencilere göre dersinizi yönlendiriyor musunuz? Nasıl?

Dou you teach according to the students who learn differently? How?

Alternatif soru 1: Sizce bütün öğrenciler aynı şekilde öğreniyor mu? Bu sorunu çözmek için neler yapıyorsunuz?

Do you think that all of your students learn in same way? What do you do to solve this issue?

Alternatif soru 2: Öğrencilerinizin gelişim düzeylerine ve öğrenme biçimlerine uygun öğretim yöntemi kullanıyor musunuz? Nasıl?

Do you use teaching and assessment methods appropriate for your students' development level and learning styles?

11: Öğrencilerinizi değerlendirirken bireysel farklılıkları göz önüne alıyor musunuz? Nasıl?

Do you take individual differences into account while you are assessing your students?

12: Öğrencileriniz arasındaki bireysel farklılıkların onların öğrenmelerini ne şekilde etkileyeceğini düşünüyorsunuz?

What do you think that 'How individual differences affect your students' learning?'

Alternatif soru: Öğrencileri tanımanın öğretim öğrenme sürecindeki yeri ile ilgili ne düşünüyorsunuz?

What do you think that 'What is the importance of knowing students in teaching and learning process?'

Problem cümlesi 6 What are the needs of classroom teachers to apply the teaching and assessment methods based on individual differences in science and technology classes?

(Sınıf öğretmenlerinin öğrenci farklılıklarını göz önüne alan öğretim yöntemlerini kullanımlarına ilişkin ihtiyaçları nelerdir?)

13: Öğretim sürecinizde bireysel farklılıkları göz önüne alırken,

When you consider individual differences in your teaching process, do you have any difficulties? (in terms of knowledge, experience, application; principals; parents; materials and sources; and students)

a. bilgi, deneyim ve uygulama bazında yaşadığınız sıkıntılar var mı? Açıklar mısınız?
b. yönetimle ilgili yaşadığınız sıkıntılar var mı? Açıklar mısınız?
c. velilerle ilgili yaşadığınız sıkıntılar var mı? Açıklar mısınız?
d. okulunuzda bulunan kaynaklar ve olanaklar ile ilgili yaşadığınız sıkıntılar var mı? Açıklar mısınız?
e. öğrencilerinizle ilgili yaşadığınız sıkıntılar var mı?Açıklar mısınız?

Önemli olduğunu düşündüğünüz fakat burada sözü edilmeyen unsurlar var mı? Eğer varsa bu noktalar bizim için yararlı olacaktır. Bu görüşme derslerin nasıl bireysel farklılıkları göz önüne alınarak işlenebileceği konusunda araştırmamız için çok yararlı oldu. Araştırmamıza sağladığınız katkı için teşekkür ediyoruz.

APPENDIX E

OBSERVATION PROTOCOL

Observation Protocol				
Research Questions	Data Collection	Questions to guide observation	Actions and activities from which to draw inferences	Data Analysis
Which teaching and assessment strategies do classroom teachers use in science and technology classes? (sub-problem 1)	Videotape recorder with a camera to capture teaching and assessment methods used in the class, field notes, memos, listing all traditional and non traditional teaching and assessment strategies	What types of instructional strategies are in use?	Learning environment, make connection to prior lessons, student and teacher centered,	Transcribing the videotape of the class, cross check with the field notes, identifying meaningful data units, coding the data, generating themes and categories, organization of categories under research questions
		What types of assessment strategies are in use?	Multiple assessment methods, the use of portfolios, projects, open ended questions, individualized assessment	
		Is the teacher relying solely on textbooks?	Homeworks, additional resources	
		Strategies to assess students' prior knowledge		
		Are individual differences taking into account?	Grouping students, learning styles, multiple intelligences	

APPENDIX F

OBSERVATION SCHEDULE

GÖZLEM FORMU

Amaç: Bu gözlemin amacı sınıf öğretmenlerinin fen ve teknoloji derslerinde hangi öğretim ve değerlendirme yöntemlerini kullandıklarını gözlemlemek ve öğrenci farkılıklarını göz önüne alan öğretim ve değerlendirme yöntemlerini ne derece kullandıklarını belirlemektir.

Araştırma Soruları
1. Fen ve Teknoloji derslerinde sınıf öğretmenleri hangi öğretim ve değerlendirme stratejilerini kullanmaktadırlar?
(Which teaching and assessment strategies do classroom teachers use in science and technology classes?

Veri Toplama

İlköğretim 4. ve 5. sınıf düzeyinde iki farklı okuldan seçilmiş birer sınıfta fen ve teknoloji derslerinde öğrenci farklılıklarını göz önüne alan öğretim ve değerlendirme yöntemlerinin sınıf öğretmenleri tarafından kullanımına ilişkin her bir sınıfta 12 ders saati gözlem yapılacaktır. Aşağıda belirtilen boyutlara ilişkin alınacak notlar yanında, sınıf ortamı kamera ile videoya çekilecektir.

1. Sınıf öğretmeninin kullandığı öğretim stratejileri

2. Öğrenci farklılıklarını göz önüne alan öğretim ve değerlendirme yöntemlerinin kullanım derecesi

3. Öğretmen ve öğrenci aktiviteleri

<u>Gözlem notlarının analizinde kullanılacak kodlama listesi</u>
Gözlem sırasında dikkat edilmesi gereken boyutları içeren bu kodlar elde edilen verilere göre her gözlem sonrasında yeniden düzenlenmektedir.

- Sınıf öğretmenin kullandığı öğretim yöntemi ve stratejiler (örnekler)

Yapısalcılık
- Buluş yoluyla öğrenme
- Kavram haritaları
- Tartışma tekniği
- Proje çalışmaları
- İşbirlikli öğrenme
- Deney ve gözlem yapma

Çoklu zeka kuramı
- Beyin fırtınası tekniği
- Problem çözme becerileri
- Eğitsel oyunlar tekniği
- Bilgisayar destekli öğretim
- Drama tekniği
- Örnek olay tekniği

Davranışçı yaklaşım
- Soru cevap tekniği
- Düz anlatım

- Öğrenci farkılıklarını göz önüne alma

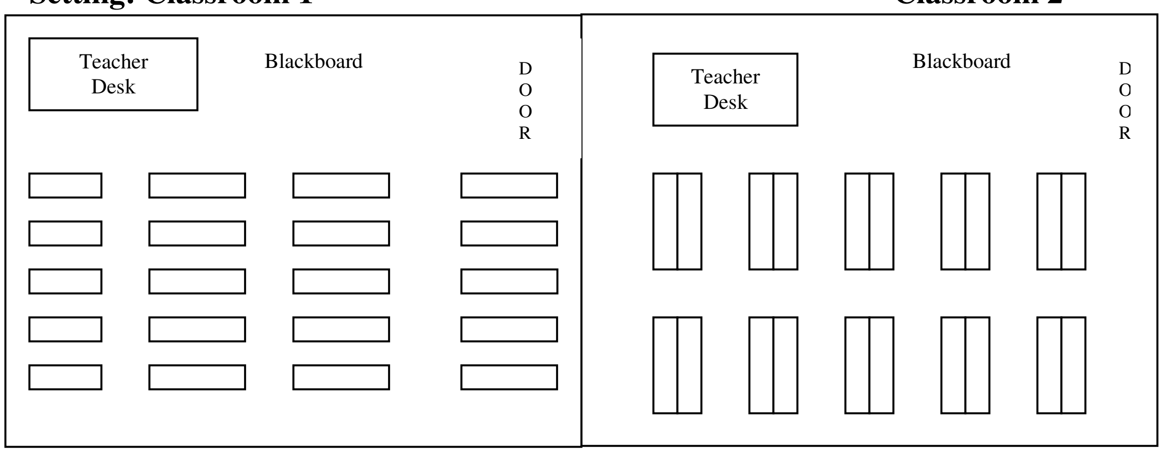
Öğrenci farklılıkları
- Öğrenme stilleri
- Cinsiyet
- Çoklu zeka
- Duygusal zeka
- Öğrenme stilleri envanteri uygulama

Değerlendirme yöntemi
- Öz değerlendirme
- Akran değerlendirme
- Öğrenci ürün dosyası (portfolyo)
- Rubrik
- Gözlem formu

APPENDIX G

CLASSROOM OBSERVATION NOTE TAKING FORM

Setting: Classroom 1 **Classroom 2**



Observer: Pınar Özdemir
Teacher observed: X
Observer involvement: Katılımcı
Date/Time: 1-31 Mayıs 2006

Descriptive Notes

(Detailed chronological notes about the research question)

Reflective Notes

(Concurrent notes about the observer’ thoughts, personal experiences)

APPENDIX H

OBSERVATION CONSENT FORM

Sınıf İçi Gözlem İzin Yazısı

Sayın Öğretmen,

Milli Eğitim Bakanlığı'ndan izinli olarak yapılacak bu gözlemin amacı 4. ve 5. sınıf öğretmenlerinin fen ve teknoloji derslerinde hangi öğretim ve değerlendirme yöntemlerini kullandıklarını gözlemlemek ve öğrenci farkılıklarını göz önüne alan öğretim ve değerlendirme yöntemlerini ne derece kullandıklarını belirlemektir. Bu gözlem çalışması araştırmacının katılımcı olarak derslerinize devamı ile gerçekleşecektir. Araştırmacı bir ay süre ile fen ve teknoloji derslerinizi gözlemleyerek not tutacak, ayrıca sınıf ortamını ve dersin işlenişini kamera kullanımı ile kaydedecektir. Gözlem sonucunda oluşturulacak raporda okulunuzun ya da sınıfınızın adı geçmeyecek, çekilen görüntüler araştırma dışında başka hiçbir yerde kullanılmayacaktır. Ayrıca araştırmacının katılımcı olarak dersinize katılması öğretim programınızda herhangi bir aksaklığa neden olmayacaktır. 2005-2006 öğretim yılı Mayıs ayında başlayacak bu çalışma için öğrenci velilerini de bilgilendirmenizi, sizin ve velilerin verdiği karara göre de gönüllü olarak bu çalışmayı sizin derslerinizde yürütüp yürütemeyeceğime ilişkin olarak beni bilgilendirmenizi rica ediyorum. Teşekkürler.

Pınar Özdemir

Ortadoğu Teknik Üniversitesi Doktora öğrencisi

APPENDIX I

LETTER FOR GETTING PERMISSION FROM MEB

22.03.2006

Orta Doğu Teknik Üniversitesi

Orta Öğretim Fen ve Matematik Alanları Eğitimi Bölümü'ne

Hacettepe Üniversitesi Eğitim Fakültesi İlköğretim Bölümü, İlköğretim Fen Bilgisi Eğitimi Anabilim Dalı'nda araştırma görevlisi olarak çalışmaktayım. Orta Doğu Teknik Üniversitesinde Orta Öğretim Fen ve Matematik Alanı bölümünde doktora eğitimimi sürdürmekteyim. Doktora tezimin konusu öğretmenlerimizin, öğrencilerin bireysel farklılıklarını göz önüne alan günümüz çağdaş yaklaşım ve stratejileri ile ilgili olarak görüşlerini belirlemektir. Bunun yanı sıra bu yeni yaklaşımları uygulamalarına yansıtıp yansıtmadıkları ya da yansıtabilmek için nelere ihtiyaçları olduğunu saptamaktır. Bu amaca yönelik olarak doktora tezim ile ilgili ilimiz X ve Y İlköğretim Okullarının 4. ve 5. sınıflarında Fen ve Teknoloji Bilgisi Derslerinde nitel bir araştırma (anket, görüşme ve gözlem) için gerekli izni almak istiyorum (Her iki okuldan seçilen birer sınıfta 4 hafta boyunca Fen ve teknoloji derslerinin kameraya çekilmesi ve katılımlı gözlemci olarak sınıf ortamının araştırmacı tarafından gözlemlenmesi ve ekteki görüşme sorularının sınıf öğretmenlerine yüzyüze görüşmeler yapılarak sorulması). Ayrıca Yenimahalle ve Çankaya ilçesine bağlı İlköğretim Okullarında görev yapmakta olan 4. ve 5. kademede görevli sınıf öğretmenlerine, Fen ve Teknoloji derslerinde öğrenci farklılıklarını göz önüne alan öğretim yöntemlerinin kullanımına ilişkin ekteki anketi uygulamak istiyorum. Gereğini arz ederim.

Ek1-Araştırma önerisi özeti
Ek2- Gözlem için seçilen okulların listesi
Ek3-Veri toplama aracı

Saygılarımla,
Arş. Gör. Pınar Özdemir
Tez Danışmanı: Prof. Dr. Sibel Güneysu

EK 1-Araştırma Özeti

Problem: Ankara ilinde rasgele örneklem yöntemiyle seçilmiş olan ilköğretim okullarında görev yapmakta olan Fen Eğitimindeki öğrenci farklılıklarını göz önüne alan günümüz çağdaş yaklaşım ve stratejilerinin kullanımına ilişkin olarak görüşleri ve ihtiyaçları nelerdir?

Amaç: Bu çalışmanın amacı Ankara ilinde görev yapmakta olan 4. ve 5. kademede görevli sınıf öğretmenlerinin öğrencilerin bireysel farklılıklarını göz önüne alan günümüz çağdaş yaklaşım ve stratejileri ile ilgili olarak görüşlerini belirlemektir. Bunun yanı sıra bu yeni yaklaşımları uygulamalarına yansıtıp yansıtmadıkları ya da yansıtabilmek için nelere ihtiyaçları olduğunu saptamaktır.

Önem: İlköğretim; çocuğun çevresini anlamaya yönelik bilgi edinmesini sağlama ve bir düşünce sistemi geliştirmesine yardım etme gibi fonksiyonları içerir. Çocukta bu özelliklerin gelişmesinde öğretmenin rolü büyüktür. Bu açıdan hizmet öncesi öğretmen eğitimi günümüzde büyük önem kazanmıştır. Bilgi çağını yaşadığımız günlerde, değişen yeni öğretmen rolü çerçevesinde; öğretmenlerin yeni öğretim yaklaşımlarından haberdar olmaları ve bu yaklaşım, yöntem, teknik ve stratejileri hangi sıklıkta ve ne şekilde sınıf ortamlarında kullandıkları önem taşımaktadır. Öğretmenlerin bu konuda bilgi sahibi olmaları ve kendilerini geliştirmeleri öğrencilerinin bilime olan meraklarını artırmaları hususunda önemlidir. Çalışmadan elde edilen bulguların öğretmenlerin Fen ve Teknoloji Eğitiminde öğrenci farklılıklarını göz önüne alan yeni yaklaşımlardan (çoklu zeka kuramı, öğrenme stilleri, sol beyin-sağ beyin) ne derece haberdar olduklarını, bu yaklaşımları sınıf ortamında ne şekilde kullandıklarını, fen eğitimindeki yeni yaklaşımları kullanmak için nelere ihtiyaçları olduklarını belirlemede yardımcı olarak, gereken hususlarda neler yapılması gerektiği konusunda eğitimcilere yol göstermesi düşünülmektedir

Sınırlılıklar: Bu çalışma araştırmaya katılacak olan örneklem ile sınırlıdır.

Yöntem: Bu çalışmada öğretmenlerin sınıf içinde kullandıkları öğretim yöntemlerine ilişkin mevcut durum analizi değerlendirmesi ve konuya ilişkin ihtiyaç analizi yapılacaktır. Bu bağlamda çalışma ağırlıklı olarak nitel bir çalışmadır. Bu amaçla seçilen iki okulda Fen ve Teknoloji derslerinde 4 hafta boyunca araştırmacı tarafından sınıf içi gözlemler yapılacaktır. Tez çalışmasına yönelik sınıf içi gözlemler kamera çekimleri ve katılımlı gözlemci olarak sınıf ortamının araştırmacı tarafından gözlemlenmesi ile gerçekleştirilecektir. Ayrıca seçilmiş bazı öğretmenlerle konuyla ilgili yapılandırılmış görüşmeler yapılacaktır. Seçilen sınıflarda yapılacak nitel araştırma uygulama çalışmaları, ilgili okullarda eğitim düzenini bozmayacak, öğrencilere hiçbir şekilde zarar vermeyecek ve öğretim programında herhangi bir değişiklik yapılmadan uygulanacaktır.

