CLASSROOM TEACHERS' AND SCIENCE AND TECHNOLOGY TEACHERS' VIEWS ON SCIENCE AND TECHNOLOGY CURRICULUM

A THESIS SUBMITTED TO
THE GRADUATE SCHOOL OF SOCIAL SCIENCES
OF
MIDDLE EAST TECHNICAL UNIVERSITY

BY

YELĠZ TEMLĠ

IN PARTIAL FULFILLMENT OF THE REQUIREMENTS
FOR
THE DEGREE OF DOCTOR OF PHILOSOPHY
IN
THE DEPARTMENT OF EDUCATIONAL SCIENCES

FEBRUARY 2012

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ABSTRACT

CLASSROOM TEACHERS' AND SCIENCE AND TECHNOLOGY TEACHERS' VIEWS ON SCIENCE AND TECHNOLOGY CURRICULUM

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February 2012, 203 pages

The purpose of the current study was to investigate the classroom teachers' and science and technology teachers' views on science and technology curriculum. In this nation-wide study, survey design was utilized. The participants of the study consisted of 960 teachers in 26 provinces across Turkey and 601 of the teachers were classroom teachers and 359 teachers were science and technology teachers. In order to investigate teachers' views, Teachers' Views on Science and Technology Curriculum Questionnaire was developed by the researcher. The questionnaire was composed of 3 parts: demographic information part, science and technology teachers' views questionnaire and open ended questions. To analyze the data, descriptive statistics and inferencial statistics (MANOVA) were used. The responses to open-ended questions were subjected to qualitative analysis. Results of the descriptive analyses revealed that classroom teachers and science and technology teachers had positive views towards attainments-content, learning-teaching process and assessment component of science and technology curriculum. Results of MANOVA analysis demonstrated that graduation fields affect teachers' views towards attainments-content and assessment component of the Science and Technology Curriculum; whereas graduation fields did not affect teachers' views towards learning-teaching process. Similarly, teaching experiences affect teachers' views towards attainments-content and assessment component of the curriculum. As for teaching field, the results showed that teaching field affects teachers' views towards attainments-content and assessment component of the curriculum and classroom teachers had more positive views on these components. Gender did not illustrate statistically significant results on teachers' views on science and technology curriculum components.

Keywords: Elementary Science and Technology Curriculum, Teachers' Views, Teachers' Career Cycles, Teachers' Experience

ÖZ

SINIF ÖĞRETMENLERĠ VE FEN VE TEKNOLOJĠ ÖĞRETMENLERĠNĠN FEN VE TEKNOLOJĠ ÖĞRETĠM PROGRAMINA YÖNELĠK GÖRÜġLERĠ

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ġubat 2012, 203 sayfa

Bu çalıÇmanın amacı sınıf öğremenlerinin ve fen ve teknoloji öğretmenlerinin fen ve teknoloji öğretim programına yönelik görüÇlerini belirlemektir. Bu ulusal çalıÇmada tarama deseni kullanılmıÇtır. ÇalıÇmanın katılımcılarını Türkiyenin 26 Çehrinden 960 öğretmen oluÇturmuÇtur. Katılımcıların 601'i sınıf öğretmeni, 359'u fen ve teknoloji öğretmenidir. Veriler, araÇtırmacı tarafından geliÇtirilen Öğretmenlerin Fen ve Teknoloji Öğretim Programına Yönelik GörüÇleri Anketi ile toplanmıÇtır. Anket demografik bilgiler, öğretmen görüÇleri ve açık uçlu sorular olmak üzere üç bölümden oluÇmaktadır. Nicel verilerin analizinde betimsel istatistik ve çok yönlü varyans analizi (MANOVA) kullanılmıÇtır. Açık uçlu sorulardan elde edilen yanıtlar ise içerik analizine tabi tutulmuÇtur. Betimsel istatistik sonuçları, sınıf öğretmenlerinin ve fen ve teknoloji öğretmenlerinin, kazanım-içerik, öğrenme-öğretme süreci ve değerlendirme boyutlarından oluÇan fen ve teknoloji öğretim programına yönelik görüÇlerinin olumlu olduğunu ortaya

koymaktadır. MANOVA analizi sonuçları programın kazanım-içerik ve değerlendirme boyutlarına yönelik öğretmen görüĢlerinde, mezun olunan alanın etkili olduğunu göstermektedir; fakat mezun olunan alanının öğretmenin öğrenme-öğretme sürecine yönelik görüĢü üstüne anlamlı bir etkisi bulunmamaktadır. Benzer Ģekilde, kazanım-içerik ve değerlendirme boyutlarına yönelik görüĢlerini öğretmenlik deneyimi etkilemektedir. Öğretme alanlarının öğretmenlerin programa yönelik görüĢlerini etkilediği ve sınıf öğretmenlerinin programa yönelik daha olumlu görüĢe sahip olduğu ortaya konulmuĢtur. Öğretmenlerin programa yönelik görüĢlerinde cinsiyetin anlamlı bir etkisi olmadığı görülmüĢtür.

Anahtar Kelimeler: Ġlköğretim Fen ve Teknoloji Öğretim Programı, Öğretmen GörüĢleri, Öğretmen Meslek Döngüsü, Öğretmenlik Deneyimi

To my parents Sevim & Yusuf Temli

To my siblings Yeşim Temli & Tuğba Temli Diker &Cihangir Diker

To my energy sources, my nephew Baran & my niece Janset Zeynep

ACKNOWLEDGMENTS

I would like to start by expressing my greatest appreciation to my thesis supervisor Assoc. Prof. Dr. Ahmet OK for his guidance, constructive feedback and support. I especially thank him for read the manuscripts of the dissertation several times with patient.

I also would like to express my gratitude to committee members Prof. Dr. Ayhan Demir, Assoc. Prof. Dr. Jale Çakıroğlu, Assoc. Prof. Dr. Sadegül Akbaba Altun and Assoc. Prof. Dr. Hanife Akar for their constructivist feedbacks and criticism.

I would like to thank in particular to Prof. Dr. Ayhan Demir for his feedbacks, support, tolerance, valuable personal and professional advice and paternalist attitude. His door was always open for students, no matter what the department they enrolled in. I hope I can be a teacher like you. I will never forget your support.

I wish to give special thanks to EARGED. Without support of EARGED, it was too hard to conduct a nation wide study.

My dear friend Derya ġen, you read the draft items of the data collection tool several times, sometimes you gave up your works to help me, whenever I need you were with me. Without your help, it would be more difficult to complete the dissertation. I should also thank your spouse, my dear friend Uğur ġen for his tolerance.

I gratefully thank statistics expert Dr. Esma Emmioğlu for her encouragement, invaluable revisions, contribution and moral support.

I am also thankful to Assoc. Prof. Dr. Gilligan Roehrig for sharing her experiences with me during the my visit to University of Minnesota.

I would like to thank my dear friends Dr. Aygil Takır, Dürdane Lafçı Tor, Fevziye Dolunay, Ġbrahim Tanrıkulu, Jale UlaĢ, Özlem Tokgöz, Rana Ceylandağ, Rukiye Kahraman and Sevinç Gelmez Burakgazi for being supportive. FatoĢ Barnes, Ruken Alkan Kaya, and Songül AkgüneĢ, I will never forget your support. Thank you all.

I would like to express my special thanks to Dr. Aslı Bugay and Özgür Önen who helped me during pilot study and you were willing to encourage me.

Special thanks to Mücahid DurmuĢ for his ongoing support, help and patience.

I would like to indicate my gratefulness to my family. My father Yusuf Temli, my mother Sevim Temli, my sisters YeĢim Temli and Tuğba Temli Diker for their endless encouragement, support and belief in my success at every stage of my life.

TABLE OF CONTENTS

LIST OF TABLES

TABLES

LIST OF FIGURES

FIGURES

CHAPTER 1

INTRODUCTION

1.1. Background to the Study

There have been various proposals in science teaching to make educational implementations more effective in many countries. For example, in order to meet the educational needs in science education, attention was drawn to constructivist theory of learning in the recent years (Cobb, 2011; Sanchez & Valcarcel, 1999). It is a theory about how people learn or make meanings and how knowledge is constructed. Its central claim is that human knowledge is acquired through a process of active construction (Brooks & Brooks, 1999) and learners actively take knowledge, connect it to previously assimilated knowledge and make it theirs by constructing their own interpretation (Cheek, 1992). In summary, constructivism rejects the teacher as knowledge dispenser as was believed to be in traditional education, and puts learner independence at the heart of effective education (Bruner, 1973). Very similarly, Yager (2000) emphasizes the learners' experiences in science learning and utters the terms „science in action' to highlight the learners active participation in science classes. As Blooser (1999) discovers in his observations, despite newly developed curricula which require constructivist implementations, teacher-centered and passive roles of sitting and listening are going on. Richardson (1997) adds, if constructivism practices in undergraduate classes and constructivist learning environment were provided during these years, gaining practical habits would be easy, more effective and permanent. Briefly, all around the world, constructivism, process based assessment, educational technology, science-technology-society, cooperative learning, hands-on activities are the essence of the science education reform practices (Lumpe, Haney, & Czerniak, 2000).

The rapid development in technology, globalization, and impact of economical competition leaded to heated discussions about the existing education system (MONE, 2003). Additionally, Turkey had low rankings on international exams such as PISA or TIMMS (ġahin & Özata, 2007) and importance of elementary education attracted more attention to increase the science success of students and raise children who can search for and reach knowledge, who are creative and love to research (Erktan, 2003). The discussions resulted in reconsideration of educational implementations. Educators believe that science curriculum developed in 2000 had some limitations and a new curriculum was developed. All of the reasons above result in reconsideration of educational implementations and Ministry of National Education; Board of Education gave instruction to Science Course Experts Committee to develop a new science curriculum. The content of science curriculum would be enriched, the discrepancy between 4th and 5th grade science subjects would be corrected, content structured was checked and spiral curriculum characteristics would adopted and harmony among 4th and 5th grade curriculum and 6th, 7th and 8th grade curriculum would be ensured, and connection between daily life and technology would be provided (Değirmenci, 2007; MONE, 2006). Finally, new science and technology curriculum in elementary schools was announced by the Ministry of National Education (MONE) in 2004 and started to be implemented national-wide in the 2005-2006 academic year.

Bringing about changes in curriculum does not necessarily make changes automatic in practices (Wilson & Berne, 1999). In other words discrepancies are observed between „formal curricula' and „operational curricula'. The formal curricula refer to curricula which have gained official approval, and operational curricula refer to the implementation of formal curriculum by the teachers (Goodlad, 1979). As curriculum implementers, teachers play crucial role in educational reforms (Duffee & Aikenhead, 1992) and their beliefs and knowledge can influence on the success of the reforms (van Driel, Beijaard, & Verloop, 2001). Curriculum development team may produce a perfect formal curriculum whereas if the changes are not stated in a comprehensible way and cannot be perceived appropriately, it cannot be named as successful curriculum (ġahin & Özata, 2007).

Davis (2002) asserts that educational reforms and, accordingly, changing curriculum are not sufficient to realize the intended changes. Despite the great effort to develop educational practices, little changes can be realized in actual classroom situations (Davis, 2002). Implementing a new curriculum requires the willing abandonment of familiar practices and the adoption of new ones (Brooks & Brooks, 1999, p. 25).

Fullan and Pomfret (1977) maintain that the success of educational innovations depends on teachers and teacher related factors. These are the teachers' clear understanding of innovation, their qualification to implement, and teachers' acceptance of new curricula. Teachers' views on curriculum affect the all of the components of it. Additionally, the availability of required materials and harmony in organizational structures are among other factors. Fullan (1982) also categorizes the factors which affect the change in implementation. The four broad categories are characteristics of curriculum change, local contextual conditions at the school district and school levels, local strategies at the district and school levels used to foster implementation, and local factors affecting the likelihood of implementation. In a similar vein, Sağlam (2008) attracts attention to the socio-economic status and cultural aspects of the districts where teachers work. In order for the teachers' views about the curriculum change to be positive, the required opportunities like materials, technological materials and laboratories, are expected to be provided (Day, 1999). Since teachers' views affect their practices and decision-making process directly (Abrams, Pedulla, & Madaus, 2003; Bloomfield & Harries, 1994; Nisbet & Warren, 1999), successful curriculum implementations requires active participation of teachers and their views illuminate the coming steps of curriculum development and implementation (Ornstein & Hunkins, 1998). Teachers' isolation from the curriculum development process (Scott, 1994) and the lack of teacher support in the implementation cause failure in the implementation of curriculum reforms.

Lack of clarification on teachers' and schools' needs is accepted as one limitation of the previous science curriculum which started to be implemented in 2000 and limitations and positive aspects of the curriculum can be easily analyzed by teachers (Ünal, CoŞtu & KarataŞ, 2004). So as to educational implementation function well, firstly teachers are trained on how to implement educational reforms. Practicing the requirements of curricula in undergraduate classes helps teachers implement these requirements successfully (Yiğit, Akdeniz & Kurt, 2002). Although teachers are in need of getting training about the implementation of the new curriculum which was developed in 2004 (Özpolat et al., 2007), Gültekin and Çubukçu (2008) reported that teachers believe pre-service education sufficient to implement the new curriculum (Gültekin & Çubukçu, 2008).

Another important suggestion to increase the effectiveness of the curriculum implementation is to establish cooperation among schools, teachers and parents (Ercan & Akbaba-Altun, 2004). The new curriculum holds families accountable for sharing educational responsibilities with students; especially activities require parents' involvement in the learning process (Metin & Cansüngü-Koray, 2007). In addition, Ornstein and Hunkins (1998) stress the importance of cooperation between teachers and educational institutions such as the Ministry of National Education to find urgent solutions to problems of implementations. Furthermore, supervisors' visits to schools would be beneficial for identification of possible problems (Erdoğan, 2007).

As for the frequently highlighted aspects of the new science and technology program, the role of the students, the constructivist approach and the complementary evaluation techniques are the main changes. Teachers try to get accustomed to complementary evaluation techniques but they thought that using complementary assessment techniques is time consuming (Cepni & ġenel-Çoruhlu, 2010; Remesal, 2011) and it is difficult to apply them in crowded classrooms. Furthermore, the official procedure requires that the teachers should score two written exams and one oral exam. That is why teachers hesitate to use complementary evaluation techniques (Ercan & Akbaba-Altun, 2004). The teachers also stress on the changes in the role of students' as a positive aspect of new science and technology curriculum; they are not passive recipients anymore, and the role of the teachers changed as well. The teachers provide assistance or supervision to be attained a learning outcome (Erdoğan, 2005). Constructivism plays a main role in the science and technology curriculum and according to the requirements of constructivism; knowledge cannot be transferred from the teacher to the learner. It has to be conceived instead (von Glaersfeld, 1998). So, the new curriculum requires active learners in the learning process. On the other hand teachers encounter some difficulties in the learning-teaching process (Gözütok, Akgün & Karacaoğlu, 2005).

Demirel (2000) maintains that curriculum is composed of the dynamic relationships among objectives, content, learning-teaching process and evaluation. With the implementation of the new curricula, the term „attainments' started to be uttered instead of „objectives' and sub-fields such as science process skills and attitudes were determined. The number of units and content were changed and spiral curriculum characteristics were embraced. In the learning-teaching process, constructivism was determined as the baseline, individual differences were featured and the importance of complementary evaluation techniques was emphasized (Bayrak & Erden, 2007; Ercan & Akbaba-Altun, 2004; Metin & Cansüngü-Koray, 2007).

Furthermore, places where teachers work and social and cultural characteristics of the location affect teachers' views toward change and the success of the curriculum and teachers' views toward curriculum's anticipated changes are essential for its success (Day, 1999). With the implementation of the new science and technology curriculum, teachers' and learners' roles and responsibilities and educational implementations changed and teachers' views came into prominence (Bayrak & Erden, 2007; Bennet, Crawford & Riches, 1992; Metin & Cansüngü-Koray, 2007). In different cities, curriculum is implemented within the bounds of possibility such as working conditions of teachers and the existence of educational materials (Fullan 1997; Nias, 1989). Nias (1989) suggests conducting studies to highlight these characteristics of the location and teachers' views. Some research on the changes in science and technology curriculum which started to be implemented in 2004 was generally conducted in the pilot implementation process in the pilot schools. The perception of a fact requires time to develop (Ornstein & Hunkins, 1998) and it is assumed that teachers employing science and technology curriculum have developed their views and have had an in-depth analysis of the curriculum in the last five years. It is clearly understood from the literature that there are some background variables and individual experiences that affect the in-class implementations. Result of a study showed that science teachers' graduation fields affect their views on science and technology teaching. The teachers who graduated from elementary science education experienced difficulties in science courses when they are appointed to a primary school as a classroom teacher. The participants who graduated from department of secondary science education and mathematics education expressed similar difficulties. Accordingly, they had difficulty in explaining scientific concepts to elementary school students since their undergradate education involved secondary school students not the elementary ones. Namely, the study subjects and cognitive levels of students are not parallel with what they learned in undergraduate education. The participants who graduated from faculty of arts and sciences focus on the subjects that are their field. For instance, a science and technology teacher graduated from biology department is willing to explain biology subject and is reluctant to explain chemistry or physics subject in the content of science and technology curriculum

(Akpınar, Ünal, & Ergin, 2005). As a reality of Turkey, compound classroom teachers have some difficulties in implementation of curriculum (Akpınar, Turan, & Gözler, 2006; Dalka, 2006, Taneri, 2004). Dursun (2006) argued the possibilities of new curriculum implementations in compound classroom and based on the views of 33 compound classroom teachers concluded that it is impossible to implement new curricula in the compound classrooms. It is still a problem to determine to what extent the background variables like teaching experience, graduate faculty or high school or the teaching field affect views on science and technology curriculum. It is expected that the findings of the study would provide insights into further curriculum development processes and revisions.

1.2. Purpose of the Study

The purpose of the study was to determine classroom teachers' and science and technology teachers' views on science and technology curriculum. Further, identifying the views of the teachers on attainments, content, learning-teaching process and evaluation, including positive aspects and the basic limitations of the science and technology curriculum were purposes of the study.

1.3. Problem Statements of the Study

The following 3 research questions guided and shaped the flow of the study.

1. What are the teachers' views on science and technology curriculum?

1.1 What are the teachers' views on the attainments-content of science and technology curriculum (STC)?

1.2 What are the teachers' views on the learning-teaching process of science and technology curriculum (STC)?

1.3 What are the teachers' views on the assessment procedures of science and technology curriculum (STC)?

1.4 What aspects of Science and Technology Curriculum (STC) need to be improved?

2. Are there statistically significant differences among the views of teachers who differ in relation to some demographic variables towards science and technology curriculum?

2.1 Are there statistically significant difference among the views of teachers who graduated from department of elementary science education, department of primary classroom teacher education, faculty of arts and sciences and other faculties towards science and technology curriculum?

2.2 Are there statistically significant differences between male and female teachers' views towards science and technology curriculum?

2.3 Are there statistically significant differences among the views of teachers who are in different stages of teaching career?

3. Are there statistically significant differences between the views of primary classroom teachers and science and technology teachers towards science and technology curriculum?

1.4. Significance of the Study

The effects of globalization, developments in science and technology, having low scores on international exams such as TIMMS and PISA made curriculum changes necessary in Turkey like the other countries. With the effect of these reasons, the new science and technology curriculum started to be implemented in 2004 (MONE, 2006). First of all, teachers' views directly affect the in-class practices and curriculum developers find the ways of fostering teachers to new roles and engagement of them with the new responsibilities (Ornstein & Hunkins, 1998). If the teachers have objections on the implementation of a new curriculum, the reasons behind the development of the new curriculum should be explained clearly, resistance to provide a harmony with the philosophy of the curriculum should be reduced to provide successful implementations (Ornstein & Hunkins, 1998). As Fullan (1982) states, acceptance of new curriculum by teachers is essential for effective implementation and continuation.

The aim of the study was to determine classroom teachers' and science and technology teachers' views on science and technology curriculum. The importance and the contribution could be discussed in different aspects. Firstly, a new approach was adapted and expected to be implemented in the classes and the teachers' views, who are the implementers of the curriculum both draw a general picture about the Turkish teachers' views and provide a base to discuss positive aspects and limitations of the science and technology curriculum from teachers' perspectives. Secondly, attainments and sub-areas of attainments were modified. Thirdly, the complementary evaluation techniques expected to be implemented leads to changes in assessment procedure. In the light of spiral curriculum, content structure of the curriculum was altered as well. This study tried to draw a general picture about the attainments, content, learning-teaching process and evaluation in a holistic approach.

Studies on the views on different units in the curriculum (Kesercioglu et. al., 2006; Tas, Ocak & Ocak, 2009); analysis of science and technology curriculum (Bozyılmaz & Bağcı-Kılıç, 2005; Erdoğan, 2007; Temli, 2009); evaluation of the curriculum (Bayrak & Erden, 2007; Kutlu, 2005; ġahin, 2008), the curriculum development process (Çalık, Ayas, & Coll, 2008) were conducted. However, the literature is very limited in terms of research on the views of teachers working in places with different socio-economic status that reflect different opinions on the curriculum. Additionally, the studies are conducted with a limited sample size and limited in a few districts in a city or a region. For example, the purpose of a study conducted to identify the classroom teachers' views on science and technology curriculum with a sample of 19 teachers (Ercan & Akbaba-Altun, 2005) reflect teachers' views from few schools. The senior student-teachers' qualification degree to achieve the attainments of science and technology curriculum in a university (BuluĢKırıkkaya, 2009) or classroom teachers' views on new curricula was carried with a sample of 100 teachers working in 10 schools in a city's center (Özpolat, Sezer, ĠĢör, & Sezer, 2007). Teacher candidates' opinions on science and technology curricula in another university with a sample of 60 junior students, or views of 48 teachers participated in in-service teacher training about the science and technology curriculum in a city (Demirci-Güler & Laçin-ġimsek, 2007) provided important contributions for pilot implementation process of the curriculum. Whereas, these studies were limited with views of teachers working in a region, city or views of students who have yet to practice the curriculum in real classroom environment. Furthermore these studies were conducted in the process of pilot implementation. As Ornstein and Hunkins (1998) point out that implementation of a new curriculum cannot occur all at once with all teachers. It requires time to orient themselves to materials, engage in the new requirements of the curriculum. As they become more comfortable with the new curriculum, they may achieve further goals (Ornstein & Hunkins, 1998).

This study aims to reflect the common views of teachers working in different places that represent different socio-economic status. In other words, the teachers working in unequal educational opportunities, education level of parents, educational materials in schools, and unequal income would have chance of reflecting their own view.. Therefore, the findings of the study will represent a broad range of findings that cover all implementers of science and technology curriculum until today. The factors associated with the views of the classroom teachers' and the science and technology teachers were included in few studies. Independent variables such as teachers' experiences, graduation level of teachers (graduates of university or lower forms) were included in few studies. Furthermore, teachers have implemented the curriculum for 5 years, so their views on the curriculum have become more crystalize. It was supposed that the findings would provide insights into further curriculum development processes and revisions, and establishing a stronger infrastructure for implementation.

1.5. Definitions of Terms

Teaching Fields: In this study, teaching fields refers to the areas of teachers who are employing 4^{th} and 5^{th} grade science and technology curriculum, and science and technology teachers employing 6^{th}, 7^{th} or 8^{th} grade science and technology curriculum. In other words, teaching fields refer to classroom teachers or science and technology teachers.

Graduation Fields: Among the sample in the study, four basic graduation fields were determined as variables: Teachers who graduated from elementary classroom teaching, teachers who graduated from elementary science teaching, teachers who graduated from the faculty of arts and sciences, and teachers who graduated from fields other than these stated in the first three groups such as faculty of agriculture, faculty of economics and administrative sciences or faculty of engineering.

Gender: Female and male participants

Teaching Experience: This continuous variable is designed as 5 category variable based on Huberman (1989) Teacher Career Cycle Model: Teachers with 0-3 years of teaching experience (Career Entry Stage), 4-6 years of teaching experience (Stabilization Stage), 7-18 years of teaching experience (Experimentation-Diversification Stage), 19-30 years of teaching experience (Serenity Stage) and 31 or more years of teaching experience (Disengagement Stage).

Science and Technology Curriculum: The new science and technology curriculum implemented nation-wide in 2005-2006 academic year onward.

Classroom Teachers: Those who are trained as classroom teachers or generalist.

Science and Technology Teachers: The science and technology teachers who have been trained for teaching science and technology curriculum in elementary schools.

CHAPTER 2

LITERATURE REVIEW

In this chapter, the existing research literature most relevant to the purpose of the study is summarized. First of all, curriculum change and teachers is presented. Then, the main characteristics of the present science and technology curriculum are presented by considering four main aspects of the curriculum; attainments, content, learning teaching process and assessment. After that, research on science and technology curriculum is summarized. At the end, a general summary is provided based on the review of literature.

2.1. Curriculum Change and Teachers

As curriculum implementers, teachers play an important role in the implementation of curricular reforms (Duffee & Aikenhead, 1992) and their performances affect the success of the reforms (van Driel, Beijaard, & Verloop, 2001). Scott (1994) also stresses the roles of the teachers because they control the change and the degree of change reflecting in classrooms. When a curriculum change is decided to do, „to what extend these changes can be put into implementation by teachers with their teaching experiences' is suggested to be discussed by the curriculum development team (Scott, 1994). At that point, the teacher training programs was indicated to help teachers get experiences. By this way teachers can become familiar with new requirement of the curriculum. It is also suggested that if the programs focus on "how-to-do-it" instead of focusing on theoretical rationale, curriculum changes can be more successful (Ponder & Doyle, 1977). It is also suggested to keep in mind that during the curriculum development process, the development committees take into accounts the past experiences of teachers and basic equipment in schools (Clarke, Clarke & Sullivan, 1996).

According to Scott (1994), there is a close relationship between the role of the teachers and success of the new curriculum which involves comprehensive requirements compared to the old teaching-learning habits. On carrying out a new curriculum, teachers may need some assistance for practicing it (Scott, 1994). This is because teachers may hesitate on the practices of main teaching approaches and what to teach. All these signify the importance of teacher education and teachers' continuous support in the successful implementation of newly developed curriculum (Scott, 1994).

Similarly, Ornstein and Hunkins (1998) also note the importance of supporting teachers for implementation of newly developed curriculum. Working with colleagues, discussion on the ideas about implementation process and creating materials for effective learning are among the ways for successful implementation. In the same vein, Davis (2002) underlines that the starting point of curricular change is to enable teachers to implement changes and to provide them with new skills required in the new curriculum. Therefore, providing experiences for teachers and encouraging them to continue their endeavors in the change process are necessary. Likewise, Gallagher and Tobin (1987) emphasize on the support offered to teachers by their colleagues and school administration. They criticize that teachers are alone; and the success of practices depends on their own endeavor. The central role of teachers was highlighted by Motshekga (2009) as well. How a curriculum is put into practice depends on teachers' perceptions. Teachers' views on curriculum are vital for successfuly practicing the curriculum as it is intended (Motshekga, 2009).

In order to implement curricular reforms successfully, what is going on in a regular science class and problems or effective practices should be investigated carefully (Strage & Bol, 1996a). The results of the investigation emphasize the discrepancies between what the curriculum intended and what is going on in real science classrooms. Another important point is deciding on how to support the teachers for successful implementations in curricular reforms. This decision is also a key point to leave old routines in the classes and give a chance of adaptation of new experiences required for successful and intended implementations of curricular changes.