Çalışma Takvimi:

İzlenen Aşamalar	*Tarih*
Problemin Tanımı	10.05.2005
Literatür taraması	01.06.2005
Anahtar sözcüklerin belirlenmesi	08.06.2005
Veritabanlarının taranması	10.05.2005
Makale, döküman ve kitap araştırması	10.05.2005
Okunan makale ve dökümanların sonuçlarının özetlenmesi	15.06.2005
Veri toplama araçlarının belirlenmesi ve geliştirilmesi	22.06.2005
Araştırmanın populasyonunun ve örnekleminin belirlenmesi	25.07.2005
Veri toplama araçlarının güvenirlik ve geçerlik çalışmasının yapılması	20.10.2005
Veri toplama araçlarındaki gerekli düzeltmelerin yapılması	15.11.2005
Görüşme ve gözlemlerin yapılandırılması	05.01.2006
Veri toplama araçlarının uygulama izninin alınması	03.04.2005
Görüşme ve gözlemlerin yapılması	01.05.2006-09.06.2006
Veri toplama araçlarının uygulanması	01.05.2006-09.06.2006
Verilerin toplanması ve analizi	31.05.2006-04.09.2006
Bitiş	10.02.2007

APPENDIX J

MEB' ten İzin Yazısı

T.C.
MİLLÎ EĞİTİM BAKANLIĞI
Eğitimi Araştırma ve Geliştirme Dairesi Başkanlığı

Sayı : B.08.0.EGD.0.33.05.311-593 / 1856 ../05/2006
Konu : Araştırma İzni

ANKARA VALİLİĞİNE
(İl Millî Eğitim Müdürlüğü)

İlgi : 12.04.2006 tarih ve B.08.4.MEM.4.06.00.11.070-1057/3552 sayılı yazınız.

Orta Doğu Teknik Üniversitesi Fen ve Matematik Alanları Eğitimi Ana Bilim Dalı doktora öğrencisi Pınar ÖZDEMİR'in "Fen Bilgisi Öğretmenlerinin Öğrenci Farklılıklarını Göz Önüne Alan Çağdaş Öğretim Yaklaşımlarını Kullanmalarına Yönelik İhtiyaç Analizi" konulu araştırmada kullanılacak veri toplama araçlarının, İliniz Ayten Şaban Diri ve Necdet Seçkinöz ilköğretim okullarında görüşme ve gözlem yapma ve ekli listede belirtilen okullarda anket uygulama izin talebi incelenmiştir.

Orta Doğu Teknik Üniversitesi tarafından kabul edilen, onaylı bir örneği Bakanlığımızda muhafaza edilen (9 sayfa - 95 sorudan oluşan) anketin belirtilen okullarda uygulanmasında bir sakınca görülmemektedir.

Araştırmanın bitiminde sonuç raporunun iki örneğinin Bakanlığımıza gönderilmesi gerekmektedir.

Bilgilerinizi ve gereğini rica ederim.

Cumaali DEMİRTAŞ
Bakan a.
Müsteşar Yardımcısı

EKLER :
EK-1: Araştırma Örneği (1 Adet-9 Sayfa)
EK-2: Okul Listesi (1 Adet-1 Sayfa)

635
04.05.2006

T.C.
ANKARA VALİLİĞİ
Milli Eğitim Müdürlüğü
Gelen Evrak Kayıt No: 1421
Gelen Evrak Tarihi: 03-05-2006
Bırakıldığı Bölüm

G.M.K. Bulvarı No: 109
06570 Maltepe / ANKARA

Tel : (0312) 230 36 44
Faks : (0312) 231 62 05
e-posta: earged@meb.gov.tr

ÖĞRENCİ İŞLERİ
DAİRESİ BAŞKANLIĞI

T.C.
ANKARA VALİLİĞİ
Milli Eğitim Müdürlüğü

BÖLÜM : Kültür
SAYI : B.08.4.MEM.4.06.00.11-070 1396
KONU : Araştırma
(Pınar ÖZDEMİR)

05.05.2006

ORTA DOĞU ÜNİVERSİTESİ REKTÖRLÜĞÜNE
(Öğrenci İşleri Dairesi Başkanlığı)

İLGİ: 30.03.2006 tarih ve B.30.2.ODT.0.70.72.00/400/2796-005005 sayılı yazınız.

Üniversiteniz, Fen ve Matematik Alanları Eğitimi Ana Bilim Dalı doktora öğrencisi Pınar ÖZDEMİR'in "Fen Bilgisi Öğretmenlerinin Öğrenci Farklılıklarını Göz Önüne Alan Çağdaş Öğretim Yaklaşımlarını Kullanmalarına Yönelik İhtiyaç Analizi" konulu araştırmada kullanılacak veri toplama araçlarının, İlimiz Ayten Şaban Diri İlköğretim Okulu ile Necdet Seçkinöz İlköğretim Okulu'nda görüşme ve gözlem yapma ve ilgi yazınız ekinde belirtilen okullarda anket uygulayabilmelerine ilişkin Bakanlığımız, Eğitimi Araştırma ve Geliştirme Dairesi Başkanlığı'nın 03.05.2006 tarih ve 593-1856 sayılı yazısı ekte gönderilmiştir.

Bilgilerinizi rica ederim.

Erol ORTAKAYA
Vali a.
Milli Eğitim Müdür Yardımcısı

EKİ:1- Bakanlık Emri

17.05.06 007806

DANIŞMA 444 0 632 HATTI
EĞİTİME %100 DESTEK

Milli Eğitim Müdürlüğü Kültür Bölümü
06500- Beşevler/ANKARA
212 46 42 – 413 37 04- 212 66 40/184 Fax: 0 (312) 212 78 20
ankaramem@meb.gov.tr
kultur06@meb.gov.tr

APPENDIX K

CODING LISTS FOR THE INTERVIEW QUESTIONS

Sub-Problem 1 Interview Questions 3, 4, 5, 6 Themes and Codes Generated	
3.1 TEACHING METHODS	3.2 ASSESSMENT METHODS
3.1.1.1 Before starting to a topic	3.2.1 Testing
3.1.1.1 Preparation of questions by stds	3.2.1.1 Open-ended
3.1.1.2 Arousing curiosity and attention	3.2.1.2 Multiple Choice
3.1.1.3 Questioning	3.2.1.3 Fill in the Blank
3.1.1.3.1. Guessing questions	3.2.1.4 Essay Exams
3.1.1.3.2. Comparison of guessing questions with topic	3.2.2. Performance
	3.2.2.1 Preparation for lesson
3.1.1.4 Handing out questions to stds	3.2.2.2 Effort
3.1.1.5 Outside investigations by stds	3.2.2.3 During presentations
3.1.1.5.1 Internet	3.2.2.4 Involvement to lesson
3.1.1.5.2 Written materials	3.2.2.5 Investigations
3.1.1.5.3 Newspapers	3.2.2.6 During projects
3.1.1.6 Preparation of the teacher	3.2.2.7 During experiments
3.1.1.6.1 Objectives	3.2.2.8 During activities
3.1.1.6.2 Content	3.2.3 Honesty
3.1.1.6.3 Planning	3.2.4 Interest
3.1.1.6.4 Investigations	3.2.5 Achievement in the past
3.1.1.7 Back to past topics	3.2.6 Relationship with friends
3.1.1.8 Knowing stds knowledge from their background	3.2.7 Peer teaching forms
	3.2.8 Process assessment
3.1.1.9 Observations of stds from daily life	3.2.9 Self assessment
3.1.1.10 Bringing stds to the same level	3.2.10 Portfolios
3.1.1.11Forming corners or centers in class	3.2.11 Assessment at the beginning
3.1.1.12 Brain storming	3.2.11.1 For readiness
3.1.2 Presentations by stds	3.2.12 Questioning
3.1.2.1 Group presentations	3.2.13 Family involvement
3.1.3 Homeworks	3.2.13.1 Feedbacks for families
3.1.4 Experiment in class	3.2.13.2 Feedbacks from families
3.1.5 Group works	3.2.14 Project assessment
3.1.6 Observations	3.2.15 Formative evaluation
3.1.7 Equipments	3.2.16 Verbal examination
3.1.9 Investigations	3.2.17 Homeworks

3.1.10 Poem
3.1.11 Song
3.1.12 Plays
3.1.13 Dramatization
3.1.14 Discussions
3.1.15 Questioning
3.1.16 Visual materials
3.1.17 Student prepared materials
3.1.18 Expository teaching
3.1.19 Lecturing
3.1.20 Peer teaching
3.1.21 Projects
    3.1.21.1 In class
    3.1.21.2 At home
    3.1.21.3 Individual
    3.1.21.4 Group
3.1.22 Daily life examples
3.1.23 Giving examples from teacher experiences
3.1.24 Drama
3.1.25 Role playing
3.1.26 Outdoor activities
    3.1.26.1 Field trips
3.1.27 Laboratory
3.1.28 Puzzles
3.1.29 Summary
3.1.30 Individualized teaching
3.1.31 Preparing posters
3.1.32 Explaining
3.1.33 Establishing relations with other lessons
3.1.34 Preparing an index about concepts in unit
3.1.35 Materials
    3.1.35.1 Stories
    3.1.35.2 Articles
    3.1.35.3 Biographies
    3.1.35.4 Child magazines
    3.1.35.5 Real materials
3.1.36 Analogy
3.1.37 Learning by doing
3.1.38 Using models
3.1.39 Activity based learning
3.1.40 Peer teaching	

Sub-problem 2 Interview Questions 10, 11, 12 Themes and Codes generated	
Considering individual differences 6.1 Teaching Methods based on TAMBID 6.1.1 Simple schemes 6.1.2 Pictures 6.1.3 Plays 6.1.4 Drama 6.1.4.1 Dramatization 6.1.4.2 Role playing 6.1.5 Watching Films 6.1.6 Drawing 6.1.7 Hands-on activities 6.1.8 Peer teaching 6.1.9 Sport activities 6.1.10 Group works 6.1.11 Reading activities 6.1.12 Writing Poems 6.1.13 Presentations 6.1.14 Music 6.1.14.1 Song 6.1.14.2 Playing musical instrument 6.1.15 Teaching ways to reach knowledge 6.1.16 Implementation of NSTC to satisfy TAMBID 6.1.17 Individualized teaching for handicapped students 6.1.18 Arousing attention for students 6.1.19 Selection of methods based on grade level 6.1.20 Individual studies 6.1.21 Projects 6.1.22 Motivation for low achievers 6.1.23 Use of various methods 6.1.24 Considering 5 senses 6.1.25 Giving responsibilities based on level of the students 6.1.26 Trying to be equipped in every respect 6.1.27 Repetitions of the topic to fill the gap for individual differences	Considering individual differences 6.2 Assessment methods based on TAMBID 6.2.1 Verbal exam 6.2.2 Effort of students 6.2.3 Performance assessments 6.2.3.1 On investigations 6.2.3.2 Study habits 6.2.4 Essay exams 6.2.5 Compositions 6.2.6 Individualized assessment for handicapped students 6.2.7 Peer assessment 6.2.8 Portfolio assessment 6.2.9 Evaluating the exams based on learning abilities of the students 6.2.10 Giving high grades for low achievers to motivate them 6.2.11 Self assessment of the students 6.2.12 Self assessment of the teacher 6.2. 12.1 Criticism of teacher herself 6.2.13 Individualized assessment 6.2.14 Objective assessment by taking curve 6.2.15 Assessment still based on old curriculum 6.2.16 Implementation of the same exam for all students 6.2.17 Considering interest area

6.3 Importance and positive features of using TAMBID 6.3.1 Better learning 6.3.2 Sharing knowledge 6.3.3 Developments of students in time 6.3.4 Developing self confidence in students 6.3.5 Preparing students for the life and future 6.3.6 Developing verbal expression of students 6.3.7 Supporting the efforts of students to reach high achievers 6.3.8 Acquisition of long lasting knowledge 6.3.9 Useful for the students 6.3.9.1 Students know the responsibility 6.3.9.2 Increasing interaction among stds 6.3.9.3 Better learning achieved in their own interest area 6.3.10 Learning methods from students 6.3.11 To reach and gain each student	

Sub-problem 3 Interview Question 2 Themes and Codes generated	
2.1 NEGATIVE PERSPECTIVES ON NTSC 2.1.1 Lack of teacher training 2.1.1.1 Taking seminars from unqualified persons 2.1.1.2 Lateness in getting teachers' book 2.1.1.3 Technical inadequacies 2.1.1.4 Unqualified in laboratories 2.1.1.5 Inadequate support of the director 2.1.2 Feeling unfair about old science curriculum 2.1.2.1 Effect of inspector 2.1.2.2 Change of curriculum many times 2.1.3 Problems related to laboratory 2.1.3.1 Having no lab lesson 2.1.3.2 Having no lab notebooks 2.1.3.3 Need for lab a teacher 2.1.3.4 Lack of equipments 2.1.3.5 Difficulties during experiments 2.1.3.6 Lack of time 2.1.3.7 Inappropriate with levels of stds 2.1.3.8 Difficulties in searching and reaching materials 2.1.3.9 Difficulties in preparation for the experiments 2.1.4 Problems related to science book 2.1.4.1 Inappropriate with levels of the stds 2.1.4.2 Inappropriate with sources available 2.1.4.3 Being explanations long 2.1.4.4 Giving no emphasis on Turkish scientists 2.1.4.5 Problems in working books of stds 2.1.4.6 High number of subjects 2.1.4.7 High number of units 2.1.4.8 Inappropriate with time 2.1.4.9 High number of experiments 2.1.4.10 Lack of knowledge 2.1.5 Number of many stds in class 2.1.6 Small size of the class 2.1.7 Stds being used to the system in OSC 2.1.8 Inappropriate features of schools 2.1.9 Assessment of stds still by examination 2.1.10 Lack of assessment tools	2.3.7 Structure of the School 2.3.7.1 Presence of equipments 2.3.7.2 Presence of materials 2.3.7.3 Number of stds in the classroom 2.3.7.4 Size of the classroom 2.3.8 Guidance of teachers 2.3.9 Background of teachers 2.3.10 Presence of examinations in Turkey (OKS&OSS) 2.3.10.1 Knowledge based 2.3.10.2 Affecting full application of NSTC 2.3.11 Cooperative workings of persons in school 2.3.11.1 Principal 2.3.11.2 Colleagues 2.3.11.3 Parents 2.3.12 Harmony with other teachers 2.3.12.1 Same applications 2.3.12.2 Same types of assessment 2.3.12.3 Sharing knowledge among teachers 2.3.12.4 Getting help from science teachers 2.3.13 Comfortable and relax working conditions 2.4 COMPARISON OF OLD AND NEW CURRICULUM (OSC& NSTC) 2.4.1 Good application of old curriculum 2.4.1.1 Having laboratory in OSC 2.4.1.2 Having lab teachers in OSC 2.4.1.3 Having notebooks for each child in OSC 2.4.2 Being more innovative of NSTC 2.4.3 More emphasis on group works in NSTC 2.4.4 Same application in OSC and NSTC 2.4.5 Giving more theoretical knowledge