2.2. Main Characteristics of Present Science and Technology Curriculum

Two main sections exist in Science and Technology Curriculum prepared for 4th to 8th graders (TTKB, 2004). The first section named as „foundations of science and technology curriculum' includes vision of the curriculum, basic approach and structure of the curriculum, learning-teaching process, assessment and evaluation, taking into account needs of all students, organizational structure of the curriculum, and the suggestions for implementers. The second main section was named as science and technology course learning areas and units. The first heading in this section is „Teaching areas and the essence of attainments in science and technology curriculum' and has 3 sub headings: Attainments on science-technology-society-environment, Attainments on scientific process skills, and Attainments on attitudes and values. The essence of unit organization of the science and technology program is the second common heading for 4th to 8th grade classes. The other headings are not explained clearly but they included in the units. Different disciplines' attainments which interact with science and technology and the subject of science which is in harmony with Ataturk's principles were included by the content. Additionally, activity samples for 4th to 8th grades and explanations on assessment are offered in the second section of science and technology curriculum. Since teacher centered and traditional teaching methods are not enough to develop scientific literacy skills of students, science and technology curriculum's seven dimensions should be taken into account while educating students as scientifically literate (TTKB, 2006). Seven dimensions (themes) of science and technology curriculum were determined as:

1. The nature of science and technology
2. Key concepts of science
3. Scientific process skills
4. The interactive relation among science-technology-society and environment
5. Scientific and technical psycho-motor skills
6. Values about essence of science
7. Attitudes and Values on Science (MONE, 2005, p.5).

The vision of the science and technology curriculum started to be implemented in 2004 was explained as "No matter what the individual differences are, every student can be educated as science literate". Adults of the future should be educated for overcoming the difficulties of these scientific and technological changes to create a powerful society. Furthermore, social, economic and global development has an effect on people's life and students can be equipped with the adaptation skills and awareness (MONE, 2005). "Science literacy", is defined as "the combination of scientific skills, attitudes, values, perception and knowledge required to keep going the curiosity on earth and environment and the development of research skills, problem solving, critical thinking, and to educate people as life-long learners (MONE, 2005).

There are also seven learning areas in the curriculum but three of them were not offered as units but these learning areas were integrated with attainments and activities of units selected from other learning areas. In order to realize the vision of being a science literate person, the learning areas were determined as: "living organism and life", "matter and change", "physical events", "world and universe", "relationship among science-technology society, environment', "scientific process skills" and "attitudes and values". Organizational structure of science and technology curriculum for learning areas is shown in Table 2.1. These seven areas are divided into two groups. Learning areas related to units were determined as a base when the content was presented. Learning areas related to scientific literacy is explained in detail for each unit.

Table 2.1.

Organizational structure of science and technology curriculum for learning areas

Learning Areas Related to Units	*Learning Areas Related to Scientific Literacy*
1. Living organism and life	1. Relations of Science-Technology-SocietyEnvironment
2. Matter and Change	2. Scientific Process Skills
3. Physical Events	3. Attitudes and Values
4. World and universe	

The aims of science and technology curriculum are to;

- enable students to learn and perceive the natural world;
- recognize and get excited on intellectual richness about the nature
- increase students' curiosity on scientific and technological developments
- understand the interaction among science, technology, society, and environment
- help students construct knowledge through reading, discussing and research
- get a base for learner's occupational preferences related to science and technology
- develop broader capacity to understand occupations' evolving characteristics
- help students internalize „learning to learn'
- construct knowledge when learners fall into unexpected situations
- make use of scientific processes and principles on making personal decisions

- enable learners to be aware of and feel responsible for social, economical, ethical and environmental concerns
- acquire scientific values while making investigations and at the same time care about environment,
- feel responsible for their actions, and internalize and reflect scientific values of the society
- enhance economic welfare in learner's prospective occupational life by using scientific knowledge and skills (MONE, 2005, p.9).

2.2.1. Attainments

Ornstein and Hunkins (1998) define objectives as an indicator of end points and expected outcomes. Popham (1993) highlights the importance of interaction between objectives and achievement since whether the objectives is achieved as it is intended or not as important as stating the objectives. Morris and Fitz-Gibbon (1978) explain ends-goals which are product based, and means-goals which attach attention to process. They criticized the misuse of „behavioral objectives' term. They define the term as "A behavioral objective is a statement of certain behaviors that, if exhibited by students, indicate that the students have some skills, attitude, or knowledge" (p.19). Behavioral objectives can be thought as iceberg. Behaviors can be observed like the observable part of the iceberg and the main part is under water which is knowledge or attitudes resulting from achieving the objectives. Navigators do not examine carefully every detail of the part which is under water like density or volume of this part. They only examine the size and characteristics of visible part, and they deducate how far they need to stay away. In a similar way, behavioral objectives include an observable indication which can be evaluated by teacher as a sign for knowledge, attitude or skill (Morris & Fitz-Gibbon, 1978, p.19).

In 2004 science and technology curriculum the term „attainments' was preferred instead of uttering the term „objective' due to approach followed in developing the curriculum. For each strand and sub-strand, attainments were written in the curriculum and for each sub-strand, activities and necessary explanations about the implementation of these activities were suggested. It was clearly stated in the curriculum that materials which were used for instruction should match with the attainments and reflect the purpose of the curriculum (Temli, 2009).

There is a general agreement about the objectives of a modern science program in science classes; whereas, preferring to use different statements are considered. For example, instead of the process, content, skill, and affective categories, the educators can prefer to classify the objective in a category as follows: science knowledge, rational thinking process, manipulative and communication skills, and scientific attitudes (Adler, 1991; Michaelis, Grossman, & Scott, 1975). In science and technology program, attainments were categorized based on the seven learning areas (Table 2.1).

2.2.2. Content

The second section of science and technology curriculum summarizes the unit organization and is examined in three main parts which are seven learning areas, acquisitions, and activity samples.

In order to realize the vision of being a science literate person, the content was determined based on four learning areas. At 4^{th}, 5^{th} and 7^{th} grades, there are 7 units from four learning areas. At 6^{th} and 8^{th} grades, 8 units exist. The distribution of the units based on the learning areas is presented in Table 2.2.

A study was conducted by Küçükmert-Ertekin (2010) which investigated the needs of classroom teachers and science and technology teachers in relation to in-service teacher education and training to implement science and technology curriculum. The results showed that teachers are in need of in-service education especially in Physical Events Learning Area. In general the participants of the study, who are 304 teachers working in Istanbul, reported the needs for in-service education in applying experiments in physics subjects, structure of atom and distribution of electrons, cellular biology and ecology, and subjects about universe. The participants mentioned their demand for getting elaborated information on the subject of "Heredity, DNA, and genetic diversity" as the 8^{th} grade subject.

Table.2.2

Learning areas and related units

Learning Areas	4^{th} Grade Units	5^{th} Grade Units	6^{th} Grade Units	7^{th} Grade Units	8^{th} Grade Units
Living Organisms and Life	Let's Solve the Body Puzzle Identifying and Promenade World of Living Organism	Let's Solve the Body Puzzle Identifying and Promenade World of Living Organism	Reproduction, growing, and development in loving organisms Systems in our Body	Systems in our Body Human and Environment	Segmentation and Heredity The relationships between Living Organisms and Energy
Matter and Change	Identifying Matter	Identifying and Changes of Matter	Sub-grain Structure of Matter Matter and Heat	Structure and characteristics of matter	Structure and characteristics of matter States of Matter and Heat
Physical Events	Force and Movement Light and Sound Electricity in Our Lives	Force and Movement Electricity in Our Lives Light and Sound	Force and Movement Electricity in Our Lives Light and Sound	Force and Movement Electricity in Our Lives Light	Force and Movement Electricity in Our Lives Sound
Earth and Universe	Our Planet: World	Earth, Sun and Moon	What constitutes the Earth crust	Solar System and Beyond: Puzzle of Space	Natural Progress

Another study aimed to evaluate teachers' practicies while teaching a 7th grade science unit which is "What if the pressure does not exist". The participants were 111 science and technology teachers in public schools and private training centers. The result of the study showed that crowded classrooms, overloaded curriculum content, lack of materials, lack of information in the textbooks, time constraints, insufficient pre-requisite information, lack of interest of parents, and lack of laboratories lead to difficulties in learning in the unit.

Kaya and Gödek-Altuk (2010) conducted a study to determine 6th, 7th and 8th grade students' misconceptions related to electric circuits. An achievement test named as „Electric Unit in Our Life' was used to collect data and 156 students participated in the study. The results showed that students have lack of theoretical information related to electric circuits and almost half of the participants made mistakes while drawing the circuits (Kaya & Gödek-Altuk, 2010).

2.2.3. Learning-Teaching Process

In implementation of curricular reform requires taking new roles for teachers. Abandon of old teaching habits, adaptation of new approaches emphasized in a new curriculum as essential to reach success. Traditional ways of learning such as transmission of knowledge is a limited way to satisfy requirements of new curriculum that emphasize constructivism and teacher training programs are critical to create suitable learning environments and realize the curriculum as it is intended. In the teacher training programs teachers can have a chance of applying the requirements of new curriculum (Kwakman, 2003). In the same vein, Davis (2002) stresses the importance of experiencing new ways of teaching by actually realize it. By this way, the teachers can experience new roles and find solutions the problems they encountered. They would have opportunity for sharing ideas, discussing on the implementations, examine the approaches and piloting the new learning strategies and these opportunities leads to effective and successful curricular implementation in learning environments (Davis, 2002). From students' point of view, they also need for opportunity to do science in science class (Marlowe & Page, 1998). Briefly, learning by doing is essential for all learners.

Unayağyol (2010) developed a questionnaire for determination of classroom teachers' and science and technologies teachers' problems encountered in learner centered learning teaching process. Participants of the study were 255 classrooms teachers and 70 science and technology teachers from Yozgat-city in Türkiye. The results showed meaningful differences based on the class size, teaching experiences and the schools location whether they are in rural areas or urban areas. The results illustrated that the larger class size is, the more problems teachers encountered in assessment. In the learning-teaching process the teachers tend to use brain storming, multiple intelligences and collaborative learning methods.

Although teachers are confident about their implementation in the science classes, some research results show misconceptions and misapplication of teachers in constructivist implementations (Akar, 2003; Gömleksiz & Dilci, 2007; Williams, 2008). Turkish teachers found constructivist approach difficult. Altun and Büyükduman (2007) assert that teachers have some difficulties because the process is more important than the product, and assessing the success is difficult.

2.2.3.1 Learning Environment and Teachers

It was stressed before; learning environment has great importance in constructivism. Constructivism is not a theory of teaching because „learning' concept is focus point of constructivism. As it is stated under constructivism heading, in the learning process students participate in the learning process actively and construct their own knowledge with the interaction of previous experiences and the new concepts which is leaning. Therefore, learning environments should let learners be active.

Wilson (1996) offers to utter „leaming environment' instead of uttering classroom term because the places where learning occur can be named as learning environment and these places let learners work together and include various types of resources. Authentic and real-world environments are essential for knowledge construction. As an active process, learning take place when learners apply their understandings, evaluate the consistency between prior knowledge and the thoughts which is being constructed (Hein, 1991). Terhart (2003) defines the prior knowledge as starting point and it cannot be zero because every learner has past experiences in their environment and the culture they live in. Misconceptions and wrong information may hurt the learning process and in this case, teachers may spare more time for fixing misconceptions and motivate learner for learning. Learners' errors are means for gaining insight into how they are organizing their experiential world. The educator should be able to establish a hypothetical model of the conceptual worlds of students because these worlds could be very different from what is intended by the educator. The concept of "multiplicity" dominates constructivist learning environments since multiple worlds mean multiple truths, representations, perspectives and realities. What is important is not the retrieval of an objectively true answer but how one arrives at a particular answer. Thus, in constructivist learning, it is the process but not the product that matters. If learning is a process of constructing meaningful representations and of making sense of one's experiential world, there is no notion of doing something right or correctly. Right and wrong answers are important to constructivist teachers since the answers let teachers gain insight into learners' current understanding. Furthermore, teachers can get a chance to determine the misconceptions (Brooks & Brooks, 1999). Doolittle (1999) highlights the active learning process and summarizes the process as mental manipulation and self organization of experiences. Students bring order their own knowledge, make connection between existing knowledge and forming new knowledge and form the awareness of new knowledge structures. As it is stated learning is a mental process and physical activities, hands-on experiences and cognitive engagement are necessary for learning. Work with peers as a social activity is another requirement (Hein, 1991).

Another important point is context in constructivism. Learning is contextual and learner cannot learn abstract instruction out of context (Hein, 1991). In constructivist learning environments, students are associated with labels as “sense makers” (Mayer, 1996), “active, social and creative learners and critical thinkers” (Graffam, 2003). Teachers’ qualifications have a great importance in constructivism and the teacher should be away from the role of a traditional all knowing position (Altun & Büyükduman 2007; Jofili, Geraldo, & Watts, 1999).

In constructivist learning environment, teachers as guides share their responsibilities with learners. Von Glaserfeld (1995) defines the role of the teachers as “midwife in the birth of understanding” and criticizes perception on teacher role as “mechanics of knowledge transfer”. Marsh and Willis (2003) state that a constructivist teacher assists her/his students in resolving cognitive conflicts which can be determined through concrete experience, collaborative discourse and reflections. Teachers also help students to explore ideas and concepts so as to construct their own knowledge. Constructivist teachers are familiar with new technology, encourage students’ collaboration, and support learning of scientific concepts and process (Rivet & Krajcik, 2004).

The traditional concept of a teacher is the one who is standing in front of the classroom and teaching a subject or observing the students to determine when they complete the given hands-on activities. The role of students is passive and they are in the classroom to sit, listen and complete the task if it is given to them in a silent classroom. As it is stated in the Constructivism heading, constructivist approach requires work with other learners and active learning tasks (Marlowe & Page, 1998). Three characteristics are the basic characteristics to create a dynamic setting for learning: flexibility, accessibility and usability. Flexibility in arranging study centers, accessibility of the materials and sources for learners’ use, and usability of materials and equipment with clearly established guidelines are necessary in an ideal learning environment (Michaelis, Grossman, & Scott, 1975; ġahan, 2010).