Sub-problem 4 Interview Questions 7, 8, 9 Themes and Codes generated	
4.1 Individual differences of the students (According to primary school teachers, students are different wit respect to;) 4.1.1 Perception differences 4.1.2 Interest 4.1.3 Imagination 4.1.4 Learning styles 4.1.5 Intelligence 4.1.6 Personality 4.1.6.1 Intrapersonality 4.1.6.2 Active or inactiveness in class 4.1.6.3 Effect of social environment 4.1.7 Achievement 4.1.7.1 Low achievers 4.1.7.2 High achievers 4.1.8 Approaches to deal with a topic 4.1.9 Skills 4.1.9.1 Investigation skills 4.1.9.2 Presentation skills 4.1.10 Development level 4.1.11 Multiple intelligences 4.1.12 Family structure 4.1.12.1 Number of sisters and brothers 4.1.12.2 Having divorced parents 4.1.13 Curiosity 4.1.14 Attention during lessons 4.1.15 Emotions 4.1.16 Hobbies of the students 4.1.17 Presence of Hyperactive students 4.1.18 Easy-difficult learners 4.1.19 District differences 4.1.20 Family characteristics 4.1.20.1 Socio economic status (SES) 4.1.20.2 Cultural level of the parents 4.1.20.3 4.1.21 Being honest or not 4.1.22 Having learning difficulties 4.1.23 Behaviors	4.2 Ways used by the primary school teachers to know their students 4.2.1 Talking to child 4.2.2 Talking to family 4.2.2.1 Cooperation with mother 4.2.2.1 Cooperation with the family 4.2.3 Getting information from previous teacher of the student 4.2.4 Observations on students 4.2.5 Knowing personality features from past 4.2.6 Information forms 4.2.7 Meetings between the teacher and parents 4.2.8 Objectiveness for giving each student equal chances 4.2.9 Determining the way of guidance 4.2.10 Surveys 4.2.11 Presence of guidance teacher at school 4.2.12 Considering age groups 4.2.12.1 Perception differences among age groups 4.2.12.1 Selection of methods based on grade level 4.2.13 Knowing and understanding students and the teacher each other 4.2.14 Sharing experiences among teachers in school 4.2.15 Cooperative workings of students, teacher, administration, parents and guidance teacher 4.2.15.1 School, family, and teacher triangle

4.1.23.1 Behavioral disorder 4.1.24 Presence of gifted students 4.1.25 Differences in taking responsibility 4.1.26 Expression of the knowledge known 4.1.27 Performance 4.1.28 Investigation styles (Restricted & Detailed) 4.1.29 Reading habits 4.1.30 Preparation for the lesson at home 4.1.31 Creativity	4.2.16 BEP (Individualized education program) for students having perception difficulties 4.2.16.1 Use of different assessment systems 4.2.16.2 Different education 4.2.16.3 Assessment within a group of students 4.2.17 Depending on years of experience 4.2.18 Giving responsibilities for parents to supply materials 4.2.19 Observation notebooks for each child 4.2.20 Changing the method if not appropriate 4.2.21 Autobiographies written by students 4.2.22 Drawing graphics for physical development of the students 4.2.23 Minimizing individual differences 4.2.24 Avoiding facing parents with the administrator

Sub-problem 5 Interview Questions 13, a, b, c, d and Suggestions Themes and Codes generated	
5.1 Possible Barriers to reach students & to apply TAMBID 5.1.1 Barriers on resources and opportunities 5.1.1.1 Lack of Internet connection 5.1.1.2 Lack of resource books 5.1.1.3 Lack of equipments 5.1.1.4 Lack of laboratory at school 5.1.1.4.1 Lack of laboratory for 4th and 5th grades at school 5.1.1.5 Restricted use of laboratory 5.1.1.6 Lack of a laboratory teacher 5.1.1.7 Lack of guide as a teacher 5.1.1.8 Lack of materials in laboratory 5.1.1.9 Obtaining materials from parents 5.1.1.10 To make resources available for students' use 5.1.1.11 Lack of computer laboratory 5.1.1.12 Adaptation to science book as it was changed frequently 5.1.2 Barriers about students 5.1.2.1 Attention problems in students 5.1.2.1.1. Remembering knowledge 5.1.2.2 Impatience of students 5.1.2.2.1 Impatience & easiness to reach knowledge 5.1.2.3 Preference for multiple choice tests 5.1.2.4 Use of computers 5.1.2.4.1 Short way to reach learning material 5.1.2.5 Transferring of the students among schools 5.1.2.6 Behavior differences among students from different districts 5.1.2.7 Students' giving importance for themselves in peer teaching and assessment 5.1.2.8 Discipline problem 5.1.2.9 Restricted use of libraries 5.1.2.10 Ineffectiveness of documents downloaded from net	5.1.4 Barriers about parents 5.1.4.1 Unacceptness of the parents about their child problems 5.1.4.2 Contradiction of education and feeling of being a mother and father 5.1.4.3 Resistance of parents on problems about their child 5.1.4.4 Charging of the teachers with the problems by parents 5.1.4.5 Effect of family life on students 5.1.4.5.1 Presence of democracy at home 5.1.4.5.2 Relations at home 5.1.4.5.3 SES (income) 5.1.4.6 Being used to the former curriculum 5.1.4.7 Trustness to dersane 5.1.4.8 Questioning of parents on teachers about unsuccessfulness of their child 5.1.4.9 Trustness for teacher 5.1.4.10 Interference of parents on teachers 5.1.4.11 Cultural level of parents 5.1.4.12 Coming to class during the presentation of their child 5.1.4.13 Lack of auto control in families 5.1.4.14 Confusing freedom and unrespectiveness in families 5.1.4.15 Lack of communication with some parents 5.1.4.16 Competition among parents 5.1.5 Barriers on knowledge and experience

5.1.2.11 Unwillingness to learn 5.1.2.12 Presence of aggressive students in class 5.1.2.13 Problems with students having divorced parents 5.1.2.14 Selfishness of the students 5.1.2.15 Criticism of the teacher by the students 5.1.2.16 Lack of interest for the lessons 5.1.2.17 Problems with handicapped and hyperactive students 5.1.2.18 Facing with different generations 5.1.3 Barriers about administrators 5.1.3.1 Lack of support for developing laboratory 5.1.3.2 Lack of love 5.1.3.3 Unequal behaviors among teachers 5.1.3.4 Waiting respect from teachers 5.1.3.5 Affecting motivation of teacher 5.1.3.6 Unsuccessfulness in reducing the number of students in class 5.1.3.7 Lack of guidance teachers 5.1.3.8 Lack of guidance of administrators 5.1.3.9 Not giving permission for U arrangement of the class 5.1.3.10 Inconsistency of inspectors on teachers' works	5.1.5.1 Poor reading habit 5.1.5.2 In-service education 5.1.5.2.1 Self efforts in learning new approaches 5.1.5.3 Taking seminars from unqualified persons 5.1.5.4 To be unprepared to apply NSTC 5.1.5.5 Inspection based on OSC 5.1.5.6 Feeling unfair about the evaluation by inspector 5.1.5.7 Help of science teacher at school 5.1.5.8 Lack of knowledge for using equipments in laboratory 5.1.5.9 Lack of knowledge for teaching equipments in laboratory 5.1.5.10 Lack of discussion platforms on NSTC 5.1.5.11 Graduation from a faculty other than education 5.1.6 Time 5.1.6.1 Not dealing with all students 5.1.6.2 For carrying out more activities, experiments and examples 5.1.6.3 Use of TAMBID at different times 5.1.7 Examinations in TURKEY 5.1.7.1 Difficulties of questions in LGS 5.1.8 High number of units in NSTC 5.1.9 Poor reading habits in Turkish people 5.1.10 Unprepared sub-structures of Turkish educational system for giving each student equal chances 5.1.11 Effect of systems in dersane

	5.1.11.1 Covering topics not present in curriculum 5.1.12 Class size 5.1.12.1 High number of students in class 5.1.13 Problems with MEB 5.1.13.1 Unsatisfied responses from MEB on teachers' requirements 5.1.14 Unequal chances for public and private schools 5.1.15 Lack of dialog among teachers 5.1.16 Preparation before the lesson because of the difficulties 5.1.17 Needs related to science book 5.1.17.1 Inappropriateness of the science book with students' level 5.1.17.2 Not taking individual differences of the students in books 5.1.17.3 Not appropriate with environmental conditions

<table>
<tr><th colspan="2">Suggestions Emerged from Interviews</th></tr>
<tr><td>Suggestions on NSTC
1. Related to Laboratories
-Presence of laboratories
-Presence of laboratory teachers
-Simplifying the experiments
-Arrangement of lab hours for primary school teachers at school
-Taking courses on using laboratory equipments
2. Related to Science Book
-Shortening explanations
-Giving more emphasis on Turkish scientists
-Preparation of the book appropriate with level of stds
-Joining science book with working book
-to be more useful
-avoids forgetting at home
-more productive
-Adding text book
-Placing more questions for evaluation
3-Reducing the number of stds in classroom
4-Enlarging the size of the classrooms
5-Reducing units and subjects in curriculum
6-Using easy materials for the experiments
7-Having specialist on assessment and evaluation in schools
8-To include electric or sound units at 6th grade
9- Getting help from the science teacher at school</td>
<td>Suggestions on individual differences
1. Education of students having perception problems by a specialist at school
2.Education of the teacher on hands-on activities
3. Supplying special education for mentally retarded students on some days with normal education on other days
4. A science book can be prepared taking individual differences into account</td></tr>
</table>

APPENDIX L

CODING LIST FOR THE OBSERVATION PROCESS

<table>
<tr><th colspan="2">Teaching Methods Used by the Teachers</th></tr>
<tr><td>1.1 Questioning
1.2 Lecturing
1.2.1 Daily life examples
1.2.2 Explaining
1.2.3 Giving examples
1.2.3.1 Giving examples from teacher experiences
1.2.4 Summary
1.3 Analogy
1.4 Demonstration
1.4.1 Using models
1.4.2 Model construction
1.4.3 Observations
1.5 Drama
1.5.1 Dramatization
1.5.2 Role playing
1.6 Presentations by the students
1.6.1 Group presentations
1.6.2 Individual presentations
1.7 Discussion
1.7.1 Whole class discussion
1.7.2 Discussion on presentations
1.7.2.1 Being original
1.7.2.2 Being creative
1.8 Activity based teaching
1.9 Independent Study
1.7.1 Investigations
1.10 Experiments
1.10.1 Experiments in class
1.11 Discovery
1.11.1 Learning by doing
1.12 Brain storming
1.13 Group works
1.14 Projects
1.14.1 In class
1.15 Homeworks</td><td>Materials used in class
1. Transparencies
2. Slight projector
3. Real materials (balls, glass, watch, spoon, dish, chalk, eraser, phone, paper, cotton, sack, box)
4. Computer (at home)</td></tr>
</table>

Teachers' Interactive Activities	Students' Interactive Activities
-Questioning -Asking for attention -Responding -Using gestures -Restating -Direct look -Verbal message -Being helpful -Controlling -Clarifying -Eye-contact -Praising -Explaining -Guiding -Inferring -Criticizing on science book -Criticizing inappropriate behavior -Providing whole class participation -Giving directions -Solving students' problems -Ensuring arrangement in class -Checking homeworks -Comparing -Reinforcement -Giving time for preparation -Warning -Supporting appropriate behavior -Taking attention -Approving	-Listening silently -Raising hand -Taking notes -Reading -Studying -Asking questions -Participating in class discussions -Willingness to class activities -Motivation -Explaining -Talking -Arguing -Asking questions -Smiling -Guiding -Guessing -Jogging -Cooperation -Raising curiosity -Sharing activities -Observing -Respecting -Applausing -Comparing -Explaining -Giving examples -Giving time for thinking -Writing on blackboard -Discussing -Aggreing

APPENDIX M

RAW DATA OF THE QUANTITATIVE PART

Table M.1 Raw Data of the Quantitative Part of the Study

NO	GENDER	Program graduated	Years of Experience	Grade	Pre-service education	In-sevice education	Type of school
1	1.00	2.00	2.00	5.00	1.00	1.00	1.00
2	2.00	1.00	6.00	5.00	1.00	1.00	1.00
3	2.00	1.00	6.00	4.00	1.00	1.00	1.00
4	2.00	1.00	5.00	4.00	2.00	2.00	1.00
5	2.00	2.00	5.00	4.00	1.00	1.00	2.00
6	2.00	2.00	2.00	5.00	1.00	2.00	1.00
7	2.00	1.00	4.00	5.00	1.00	1.00	1.00
8	1.00	2.00	3.00	4.00	2.00	1.00	2.00
9	1.00	2.00	2.00	5.00	2.00	1.00	1.00
10	1.00	2.00	3.00	5.00	2.00	1.00	1.00
11	1.00	2.00	4.00	5.00	1.00	1.00	2.00
12	2.00	2.00	2.00	5.00	2.00	1.00	2.00
13	1.00	1.00	6.00	4.00	2.00	1.00	1.00
14	1.00	2.00	2.00	5.00	2.00	2.00	1.00
15	1.00	2.00	2.00	5.00	1.00	1.00	1.00
16	1.00	2.00	1.00	5.00	2.00	2.00	1.00
17	1.00	2.00	3.00	5.00	2.00	1.00	1.00
18	2.00	2.00	2.00	4.00	1.00	1.00	1.00
19	2.00	2.00	2.00	4.00	1.00	1.00	1.00
20	2.00	3.00	2.00	5.00	2.00	1.00	1.00
21	1.00	2.00	1.00	5.00	2.00	1.00	2.00
22	1.00	2.00	2.00	4.00	1.00	2.00	1.00
23	2.00	2.00	4.00	5.00	2.00	1.00	1.00
24	2.00	2.00	3.00	4.00	2.00	1.00	1.00
25	1.00	2.00	2.00	5.00	1.00	1.00	1.00
26	1.00	2.00	2.00	5.00	2.00	1.00	1.00

Table M. 1 (cont'd)

27	2.00	1.00	6.00	5.00	2.00	1.00	1.00
28	2.00	2.00	3.00	5.00	2.00	2.00	2.00
29	1.00	2.00	1.00	4.00	2.00	1.00	2.00
30	2.00	1.00	6.00	5.00	2.00	1.00	1.00
31	1.00	3.00	2.00	4.00	2.00	2.00	1.00
32	1.00	2.00	6.00	4.00	2.00	1.00	1.00
33	1.00	2.00	3.00	5.00	2.00	2.00	1.00
34	2.00	3.00	2.00	5.00	2.00	1.00	1.00
35	2.00	1.00	6.00	4.00	2.00	1.00	1.00
36	1.00	2.00	6.00	5.00	1.00	1.00	1.00
37	1.00	2.00	3.00	4.00	2.00	1.00	1.00
38	1.00	1.00	4.00	4.00	1.00	1.00	1.00
39	2.00	1.00	6.00	5.00	2.00	1.00	1.00
40	1.00	2.00	2.00	5.00	1.00	1.00	1.00
41	1.00	1.00	6.00	4.00	2.00	1.00	1.00
42	2.00	2.00	6.00	5.00	1.00	1.00	1.00
43	1.00	1.00	5.00	5.00	2.00	1.00	1.00
44	1.00	2.00	2.00	4.00	1.00	1.00	1.00
45	1.00	2.00	1.00	4.00	1.00	1.00	1.00
46	1.00	2.00	1.00	5.00	1.00	2.00	1.00
47	1.00	2.00	1.00	4.00	2.00	1.00	1.00
48	2.00	1.00	6.00	5.00	1.00	1.00	1.00
49	1.00	2.00	2.00	4.00	2.00	1.00	1.00
50	2.00	2.00	2.00	5.00	1.00	2.00	1.00
51	2.00	1.00	6.00	4.00	1.00	2.00	1.00
52	2.00	1.00	6.00	5.00	1.00	1.00	1.00
53	2.00	2.00	2.00	4.00	2.00	1.00	1.00
54	2.00	1.00	4.00	4.00	1.00	1.00	1.00
55	1.00	1.00	4.00	5.00	2.00	1.00	1.00
56	2.00	2.00	2.00	4.00	1.00	1.00	1.00
57	2.00	2.00	2.00	5.00	2.00	1.00	1.00
58	2.00	1.00	6.00	4.00	2.00	1.00	1.00
59	1.00	1.00	4.00	4.00	2.00	1.00	1.00
60	2.00	1.00	6.00	4.00	2.00	1.00	1.00
61	1.00	2.00	6.00	5.00	1.00	1.00	1.00
62	2.00	1.00	6.00	5.00	2.00	1.00	1.00
63	1.00	1.00	6.00	5.00	2.00	1.00	1.00
64	1.00	1.00	6.00	5.00	2.00	1.00	1.00
65	1.00	2.00	4.00	4.00	2.00	2.00	1.00
66	2.00	2.00	4.00	4.00	2.00	1.00	1.00

Table M.1 (cont'd)