Some school level environmental factors identified by Shymansky and Kyle (1992) are content selected, available facilities, availability of resources and materials, management of materials, access to existing and emerging technologies, instructional practices, scheduling of teacher time and assessment protocols. Similarly number of students, context and subject matter related factors are listed by Strage and Bol (1996b) as influencing the realization of instructional recommendations made by the curriculum innovators.

The characteristics of constructivist teachers were explained and specified for science and technology course by MONE (2006, p.14). The similar characteristics were proposed by Brooks and Brooks (1999) as well. The main characteristics of constructivist teachers are to:

1. encourage students' initiative and autonomous characteristics
2. encourage students to use raw data with materials.
3. utter terms like classification, analysis, guess, and create
4. let learners make decision on content and learning strategies
5. determine misconceptions and correct the concepts before sharing their own perceptions on the concepts
6. encourage learners to interact with learners' peers and the teacher
7. use „wait time' to let students think
8. allow time to make connection between existing and constructing knowledge
9. deal with the learners' experiences which does not match with previous conclusions of them and then encourage learners to discuss.
10. ask open ended questions, encourage learners to ask questions to each other.

2.2.4. Assessment

In literature a common decision does not exist on asessment techniques or methods which are used for assessing higher order cognitive skills. Some researchers ulter “alternative assessment techniques” term while some other researchers prefer to utter “complementary assessment techniques” (Büyüköztürk, 2007). Because of the supportive role of techniques some researchers opt for uttering “complementary assessment techniques” (Anıl & Acar, 2008).
In constructivism, process evaluation of students’ success is essential. Day-to-day observations on student interactions, students work with ideas and materials, assessment in advancement of behaviors and achievements are helpful to assess students’ understandings (Graffam, 2003).

Assessment can be also done by traditional paper-pencil tests in constructivism. Newly developed curricula suggest complementary assessment methods to determine students’ advancement such as projects or portfolios which are assignments allowing students to document what they deal with and their questions asking to construct their own knowledge and focusing on process as well as product (Graffam, 2003).

In science and technology curriculum, traditional assessment methods are listed as multiple choice exams, true-false questions, matching questions, fill-in the blanks questions, and essay exams. Complementary assessment techniques named as alternative techniques and listed as performance assessment, portfolio, concept maps, structured grid, projects, drama, interview, word association, written reports, diagnosis branches tests demonstration, poster, group or peer assessment and self-assessment (MONE, 2005). In science and technology curriculum, assessment is suggested to be used for determination of students’ learning level and determination of whether educational attainments are achieved or not, and providing feedback to make learning more meaningful and effective. Furthermore, it is used to determine the students’ needs in the future provide information about students' learning and share it with parents and assess the effectiveness of teaching strategies and program content (MONE, 2005). Traditional assessment techniques take part in the curriculum, whereas they have less emphasis than the complementary assessment techniques. Complementary assessment techniques were explained in the curriculum to help the teachers in the assessment process. For instance, samples of student observation forms, peer assessment forms, Form of Project Studies' Assessment, Control forms for assessment of an experiment. All these are explained in science and technology curriculum's first part named as Foundations of the Program.

Performance based assessment offers students to construct assessment criteria for themselves. Criteria for performance assessment clearly stated by teacher and the students and these criteria are implemented exactly in learning process (Richards, 1995). Performance based assessment has two parts/forms. One is performance task and the other one is scoring rubric (Popham, 1997).

Peer assessment was defined as a process of being evaluated and evaluation of others (Cartney, 2010). Determining evaluation standards and giving feedback was stated as two important characteristics of peer assessment (Black & William, 1998 as cited in Koç, 2011).

Rubrics are rating scales and defined as scoring guides, consisting of specific pre-established performance criteria. Rubrics are a form of scoring instrument. They are used to evaluate students' performances resulting from a performance task.

The results of a study conducted with the participation of 292 classroom teachers working in Ankara showed that teachers believe in they have enough information to use rubrics in their classrooms although half of them have negative attitudes towards rubric assessment. While the teachers with negative attitudes used the information obtained from the rubrics only for "grading", the teachers with positive attitudes towards used rubrics for "observing the development of students' higher order thinking skills" and "observing to what extent the students used their knowledge and skills in real life situations" (Kutlu, Yıldırım, & Bilican, 2010).

In a similar study, 10 science and technology teachers' views on the problems of complementary assessment were researched in Trabzon. The results illustrated that teachers were in need of learning more on alternative assessment methods. Beside the insufficient information to use assessment methods effectively, lack of physical infrastructure of schools, laboratories and libraries were among the reasons for problems teachers encountered (Sağlam-Arslan, Devecioğlu-Kaymakçı, & Arslan, 2009).

Portfolios are purposeful collection of learners' work that show learners' endeavors, and advancement in a specific subject (Richards, 1995). According to Coppola (1999) using portfolio assessment aims to collect documents constituted by sharing, feedback and revision. According to Lyons (1999, as cited in Marsh & Willis, 2003) portfolios can include not only completed tasks, but also drafts, notes, photographs and preliminary models or plans.

YeŞilyurt (2010) investigated assessment methods used by the science and technology teachers to assess students' success and the difficulties they encountered during the assessment process. In this qualitative study, the researcher interviewed with 54 science and technology teachers working in 6 cities' downtowns and these cities' center. The result of the study shows that teachers prefer to use „fill in the blanks' types of questions, multiple choice tests, true-false questions, and matching questions. Among complementary assessment methods, teachers opt for using performance based and project assessment. As for the problems teachers faced, the students' misconceptions on research works is found as a difficulty. The students copy and paste the documents on the paper and print those as research work. Excessive parental help causes problems and students cannot create original products.

Kazu and Pullu (2010) specifically focused on the classroom teachers' knowledge level and the researchers aimed to determined how often classroom teachers use complementary assessment methods and techniques. In sum, 515 classroom teachers working in Elazığ participated in the study and the results showed that the participants felt incompetent to use rubrics, diagnosis branches tests and structured grids and they use frequently performance based assessment.

Similarly, another study was conducted in Kırşehir with 79 teachers and the elementary school teachers' opinion on assessment component of the science and technology curriculum was investigated. The results showed that teachers have positive opinions on the assessment component of the science and technology curriculum and class size is not statistically important variable that affect teachers' opinions. Similarly, in another study conducted by Sağlam and Küçüker (2010) primary school teachers' feel competent in using complementary assessment methods and their self-efficacy beliefs are high. The sense of efficacy beliefs is found related to teaching profession experiences. The teachers who have more teaching experience had higher efficacy beliefs than the other teachers.

2.2.5. Constructivism

Constructivism is a theory of learning which holds that every learner constructs his or her ideas, as opposed to receiving them, complete and correct, from a teacher or an authority. This construction is an internal, personal and often unconscious process (Selley, 1999). It consists largely of reinterpreting bits and pieces of knowledge –some obtained from first-hand personal experience, but some from communication with other people– to build a satisfactory and coherent picture of the world. This "world" may include areas which are physical, social, emotional or philosophical (Selley, 1999).

It is widely accepted that transferring knowledge to learners does not result in effective learning, in other words, curricular changes promote students' construction of their own knowledge in science (Kwakman, 2003; Schneider & Krajcik, 2002). Instead of lecturing and being active during the classes, teachers' new role is defined as being a facilitator of the students' learning process and creating an appropriate learning environment for students' effective learning.

Constructivism was among the important characteristics of previous science curriculum which started to be practiced in 2000, whereas constructivism attracts much more attention in the new (2005) curriculum (Kılıç, 2001; ġahin et al., 2005). As a theory of learning, constructivism deals with how knowledge is constructed.

Four epistemological assumptions lie at the heart of the theory of constructivism (Fosnot, 1996, p.126):

1. Knowledge is physically constructed by learners who are involved in active learning,
2. Knowledge is symbolically constructed by learners who are making their own representations of action,
3. Knowledge is socially constructed by learners who convey their meaning making to others,
4. Knowledge is theoretically constructed by learners who try to explain things they do not completely understand.

These four tenets of constructivism lay the foundation for basic principles of teaching, learning and knowing process within the scope of constructivism. Based on their degree of emphasis, three fundamental categories of constructivism were defined; cognitive constructivism, radical constructivism and social constructivism. Firstly, Jean Piaget (1896-1980) is viewed as the father of the view of cognitive constructivism. Piaget's constructivism is based on his view of the psychological development of children (Resnick, 1987). Piaget introduced schemata terms described as the knowledge structures and learners construct their own knowledge schemes depending on their previous and current experiences. Additionally, he described mental development as a process of equilibrium in response to external stimuli. The development of human intellect proceeds through organization and adaptation. People organize their thoughts so that they make sense through separating the more important thoughts from the less important ones and connecting one idea to anoyher. At the same time, people adopt their thinking to include new ideas. This adaptation takes place in two ways: while interacting with the environment, the learner assimilates the new information of the external environment into his cognitive structures (schemata). If the experiences do not fit the existing schemes, the learner will change those structures to accommodate the new information (Doolittle, 1999). Briefly, there are two key assumptions of cognitive constructivism: Knowledge is an individual creation and is constructed by each learner for her/himself. There is thus no notion of absolute knowledge. In other words, learners actively construct new understanding by interpreting new experiences within the context of what they already know (Resnick, 1987).

Ernst von Glaserfeld, who was influenced by the theories of Piaget, is one of the leading proponents of radical version of constructivism both as a theory of knowledge and as a guide for science education. He focused on the subjectivity of knowledge and named it "radical constructivism." It is radical "because it breaks with convention and develops a theory of knowledge in which knowledge does not reflect an objective, ontological reality but exclusively an ordering and organization of a world constituted by our experience" (von Glaserfeld, 1995, p. 24). According to him, knowledge is constructed from individual experience but it is not an accurate representation of external reality, as opposed to Piaget's cognitive constructivism (Doolittle, 1999). In other words, the knower does not necessarily construct knowledge of "real" world. Radical constructivism does not deny an objective reality, but states that we have no way of knowing what that reality might be (Dougiamas, 1998).

Thirdly, in cognitive and radical constructivism, the emphasis is on the learner as a constructer. The primary emphasis of social constructivism is culture and context in understanding what occurs in society. People construct knowledge based on culture and social affects (Kim, 2001). Social constructivism is associated with the Soviet psychologist Lev Vygotsky (1896-1934). Social constructivism, unlike radical and cognitive constructivism, emphasizes all four of the constructivist epistemological tenets mentioned above. In accordance with these tenets, knowledge, in social constructivist perspective, can be considered as the result of social interaction and language use and thus is shared, rather than an individual experience (Doolittle, 1999). Two important concepts determined by Vygotsky; "More Knowledgeable Other" and "Zone of Proximal Development". More knowledgeable other refers to someone who has better understanding or skills about a task or concept. More knowledgeable other could be peer of the learner or even an electronic tutor (Vygotsky, 1978, p. 86). Zone of Proximal Development means the distance between actual development of problem solving and potential development with the guidance of more knowledgeable other.

In a report prepared by MONE (2010), social constructivism was underlined as the main approach. Arranging the learning environment which let students' cooperation and interaction, requirement of broad yards by school to enhance students' physical activities and social interaction in games, original appearance of schools which was made attractive for students' learning are emphasized in the report. Sluijsmans and Strijbos (2010) highlighted the social aspects of peer evaluation and underline that peer assessment as a part of social constructivism. Furthermore, traditional ways of learning such as transmission of knowledge is a limited way to implement requirements of new curriculum that emphasize constructivism and teacher training programs are critical to create suitable learning environments and realize the curriculum as it is intended. In the teacher training programs teachers, who would practice the requirements of a newly developed curriculum can have a chance of implementing the requirements of new curriculum (Kwakman, 2003). In the same vein, Davis (2002) stresses the importance of experiencing new ways of teaching by actually realizing it. By this way, the teachers can experience new roles and find solutions the problems they encountered. They would have opportunity for sharing ideas, discussing on the implementations, examine the approaches and piloting the new learning strategies and these opportunities leads to effective and successful curricular implementation in learning environments (Davis, 2002).

Gallagher (2000) criticizes rote learning in science classes. Struggling to fixed knowledge to students' memory in science classes is evaluated as waste of time and he highlights the importance of experiencing scientific truth in science classes. He also notices that teachers expect for memorization mass science knowledge and think that the time allocated for the subjects is very limited.

2.3. Research on Science and Technology Curriculum

Güven (2008) interviewed 20 classroom teachers and asked 4 questions on new curricula. The questions were about the differences between old curricula (implemented in 2000) and new curricula (implemented in 2004), teachers' role, students' roles and important limitations of new curricula. Regarding teachers' roles, the participants listed some changes, these changes were teachers' guidance responsibility has increased, teachers are more active, teachers are continuous learners, making effective connection with the parents, and teachers believe that the teachers role were not changed. Study skills of students, active participation of students, making connection with daily life, cooperation among students and presentation skills of students increased. As for the limitations of the curricula, time constraints were mentioned. Especially for the implementation of complementary evaluation methods and activities, time constraints were perceived as most important problem. According to result of the same study (Güven, 2008), teachers were hold responsible for implementing curricula and the requirements of the curricula and they were not trained about how the curriculum can be implemented effectively. At that point, pre-service teacher education programs and in-service education training programs were criticized. Insufficient knowledge on complementary evaluation methods and lack of materials were other frequently stressed limitations of new curricula.

ġeker (2007) investigated teachers' views on 6th grade science and technology curriculum with the sample of 46 science and technology teachers working in GümüĢhane, Türkiye. Additionally, interviews were conducted with 21 teachers to identify effect of schools' structure and the problems teachers encountered. Results revealed that attainments are consistent with the general goals of science and technology course and appropriate with the students' level. Instruction process was determined as another factor and teachers did not have difficulty in implementation of the curriculum but sometimes they preferred to use old teaching strategies. The serious problems were detected due to insufficient theoretical and practical information on constructivism, multiple intelligences and complementary assessment techniques. Physical infrastructures of schools were stated as a limitation to implement curriculum effectively (ġeker, 2007).

Ayvacı and Devecioğlu (2009) interviewed with 20 science and technology teachers to determine their views towards science and technology teachers working in Trabzon. They found that attainments are clear and comprehensible, related to daily life and they can be used as a guide for teachers. The limitations to achieve the attainments are determined as classes assigned to science and technology course in week schedule. In general, science and technology curriculum is feasible. The participants summarize the main characteristics of the curriculum as student-centered, up-to-date, and appropriate for students' level. Over-loaded content and individual differences stated as problems they encounter related to content. Teachers faced some difficulties due to insufficient number of materials, economic statues of parents, and crowded classrooms. The findings of the same study show that teachers make effort to create active learning-teaching process and by this means, they use complementary evaluation methods as well. Project and performance tasks are used to make students more active. The most frequently expressed problem of the participants is related to assessment. Teachers have difficulty in checking project tasks and assigning time for all of the complementary assessment techniques. Time constraints and crowded classrooms are mentioned as the reasons not to use the suggested assessment methods.

Çiftçioğlu (2009) investigated 5th grade classroom teachers' views on implementation of science and technology course. Participants were 309 5th grade classroom teachers and they categorized the effectiveness levels of attainments, content, learning-teaching situations and assessment. Result of the study showed that attainments are "less effective" in the implementation of curriculum. Implementation of content is another "less effective" component of the curriculum. Teachers' effectiveness on instruction process was reported as "medium" and lastly, assessment is "less effective". In the same study (Çiftçioğlu, 2009), teachers' gender, location of schools (city center/county center/village), age, teaching field (classroom teachers/science and technology teachers), teaching experiences, education level (master, PhD), existence of internet connection in school and existence of science laboratory were determined as independent variables. According to results of the study, age, teaching field, graduated faculty, education level and teaching experience do not have a statistically significant affect on attainments, content, learning-teaching situations and assessment. As for schools' location, teachers working in villages have more positive views than the teachers working in county centers or city centers. Other statistically significant results are related to existence of science laboratory and internet connection. The teachers working in schools where science laboratory does not exist have more positive views on effectiveness of learning-teaching situations than teachers whose schools have a laboratory. Similarly, the teachers, working in schools where internet connection is not available have more positive views on the effectiveness of learning-teaching situation. These unexpected results were explained by the researcher as "*participants thought that if the conditions were better, the components of the curriculum could be implemented effectively*." (Çiftçioğlu, 2009)

Gömleksiz and Bulut (2006) also investigated classroom teachers' views on science and technology curriculum. The study was conducted in pilot schools in 8 different cities and participants were 383 classroom teachers. The data collection tools were developed by the researchers and Cronbach alpha was found .98. After factor analysis was run, 4 factors were determined and then the names of the factors were determined. The factors named as "attainments", "content", "educational level" and "evaluation". In the items, realization of the cases was asked to teachers. According to result of the study, teachers realize "very much" the attainments, content and evaluation. The results showed that "gender" "teaching experience", "educational background" do not have a statistically significant effect on the teachers' views on attainments.

Aydın (2007) conducted a study to determine 4^{th} and 5^{th} grade classroom teachers' views on science and technology curriculum. The data was collected from 192 classroom teachers in Kutahya. The researcher developed a 5 point Likert Scale, the cronbach alpha level was found .95. The result of the study showed that teachers have positive opinions towards attainment, content, learning-teaching process and assessment process. Participants generally expressed their views by circling "agree" choice. They disagree to some items such as; "Suggested time is enough for conducting activities" and "Suggested hours for the course is enough for assessment".

Yangın (2007) inquired teachers' and students' views on science and technology curriculum in his dissertation. In this quantitative study, the participants were 75 4^{th} and 5^{th} grade classroom teachers and 1672 students whose school is located in 4 counties of Ankara. Teachers and students stated that the most important topics of the STC are air pollution, human health, war weapon and nuclear technology. Insufficient available materials, insufficient information of teachers and crowded classrooms were criticized. Using of auditory and visual materials during in-service teacher training was a demand of teachers.

Tabak (2007) conducted a study to provide information from managers, program developers, teachers and students on to what degree learning-teaching and assessment - evaluation approaches in the new science and technology curriculum were used. The participants were 36 5th grade classroom teachers and 560 5th grade students in Mugla. The results showed that lack of materials and time constraints leads to limitations in learning-teaching process. The results also showed that teachers are still using traditional assessment approaches. The reason was shown as insufficient knowledge on complementary assessment methods. Similarly, the researcher concluded that teachers and students try to get used to constructivist approach. However, this approach could not be implemented appropriately.

Tatar (2007) conducted a study to research 4th and 5th grade classroom teachers' views on science and technology curriculum in central counties of Ankara. Interview questions were asked to 20 classroom teachers and instruments were filled by 308 classroom teachers. The instrument developed by the researcher consists of 4 main factors named as attainments, content, learning-teaching process and assessment-evaluation factors and Cronbach alpha was found .97. Expert opinions were taken for interview questions and pilot study was done with 8 classroom teachers. The results showed that attainments are connected to daily life, clear and comprehensible, and in a harmony with the content. Additionally, attainments guide students develop scientific process skills, and develop positive attitudes towards science. Teachers also agree on the items: implementation process help us raise creative people, explanations about the learning teaching process is clear and can be used as a guide, and suggested activities encourage students to think, observe and research. Participants agree about the ideas which are explanation are enough to use suggested assessment techniques, curriculum attach priority to both product and process based assessment, the suggested assessment techniques can be implemented, suggested assessment techniques are effective for evaluation of attainments, and assessment help students to recognize their personal progress.

Ercan (2007) investigated 4th and 5th grade classroom teachers', students' and school managers' views on science and technology curriculum in Bolu. The results of this qualitative study showed that teachers criticized the changing process to adopt requirement of the curriculum. Step by step explanation of the suggested implementations in real classes was demanded. They thought that incremental entrance to new implementation process would be more effective. They also criticized ineffective in-service teacher training, and drawback like crowded classrooms and infrastructure of schools.

Aydın and Çakıroğlu (2010) conducted a study to get science and technology teachers' views and positive and negative aspects of the curriculum. Science and technology teachers working in 10 different public or private schools in 6 counties of Ankara were interviewed. Data were collected from 16 teachers with the 1-15 years teaching experience. According to participants' views; students are more willing to participate in learning teaching process, participants are satisfied with their in class practices, and activities can be conducted in classes with easily accessible materials. Negative aspects were stated as ineffective in-service training, and insufficient information on assessment techniques.

Doğan (2009) researched that the frequency of using „requirements of constructivism' in science classes with the participation of 455 classroom teachers. The finding of the study showed that teachers often apply teaching activities, complementary assessment methods and use physical conditions as it is suggested in the curriculum. The participants of Doğan's (2009) study asserted that they "always" ask open-ended questions to reinforce students to let them construct new knowledge and searching truths; guide students to teach how to learn; ask new questions when students ask questions to provide finding the solutions themselves".

Similarly, Kurtdede-Fidan (2008) investigated the 4th and 5th grade classroom teachers' views on materials. She interviewed 9 classroom teachers. Teachers believe that the public schools do not have sufficient materials. The socio-economic statues were stated as an important factor that affects existence or the number of materials. Results show that teachers who are working in village cannot get the necessary materials while the teachers working in private schools can get support of the families or school managers.

Kara (2008) investigated science and technology teachers' views on the implementation of 6th grade science and technology curriculum in Afyon. In total, 75 science and technology teachers participated in the study and all of the participants were practicing 6th grade science and technology curriculum. The results showed that teachers encounter some problems regarding ignorance of individual differences in the curriculum. Another limitation was stated as schools' facilities which limit teachers to implement curriculum as it suggested.

Tüysüz and Aydın (2009) researched science and technology teachers' views on the curriculum. The participants were 312 science and technology teachers working in Izmir. Data collected through five point likert scale questionnaires consisting of 24 items were sent to participants. Teachers agree that with „science and technology curriculum appropriate for students' level', and „the curriculum encourages students to discover information'. The major problem was crowded classrooms.

2.4. Summary

The part of this chapter reviewed the relevant literature regarding the studies on teachers' views on science and technology curriculum. The literature review results showed that qualitative and quantitative studies were conducted to determine teachers' views on science and technology curriculum. Some research studies were conducted during the pilot implementations in pilot schools and some revisions were done in time. While qualitative studies provide in-depth information on teachers' views, quantitative studies focused on findings from some schools or a particular city. Qualitative studies focused on limitations of the STC and crowded classrooms, overloaded curriculum content, time constraints were stated as limitations.

Previous studies examined the effect of different demographic variables such as gender, graduation field, age, teaching experiences on teachers' views and some adversities attract attention. The studies which determine demographic variables as independent variables illustrate different results. Some research results indicate that demographic variables have a statistically significant effect on teachers' views or perception of STC, some research results do not show there is a statistically significant effect. Limited number of studies in which the other demographic variables, such as SES level, teaching field were researched. In order to draw general picture of teachers' views, it was necessary to reach teachers working in different cities. Thus, science and technology curriculum literature need to more research results on the effect of different variables and determine views of teachers working in different cities and schools under various conditions.

CHAPTER 3

METHOD

This chapter presents the method of the study. It starts with overall design of the study with a systematic schema to present the followed steps. The chapter continues with population and sample, data collection instrument, validity and reliability of data collection instrument, data collection and data analysis procedure, external and internal validity threats and limitations.

3.1. Overall Design of the Study

This study is a survey study used for describing a large group of people's opinions about a topic or issue (Gay, Mills, & Airasian, 2006). Especially when the aim of study is to get a large population's views about a particular issue or topic, survey design offers advantages about asking a number of questions related to subject (Fraenkel & Wallen, 2003). There are two important reasons to choose survey research. The first one is to find out teachers' views on science and technology curriculum implemented by teachers. That is why a nation-wide study was performed. The other reason is that certain characteristics such as the faculties or departments teachers have graduated from affect their views (Fraenkel & Wallen, 2003).

As it is summarized in Figure 3.1, the study started with a conceptual framework based on the literature review. After identifying categorical variables such as gender, teaching experience, teaching field and graduation fields, sample selection was done. Next, the data collection instrument consisting of 3 main parts (I-demographic information, II- Questionnaire of science and technology teachers' views on science and technology curriculum and III- Participants' Views) was developed. While developing the questionnaire, the main changes in the science and technology curriculum were considered. After completing pilot study in 96 public primary schools in Ankara with the participation of 290 teachers, reliability and validity of the instrument was examined. Finally, data collection process got started after taking permission and support from ERDD in 26 different provinces around Turkiye. The instruments were sent to randomly selected 332 public primary schools and planned to reach 1328 teachers who taught science and technology curriculum. In other words, it was planned that 664 science and technology teachers and 664 classroom teachers would participate in the study. The sample was composed of 601 classroom teachers who are 4^{th} grade, 5^{th} grade or combination classroom teachers and 359 science and technology teachers. They were from 26 randomly selected provinces as defined by State Planning Organization (2003). After teachers filled out the instrument, 1167 completed instrument were sent back to ERDD by provincial national education directorates in each province. The researcher picked the instruments from ERDD office. Finally, the data set was prepared and statistical analysis was run. Confirmatory factor analysis was administered by means of Mplus student version 5.21. SPSS version 15.0 was used to calculate Cronbach alpha values to examine the internal consistency of the instrument subscales. Having checked the assumption of multivariate analysis of variance, MANOVA was administered.These steps were mentioned in following titles.