67	2.00	2.00	5.00	4.00	2.00	1.00	1.00
68	1.00	2.00	4.00	5.00	2.00	1.00	1.00
69	1.00	1.00	6.00	5.00	2.00	1.00	1.00
70	1.00	1.00	6.00	5.00	1.00	2.00	2.00
71	1.00	1.00	4.00	5.00	1.00	1.00	1.00
72	1.00	3.00	3.00	5.00	2.00	2.00	1.00
73	1.00	1.00	6.00	4.00	1.00	1.00	1.00
74	2.00	1.00	6.00	4.00	2.00	1.00	1.00
75	2.00	1.00	5.00	5.00	2.00	2.00	1.00
76	1.00	2.00	5.00	4.00	2.00	1.00	1.00
77	1.00	2.00	2.00	5.00	2.00	1.00	1.00
78	2.00	1.00	6.00	4.00	2.00	2.00	1.00
79	1.00	2.00	3.00	4.00	2.00	1.00	2.00
80	1.00	1.00	6.00	5.00	2.00	1.00	1.00
81	1.00	3.00	6.00	4.00	1.00	1.00	1.00
82	1.00	1.00	4.00	4.00	2.00	1.00	1.00
83	1.00	3.00	3.00	4.00	2.00	2.00	2.00
84	2.00	1.00	4.00	5.00	1.00	1.00	1.00
85	2.00	3.00	6.00	4.00	2.00	2.00	2.00
86	2.00	1.00	5.00	5.00	2.00	1.00	1.00
87	1.00	2.00	3.00	5.00	1.00	1.00	1.00
88	1.00	1.00	2.00	5.00	1.00	1.00	1.00
89	1.00	1.00	2.00	5.00	1.00	1.00	1.00
90	1.00	2.00	6.00	5.00	1.00	1.00	1.00
91	1.00	1.00	6.00	4.00	2.00	2.00	1.00
92	1.00	1.00	6.00	4.00	2.00	2.00	1.00
93	1.00	1.00	6.00	4.00	1.00	1.00	1.00
94	1.00	2.00	3.00	4.00	2.00	1.00	1.00
95	2.00	1.00	5.00	5.00	2.00	2.00	1.00
96	1.00	1.00	6.00	5.00	2.00	1.00	2.00
97	1.00	1.00	6.00	4.00	2.00	2.00	2.00
98	1.00	3.00	6.00	5.00	2.00	2.00	2.00
99	2.00	1.00	6.00	5.00	2.00	1.00	1.00
100	1.00	2.00	1.00	4.00	1.00	1.00	1.00
101	1.00	2.00	3.00	5.00	2.00	1.00	1.00
102	2.00	2.00	2.00	4.00	2.00	2.00	2.00
103	1.00	2.00	1.00	5.00	1.00	1.00	2.00
104	1.00	1.00	6.00	5.00	1.00	2.00	2.00
105	2.00	2.00	3.00	5.00	2.00	1.00	2.00
106	1.00	1.00	6.00	5.00	2.00	2.00	2.00

Table M.1 (cont'd)

107	1.00	2.00	2.00	4.00	2.00	1.00	2.00
108	1.00	1.00	6.00	5.00	1.00	2.00	1.00
109	1.00	1.00	3.00	5.00	2.00	1.00	1.00
110	2.00	2.00	2.00	5.00	2.00	2.00	1.00
111	2.00	2.00	2.00	4.00	2.00	1.00	2.00
112	2.00	2.00	2.00	5.00	1.00	2.00	2.00
113	1.00	2.00	5.00	5.00	2.00	2.00	1.00
114	1.00	1.00	4.00	5.00	2.00	1.00	1.00
115	2.00	2.00	6.00	5.00	2.00	1.00	1.00
116	1.00	2.00	2.00	5.00	2.00	1.00	1.00
117	2.00	2.00	6.00	5.00	2.00	1.00	1.00
118	2.00	2.00	3.00	5.00	2.00	2.00	1.00
119	1.00	2.00	2.00	5.00	2.00	1.00	2.00
120	2.00	1.00	3.00	5.00	2.00	2.00	1.00
121	1.00	1.00	6.00	5.00	2.00	1.00	1.00
122	1.00	2.00	2.00	4.00	2.00	1.00	1.00
123	1.00	1.00	4.00	5.00	2.00	1.00	1.00
124	1.00	2.00	3.00	4.00	2.00	1.00	1.00
125	1.00	2.00	2.00	4.00	2.00	1.00	1.00
126	1.00	2.00	1.00	4.00	1.00	1.00	1.00
127	1.00	2.00	2.00	4.00	2.00	1.00	2.00
128	1.00	2.00	2.00	4.00	2.00	1.00	2.00
129	1.00	1.00	6.00	5.00	2.00	1.00	2.00
130	1.00	1.00	5.00	4.00	2.00	2.00	1.00
131	1.00	2.00	2.00	5.00	2.00	2.00	1.00
132	1.00	2.00	2.00	4.00	1.00	1.00	1.00
133	2.00	2.00	5.00	5.00	2.00	1.00	1.00
134	1.00	1.00	6.00	4.00	2.00	2.00	2.00
135	1.00	1.00	6.00	4.00	2.00	2.00	1.00
136	2.00	1.00	6.00	4.00	2.00	1.00	1.00
137	2.00	2.00	2.00	4.00	2.00	2.00	1.00
138	1.00	2.00	3.00	4.00	2.00	1.00	1.00
139	1.00	2.00	6.00	4.00	1.00	1.00	1.00
140	2.00	1.00	6.00	4.00	1.00	1.00	1.00
141	1.00	1.00	1.00	4.00	1.00	2.00	1.00
142	1.00	2.00	6.00	4.00	2.00	2.00	2.00
143	1.00	2.00	3.00	4.00	2.00	2.00	1.00
144	1.00	1.00	6.00	5.00	2.00	1.00	1.00
145	2.00	2.00	2.00	5.00	2.00	2.00	1.00
146	1.00	2.00	2.00	5.00	2.00	1.00	1.00

147	1.00	2.00	2.00	4.00	2.00	1.00	1.00
148	1.00	1.00	6.00	4.00	2.00	1.00	1.00
149	1.00	2.00	2.00	5.00	2.00	2.00	1.00
150	2.00	1.00	6.00	4.00	2.00	1.00	2.00
151	2.00	2.00	5.00	5.00	2.00	1.00	1.00
152	1.00	2.00	1.00	5.00	1.00	1.00	1.00
153	1.00	2.00	1.00	4.00	1.00	2.00	1.00
154	2.00	1.00	6.00	5.00	1.00	2.00	1.00
155	2.00	2.00	4.00	5.00	2.00	1.00	1.00

Table M.2 Raw Data for Section 3 of the Questionnaire

A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	A11	A12	A13	A14	A15	A16	A17	A18	A19	A20	A21	A22	A23	A24	A25	A26	A27	A28
5	5	4	4	4	5	5	5	4	4	5	5	5	5	5	5	3	5	5	4	4	5	5	3	5	5	4	5
4	5	5	4	5	4	5	4	4	4	4	4	5	4	5	5	4	4	5	4	4	4	4	5	4	4	4	4
4	5	4	3	4	5	5	5	2	2	3	3	4	5	5	3	2	2	5	5	3	5	5	2	3	5	2	2
3	5	3	4	4	4	2	3	3	2	4	4	4	4	3	3	3	3	4	2	4	4	4	2	4	5	4	3
5	4	5	5	5	5	2	5	4	1	4	4	5	4	4	3	2	4	5	4	4	5	4	4	5	5	2	2
3	4	3	5	2	4	4	3	2	4	3	4	5	2	5	2	5	2	4	5	1	2	4	2	2	2	3	5
5	5	5	4	5	5	5	5	4	5	5	5	5	5	5	5	4	5	5	2	4	5	4	3	5	5	5	5
4	5	4	5	5	5	3	5	4	4	4	5	5	5	5	5	5	5	5	4	4	5	4	5	4	5	5	5
5	5	5	5	5	5	5	5	4	5	5	5	5	5	5	5	5	5	5	2	5	5	5	3	5	5	5	5
5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
2	4	4	4	4	4	1	3	4	2	4	4	4	3	2	3	1	3	4	4	3	3	4	1	4	4	3	3
5	5	5	5	5	5	4	5	4	2	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
4	5	5	5	5	5	5	5	4	2	5	5	5	5	5	5	4	5	5	2	5	5	5	3	5	5	4	5
5	5	5	5	5	5	2	4	5	5	5	5	5	5	5	5	5	5	5	5	5	5	4	5	5	4	5	5
3	4	4	5	5	5	4	4	3	2	4	4	5	4	4	4	4	4	5	3	4	4	4	5	5	5	5	5
4	5	5	5	5	5	2	5	4	4	5	5	5	5	4	4	5	5	5	5	4	5	5	4	4	5	5	3
4	5	5	5	5	5	5	5	5	5	2	5	5	5	4	4	4	5	4	2	5	4	2	4	5	4	3	4
5	5	4	4	5	5	4	5	2	2	5	5	5	5	5	4	5	4	5	5	5	4	5	4	5	4	4	4
5	5	5	5	5	5	4	4	2	1	5	4	5	4	4	4	3	3	5	3	4	5	4	3	5	4	5	4
5	5	5	5	5	5	2	5	4	2	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
3	4	4	5	4	3	3	3	4	2	4	4	5	3	4	4	2	3	3	3	3	2	2	3	5	3	3	2
5	5	5	4	5	5	5	5	4	3	5	5	5	5	5	5	3	4	5	5	4	5	5	5	5	5	3	4
3	4	5	4	4	5	4	5	2	3	3	4	5	4	3	4	3	4	5	2	4	4	4	3	5	4	4	4

Table M.2 (cont'd)

5	5	5	5	5	5	2	5	4	5	5	5	5	5	5	5	4	5	5	5	5	5	5	5	5	5	5	5
2	4	4	4	4	4	1	3	4	2	4	4	4	3	2	3	1	3	4	4	3	3	4	1	4	4	3	3
5	5	5	5	5	5	2	5	4	5	5	5	5	5	5	5	5	5	5	2	5	5	5	5	5	5	5	5
4	5	4	5	4	5	5	5	4	4	5	5	5	5	5	5	1	4	5	5	5	5	4	5	5	5	4	4
4	4	3	5	5	5	4	4	4	2	4	5	5	5	5	4	2	4	5	2	5	5	5	5	5	5	5	5
3	5	4	4	3	4	4	4	3	4	3	4	4	4	3	3	3	3	3	4	4	4	4	3	4	3	2	4
4	4	4	5	5	5	4	4	5	2	3	5	5	5	5	4	2	4	5	3	5	5	5	5	5	5	5	5
3	5	4	2	4	5	1	4	1	1	2	4	5	4	4	4	1	5	4	5	3	5	5	4	4	5	4	4
5	3	4	3	5	5	5	5	2	2	4	5	5	3	2	1	3	4	4	3	5	5	3	2	4	5	5	4
5	5	4	5	5	5	5	5	5	5	4	5	5	5	5	5	3	4	4	5	4	4	4	5	5	5	4	5
4	5	5	5	5	5	5	5	4	2	5	5	5	5	5	5	2	2	5	3	5	5	5	5	5	5	2	2
4	4	3	5	3	4	5	2	4	3	4	4	3	3	3	3	5	5	1	3	3	3	3	4	4	3	3	2
5	5	5	5	5	5	5	4	5	5	4	4	5	5	5	5	2	5	5	5	5	4	4	5	5	5	3	5
4	5	4	5	5	4	4	4	4	4	4	5	5	4	4	4	3	4	5	3	4	4	3	4	4	5	4	5
5	5	5	5	5	5	4	5	4	5	5	5	5	5	4	4	4	5	5	5	5	4	4	3	5	5	4	5
3	4	3	3	3	3	3	3	3	3	3	3	3	4	3	4	3	3	3	3	3	4	3	3	3	3	3	4
4	5	5	2	5	4	4	5	2	2	4	5	5	5	5	4	3	4	5	3	4	5	5	3	4	4	3	5
5	5	5	4	5	4	5	5	5	5	5	5	5	5	5	4	5	4	4	4	5	5	5	5	5	5	5	5
5	5	5	5	5	5	4	5	4	5	5	5	5	5	5	5	5	5	5	5	4	5	5	3	5	5	5	5
3	5	4	3	4	4	4	5	3	3	5	5	5	4	4	4	3	4	4	3	3	3	3	4	5	5	2	3
5	5	4	5	5	5	2	5	3	2	4	5	5	5	4	2	4	5	5	5	3	5	5	5	5	5	4	3
5	4	4	4	5	5	3	5	3	2	5	5	4	4	4	4	4	5	5	3	5	5	4	5	4	5	5	5
4	5	5	5	5	5	3	5	2	2	5	5	5	4	4	3	3	5	5	5	5	5	4	4	5	5	4	5
4	3	4	4	4	5	4	3	5	4	3	4	4	4	4	4	3	3	4	4	4	4	4	3	3	4	4	4
5	4	5	5	5	4	2	5	4	5	5	5	5	5	5	4	4	5	5	5	4	5	5	5	5	5	5	5
4	5	5	5	5	5	5	5	4	4	5	5	5	5	3	3	3	2	5	4	4	4	4	5	5	5	5	5
5	5	5	4	5	5	3	5	5	4	5	5	5	5	5	5	3	5	5	5	5	5	5	5	5	5	5	5
4	5	5	4	4	5	4	5	5	2	4	5	4	4	5	5	3	5	5	4	3	5	4	5	5	5	5	3

Table M.2 (cont'd)

2	4	4	5	4	4	2	4	3	2	4	5	4	4	4	4	3	3	4	5	5	5	4	4	4	4	5	4
3	5	5	4	4	5	3	5	3	3	4	5	5	4	4	5	4	5	5	4	5	4	4	2	5	5	4	4
4	5	5	5	4	4	4	5	5	3	4	5	5	3	4	4	5	3	5	5	4	5	5	3	5	5	4	5
3	5	4	5	5	5	1	4	2	3	3	4	3	3	4	3	2	3	4	4	3	4	3	4	3	3	3	2
3	5	3	5	4	4	4	3	3	3	4	5	4	2	4	3	2	4	5	4	5	5	4	5	4	5	4	5
4	5	5	4	5	5	5	5	4	5	5	5	4	5	5	5	4	5	5	5	4	5	4	4	5	5	4	4
5	5	3	3	5	5	5	4	2	4	5	5	4	5	4	4	4	4	5	4	4	5	4	5	4	5	4	3
2	3	4	4	4	3	1	3	4	3	4	4	4	4	2	3	1	4	4	3	3	4	4	1	4	3	2	3
5	5	5	5	5	5	3	5	5	3	5	5	4	4	5	4	4	4	4	4	4	5	5	4	4	5	4	5
5	5	5	5	5	5	3	5	4	4	5	5	5	5	5	5	4	5	5	4	5	5	5	4	5	5	4	4
5	5	5	5	4	4	3	5	5	4	4	5	5	5	5	4	5	5	5	5	5	5	5	5	5	5	4	4
2	5	4	5	5	5	5	5	5	4	5	5	5	5	5	5	4	5	5	4	5	5	5	5	5	5	4	5
3	5	4	5	5	4	2	5	5	5	4	5	4	5	3	5	4	5	3	3	5	3	3	3	5	4	4	3
5	5	5	5	5	5	3	5	4	5	5	5	5	5	5	5	5	4	5	3	5	5	5	5	5	5	4	5
3	3	1	3	1	3	3	1	2	1	3	1	1	3	1	2	1	3	1	1	2	2	3	2	3	3	3	3
5	5	5	5	5	5	4	5	5	4	5	5	4	5	5	4	4	5	5	5	4	5	4	5	5	5	4	4
5	5	5	5	5	5	3	5	5	3	5	5	5	5	5	5	4	5	5	4	5	5	5	5	5	5	5	5
5	5	5	3	4	5	4	4	5	4	4	4	5	5	5	5	2	5	5	5	5	5	5	5	5	5	3	5
5	5	3	5	5	5	5	5	4	3	3	4	4	4	3	4	3	4	5	4	5	5	4	2	4	4	3	5
5	5	5	5	5	5	3	5	5	2	5	5	5	5	5	5	5	5	5	5	5	5	5	3	5	5	5	5
4	4	4	4	4	5	5	5	4	4	5	5	5	5	5	5	5	5	5	5	5	5	5	3	5	5	5	5
4	4	4	4	5	5	3	5	4	4	5	5	5	4	5	4	5	4	4	5	5	5	4	5	5	5	5	5
5	5	4	5	4	4	4	5	4	3	5	5	4	4	4	4	4	4	5	5	5	4	5	5	5	5	4	5
5	5	5	5	5	5	3	5	4	5	5	5	5	5	5	5	4	5	5	5	5	5	5	5	5	5	5	5
4	5	5	5	2	4	3	4	4	3	5	5	5	5	5	2	2	3	5	5	5	5	5	4	5	5	5	5
3	4	3	4	4	3	2	3	3	2	4	5	3	4	5	4	4	3	4	5	3	4	5	3	4	4	3	3
5	5	5	5	5	5	2	5	4	3	5	5	5	5	5	5	4	5	5	5	5	5	4	4	5	5	5	5
5	4	5	5	4	5	4	5	4	3	5	5	4	4	4	5	5	4	5	5	5	4	5	3	5	5	5	4