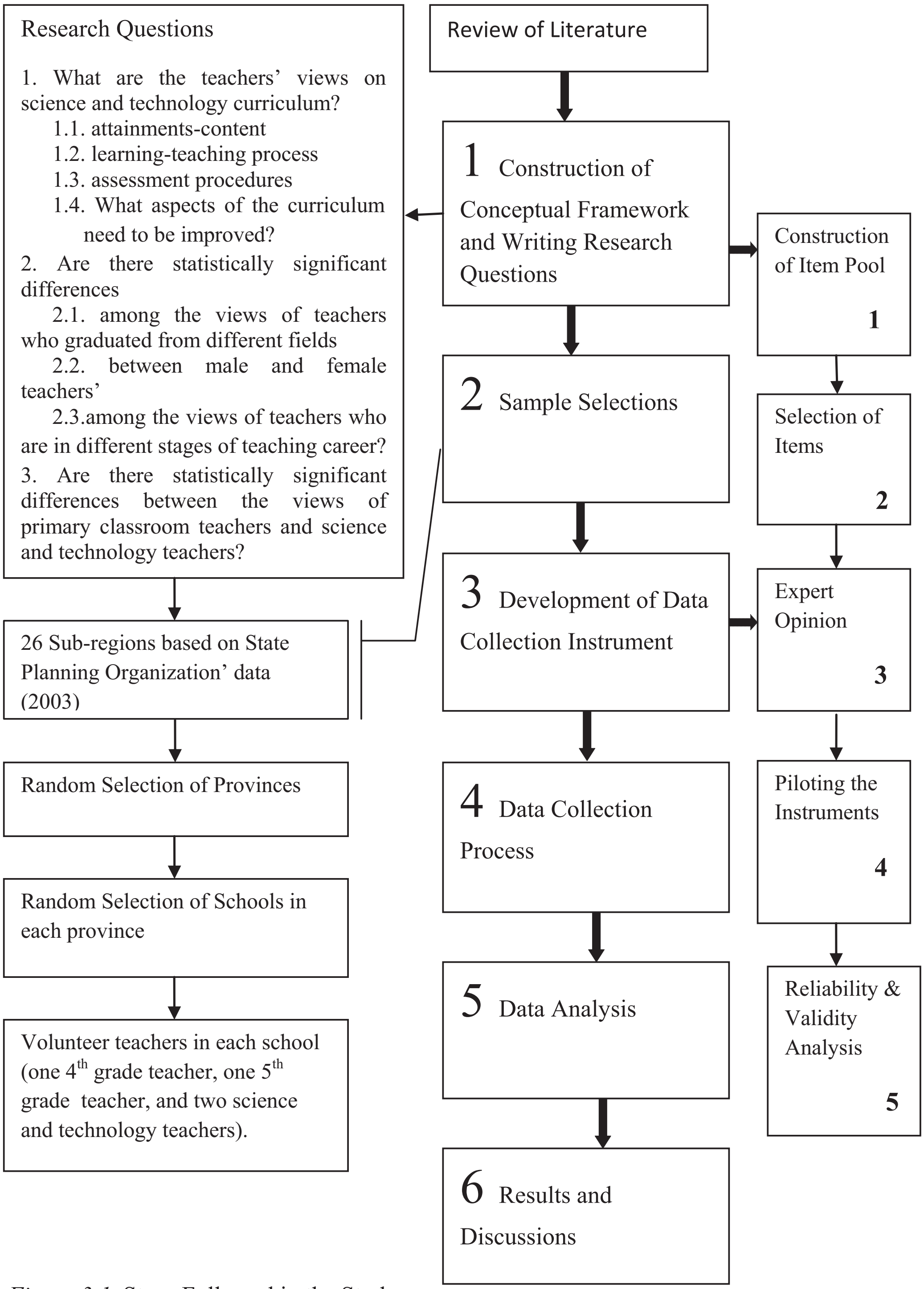

Figure 3.1. Steps Followed in the Study

3.2. Population and Sample

The population of the study was all primary school science and technology teachers in Turkey including 4th and 5th grade classroom teachers teaching science and technology. There were 3 main reasons behind selecting this subject. Firstly, the implementation of the new science and technology curriculum initiated nationwide in 2005-2006 education year. After 5 years has passed, teachers could had developed an in depth view about curriculum implementation, its positive aspects and limitations. Secondly, teachers' views directly affect the in-class implementation and their role is considered as a key in curriculum implementation (TekıÇık, 2005). Successful curriculum implementation could be done with successful implementers, who are teachers. Thirdly, the nature of the science and technology classes requires a variety of different equipment and a laboratory. However, not every school has the equal opportunities. So as to capture different views of teachers who work in different school, cities and areas, the sample was selected from 26 provinces (Table 3.1).

Table 3.1

The List of Selected Province in Each Region

Name of Sub-Region	Cities in the Sub-region	Random Selected Provinces	Number of primary School: Total number	Invited Schools
1. İstanbul sub-region	İstanbul	İstanbul	1616	35
2. Ankara sub-region	Ankara	Ankara	966	21
3. Konya sub-region	Konya, Karaman	Konya	951	20
4. Bursa sub-region	Bursa, Eskişehir, Bilecik	Eskişehir	237	5
5. Kocaeli sub-region	Kocaeli, Düzce, Sakarya, Bolu, Yalova	Yalova	65	1
6. İzmir sub-region	İzmir	İzmir	967	21
7. Aydın sub-region	Aydın, Denizli, Muğla	Aydın	481	10
8. Manisa sub-region	Manisa, Afyon, Kütahya, Uşak	Uşak	182	3
9. Tekirdağ sub-region	Tekirdağ, Edirne, Kırklareli	Edirne	153	3
10. Balıkesir sub-region	Balıkesir, Çanakkale	Balıkesir	538	11
11. Antalya sub-region	Antalya, Isparta, Burdur	Antalya	681	14
12. Adana sub-region	Adana, Mersin	Mersin	560	12
13. Hatay sub-region	Hatay, Kahramanmaraş, Osmaniye	Kahramanmaraş	777	16
14. Zonguldak sub-region	Zonguldak, Karabük, Bartın	Zonguldak	307	6
15. Kastamonu sub-region	Kastamonu, Çankırı, Sinop	Sinop	185	4
16. Samsun sub-region	Samsun, Tokat, Çorum, Amasya	Samsun	953	20
17. Kırıkkale sub-region	Kırıkkale, Aksaray, Niğde, Nevşehir, Kırşehir	Niğde	214	4
18. Kayseri sub-region	Kayseri, Sivas, Yozgat	Kayseri	558	12
19. Trabzon sub-region	Trabzon, Ordu, Giresun, Rize, Artvin, Gümüşhane	Ordu	455	9
20. Gaziantep sub-region	Gaziantep, Adıyaman, Kilis	Gaziantep	625	13
21. Şanlıurfa sub-region	Şanlıurfa, Diyarbakır	Diyarbakır	1127	24
22. Mardin sub-region	Mardin, Batman, Şırnak, Siirt	Mardin	672	14
23. Malatya sub-region	Malatya, Elazığ, Bingöl, Tunceli	Malatya	570	12
24. Van Alt Bölgesi	Van, Muş, Bitlis, Hakkari	Van	855	18
25. Erzurum sub-region	Erzurum, Erzincan, Bayburt	Erzurum	985	21
26. Ağrı sub-region	Ağrı, Kars, Iğdır, Ardahan	Iğdır	167	3
Total		26 provinces	14855	332

In order to determine a representative sample, some criteria were taken in consideration. Sağlam (2009) indicated that socio-economic and cultural characteristics of provinces had an important effect on science and technology classes' implementation. Some schools in some rural areas suffered from students' absenteeism because these students tend to be employed as seasonal workers (Sağlam, 2009). Additionally, physical facilities or infrastructure of schools made differences in the curriculum implementation (Beydoğan & Can, 2010). Lack of laboratory equipment or laboratory increased the difficulties in science and technology courses (Ekici, 2002). In order to realize successive implementations, firstly the teachers should accept and internalize the curricula (Ornstein & Hunkins, 1998). So as to reflect different views of teachers working in different socio-economic provinces, based on State Planning Organization data, 26 provinces were randomly selected in this nationwide study. Table 3.1 shows the sub-regions, the cities in the sub-region, randomly selected province in each sub-region and the number of public primary schools. In this category, the first column shows the total number of schools for the corresponding province. This number was taken from MONE Statistics 2008-2009 data (MONE, 2009). The second column indicates the number of schools invited for the study.

Among the 81 provinces, Tunceli had the least number of public primary schools in Turkey; 46 primary schools. While determining the sample, number of public primary schools in each randomly selected province was divided by 46, so that the member indicated how many public primary schools would be invited to the study from each of the 26 regions. In order to select the schools, a random selection was applied to the list of all the schools in each province. The names of the public schools in each province were written on a list and numerated. Than these numbers were written down on pieces of papers put in a plastic bag and randomly drown. Name of the schools were available in MONE's web-page. Totally 332 schools in 26 provinces were included in the study. The reason for random selection was to capture schools in urban (city center) and rural (county or village) areas in the sample. In this way, the schools and consequently teachers working in urban or rural schools could represent variety of aspects from around the country reflect different views because their schools had different physical facilities and equipments and the students with different backgrounds (Figure 3.2).

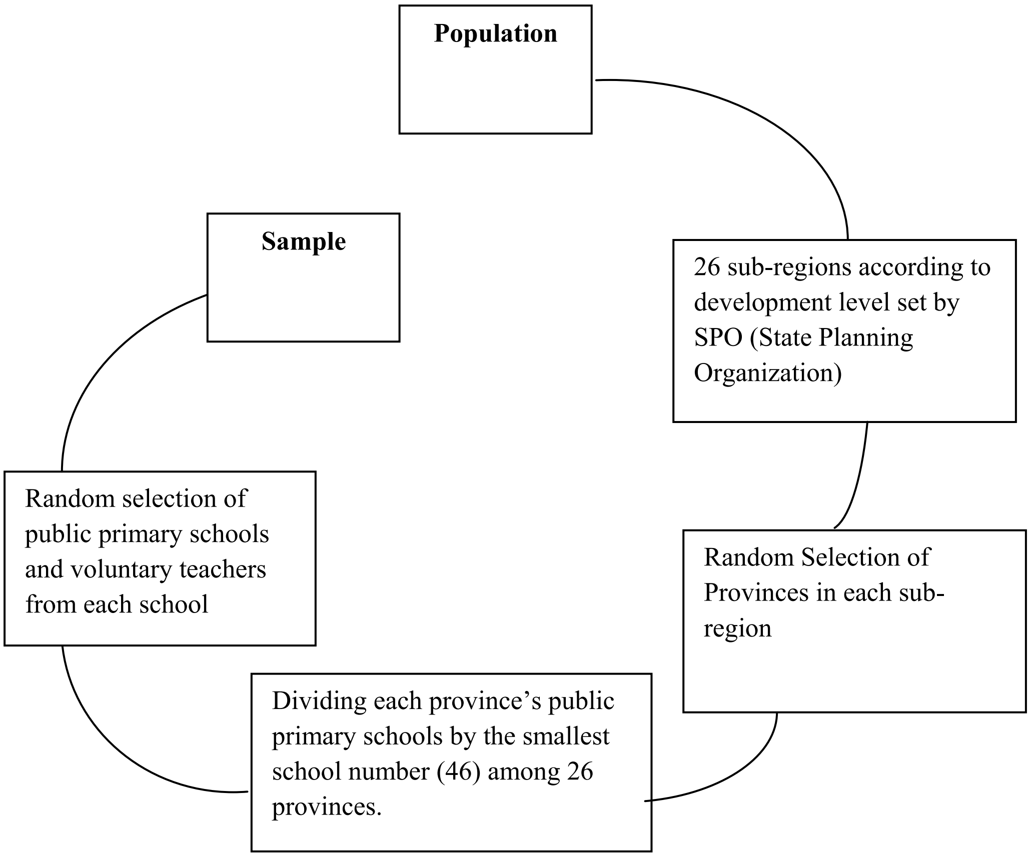

Figure 3.2. Sample selection cycles (adapted from Erdoğan, 2009)

Based on criteria procedure represented in Figure 3.2**,** the sample of the study was formed of 1328 teachers who taught science and technology classes in public primary schools. After loading the data to electronic medium and eliminating irrelevant ones, the sample size decreased to 960 teachers.

The characteristics of the sample are summarized in Table 3.2. Data were collected from 504 female (52.5%), and 454 male (47.3%) teachers. As for experiences of the participants, five categories were constituted based on Huberman (1989) Teacher Career Cycle Model. According to this model, teaching profession is a life-long process and it includes several stages following each other. Early years of teaching profession differ from person to person. The stages of the model start with Career Entry. The first three years of teaching profession constitute this stage. This is similar to Teacher Career Cycle Model by Wiesman and his colleagues (1999, as cited in Taneri, 2004). Among the 960 participants of this study, 177 (18.4%) participants were in their first stage. According to the model, the second stage is named as Stabilization and lasts from 4 to 6 years of teaching. In the study, 146 participants (15.2%) were in the Stabilization stage. The third stage usually occurs during years 7 to 18 of the teaching career and named as Experimentation or Diversification. Slightly fewer than half of the participants (*n*=434; 45.2%) were in the Experimentation Stage. This stage is followed by Serenity phase. It starts in the 19^{th} year of teaching profession and ends in the 30^{th} year. The cycle arrives at its conclusion with the Disengagement stage. This stage takes place in the 31^{st} year of teaching and beyond. In total 34 participants (3.5%) in this study were in the Disengagement stage.

Besides the questions demand for demographic information, the participants were also asked whether their schools had a usable science and technology laboratory or not as a part of this study. About 71.6% (n=687) of participants were working in schools with usable laboratory, whereas 27.5% of participants (n=264) indicated that their schools did not have a usable laboratory (Table 3.3). Moreover, it was found out that while 368 participants (38.3%) attended an in-service teacher training on newly developed curricula, 580 participants (60.4%) did not attend any in-service training (Table 3.4).

Table.3.2

Basic Characteristics of the Sample

Variables	*f (frequency)*	*% (percent)*
Gender		
Female	504	52.5
Male	454	47.3
Missing	2	.2
Teaching Field		
Classroom Teacher	601	62.6
Science and Technology	359	37.4
Experience		
1-3 years of experience	177	18.4
4-6 years of experience	146	15.2
7-18 years of experience	434	45.2
19-30 years of experience	160	16.7
31 and more years of experience	34	3.5
Missing	9	.9

Table 3.3

Existence of Usable Laboratory

	f (frequency)	*% (percent)*
Exist	687	71.6
Does not Exist	264	27.5
Missing	9	.9

Table 3.4

In-service Teacher Training

	f (frequency)	*% (percent)*
Attended	368	38.3
Not-attended	580	60.4
Missing	12	1.3

3.3. Data Collection Instrument

In order to collect data from the sample group of teachers, Teachers Views on Science and Technology Curriculum Instrument was developed by the researcher. It was composed of three parts. The first part was demographic information part. The second part was the questionnaire of science and technology teachers' views and consisted of 5 point Likert Scale items. The third and last part was composed of open ended questions. Development process was initiated with the literature review which is followed by a conceptual framework. The 5 steps followed in the development process are summarized in Figure 3.1. The steps were as following;

Step 1: Developing conceptual framework and reviewing related literature. This stage covers related national and international conferences' proceedings and journals.

Step 2: Analysis of 6th grade science and technology curriculum based on Posner's (1995) curriculum analysis questions.

Step 3: Writing items and constructing the instruments.

Step 4: Consulting expert opinion.

Step 5: Piloting the instrument in 6 districts of Ankara.

Each of these steps is explained respectively in the following sub-sections.

3.3.1. Step 1: Developing Conceptual Framework for the Questionnaire

The instrument development process is initiated by developing a conceptual framework. Substantial professional literature regarding curriculum change, formal, perceived and implemented curriculum, teachers' self-efficacy beliefs in the curriculum implementation, teachers' attitudes and beliefs toward change or curriculum were reviewed. It was concluded that the main challenges were limitation of schools' equipments (Gözütok 2005; Ekici, 2002), misconceptions on constructivist applications (Sağlam, 2009; Richardson, 2003), difficulties in complementary evaluation techniques (YaÇar et. al., 2005), changing roles of teachers and students (Gözütok, Akgün, & Karacaoğlu, 2005). While developing the instrument, these challenges were taken into consideration.

3.3.2. Step 2: Analysis of 6th Grade Science and Technology Curriculum

As the second step of the instrument development process, 6th grade science and technology curriculum was analyzed. The analysis procedure includes teachers' opinions as well. When the analysis was initiated, 6th grade science teachers have just started to implement the curriculum. Therefore, they experienced the difficulties and positive aspects of the curriculum. The aim of the 6th grade science and technology curriculum analysis was to determine main characteristics of the curriculum. In this step, researcher addresses Posner's (1995) curriculum analysis questions through using the documents provided on MONE's web-page (http://ttkb.meb.gov.tr/). In order to do so the following questions, based on Posner's (1995) curriculum analysis questions, were asked: a) how is the curriculum documented b) how is the curriculum developed c) what perspectives does the curriculum present d) what are the purposes and content of the curriculum e) how is the curriculum organized f) how is the curriculum implemented g) how is the assessment and evaluation done h) what are the strengths and weaknesses in terms of the curriculum and its implementation. The curriculum analysis served to development of the some questions in the instrument and helped understanding of the formal curriculum.

3.3.3. Step 3: Writing Items and Constructing the Questionnaire

In the light of information indicated in the previous 2 steps, an item pool was developed. The initial data collection instrument consisted of three main parts and 123 items. These items were grouped under four elements of curriculum; attainments, content, learning-teaching process, and evaluation as suggested by Demirel (2000). Additionally, items related to in-service training were added to the initial instrument based on literature review. The initial data collection instrument consisted of three main parts; part 1 including demographic information, part 2 including science and technology questionnaire, and the third part including open-ended questions.

Part 1: Demographic Information: This part of the instrument includes gender, high school, faculty, department participants graduated from, experience in teaching profession, cities they work in, the subject they teach, whether they have attended an in-service training program about the new curricula which has begun to be implemented nationwide in 2005-2006 academic year, and whether their schools have an usable laboratory and necessary equipment. As the ninth and final demographic question the grade they were teaching on the time of data collection was included.

Part 2: Science and Technology Questionnaire: This part of the instrument aimed to identify science and technology teachers' views on science and technology curriculum in this nationwide study. Initially, there were 123 items related to attainments, content, learning-teaching process, evaluation and in-service training. Although 123 questions were written, then, the numbers of items was reduced to 82 by focusing on the main aims of the study. Next, 11 items were excluded again due to wording and long sentences. The other reason for excluding was overlap statements. The questionnaire that would be sent to experts for experts opinions included 71 items.

Part 3: Open-Ended Questions: The third part was formed of open-ended questions to elicit in-detail information and support the second part by taking participants' opinions on attainments, content, learning-teaching process and assessment. Another purpose of this part was to determine the basic factors that affect teachers' views like the infrastructure of schools and resources in the classes. The questions in this part went along with the items covered in the second part of the draft questionnaire.

3.3.4. Step 4: Expert Opinions

Before the pilot study was conducted, 10 experts from different areas of specialization (counseling, curriculum and instruction, science education, science and technology course) reported their opinions about the 71 items questionnaire. Experts' were asked to examine the draft questionnaire in relation to the purpose of the study, clear wording, content of the 71 item scale, and the length of the questionnaire.

Based on the feedback received from experts, among 71 items, a total of 21 were eliminated from the questionnaire based on expert opinions and suggestions. Considering the attainment section, 11 items were approved by the experts and 3 items were eliminated. One of which was "Determining attainments based on learning areas (Science- Technology- Society- Environment) make no differences in implementation". The item was eliminated because experts clarified that the item had two different judgments; one was related to determination of the attainments, and the other which was regarding making differences in implementation process. Another criticism was related to the ignorance of „attitude' and „Scientific Process Skills' learning areas. Another eliminated item in attainments was "Target attainments' accomplishment could not be assessed". The wording of it was found inconceivable. Another dropped item in attainments section was "No matter what the individual differences, every child can be science literate'. Since the term „science literate' was found unclear, this item was dropped as well.

As for content section, 12 items were written before consulting expert opinion. "I like the way the flow of the subject goes from hard to easy, from complex to simple" was dropped item by reason of assumption. Whether it is really flow complex to simple or hard to easy was arguable according to one expert's opinion. Two other dropped items written under the "content" section were found irrelevant with the aim of the questionnaire. The items were regarding general attitudes towards science. Finally, the initial instrument including 9 content items was prepared for pilot study.

The third section was related to learning-teaching process in the initial instrument. Firstly 32 items were written. After consulting expert opinion the number of the items dropped to 21, in other words 11 items were eliminated. The reasons of the elimination were summarized under four reasons. The first one, the three items were related to effects of the in-service training and some participants might have not attended in an in-service teacher training programs. For example, "in-service training met teachers' needs to practice curriculum" was eliminated. The second one, some items were about undergraduate education and these questions could not be evaluated under learning-teaching process section. For example, the item of "my undergraduate education is ineffective to practice constructivism in the classroom" was eliminated because undergraduate education is composed of several factors and which factor would be insufficient might cause conflict in the participants' mind. In addition, this item was not related to learning-teaching process directly. The third one required a frequency scale and it was necessary to change scale from agree-disagree scale to always-never format. Fourth and last one is that two items were evaluated as unclear items and deleted from the initial instrument.

As the last section, evaluation items include general views towards assessment and the views towards "complementary" assessment methods suggested in the curriculum. Before consulting expert opinions, there were 16 items. After being analyzed by the experts, 12 items regarding assessment section were placed in the instrument for the pilot study. "I try to get information about new assessment methods/techniques suggested in the curriculum" item was not found convenient with the "agreement-disagreement" scale. The item requires scale ranging from always to never. „Project work assesses parents' performances instead of students' performances' item was eliminated because the item was based upon an assumption. The item „The actual time devoted to complementary assessment methods/techniques such as concept maps, performance works, or portfolio assessment' was commented as multidimensional. Therefore, the item was eliminated.

In order for the participants to express additional views, open-ended question had been written. The experts examined the 3rd part, consisting of open-ended questions. One of the questions was „if there are any positive or negative aspects of the content of the science and technology curriculum please write'. In light with the experts' opinions the question was changed as „Could you write the positive and if there is any limitation of content section of science and technology curriculum'. Additionally, the last question was changed to „In general, please write if there is anything you would like to add' by deleting „Could you write what you would like to add'.

As a result, after going through the experts assessment the data collection instrument consisted of three main sections: The demographic information section includes 9 questions, the second section, the questionnaire, was composed of 50 items organized on a 5 points scale ranging from strongly agree (5) to strongly this agree (1) and the third section was composed of open-ended questions.

In the end, the whole instrument (Appendix A) was submitted to Middle East Technical University (METU) Human Subject Ethics Committee for the approval. It was examined by the committee and it was concluded that the instrument did not include any ethical violation and it was approved to be administered in schools. Then, the instrument and a list including schools names were submitted to Ministry of National Education Research and Development Directorate and the researcher got a permission letter to administer instrument to volunteer science and technology teachers for the pilot study purposes in Ankara.

3.3.5. Step 5: Pilot Study of the Questionnaire

In order to get reliable results in the pilot study, the method would be used in the main study, was tried to be adopted in the pilot study. The distribution of schools in each SES level was similar in the pilot study and the main study. Based on

Turkish Statistical Institute Central Population Administration System (MERNIS) (2007) data, schools in different Socio-Economic Status (SES) in Ankara were listed. In the list, each school's SES level, addresses of schools including district were stated. In total, 27270 schools existed in Ankara, 6902 of those schools were in "undeveloped" level, 14724 of those were in "underdeveloped" level and 5645 schools were in "developed" level (MERNIS, 2007).

First of all, some districts except for central districts of Ankara were eliminated because the focus was not where the school is, the point was to what SES level school belongs to. Numbers of schools, which had been written in the data, were written under each SES level on a paper. Then easily accessible schools for the researcher were listed again and the pilot study data was collected from these schools. Firstly, 162 schools were selected from 3 different socio-economic status and the researcher can visit 96 schools until end of the semester. From 32 schools in each SES level, a total of 96 schools were visited from 6 different central districts in Ankara. In order to get statistically acceptable size for the questionnaire, number of items were multiplied by 10 (N/p> 10) as Hair (et. al. 1998) suggests. According to Tabachnick and Fidell (2007) 5 times more than number of item in the questionnaire was acceptable as satisfactory.

The researcher went to each school and explained the aim of the study to principals of the schools and the teachers who covered science and technology courses. Pilot study was realized with 290 teachers working in 96 public primary schools. 201 of whom were female (69.3%) and 89 of whom were male (30.7%) teachers. In terms of teaching field, 220 classroom teachers and 70 science and technology teachers who voluntarily participated responded to the questionnaire.

3.4. Validity and Reliability of the Data Collection Instrument

As a general definition, validity refers to the appropriateness, correctness, meaningfulness and usefulness of the inferences researchers makes from the collected data (Fraenkel & Wallen, 2003; p. 159).

Evidences for validity involve content validity, criterion-related validity and construct validity. Content validity reflects the degree a measurement is parallel with the intended domain and the degree of match between the questions and the research subject (Carmines & Zeller, 1991). In this study, in order to provide content validity, 10 expert's opinions were obtained in the study. Experts were asked to specify their opinions about logical format of the instrument, directions and relevancy of the items, clarity of the items and whether the instrument covered adequate sample of intended content as it was explained under expert opinion heading.

Construct Validity refers to the nature of the psychological construct or characteristics being measured by the instrument (Fraenkel & Wallen, 2003). In terms of Construct validity, factor analysis was run.

Before running factor analysis, whether the required assumptions provided were proved. Normality of each variable was endured with the acceptable level of (-3.29 +3.29) skewness and curtosis values. Outliers and omitted items were checked. If the missing items are more than 10% in the whole questionnaire, the items were not analyzed. (Tabachnick & Fidell, 2007). In data set, 19 univariate outliers were excluded.

Appropriateness of data was examined with Kaiser Meyer Olkin test (KMO) which is used for measuring whether data distribution is adequate for performing factor analysis. The acceptable minimum level of KMO is suggested as .60 (Tabachnick & Fidell, 2007). In this study, KMO yielded a value of .81 (Field, 2005), indicating that the data is appropriate in order to use factor analysis. In addition to the KMO test, Barlett's test of Sphericity was used to test whether correlation matrix is an identity matrix in which there are no correlations among the variables (items). In other words, Barlett's test of Sphericity is a test statistics used to examine the hypothesis that the variables are uncorrelated in the population (Field, 2009). In the current study, Barlett's test of Sphericity revealed a statistically significant value by rejecting the null hypothesis, $x^2 = 2273.578$, $p<.0001$, indicating that the items of the questionnaire are correlated in a way which is appropriate for running factor analysis.

Common factor analysis and oblimin rotation factor analysis were used. The analysis revealed 4 factors with eigenvalues greater than 1.0 (Hair, Anderson, Tatham, & Black, 1998). Eigen values and how many percent of the variance is accounted for the factors was explained in Table 3.5 which summarized the factor names, eigenvalues and variance of each factor. The screeplot showed 3 sharp descents that mean the instrument consists of 3 factors and three-factor structure of the instrument explained 44% of the total variance.

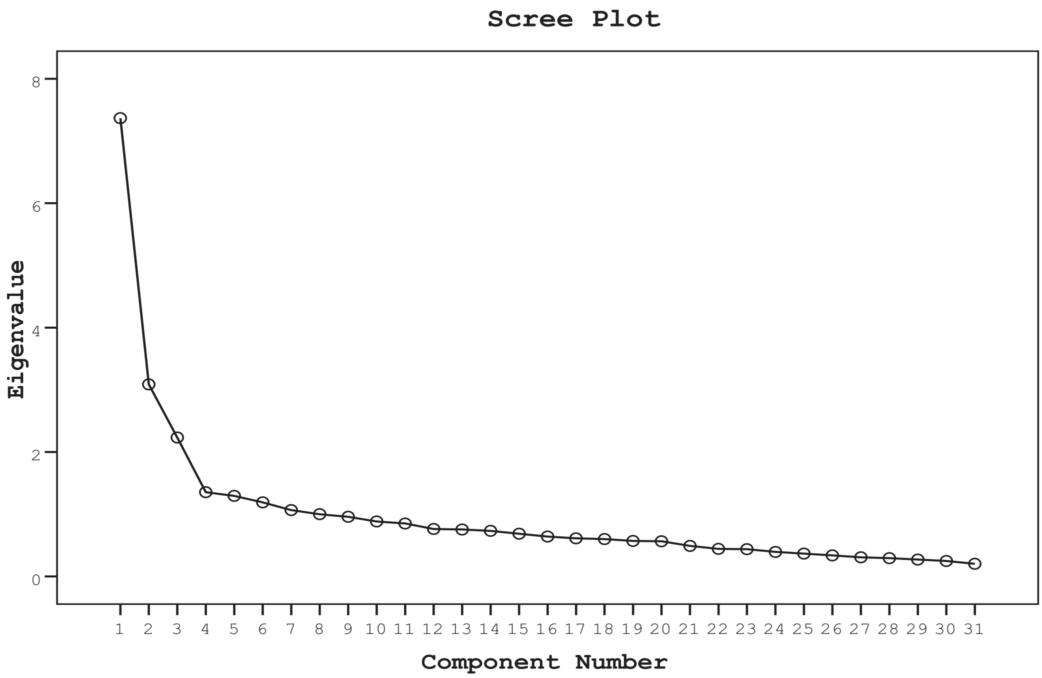

Figure 3.3. Scree plot for the pilot study

Table 3.5

Factor name, abbreviations, eigenvalues, and variance of factors

Factor Name	*Eigenvalues*	*% of variance*
Attainment and content	7.4	24.1
Learning-teaching process	3	11.1
Assessment and evaluation	2.4	8.8

Table 3.6

Factor Loadings

Item number	Factor Loadings		
	Factor 1	*Factor 2*	*Factor 3*
Item13 (AC)	**.75**		
Item1(AC)	**.73**		
Item5(AC)	**.72**		
Item18 (AC)	**.71**		
Item 15 (AC)	**.68**		
Item 26(AC)	**.67**		
Item 2 (AC)	**.66**		
Item 24 (AC)	**.66**		
Item 16 (AC)	**.66**		
Item 27 (AC)	**.65**		
Item 14 (AC)	**.56**		
Item 25 (AC)	**.53**		
Item 8 (AC)	**.42**		
Item 4 (AC)	**.41**		.
Item 3 (AC)	**.36**		
Item 17 (AC)	**.34**		
Item 20 (LTP)		**.68**	
Item 19 (LTP)		**.65**	
Item 7 (LTP)		**.52**	
Item 30 (LTP)		**.51**	
Item 28 (LTP)		**.48**	
Item 31 (LTP)		**.46**	
Item 6 (LTP)		**.46**	
Item 12 (LTP)		**-.37**	
Item 9 (LTP)	.	**.35**	
Item 22 (A)			**.85**
Item 11 (A)			**.63**
Item 21 (A)			**.62**
Item 29 (A)			**.33**
Item 10 (A)			**.32**

As it was shown in Table 3.6, the items were loaded in three factors. Totally 16 items were loaded in first factor, 9 items were loaded in second factor, and 5 items were loaded in third factor. After the factor analysis, item parceling was done to confirm the factor analysis. Items with factor loading less than .30 were not considered for the analysis. Shevlin and Miles (1998) identify three level of factor loadings which are acceptable for statistical analysis; low factor loading (.30), medium (.50) and high (.70).