Table M.2 (cont'd)

5	5	5	5	5	5	2	5	4	4	5	5	5	5	5	5	4	4	5	5	5	5	4	5	5	5	4	5
3	5	4	5	5	4	4	4	3	3	4	4	4	4	4	4	2	3	4	4	4	4	3	4	5	4	4	3
5	5	5	3	5	5	4	4	4	4	4	4	5	4	5	4	4	4	4	5	4	4	3	5	4	4	4	5
5	5	5	5	5	5	4	5	3	3	5	5	5	4	4	4	3	3	5	5	4	5	5	3	4	5	4	3
5	5	5	5	5	5	4	5	3	3	5	5	5	4	4	4	3	4	5	4	4	5	5	5	5	5	4	4
4	5	5	5	5	5	5	5	2	4	5	5	5	5	5	5	1	4	5	5	5	5	5	5	5	5	5	3
2	2	3	3	4	3	3	4	2	2	3	2	3	2	3	3	3	3	2	2	3	4	4	4	3	3	3	4
2	4	4	3	4	4	4	3	3	2	3	3	3	3	3	3	3	2	3	3	3	2	3	3	3	4	3	3
2	3	3	2	3	2	3	2	2	2	2	3	2	3	2	3	2	3	3	2	2	3	2	2	3	2	3	2
3	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	1	5	5	5	5	5	5	5	5	5	5	5
5	5	5	5	5	5	5	5	4	4	5	5	5	5	4	4	2	5	5	5	4	5	5	5	5	5	5	5
3	5	5	5	5	5	3	5	3	5	5	5	5	5	5	5	3	4	4	4	5	5	5	5	5	5	5	5
5	5	5	5	5	5	4	5	4	4	5	5	5	5	5	5	5	5	5	5	4	5	5	5	5	5	5	5
5	5	4	3	5	4	5	5	4	3	5	5	5	5	5	5	2	5	5	5	4	5	5	5	5	5	3	4
5	5	5	3	5	5	2	5	3	3	5	5	4	5	5	4	5	5	5	4	5	5	5	5	5	5	5	5
5	5	5	4	5	5	3	5	4	4	5	5	5	4	5	5	4	5	5	5	5	4	5	3	5	5	5	5
5	5	4	5	5	5	4	5	4	5	5	5	4	5	5	5	4	3	5	5	3	4	4	4	5	4	4	4
3	4	3	4	4	3	3	3	3	4	4	4	4	4	4	3	2	3	4	4	4	5	5	2	5	5	4	3
4	5	4	4	5	4	4	5	5	3	5	5	5	4	4	4	4	5	5	5	5	5	5	4	4	4	4	5
5	5	4	5	5	5	4	5	5	2	4	4	4	5	5	4	2	5	5	5	5	5	4	5	4	5	4	5
2	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	2	3	4	3	3	3	3	3	3	3	3
5	5	5	5	5	4	4	4	4	3	4	5	5	5	5	4	3	4	4	4	4	4	5	4	4	5	4	3
5	5	5	5	5	5	3	5	4	4	5	5	5	4	5	4	3	4	5	5	4	4	4	5	5	5	5	5
5	5	5	5	5	5	5	5	4	4	5	5	5	5	5	4	5	5	5	4	4	5	5	5	5	5	5	5
5	5	5	5	5	5	2	5	4	4	5	5	5	5	5	4	4	4	5	5	4	5	5	5	5	4	4	5
5	5	5	5	5	5	5	5	4	4	5	5	5	5	4	4	4	4	5	5	5	5	5	5	5	5	4	5
5	5	5	5	5	4	2	5	5	5	5	5	5	5	5	5	3	5	5	5	5	5	5	5	5	5	3	5
5	5	5	5	5	5	5	5	4	4	5	5	5	5	5	5	4	5	5	5	5	5	5	5	5	5	4	5

Table M.2 (cont'd)

5	5	5	5	4	4	4	5	5	4	5	5	5	4	5	5	2	4	5	5	5	5	4	5	5	5	4	5
5	3	4	5	5	2	5	4	3	1	4	4	5	3	5	2	4	5	4	5	4	4	1	3	4	4	4	3
5	5	5	5	5	5	3	5	5	4	4	3	4	4	4	5	5	4	4	4	5	5	5	4	4	5	5	5
2	5	3	4	4	3	4	4	4	3	4	4	3	3	4	3	3	4	4	4	3	4	4	3	3	3	2	2
5	5	5	3	4	5	3	4	4	3	5	5	5	5	5	5	4	4	5	5	4	5	5	5	5	4	1	4
5	5	5	5	5	5	2	5	5	4	5	5	5	5	5	5	3	4	5	4	5	5	5	5	5	5	4	5
5	5	4	5	4	4	3	5	5	4	5	5	4	4	5	4	4	4	4	5	4	5	4	4	5	5	4	4
2	5	4	3	4	3	3	3	3	3	3	3	3	3	3	3	2	2	4	3	3	3	3	3	3	3	3	3
5	5	3	3	5	5	4	5	4	4	5	5	4	4	5	4	1	3	5	5	4	4	1	5	5	5	4	4
4	5	4	5	5	5	5	5	4	4	5	5	5	5	4	4	4	5	5	5	4	5	5	4	5	5	5	5
4	5	5	4	5	4	4	5	4	2	3	4	3	4	4	4	2	5	5	5	4	4	4	4	4	5	4	4
4	5	5	5	5	5	5	5	3	2	5	5	4	5	4	4	4	5	5	5	5	5	5	5	5	4	3	3
4	5	5	5	5	5	3	5	3	2	5	5	3	3	3	4	2	3	5	5	3	3	5	3	5	5	4	5
2	3	3	3	3	4	2	3	2	3	2	3	3	2	3	3	3	2	3	3	3	3	3	3	3	2	3	2
4	5	4	5	4	5	5	5	3	3	5	5	4	4	4	4	4	4	5	4	4	4	4	5	5	4	5	5
2	3	3	3	3	2	2	3	3	4	3	4	3	2	3	4	3	3	3	2	3	3	3	2	3	3	2	3
5	5	4	4	5	5	3	5	4	2	5	5	5	4	4	5	4	4	5	5	5	5	5	5	5	4	3	4
5	5	4	5	5	4	5	5	4	3	4	5	5	4	4	5	3	4	5	4	5	5	5	4	5	5	3	4
4	5	5	5	5	5	2	5	4	4	5	5	5	5	5	4	2	5	5	5	5	4	4	4	5	5	5	5
5	5	4	5	5	4	5	5	4	4	5	5	4	5	5	4	3	5	5	5	5	4	4	2	5	5	5	5
4	5	4	3	4	5	2	5	5	4	4	5	4	4	4	5	5	5	5	4	4	4	4	3	4	5	5	4
5	5	4	4	5	5	5	5	4	4	5	5	5	5	5	5	2	5	5	5	5	5	5	3	5	5	5	4
5	5	4	4	5	5	3	4	5	2	5	5	5	5	5	5	2	4	5	5	4	5	5	5	5	5	2	5
5	5	4	3	5	5	1	5	4	3	3	5	3	2	5	5	3	5	5	4	3	4	3	3	3	3	3	3
5	5	5	5	4	5	3	4	4	4	5	5	5	5	5	4	2	5	5	5	4	5	5	2	5	5	3	4
4	5	5	5	4	5	3	4	4	3	3	4	5	4	5	4	4	3	4	4	4	3	4	3	4	4	3	5
4	5	5	5	4	5	3	4	4	3	3	4	5	4	5	4	4	3	4	4	4	3	4	3	4	4	3	5
4	4	4	4	4	3	4	4	3	3	4	4	4	4	3	3	2	3	4	4	4	4	4	4	4	4	2	3

Table M.2 (cont'd)

4	5	4	4	5	4	2	5	5	2	4	5	4	2	4	4	1	2	5	5	4	4	4	3	5	5	4	4
4	4	4	4	4	4	5	5	4	3	4	5	4	4	4	4	3	3	4	4	4	4	4	4	5	5	5	5
4	3	3	4	4	5	2	5	3	5	4	4	5	3	5	4	4	5	4	5	5	4	5	3	5	5	5	4
5	5	4	5	4	4	3	5	3	3	4	5	5	5	5	3	3	4	4	4	4	4	3	5	5	5	4	5
5	5	5	4	3	3	5	4	5	2	2	5	3	3	4	4	1	5	5	5	3	2	4	4	3	4	4	4
2	5	4	4	5	5	3	5	2	4	4	5	5	4	4	3	2	3	5	4	4	4	5	3	3	5	5	4
5	5	4	5	5	4	5	5	3	3	4	4	5	4	4	4	2	4	5	5	5	5	4	5	5	5	3	5
4	5	4	5	5	5	3	5	4	4	5	5	5	5	5	5	3	5	5	4	5	5	5	3	5	5	5	5
4	5	5	5	4	4	3	5	4	3	4	5	5	3	4	4	2	4	4	5	4	4	5	5	4	4	3	5
2	3	2	2	3	3	2	3	2	2	2	2	3	2	3	3	3	2	3	3	3	3	3	2	2	3	3	3
5	5	5	5	5	5	4	5	4	4	5	5	4	5	5	4	3	5	5	5	4	4	4	5	5	5	4	4
4	4	5	5	5	5	4	5	3	5	3	4	5	4	4	4	3	3	4	4	5	5	4	3	5	4	4	5
5	5	5	5	5	5	2	5	3	3	5	5	5	5	5	5	3	5	5	5	5	5	5	5	4	5	5	5
5	5	5	4	4	5	3	5	5	4	5	5	5	5	5	5	2	3	5	4	4	5	5	3	5	5	5	5
4	5	5	4	5	5	4	4	3	3	5	5	5	5	5	4	4	4	4	5	5	5	4	4	5	5	4	4
2	2	3	4	3	4	4	3	2	2	2	3	4	3	4	4	3	3	3	4	3	3	4	3	4	3	3	3
2	5	5	5	5	4	5	4	5	3	3	5	5	5	5	4	4	4	5	5	5	5	5	3	5	5	3	5
4	4	5	5	4	4	3	4	5	2	4	5	4	4	3	5	1	3	4	4	3	4	4	4	4	4	2	3
4	4	5	4	4	3	1	4	5	3	4	5	5	3	3	5	1	2	3	5	3	5	1	3	3	4	3	2
5	5	4	4	4	5	5	5	4	4	5	5	5	5	5	5	3	5	5	4	4	5	5	3	5	5	4	5

Table M.2 (cont'd)

B1	B2	B3	B4	B5	B6	B7	B8	B9	B10	B11	B12	B13
3	4	3	4	4	3	4	4	3	4	3	3	4
4	3	4	3	4	5	5	5	5	3	5	5	5
4	4	4	5	4	4	4	4	4	4	4	4	4
5	2	3	4	4	4	3	4	5	3	4	3	2
4	4	5	3	5	4	5	5	5	5	5	5	3
5	2	4	4	4	5	2	4	5	4	5	4	5
4	2	4	4	4	4	3	1	5	2	4	2	5
5	5	5	5	4	5	5	5	5	4	5	5	4
4	4	4	5	4	5	4	5	4	5	5	2	4
4	5	5	5	5	5	5	5	5	5	5	5	5
4	5	4	5	5	5	5	5	5	5	5	5	5
5	5	4	5	5	5	4	4	5	4	5	5	4
3	3	4	3	5	3	3	5	5	5	5	5	4
2	4	4	5	5	5	4	5	5	4	5	3	4
5	3	4	4	4	5	3	4	5	4	5	4	5
5	4	5	5	4	4	4	4	5	5	4	4	5
4	3	5	5	5	5	5	5	5	5	5	4	5
5	5	4	4	4	5	5	5	5	4	4	5	5
2	3	4	2	3	3	4	5	4	4	2	2	4
4	4	5	4	1	5	4	5	5	4	5	4	5
4	2	5	3	4	3	5	5	5	5	5	4	5
4	4	3	5	4	4	5	5	5	4	5	5	5
5	4	4	5	4	5	5	4	5	5	4	5	5
4	2	4	4	5	4	4	5	5	3	5	3	4
5	4	5	5	5	5	5	5	5	4	5	5	5
5	4	4	5	5	5	5	4	5	1	4	5	5
5	4	5	4	5	5	3	5	5	5	4	4	5
4	4	4	4	5	4	5	5	5	2	3	5	5
4	3	3	5	5	5	3	5	5	4	5	3	4
5	4	3	4	5	5	5	5	5	4	5	5	5
4	4	4	5	4	4	4	5	5	2	4	5	4
4	4	4	5	2	4	5	4	5	2	4	5	4
4	4	5	5	4	4	4	4	5	3	5	4	5
4	4	4	4	4	5	3	5	5	3	4	5	5
4	3	4	4	5	5	5	4	5	4	5	3	5
3	5	3	3	5	4	3	3	3	5	4	5	3
4	5	4	4	3	5	5	5	5	2	5	5	5
2	3	4	3	5	5	4	5	5	3	4	3	4
4	4	5	5	5	5	5	4	5	4	5	5	3
4	4	5	5	5	5	4	5	5	5	5	5	4
5	4	4	5	5	5	5	5	5	5	5	5	5
4	4	5	5	5	5	5	5	5	3	5	5	5
5	4	3	3	4	3	5	5	3	3	3	4	5
5	4	5	5	4	4	4	5	5	4	5	5	5
4	5	5	4	1	4	5	5	5	4	4	5	5
4	2	5	5	4	4	5	5	5	4	5	5	4
4	4	4	1	4	4	4	5	5	3	5	5	5
5	4	4	5	5	5	5	4	5	4	4	5	5
5	4	4	4	3	5	5	5	5	5	4	3	5
5	5	3	4	3	5	5	5	5	4	5	5	5
5	4	5	5	4	4	4	5	5	2	5	4	5
5	4	5	4	4	4	4	5	5	4	5	4	4
4	4	5	5	5	5	5	5	5	5	5	4	5
4	4	4	5	5	5	5	5	5	4	5	5	4
4	5	5	5	2	4	4	5	4	4	5	5	5

Table M.2 (cont'd)

C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14	C15	C16	C17	C18	C19
4	3	3	4	3	4	3	3	4	3	3	3	4	3	4	3	4	3	3
4	5	5	5	5	5	5	4	4	5	5	4	5	5	5	5	3	5	4
4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	3
3	2	5	2	2	4	4	2	1	5	3	5	2	3	4	2	2	2	2
3	3	4	3	3	3	3	4	3	2	3	4	4	4	4	4	4	3	5
4	2	4	2	2	4	4	4	4	5	4	4	4	5	4	4	2	4	3
3	5	4	5	3	4	4	1	2	3	2	2	2	3	2	3	2	3	4
5	5	5	5	5	5	5	4	5	5	5	5	5	5	5	5	5	5	1
5	5	5	4	5	5	5	5	3	5	4	1	5	5	4	4	5	5	3
5	5	5	5	5	5	5	5	5	5	5	3	5	5	5	5	5	5	1
5	4	5	5	5	5	5	5	5	5	5	2	5	5	5	5	5	5	2
3	2	4	3	1	4	3	1	2	3	4	3	2	4	4	2	2	3	4
5	4	5	4	4	3	5	5	5	5	5	3	5	5	5	5	4	5	5
5	4	5	5	4	5	4	4	5	5	5	4	4	5	4	5	2	3	2
5	5	5	4	4	4	4	5	5	5	5	3	5	5	4	4	4	5	3
5	5	4	5	5	5	5	5	5	5	4	4	4	5	5	5	1	3	4
5	3	5	4	4	5	5	5	5	5	5	2	5	5	5	5	5	5	4
4	4	5	4	4	5	4	4	4	4	4	4	5	5	4	4	2	3	5
5	5	5	5	4	5	4	4	5	4	5	4	5	5	4	4	4	4	4
5	4	3	4	5	3	4	5	3	4	5	3	4	5	4	3	4	4	5
5	4	5	5	5	5	5	2	5	5	5	5	5	5	5	5	2	5	4
4	2	2	2	3	3	3	2	3	5	5	3	2	2	3	3	2	2	5
4	3	5	4	4	4	5	2	4	5	5	5	4	5	4	5	3	5	3
4	3	4	3	4	3	3	3	3	4	5	4	4	3	4	4	2	4	4
5	4	4	5	5	5	5	4	4	5	5	5	5	5	5	5	4	5	5
3	2	4	3	1	4	3	1	2	3	4	3	2	4	4	2	2	3	4
5	5	5	5	5	5	5	5	5	5	5	3	5	5	5	5	5	5	5
4	4	5	4	4	4	5	2	5	4	4	5	4	4	4	4	3	4	3
5	2	5	4	5	4	5	2	4	5	2	3	5	5	5	5	2	5	3
3	4	3	3	1	3	4	3	4	3	3	3	4	3	2	3	1	3	2
5	2	5	4	5	4	5	2	4	5	2	2	5	5	5	5	2	5	4
5	4	5	3	3	5	5	1	1	5	4	4	4	1	1	4	1	5	2
3	3	3	1	2	4	3	3	4	5	2	2	5	4	4	3	1	3	2
4	3	5	5	5	5	5	3	3	4	4	5	4	4	5	5	3	3	1
2	2	5	2	2	2	5	2	5	5	5	2	5	5	5	2	2	5	3
3	3	5	5	4	4	4	2	2	2	1	5	2	2	5	5	5	5	5
5	4	5	5	4	5	5	2	4	4	4	3	4	5	4	5	5	4	2
4	4	4	3	4	3	4	5	4	4	4	5	4	3	3	3	3	4	4
5	5	5	5	4	4	4	4	3	3	4	3	4	3	4	4	4	4	3
3	4	3	4	3	4	3	4	3	2	3	3	2	3	2	3	2	3	4
4	3	5	4	3	4	4	4	3	5	5	4	4	5	5	5	3	4	5
5	5	5	5	5	5	5	4	4	5	4	2	4	5	4	4	3	4	3
5	4	5	4	5	5	5	5	2	5	5	5	5	5	5	5	4	5	4
4	3	4	2	2	3	3	2	2	3	2	4	2	3	3	2	2	3	2
5	4	5	3	4	5	5	2	2	4	5	2	5	5	5	3	2	5	3
5	3	3	5	5	4	4	3	2	4	3	3	5	5	4	4	2	3	1
3	4	4	5	4	4	5	3	5	5	3	4	4	3	4	4	3	5	3
3	3	3	4	3	4	3	4	5	4	4	5	5	4	5	4	4	4	1
5	5	5	5	5	5	5	4	5	4	5	5	4	5	5	4	5	5	5
5	4	4	4	5	5	5	5	4	4	4	3	2	2	4	4	2	4	3
5	5	5	5	5	5	5	5	5	4	4	2	5	5	5	5	4	5	2
5	4	5	3	5	5	5	4	4	5	4	5	4	4	4	5	5	4	4
4	3	4	3	3	4	4	3	4	5	4	4	4	4	4	4	3	4	4
4	4	5	5	5	5	5	4	4	4	4	2	4	5	5	5	4	5	4
4	2	4	3	4	4	5	5	3	5	5	3	5	5	5	4	5	5	3
2	3	2	2	3	3	3	4	4	2	4	3	4	4	4	4	4	3	3

Table M.2 (cont’d)

3	2	4	4	5	4	4	4	3	5	5	5	4	5	4	4	2	2	4
4	4	5	4	4	4	4	5	5	5	5	3	4	5	4	4	4	4	4
4	4	5	5	4	4	4	4	4	5	5	4	5	4	4	4	4	4	4
4	3	3	3	4	3	3	2	3	3	2	3	3	3	3	3	3	3	4
4	4	5	4	4	3	3	3	3	5	5	4	5	3	4	4	3	5	5
5	5	5	5	5	5	5	4	5	5	5	2	5	5	5	5	4	5	5
4	4	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	1
5	5	5	4	5	4	4	4	4	5	5	2	4	4	4	5	3	5	4
3	5	5	5	3	2	3	3	4	5	5	2	3	4	3	5	1	3	3
5	4	5	5	5	5	5	5	5	5	5	3	5	5	5	5	5	5	2
2	3	3	2	2	2	2	2	1	2	1	3	2	1	1	1	1	1	3
5	4	5	5	4	5	5	4	5	5	4	3	5	5	4	4	4	5	2
5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	4	5	2
5	5	5	2	2	4	4	3	4	4	4	3	5	5	5	4	3	5	2
4	4	4	3	3	3	4	3	4	5	5	4	4	3	3	4	3	4	2
5	5	5	5	5	4	5	5	5	5	5	5	5	5	5	5	2	5	4
5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	4	5	4
5	5	4	5	5	5	5	4	4	4	4	4	5	4	4	5	4	4	4
5	4	5	5	4	5	4	4	5	5	5	5	4	4	4	4	3	4	3
5	5	5	5	4	5	5	5	5	5	5	1	5	5	5	5	5	5	3
5	5	5	5	4	4	5	2	2	5	5	2	4	5	5	5	2	5	3
4	3	4	3	4	4	3	3	3	4	3	4	4	4	3	3	3	4	3
5	5	5	5	5	5	5	4	4	5	5	5	5	5	5	5	4	5	5
4	4	5	4	5	5	5	4	5	5	5	3	4	5	4	4	5	5	5
5	5	5	5	4	4	5	4	5	5	5	5	5	5	4	4	4	4	5
3	3	4	3	4	2	4	3	3	4	4	4	3	4	4	3	2	3	4
5	5	5	5	5	5	5	4	4	4	4	2	5	5	4	4	4	4	5
4	4	4	5	5	5	4	3	3	4	4	4	3	4	4	5	3	3	4
4	4	4	5	4	5	4	3	3	4	4	4	3	4	4	4	3	3	2
5	5	5	5	5	5	5	1	5	5	5	2	5	5	5	5	1	1	4
3	4	4	3	4	3	4	3	4	3	3	3	4	3	3	3	4	3	2
2	3	3	3	4	2	3	3	3	2	3	2	3	3	2	3	3	2	5
2	2	2	2	2	3	3	3	4	4	3	3	3	3	2	3	4	3	1
5	5	5	5	5	5	5	5	5	5	5	3	5	5	5	5	5	5	4
5	4	5	4	5	5	4	5	4	5	5	5	5	5	5	5	4	4	2
4	5	5	4	5	5	5	4	5	5	5	3	5	4	4	5	5	5	3
5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	4
5	5	5	5	3	5	3	3	5	5	5	4	3	5	5	5	3	5	5
5	5	5	5	5	5	5	5	5	5	5	2	5	5	5	5	5	5	3
5	5	4	5	5	5	5	4	5	5	5	5	5	5	5	5	5	5	4
4	3	3	3	3	4	4	3	3	4	4	3	4	4	4	4	3	3	5
4	3	4	3	3	3	5	2	3	3	3	5	2	3	2	2	3	2	2
4	3	4	4	4	5	5	4	4	5	4	3	3	5	4	4	3	4	3
5	5	5	4	5	4	5	5	4	5	5	5	5	4	5	5	5	5	5
3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
4	4	4	5	4	4	5	4	4	5	5	4	3	4	4	2	1	4	4
4	4	4	4	5	5	5	4	4	5	5	5	5	5	5	4	3	4	2
5	5	5	5	5	5	5	5	5	5	5	2	5	5	5	5	5	5	5
4	5	5	4	5	5	5	4	5	5	4	3	5	5	5	5	2	3	3
4	5	5	4	4	4	4	5	5	5	5	4	5	5	5	4	4	5	3
5	4	5	4	3	5	5	3	5	5	3	5	5	4	4	3	3	4	3
5	5	5	5	5	5	5	4	5	5	5	5	5	5	5	4	4	5	3
5	5	5	4	4	5	5	5	4	5	5	4	5	5	3	4	4	4	5
5	2	4	3	5	5	5	4	3	5	5	2	3	3	2	4	1	3	5
4	4	4	4	5	5	5	5	5	5	5	4	5	5	5	5	5	5	5
2	2	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	4
5	4	5	1	1	2	5	1	4	5	4	5	4	5	5	3	2	4	3
5	5	5	5	5	5	5	4	5	5	5	3	5	5	5	5	4	5	3
4	4	4	5	4	5	5	4	4	5	4	4	4	5	5	2	5	5	4
3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	4
4	1	3	3	3	3	3	4	4	5	4	4	4	5	4	3	4	4	5
4	4	5	4	4	5	5	4	5	5	5	5	5	5	5	5	3	5	5

Table M.2 (cont'd)

4	5	5	4	3	3	3	4	3	4	3	4	2	3	4	3	1	3	4
4	3	5	5	5	3	5	3	4	3	3	5	3	4	4	5	2	4	3
3	3	5	5	2	4	4	5	3	3	4	3	4	4	4	3	3	3	3
3	2	2	3	3	3	3	3	3	3	2	3	3	2	3	3	2	2	4
4	4	4	4	4	4	4	5	4	4	5	2	5	5	4	4	4	4	2
3	3	3	3	3	3	3	3	3	3	3	3	2	3	2	3	2	3	3
4	4	5	5	5	5	5	4	4	5	4	5	5	5	5	4	3	4	1
5	4	5	4	3	5	5	2	3	3	4	3	4	5	4	3	2	5	4
4	4	5	4	5	5	5	4	5	5	5	5	5	5	5	5	4	5	2
5	5	5	4	4	4	5	5	5	5	5	4	5	5	4	4	4	5	5
5	4	4	4	4	4	4	4	4	5	5	3	5	5	5	4	4	5	3
5	4	5	5	4	4	5	4	5	5	5	5	5	5	5	4	4	5	4
5	3	5	3	2	3	5	2	3	5	5	3	5	5	4	2	2	5	2
3	4	3	3	3	3	3	3	4	4	4	2	4	3	4	4	4	3	5
5	4	5	5	4	4	4	4	5	5	4	3	5	5	5	5	4	5	5
4	2	4	3	3	4	4	5	3	5	5	3	4	5	4	4	2	4	3
4	2	4	3	3	4	4	5	3	5	5	3	4	5	4	4	2	4	4
4	2	4	2	2	3	3	4	3	4	4	3	3	4	4	4	2	3	5
4	2	4	2	4	2	4	2	3	4	4	3	4	5	4	5	2	5	4
5	5	5	5	4	5	5	3	4	4	4	4	4	4	5	3	3	4	2
4	4	4	3	5	5	5	4	3	4	4	5	5	4	5	4	5	4	3
5	3	5	4	4	4	4	3	4	4	5	4	4	4	5	4	5	5	4
5	4	3	2	2	3	3	2	2	5	3	3	5	5	4	2	2	4	2
4	3	4	5	4	4	4	3	3	4	4	4	5	5	4	3	2	4	3
4	4	4	4	4	4	4	3	5	5	4	5	5	5	5	4	3	4	4
5	5	5	5	5	5	5	5	5	5	5	3	5	5	5	5	5	5	5
4	2	4	3	3	4	4	5	3	5	5	4	5	5	4	4	3	5	3
3	2	3	3	2	3	3	3	3	2	3	2	2	3	2	3	2	3	3
4	3	5	4	3	3	4	4	4	5	4	5	5	5	4	4	4	3	4
5	4	5	5	4	4	5	4	5	4	4	4	4	4	4	5	4	5	1
4	4	5	5	5	4	5	5	5	5	5	2	5	5	5	5	5	5	2
5	4	5	5	5	4	3	2	4	5	5	4	5	4	5	4	5	5	3
4	3	5	5	5	5	5	4	4	4	3	4	4	4	3	3	4	4	2
3	3	2	2	2	3	2	2	2	4	3	3	3	3	2	3	3	2	2
5	3	5	5	3	5	5	3	5	5	3	5	5	5	5	3	3	5	3
3	1	4	2	1	2	3	1	2	3	2	3	1	2	2	2	1	5	3
3	3	3	2	2	4	5	3	2	3	5	2	4	4	4	4	1	1	4

APPENDIX N

EXAMPLE OF CODING PROCESS FOR THE INTERVIEWS INTERVIEW TRANSCRIPT 1

INTERVIWEE'S 1:	**INTERVIEW**:
Interviewee: Classroom Teacher	**Date:** 08/05/2006
Gender: Female	**Time:** 12.30 – 13.40
Class: 5	**Place:** Meeting room
School: Public school	

1: Öğretmenlik yaşantınızı kısaca özetleyebilir misiniz?	
Sondalar: Hangi bölümden kaç yılında mezun oldunuz?, Kaç yıldır öğretmenlik yapıyorsunuz?, Mezun olduğunuz okul?, Okuttuğunuz sınıf düzeyi?	
T1: Ben 1972'de Konya Ereğli Kız Öğretmen Okulu'nu bitirdim. 4.5 sene mecburi köy hizmeti yaptım. 4.5 seneden sonra devamlı Ankara'da çalışıyorum. Önlisans hakkı verildi, onu bitirdim, bugüne geldik, 34 yıllık öğretmenim, 34 yılı bitirdim. Mezun olduğum okul dışında ayrıca rehberlik konusunda seminer aldım. Fakat benim psikolojiye özel ilgim var, özellikle bu tür kitapları çok fazla okuyorum, felsefeye çok merakım var, onunla ilgili kitapları okuyorum, bir de sosyoloji ile çok ilgileniyorum, onunla ilgili de kitaplar okumaya çalışıyorum, yani çok okurum ben. Okuduğum ve	Pre-bachelor 34 years of experience Grade level: 5

öğrendiğim şeyleri de çocuklarda uygularım. Benim en büyük özelliğim, mesela herkesin adam olmaz diye attığı, çok büyük problem diye
yıldığı o tür sınıflarda çocuklarla ilgilenmekten büyük zevk alıyorum. Onları kurtarmayı, ve öğrenim güçlüğü çeken çocuklarla ilgilenmeyi severim, sonra da hayret ederler bana, bu çocuk nasıl kurtuldu diye. Bu sene 5. sınıfları okutuyorum.

2: Yeni programlar 2005-2006 yılından itibaren ilköğretim birinci kademede uygulanmaya başlandı. Yeni programlara ilişkin görüşünüzü kısaca özetleyebilir misiniz?

Sondalar: Olumlu yönler, olumsuz yönler, eksiklikler, öğretim ve değerlendirme yöntemleri

T1: Bu programla ilgili biz geçen sene 10 günlük bir seminer aldık, fakat bu semineri verenler yetersizdi. İkincisi müfettişler öyle bir anlattı ki, önce kullanılan programları çok kötülediler. Ve kendimizi biz çok kötü hissettik, yani ben kendimi çok kötü hissettim, eskiden şöyleydi, şöyle yapıldı denerek, yaşanan tüm problemler ve sorunlar eski programa yüklendi, bu haksızlıktı, biz aslında bu programı çok güzel uygulamıştık, ben bir de şuna inanıyorum, öğretmenlik deneyim mesleği, böyle bir şey dayatmaktan ziyade öğretmen zaten anlatılan şeyleri, ben kendi adıma konuşayım, çözmüştüm, yani çocuk nasıl daha iyi yetiştirilir, nasıl öğrenmeye ilgi duyar, bunların nelerle olduğunu ben tahmin ediyordum ve uyguluyordum, bu programda aslında bilgiyi öğretmekten ziyade kişilik üzerinde çok duruluyor, yani nedir, sorumluluğunu bilecek, iyi bir vatandaş olacak, kişilikli

2.1 Negative Perspectives
2.1.1 Lack of teacher training
2.1.2 Feeling unfair about old science curriculum

2.1.1.1 Taking seminars from unqualified persons
2.1.2.1 Effect of inspector

2.2 Features on NSTC
2.2.1 Emphasis on personality rather than information

olacak, dürüst olacak, araştıracak, sorgulayacak, bir şeyi hemen kabul etmeyecek, ben bunu zaten çocuklara veriyordum, ama! kendi adıma. Herkes böyle değil. Fakat bunların dışında öğretmen değil, nitelikli öğretmen, iyi öğretmen, mesleğini seven öğretmen yetiştirmek çok önemli. Ondan sonra eğer öğretmen mesleğini seviyorsa, ona bir ideal olarak yaklaşıyorsa, ve eline verilen öğrencilerin ileride Türkiye'yi yöneteceklerini biliyorsa ve bunun bilincinde ise özveriyle çalışıyor, yoksa olmuyor, gerçekten eğer öğretmen bu işe inanmıyorsa, olmuyor. Bana bunu belki öğretmen okulunda verdiler, belki de öğretmen bir aileden geldiğim için ben böyle düşünüyorum, veya benim kendi kişiliğimle alakalı bir şey, bilemeyeceğim, yani çok özverili ve severek çalıştım ben, bir de genelde bayan öğretmenlerin maddi sıkıntıları yok, eşlerinden dolayı, o yüzden hobi gibi yapıyoruz, çok severek yapıyoruz, belki erkek öğretmen olsaydım, maddi sıkıntım çok fazla olsaydı veya ailevi sorunlarım olsaydı, kendimi mesleğime bu kadar veremezdim, bunlar çok önemli. Yani sınıfa giren bir öğretmen mutlu olmalı, o anda öğrencilerden başka bir şey düşünmemeli, kafasında başka bir sorun olmamalı ama maalesef bizim öğretmenlerimizde bu tür sorunlar çok fazla görülüyor. Bununla ilgili bir anımı anlatmak istiyorum, eğer izin verirsen ve fazla zamanımızı almayacaksa, ben 2 sene önce başka bir ilköğretim okulundaydım, 1. sınıf aldım, 2 ay okuttum sonra buraya tayinim çıktı, bir velim demişti ki; konuştuk onunla, çok hayret ettim, veliler de artık çok bilinçli, çok inceliyorlar çocuklarını okutacak öğretmenlerini, ben de dedim benim yerime gelen

2.2.2 Expectations from students
2.2.2.1 Having responsibility
2.2.2.2 Good citizen
2.2.2.3 Having good personality
2.2.2.4 To be honest
2.2.2.5 To be researcher
2.2.2.6 To be examiner
2.2.2.7 Not accepting everything as it is
2.2.2.8 Doing analysis
2.2.2.9 Doing synthesis
2.3 Factors affecting application of NSTC
2.3.1 Beliefs of teachers
2.3.2 Gender of teachers

q (1), t (1, 3)

2.3.2.1 Beliefs of teachers
2.3.2 2 Concentration
2.3.2.3 Happiness
2.3.3. Personality of teachers

öğretmen çok iyi bir öğretmen, mesleğini seviyor dedim, veli de; kaç yaşında, ailesini sordu bana, dedim iki tane çocuğu varmış lisede okuyan, eyvah dedi, onun en problemli zamanları dedi, o dedi o çocuklarla uğraşacağım derken kendini sınıfa veremez dedi, siz öyle değildiniz dedi, çocuklarınızı yetiştirmiştiniz dedi, kafanız boştu, tamamen sınıfa konsantre oluyordunuz dedi, hakikaten bana o velinin saptaması doğru geldi, çok haklı gördüm onu. Programlar değişip duruyor ama öğretmenlerin özel ve maddi sorunları olduğu sürece problemler devam edecektir. Yeni programla ilgili olarak, eski öğretmenler en büyük engelimizdir deniyordu, bütün her şeyin suçunu eski programa yüklediler, ben de eski programı savunma mekanizması oluştu, yani o kadar da kötü değildi, ben 34 yıldır bu işin içindeyim, o zaman da bize bunları vermeye çalıştılar. Programla ilgili şu ana kadar birçok değişiklik oldu, bazen okul çok baskı yaptı yeniliklerin uygulanması için ve bu değişiklikleri uygulamayan öğretmenlere müfettişler kızdılar ve ceza verdiler, eleştirdiler, çok sert eleştiriler oldu, sonra ne oldu gene değiştirdiler programı. Türkiye açısından düşündüğümüz zaman kitabı sadece sınıfta gören öğrenciler var, kültür seviyesi çok düşük, evine kitap almayan, babası kitap okumayan çocuklar var, bunlar okumayı nasıl geliştirecek, belki bu çocuğun hiçbir zaman akıcı okuması olmayacak, bizim bu tür okullarda sorun olmaz, ama yine bu dayatmalarla birçok okulda öğrenciler feni sadece ezberliyorlar ve özellikle de Türkçe dersinde çok zorlanıyorlar, ilerde bu çocuklar okula nasıl bakacaklar, çok zorlanıyorlar çünkü. Yeni fen

2.3.4 Perspectives of teachers
2.3.4.1 Liking the teaching profession

2.3.5 Family life of teachers

q (2), t (1, 3)

2.3.5.1 Having children
2.3.5.2 Age of children
2.3.5.3 Special problems
2.3.5.4 Income

2.4 Comparison with new and old science curriculum
2.4.1 Good application of old curriculum

2.1.2.2 Change of curriculum many times

2.3.6 Family life of the students
2.3.6.1 Cultural level of family
2.3.6.2 Income

2.3.6.3 Students' style of studying

2.3.6.1 Learning by heart

ve teknoloji programını uygulamaya çalıştık. Zaten ben kendim bazı şeyleri keşfetmiştim, o benim keşfettiğim şeyler de vardı programda, işte diyorum ya kişiliğini geliştirme, hiçbir zaman bir çocuktan ben umudu kesmiyorum, program da onu söylüyor zaten, yani hiçbir çocuk işe yaramaz değildir, mutlaka onun becerebileceği, yapabileceği bir şey vardır. Fen ve teknolojinin kitabını ben çok beğendim, çok güzel yazılmıştı, yalnız bu kitabın uygulanması için çok güzel laboratuarlar gerekiyor, laboratuar eksiğimiz var bizim bu okulda ve eğer bir laboratuarımız olsaydı ve başında özellikle bunu söylüyorum bir laboratuar öğretmeni; eskiden bu da vardı küçümsedikleri eski fen programında, laboratuarımız vardı ve laboratuar öğretmenimiz vardı. Bu bir yıllık deneyleri, 4. ve 5. sınıfın deneylerinin planını yapıyor, her sınıfı mecburen haftanın belirli günleri laboratuara çağırıyordu ve biz her şeyi bırakıp o saatte sınıfça laboratuarda oluyorduk, deneyleri birlikte çocuklar kuruyorlar ve yapıyorlardı, deney defterleri vardı, kullanılan malzemeler, deneyin yapılışı ve sonuç, mutlaka yapılıyordu, şimdi ise biz ne yapıyoruz, araç arıyoruz, oradan buradan bulduruyoruz, onu bulana ve kurana kadar ders bitiyor, hadi ondan sonra resim dersi oluyor ya da başka ders oluyor, her şeyi kaldırıyorsun, öğretmen geliyor ve sınıfımı elimden alıyor, bu tür konularda çok sıkıntı çektik, deneylerde korkunç sıkıntı çektik, halbuki fen ve teknoloji deney ve gözlem dersidir. Laboratuar öğretmenleri kaldırıldı, o laboratuar öğretmenleri sınıf öğretmeni olarak verildi, onlara sınıf verildi, yani tekrar bu programda mutlaka laboratuarlar

2.2.1.1 Being every child valuable

2.5 Positive perspectives
2.5.1 Well written science book

2.4 Comparison of NSTC and OSC
2.4.1.1 Having laboratory in OSC
2.4.1.2 Having laboratory teacher in OSC
2.4.1.3 Lab notebooks for each child

2.1.3 Problems related to laboratory
2.1.3.1 Having no lab lesson
2.1.3.2 Need for lab teacher
2.1.3.3 Need for lab notebooks
2.1.3.4 Lack of equipments
2.1.3.5 Difficulties during experiments
2.1.3.6 Lack of time

2.2.3 Being science, experiments &observation lesson

Suggestions
Related to lab
-Presence of laboratories
-Having lab teachers

olmalı, olmazsa olmaz, ve mutlaka o laboratuarın başında bu işi planlı olarak götüren bir laboratuar öğretmeni olmalı.

3: Fen ve Teknoloji derslerinizi nasıl işliyorsunuz?	3.1 Teaching methods
T1: Önce çocuklar soru çıkarıyorlar üniteyle ilgili olarak, işte bir ön hazırlık vardır, çocuklara sorular sorarak üniteye ilgisini toplarım, merak uyandırırım, zaten ben buna çok önem veririm, bu konuda çocukta merak uyandıracaksın, ona ben çeşitli sorular sorarak, bazı şeyler göstererek merak uyandırırım, çocukta merak uyandırdıktan sonra bu soruları hazırlarım ve daha sonra bu sorular sınıfta cevaplandırılır.	3.1.1 Before starting to a topic 3.1.1.1 Preparation of questions by students 3.1.1.2 Arousing cruosity 3.1.1.3 Questioning 3.1.1.4 Handing out questions to students
Daha sonra konuları çocuklara dağıtırım. Çocuklar bunun sunumunu hazırlıyorlar. Kendileri, yapılacak şeyleri örneğin mantarlarla ilgili; mantar çeşitleri, yararlı mantarlar, zararlı mantarla ilgili bilgileri topluyorlar.	3.1.2 Presentation by students 3.1.1.5 Outside investigation by students
Bir gruba ödev vermiştik, notlar hazırlayacaklardı,	3.1.3 Homework
bu grup sınıfa maya getirdi, onu kabarttık, hamuru mayaladık, 6. dersin sonunda baktık, izledik, mayanın nasıl kabardığına, ve	3.1.4 Experiment in class
daha sonra maya eve gitti, evde pişti, aslında sınıfta pişirmek isterdik ama zaman yetersiz, bunu yapamadık,	3.1.5 Group works
bir kere bunu yapmak için bizim 6 saat ya da en azından 4 saat fen dersinden başka ders yapmamamız lazım, kesintiye uğramadan, ama tabi mutlaka dersimiz kesintiye uğruyor, ya da ilgi dağılıyor, araya başka şeyler giriyor. Ertesi sabah o maya pişmiş ekmek olarak geldi sınıfa, herkes çok güzel olmuş, lezzetli olmuş, hayatımızda	3.1.35.5 Real materials
yediğimiz en güzel ekmek diye yediler, böyle işledik ama yinede sıkıntı çektik yinede dört dörtlük işleme olmuyor labaratuar olmadığı için	2.1.3.1 Lack of laboratory

4: Fen ve Teknoloji derslerinizde ne tür etkinlikler kullanıyorsunuz?

T1: Deney kullandık, gözlem kullandık, tepegözü kullandık, araştırmaları kullandık, çeşitli afişleri kullandık. Mesela bir öğrencim, mikroskobik camlarla ilgili bir şiir yazmıştı, o şiiri şarkı biçiminde kendi kendine bestelemişti, oyunlarla bunları yaptırdı, mikrop kılığına giren oldu, maskeler hazırlandı filan güzeldi.	3.1.4 3.1.6 Observations 3.1.7 Equipments 3.1.8 Investigations 3.1.9 Technology 3.1.10 Poem 3.1.11 Song 3.1.12 Plays 3.1.13 Dramatization
5: Öğrencilerinizi değerlendirirken hangi değerlendirme yöntemlerini kullanıyorsunuz?	
Sondalar: Başlangıç, dönüt verme, tanılama	
T1: Bize bir format vermişlerdi doğru yanlış çoktan seçmeli tamamlamalı eşlemeli ve ucu açık sorular. Ben ucu açık sorulara çok önem veriyorum, onları özellikle takip ediyorum, diğer sorular: yani o sorular çok basit geldi ve hepsi değerlendirme sorusunda iyi puanlar alıyorlardı, bu eşlemeden, tamamlamadan çünkü hatırlıyorlardı, çoktan seçmeli zaten en kolay değerlendirme yollarından biri ama ucu açık sorularda o çocuğun dünyası olaya bakış açısını ben gözlemliyordum ve onlara önem veriyordum. Örneğin: Canlılar dünyası ile ilgili bir soru sormuştum, şöyle bir soru idi: Boş bir arazimiz var, bunu bütün canlıların yaşayabileceği bir hale nasıl getirirsiniz diye sormuştum, çok güzel şeyler yazmışlardı, yani bu tür sorular çok güzel oluyor, test dışında da başka kriterleri göz önünde bulunduruyorum; çocuğun olaya hazırlanışı, araştırması, sınıfa getirdiği materyaller, İlgisini; yani çocuğun çok büyük bir dürstlükle içtenlikle o hazırlığı yapması, benim için çok önemli. Yani çocuğun o konuya gösterdiği ilgi ve bu ilgi	3.2. Assessment methods 3.2.1 Testing 3.2.1.1 Open ended 3.2.1.2 Multiple choice 3.2.1.3 Fill in blank 3.2.1.4 Essay exam 3.2.1.1 3.2.1.4 3.2.2.1 Preparation for lesson 3.2.2.2 Efforts 3.2.2 Performance 3.2.3 Honesty 3.2.4 Interest

için gösterdiği çaba, o çabaya ben çok önem veriyorum ama çok mükemmel olur olmaz o önemli değil. O çaba çok önemli, çocuğun isteğini uyandırmak benim için çok önemli.

6: Konuya başlamadan önce öğrencilerinizin konu ile ilgili var olan bilgilerini nasıl öğreniyorsunuz? 3.1.1.3

T1: Tabii konuya başlamadan önce sorular soruyoruz zeten kitapta var en iyi yazılmışı fen kitabıydı, orada ön hazırlık var, öğrencilerimize bu soruları sorarak 3.1.1.2 öğrencilerimiz de merak uyandırın veya önceden bildikleri bilgiyi su yüzüne çıkaran hatırlatmaya çalışan, bunlar güzeldi.

7: Öğrenci farklılıkları deyince aklınıza ne geliyor?

Alternatif soru: Öğrencilerinizin hangi yönlerden birbirinden farklı olduğunu düşünüyorsunuz?

T1: Öğrenci farklılığı deyince: Ben algılama farklılığını anlıyorum. Mesela normal birşey dediğin zaman çocuk algılayamıyor. Bende mesela 2 tane vardı algılaması düşük öğrenci, diğerleri hemen yapıyor anlıyordu, o 2 tanesi anlamıyordu, ilgileri dağınık oluyordu ne yapsak anlamıyordu. İşte onlara daha anlayacakları dilde daha basit şemalarla resimlerle oyunlarla göstermeye çalıştım. Bazısının hayal gücü çok yüksek oluyor, kafasında canlandırabiliyor, bazısı; mümkün değil bunu canlandıramıyor. Mesela düz anlatımdan, bazısı anlıyor, bazısı anlamıyor. Mutlaka drama haline getirmek lazım veya bir film izletmek lazım. Bazısı yaşayarak öğreniyor, buda zaten hem zor hem uzun bişe oluyor ama kalıcı oluyor ama ben bunu eğitim felsefesinde okuduğumda zor ilkel öğrenim olarak görüyor düşük bir öğrenim

4.1 Individual differences
4.1.1 Perception differences
4.1.2 Interest

4.1.3 Imagination

4.1.4 Learning styles

4.1.5 Intelligence

5.1 Possible barriers to apply TAMBID
5.1.1 Barriers on Resources and opportunities

olarak görüyor o yüzden hani en şanslı öğretmen bir dediğini leb demeden anlayan çocuklar zeki çocuklar ama malesef her sınıfta onlar olmuyor. Ayrıca her çocuğa muhakkak bir yolla ulaşılabilir, işte çoklu zeka gibi, kimilerine müzikle ulaşıyorsun, kimine drama ile ulaşıyorsun, kimine resim çizdirerek, kimine el becerileri ve bir şeyler yaptırarak ulaşıyorsun, bu açıdan güzel, fakat bunu bütün öğretmenlerin özümsemesi ve uygulaması zor. Ben uyguladım, uygulamaya çalıştım. Amaç şu: Çocuğa yolu göstereceksin, çocuk bilgiyi kendi alacak, edinecek, fakat işte burada kaynak yetersizliğinden, evinde internet yok, kaynak kitap yok, araştırma yok, bir de çağımızın çocuğu öğrencisi, geçmiş yıllardan çok farklı, ilgi çok dağınık, bir de her şeyde çok sabırsızlar, o kadar sabırsızlar ki, bunlar: Kumandaya basıyor anında kanal değiştiriyor, işte tıklıyor bilgisayarda istediği şeyi anında yapıyor, hemen metroya biniyor bir yere gidiyor, ya da altında arabası var, hemen her şeye çabuk ulaştığı için çocuklar çok sabırsız. Halbuki bilgiye ulaşmak ta sabır ve araştırma gerekiyor, yani bu konuda şimdiki çocuklarla bu çok zor oluyor ama yapmaya çalıştık.

5.1.1.1 Lack of internet

5.1.1.2 Lack of resource books

5.1.2 Barriers about students

5.1.2.1 Attention problems

5.1.2.2 Impatience of students

8: Öğrencilerinizi tanıdığınızı düşünüyor musunuz? Hangi yönlerden onları tanıdığınızı düşünüyorsunuz?

Alternatif soru: Öğrencilerinizin kişilik özeliklerini biliyor musunuz?

4.1.6 Personality

T1: Tabiki tanıyorum, sınıf öğretmeni olarak onlarla 5.senem ve her yönden onları tanıdığımı düşünüyorum. Az önceki sorunuzda da aslında belirtmiştim, çok fazla uzatmayayım konuyu. Tabii kişilik özellikleri bilinir oldukça. İçe dönük olup olmadığını, hep böyle ön planda olmak isteyeni, bazısıda vardır mesela böyle hiç parmak kaldırmaz ama ben bilirim ki o çocuk biliyor, ancak ona hadi sende söyle dediğin zaman söyler, bazısı böyle çok şeydir; bilmediği sorularda bile parmak kaldırır, ön planda olmak ister, bazısıda; ben biliyorum bukadar şeye ne gerek var sadece ben bilgimi sınavlarda sunayım derste fazla yorulmayayım diye parmak kaldırmaz ama ben kaldırınca cevap verir.

4.1.6.1 Intrapersonality

4.1.6.2 Active or inactive in class

9: Öğrencilerinizi tanımaya yönelik onlarla ile ilgili bilgi topluyor musunuz? Nasıl?

T1: Çocukla konuşuyorum, ailesi ile konuşuyorum, çocuğu ben gözlemliyorum eski öğretmeninden bilgi alıyorum, ve artık anlıyoruz dedim ya deneyim işi, çocuğun sınıftaki halinden, evde tatsız birşey olduğunu bile anlıyorsunuz yani

4.2 Ways to know students
4.2.1 Talking to child
4.2.2 Talking to family
4.2.3 Getting information from previous teachers
4.2.4 Observation

10: Sınıfınızdaki farklı şekillerde öğrenen öğrencilere göre dersinizi yönlendiriyor musunuz? Nasıl?

Alternatif soru 1: Sizce bütün öğrenciler aynı şekilde öğreniyor mu? Bu sorunu çözmek için neler yapıyorsunuz?

Alternatif soru 2: Öğrencilerinizin gelişim düzeylerine ve öğrenme biçimlerine uygun öğretim yöntemi kullanıyor musunuz? Nasıl?

T1: Şimdi bende 2 öğrenci vardı, onlara şöyle bir yöntem uyguladık: Hergün bir arkadaşı mesela matematikten bir iki soru çözdürüyordu. Çocuk, çocuktan çok daha iyi öğreniyor, birbirinin dilinden çok iyi anlıyor ve hem

6.1.8 Peer teaching
6.3 Positive features on TAMBID
6.3.1 Better learning
6.3.2 Sharing knowledge

çocuklarda yardımlaşma duygusu ve hemde bir toplumsal görevi yerine getirir gibi bilgisini başkasıyla paylaşması açısından. Bir öğrencim vardı bütün sınıftaki başarılı öğrenciler hergün öğle teneffüsünde yarım saat çalıştırıyorlardı böyle bişe denedim bu çok iyi oldu birde o çocukları biz çok yakından takip ediyoruz, ailesi ile konuşuyoruz, fakat o çocuğa odaklandığın zamanda; sınıfın büyük kısmı kalıyor, bunu işte bu şekilde götürmeye çalışıyorum. Böyle oluyor.

4.1.7 Achievement
4.1.7.1 Low achiever
4.1.7.2 High achiever

4.2.2

5.1.6 Time
5.1.6.1 Not dealing with other students

11: Öğrencilerinizi değerlendirirken bireysel farklılıkları göz önüne alıyor musunuz? Nasıl?

T1: Sözlü notu var bizde biliyorsunuz işte dedim ya çocuğun çabasına göre belki çok sayfalar dolusu yapmamıştır ama çok çaba sarf etmiştir., buda bi yerde mesela fen notuna; çok çaba sarf ettiği fen notuna 5 veremiyorsun yani 100 veremiyorsun, nihayetinde bilgi 100 lük değil şimdi burada insan uzun süre not verirken düşünür, çokta düşük vermemek için, çünkü birazda olgunlaştıkça ben çocukların gelişeceğine inanıyorum. Hani derler ya 7 sinde neyse 70 inde odur, hayır ben buna inanmıyorum, bunu söylediğiniz zaman gelişimi reddetmiş oluyorsunuz, ben buna inanmıyorum, o çabasından ötürü çok düşük vermedim iyi verdim ama çok böyle parlak böyle aaa ben neymişim diye hoş bişeye, hayalede kaptırmadım ortada böyle bir not verdim onlara

6.2 Assessment methods based on TAMBID

6.2.1 Verbal exam
6.2.2 Effort of students

6.3.3 Developments of students in time

12: Öğrencileriniz arasındaki bireysel farklılıkların onların öğrenmelerini ne şekilde etkileyeceğini düşünüyorsunuz?

Alternatif soru: Öğrencileri tanımanın öğretim öğrenme sürecindeki yeri ile ilgili ne düşünüyorsunuz?

T1: Şu şekilde ifade edeyim; genç nüfus çok fazla bizim ülkemizde onun içinde seçme sınavları yapılıyor, o tür sınavlarda da çocuklar seçme sınavını başaramıyor. O zaman ne olacak meslek liselerine yönlendirilecek fakat burda bizim en büyük engelimiz veli. Veli diyorki benim çocuğum bukadar başarılı, benim çocuğum böyle olamaz, yani çocuğunuda bir statü gibi görüyor ve onun iyi yerlerde olmasını istiyor. Anne, baba, çocuk o kadar özdeşleşmişki çocuğu başarısız olduğu zaman kendi de başarısız oluyor düşüncesinde, çocuğunuz öss yi başaramaz dediğiniz zaman o kendi çocuğunu çok başarısız görüyor, dolayısıyla kendisini başarısız görüyor, bunu asla kabul etmiyorlar, Benim mesela cem diye bir öğrencim vardı aile bunun birtürlü hiperaktif olduğunu alğılama güçlüğü çektiğini kabul etmiyordu ama ben onu görür görmez anladım 2. dönem geldi bana bu öğrenci, anne baba veteriner, bunun 3. öğretmeni idim ben. 5 yıl içerisinde 3. öğretmene getirmişler bir türlü kabul etmiyorlar, ben önce aileye bunu kabul ettirdim. Yani bakın bu bir ceza değil, bu utanılacak birşey değil, yani bu böyle, bunu siz kabul edinki çocuğa daha fazla yararlı olun, bu çocuğa siz böyle yaparsanız 18 - 20 yaşına geldiği zaman ne yapacaksınız, çocuk şiddete eğilimli idi, anne babası hep çevreyi suçluyordu, öğretmeni çok suçluyorlardı, ayrıldığı okuldaki öğretmenini, dedim ki, çocuk iletişim kurmak istiyor, fakat bu iletişimi vurarak yapıyor ve vurduğu zaman karşı tarafı acıttığını kırdığını bilmiyordu, çocukla ben konuştum, böyle yapma, seni

5.1.7 Examinations in Turkey

5.1.4 Barriers about parents

5.1.4.1 Unaccepteness of the parents about their childs' problem

5.1.4.3 Resistance of parents on problems about their child

5.1.4.4 Charging of the teachers with problems

6.1.4

6.1.5 Sport activities

çok seviyorlar böyle yapmadan konuşarak iletişim kur ve dedim ki aileye, bunu mutlaka drama kurslarına gönderin, birde bu enerjisini boşaltacağı bir spora ama spor bireysel spor olmasın futbol, basketbol, voleybol gibi grup sporlarına gönderin ki, oralarda iletişimi artsın, sonra aile ikna oldu, bir psikoloğa uzmana götürmeyi kabul ettiler, drama kurslarına yazdırdılar, spor kurslarına yazdırdılar, daha sonrada sınıflada ben konuştum cemin özel durumunu, anlattım, ona sevgi ve ilgi göstermemiz gerektiğini, tepki göstermememiz gerektiğini anlattım ve böylece kabullendiler ve güzel bir yıl geçirdik cemle.

13: Öğretim sürecinizde bireysel farklılıkları göz önüne alırken,

f. **bilgi ve uygulama bazında yaşadığınız sıkıntılar var mı? Açıklar mısınız?**

T1: Mesela bazı öğrenciler kavrayamıyor, tekrar sorduğunda unuttum diyor, bu konuda hiç bir bilgim yok diyor, bilemiyorum diyor. Bu tür öğrenciler için çocuk gelişimden stajer arkadaşlar geliyordu, dediler ki: Bunların normal insanlar arasında yaşamayı öğrenmesi lazım, onlar o açıdan bakıyordu. Bende diyordum ki: Bu tür çocuklardan her sınıfta bir ikitane var, 40 kişilik bir sınıfta 38 kişiyi bir tarafa bırakıp, o 2 kişiye ayıracak zamanınız yok, ilgilenemiyoruz ama milli eğitim diyor ki; ilgileneceksiniz o bidefa hayal, olmuyor, hiç kimsede bunu yapamaz. Eğer hergün ben ona bir 5 - 10 dakika ayırabiliyorsam, bu çocuk şanslı oluyor. Çünkü konular çok fazla, şimdi dediler ki; yeni programda konular az, konular az değil, bizim 4 fen 4 sosyal ünitemiz vardı, şimdi 7 fen 8 sosyal ünitemiz var, 15 üniteye çıktı. Bunun

5.1.2.3 Comprehension difficulties in students

5.1.2.4 Forgetting knowledge by students

5.1.6

5.1.8 High number of units in NSTC

5.1.8

hazırlığı, işlenmesi, değerlendirmesi çok zaman alıyor, o kadar koşuşturduk ki biz bu sene ve herşeyde, o gözlemler, deneyler istediğimiz gibi olmadı zaman yetersizliğinden dolayı. Şimdi bu kadar yoğun bir programda, bu çocuklarla, bu kaynaştırmalarla veya algılamada güçlük çeken çocuklarla nasıl ilgileneceksiniz. Ben bunların bir sınıfta toplanmasından ve gerçekten bu dalda eğitim almış öğretmenler tarafından eğitilmesini istiyorum. Bu avrupada böyle, ama bizimkiler diyorlar ki; yok bu normal çocukların arasına girsin. Peki, ne olacak daha sonra? Mesela ben o çocuklarla ilgili bişe okudum: onların zihinsel düzeyi yetersiz olunca el becerisi iyi gelişiyormuş, bu tür şeyler. Mesela el becerilerine yönelik eğitim verilirse, onlar ileride kendi geçiminide sağlayacak duruma gelir, bir meslek öğrenir. Ama normal öğrencilerin içerisinde tam o el becerilerinin gelişeceği veya daha küçükken bükülebileceği yaşlarda taaa 8. sınıfa kadar normal okulda 8. sınıftan sonra bunların hormonları geliştiği zaman bunlar okullarda daha büyük problem olacak, karşı cinse ilgisi başladığı zaman. Bu konuda şöyle yapalım: Bir müddet haftanın belirli günlerinde özel eğitim alabilir, belirli günlerde normal sınıfa katılabilirler.

g. yönetimle ilgili yaşadığınız sıkıntılar var mı? Açıklar mısınız?

T1: Hayır bireysel farklılıkları göz önüne almaya çalışırken yönetimle ilgili bir sıkıntım olmadı.

h. velilerle ilgili yaşadığınız sıkıntılar var mı? Açıklar mısınız?

T1: Velilerle ilgili ben hiç bir zaman sıkıntı yaşamam. Ben birinci sınıfı aldığım zaman velilerle konuşurum kurallarımı söylerim çocuklara nasıl davranacağımı söylerim ve neleri asla yapmayacağımı söylerim ben asla bir çocuğa aptalsın, gerizekalısın, senden adam olmaz, asla böyle bir şey söylemem ve velilerede çok koruyucu olmamaları, çocukalarının suçlarını örtbas etmemeleri ve öğretmene karşı çocuğu savunmamalarını söylerim. Ama birde şu var, eğitim ile anne baba duygusu çelişiyor o yüzden ben yatılı okullara çok taraftarım.

5.1.4.2 Contradiction of education and feeling of being a mother and father

i. okulunuzda bulunan kaynaklar ve olanaklar ile ilgili yaşadığınız sıkıntılar var mı? Açıklar mısınız?

T1: Burada mobilya konusunda herşey dört dörtlük ama ders araç gereçleri, çok eksik. Ama inşallah bu sene herşey olacakmış. Ama herşey bir yana birinci kademe için fen labaratuarı şart. İnşallah mutlaka kuracağız bu sene

5.1.1.3 Lack of equipments

5.1.1.4 Lack of laboratory

j. öğrencilerinizle ilgili yaşadığınız sıkıntılar var mı? Açıklar mısınız?

T1: Hayır hiç bir sıkıntım yok. Ben onların ilgisini çok güzel topluyorum, onlarla şakalaşırım.

Görüşmemiz sona erdi, katkılarınız için teşekkürler

CURRICULUM VITAE

PERSONAL INFORMATION

Surname, Name: Özdemir, Pınar
Nationality: Turkish (TC)
Date and Place of Birth: 18 September 1976 , Bursa
Phone: +90 312 297 86 25-127
Fax: +90 312 297 86 26
email: pozdem@hacettepe.edu.tr

EDUCATION

Degree	Institution	Year of Graduation
MS	METU Secondary School Science and Mathematics Education	2002
BS	METU Biology METU Biology Education	1999
High School	Bursa Atatürk Lisesi	1992

WORK EXPERIENCE

Year	Place	Enrollment
2000- Present	Hacettepe University Faculty of Education Division of Science Education	Research Assistant
2006-Present	Çağdaş Drama Derneği	Creative Drama Leader
1997-2000	TED Ankara College	Project Assistant

SOME PUBLICATIONS

1. Özdemir, P., Akkuş, O. (2005*).* Use of Creative Drama in Science and Mathematics by Preservice Elementary Teachers. *Hacettepe Üniversitesi Eğitim Fakültesi Dergisi,* 29, 157-166.

2. Akkuş, O., Özdemir, P. (2006*).* Yaratıcı Drama ile Matematik ve Fen Alanındaki Bilim Adamlarının Yaşam Öykülerine ve Bilime Katkılarına Yeni Bir Bakış, *Yaratıcı Drama Hakemli Dergisi*, 1(1), 59-74.

3. Özdemir P., Güneysu S., Tekkaya C. (2006) Enhancing Learning Through Multiple Intelligences. *Journal of Biology Education.* 40 (2), 74.