3.5 Item Parceling

There are different definitions about item parceling. As a general description' item parceling is applied for computing total score across a group of homogenous items (Bandalos, 2008) or averaging item scores from the scale with two or more items in SEM analysis (Kline, 2005). Additionally, item parceling is also applied for several other reasons in empirical studies (Bandalos, 2008; Tempelaar, Schim Van Der Loeff, & Gijselaers, 2007). One of the reasons is to get more continuous and normally distributed data. Reducing the number of model parameters and obtaining more stable parameter estimates are among the other reasons.

Having run item parceling, a confirmatory factor analysis was performed to assess the three-factor structure of the Teachers Views on Science and Technology Curriculum Instrument (TVSTC). These factors were attainment-content, learning- teaching process, and evaluation. Mplus student version 5.21 was used to run confirmatory factor analysis. SPSS version 15.0 was used to calculate Cronbach alpha values to examine the internal consistency of the instrument subscales.

As it was indicated before, initially an item parceling procedure was adopted so as to obtain more continuous and normally distributed data (Bandalos, 2008). The subscale items were divided and averaged into parcels by balancing Skewness and Kurtosis values of the items.

All of the items in each subscale were divided into three parcels as suggested by Kline (2005) who suggested that at least 3 parcels be constituted and in each parcels 3 or 4 items be included (Kline, 2005). Each item parcel was allowed to load on its hypothesized factor. It was assumed that factors of the questionnaire are related. Covariation among the item errors was not allowed.

The analysis resulted in a χ^2 of 97.14 with 17 degrees of freedom, $p<.05$. In addition to model chi-square, Comparative Fit Index (CFI), Root Mean Square Error of Approximation (RMSEA), and Standardized Root Mean Square Residual (SRMR) fit indices were inspected. Values of these fit indexes were: CFI= .98, SRMR= .03 and RMSEA= .07 with a confidence interval of .06 to .08. These values exceeded those recommended by Kline (2005). CFI makes the variables independent from each other and the range of CFI is between 0 and 1. According to Marsh (1995); the acceptable scores is .90. Hu and Bentler (1999), suggest to accept CFI scores .95 and above. The scale used in this study, satisfies both of these conditions.

Standardized estimates of parameters indicated that each of the parcels was loaded on its hypothesized factor strongly and statistically significantly, indicating convergent validity (Figure 3.4).

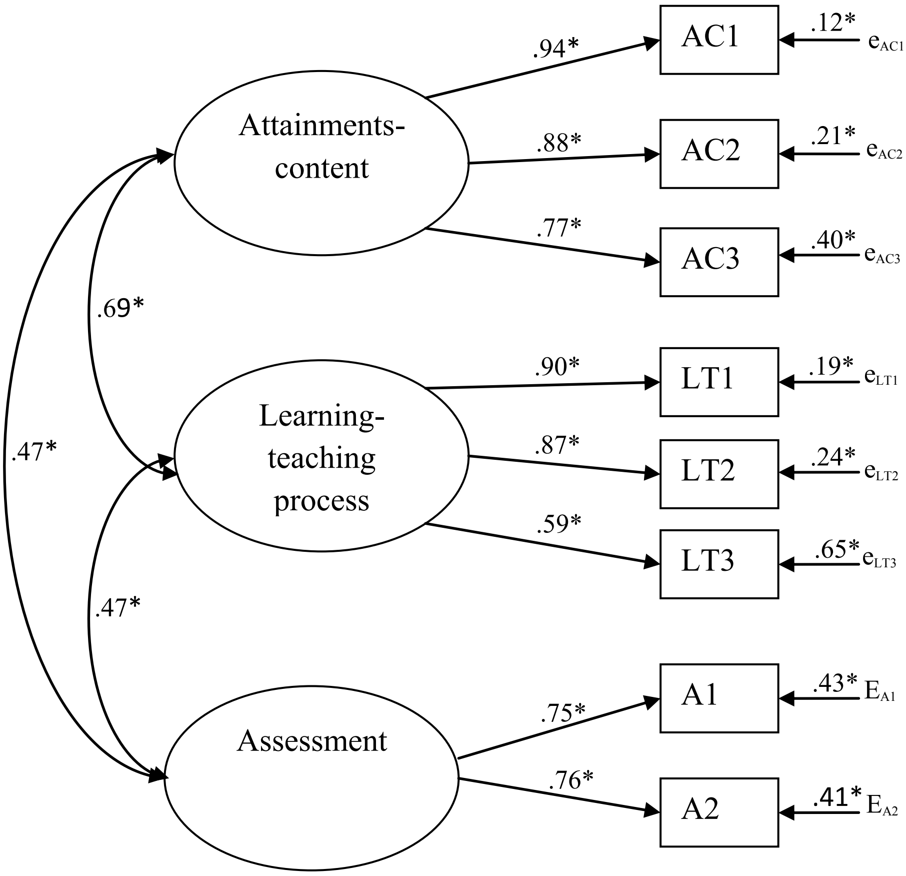

Figure 3.4. Standardized parameter estimates, *p<.05

As for reliability of the study which means consistency of scores (Fraenkel & Wallen, 2003), reliability coefficient was used. Cronbach alpha reliabilities calculate the correlation of one item with the other item in an instrument. Cronbach alpha correlation of the instrument was found .81. When reliability was calculated for the each factor, reliability (α) of factor I (Attainment and Content) was found .89, reliability (α) factor II (Learning-Teaching Process) .73 and reliability (α) of factor III (Assessment) was found .67. When we looked at the correlation among factors, attainment and content component and learning teaching process (r=.13, p<.05) and assessment (r=.30, p<.05) component were found statistically significant and positive.

Tablo.3.7.

Correlation among factors

	Factor 1	*Factor 2*	*Factor 3*
Attainment and Content	-		
Learning-teaching Process	.14*	-	
Assessment	.30*	-.01	-

*p<.05

Pearson correlation coefficient (r) shows the relationship among items and the value between .10 and .30 show "low relationship" and the value between .30 and .50 show "medium relationship" (Cohen, 1988). When Table 3.6 was examined, most of the factors were correlated with each other and the correlation changes between low and medium.

As for qualitative part of the study, firstly data were saved in SPPS version 15.0 as string data. The themes were predetermined as attainments, content, learning-teaching process and evaluation. In other words, open-ended questions were analyzed through coding-based content analysis. Validity have same mean with quantitative research; the degree to which a test measures what it is intended to measure (Gay, Mills, & Airasian, 2009). There are several strategies for ensuring the validity of qualitative data. One of them is related to credibility criteria and peer debriefing was used in this study (Gay, Mills, & Airasian, 2009). Data coding was done by the researcher and then another person analyzed a selected sample of raw data. In the end, findings of the two people were compared and differences were discussed till a common understanding was developed as suggested by Maxwell (1996).

After pilot study, it was seen that the instrument was composed of 3 factors based on construct and content validity analysis. Reliability analysis showed that items and sub-dimension of the instrument leads to reliable results to determine teachers' views on science and technology curriculum. It was concluded that newly developed instrument can be used to determine teachers' views.

3.6. Data Collection Procedure

First of all, the names of the public schools in randomly selected provinces were listed after the researcher screened the list for controlling newly opened or closed schools. So as to draw a valid sample group from the population, web pages of provincial national education directorate and schools were examined. After determination of schools, schools' webpage was checked and if the webpage was not prepared, the communication links were found in web pages of provincial directorate and schools were called whether they are open or closed. After that, proposal was offered to Ministry of National Education, Educational Research and Development Directorate (E. R. D. D. [E. A. R. G. E. D.]) for support. ERDD distributed the instrument to 332 randomly selected public schools in 26 provinces. Having got permission, the instruments were sent to schools to be filled out by classroom teachers and science and technology teachers. As it is explained before Overall Design of the Study in Chapter III, the instruments were mailed to provincial directorates of national education including list of schools by ERDD. In each school two science and technology teachers, one 4^{th} grade and one 5^{th} grade teacher were asked for completing the questions. The criterion for the selection of the teachers was the voluntariness. The school principals administered the instruments to teachers. If one science and technology teacher was working in the school, the instrument filled out by only one science and technology teacher. Data were collected in May and in less than two months period the completed questionnaire were sent back to ERDD by the principals of schools and the researcher received the completed instruments. In total 1328 instruments were sent to schools and 1167 instruments were sent back. Return rate was 87.8%. Among those completed instruments, 960 instruments were take into analysis because some instruments were not appropriately completed by the participants. Additionally, the principals of three schools in Istanbul copied only one face of the instrument although some questions exist on the other side of the instrument and give them to participants. These incomplete instruments were eliminated.

3.7. Data Analysis

Firstly, the data cleaning and screening process were performed to determine missing values. Tabachnich and Fidell (2007) suggested eliminating the data set which includes non-replied items more than 10% of the total item number. In questionnaire there were 31 items, if the participant did not answer more than 3 items in the second part of the instrument, the data was eliminated and was not analyzed. In other words, cases which have more than 10% missing data were eliminated from the analysis by means of listwise method. The statistical procedure was carried out by means of Statistical Package for Social Sciences (SPSS) version 15.0 software. Data in Demographic Information Part was analyzed with descriptive statistics including means, standard deviations, frequencies and percentages. Confirmatory factor analysis was performed with Mplus student version 5.21 to confirm the factors and items' loads found in the exploratory factor analysis. In order to find answers of research questions, MANOVA was performed.

In order to support and complement the quantitative data, open-ended questions were qualitatively analyzed. Firstly open-ended questions were recorded in SPSS version 15.0 as nominal data and then content analysis was started. The researcher examined the type of responses provided by participants, and sub-categories were formed based on data. The related answers were clustered together, and a non-participant researcher expert in qualitative research provided external checks.

3.8 External and Internal Threats

Every research has some limitations besides strengths. The limitations of the study were presented in two headings, external and internal validity threats.

3.8.1. External Validity Threats

The extent to which the results of a study can be generalized determines the external validity (Fraenkel & Wallen, 2003, p.109). In order to represent the population, sample selection is very important. In the study, 332 public schools were selected randomly based on province's SES level. Therefore, different characteristics of schools and learning environment had been represented in the sample.

3.8.2. Internal Validity Threats

The effect of different variables tried to be eliminated (Fraenkel & Wallen, 2003). There might be four internal threats of the study. Firstly, subject characteristic (selection bias) tried to be eliminated by trying to reach different teachers who are working in different schools with different SES level to reflect general views. Gender and teaching experiences were among variables of the study.

Mortality (loss of subject) might be another threat due to unwillingness, the necessity to deal with other activities in a daily school day. This threat was controlled by writing "whenever you want you can leave filling out the instrument" on the consent form. Additionally, they have approximately 3 days to fill out; that means they have chance to reflect their views when they have time. Additionally, the communication with the principal of schools was provided with the help of ERDD. During the pilot study, the participants complained about that their views would not be taken into consideration and would not affect the implementation process of the educational decisions on curriculum and their views would be considered only by the researcher. Because the study was supported by ERDD, the participants feel responsible for reflecting their own views. They may motivated by the thought that their views could improve some limitations they encounter. Therefore, they were willing to participate in the study.

Location was eliminated by offering time to apply the instrument. Where the participants feel comfortable, they have opportunity to fill out the instrument. Data collector bias was tried to be eliminated as well. During the pilot study, data was collected by the researcher and in the main study school principle gave the instrument to participants. The instrument was not including any question related to school administration; teachers might feel the „principle of voluntariness' was violated. The difficulties teachers might encounter in the administration process were unknown by the researcher.

3.9 Limitation of the Study

In the light of this study, some limitations could be considered. When participants reflect their own views, they may reflect „what should be thought in line with the ideal curriculum practices' instead of their real views.

CHAPTER 4

RESULTS

The present chapter includes the results of the statistical analysis. The chapter begins with data screening followed by the results of descriptive and inferential statistical analysis as related to research questions of the study.

4.1. Data Screening

In order to answer the research questions of the study descriptive statistics and MANOVA were run. Necessary assumptions were checked before running MANOVA analyses. These are missing data, influential outliers, multivariate normality, and homogeneity of variance.

4.1.1. Missing Data

Data were examined in terms of the pattern of missing data distribution. There were no variables with higher than 4% of missing data. As this amount of missing data was accepted as ignorable no specific method was used to deal with missing values (Hair, Anderson, Tatham, & Black, 1998).

4.1.2. Influential Outliers

Outliers are observations with a combination of characteristics which is different from the other observations (Hair, Anderson, Tatham, & Black, 1998). In the study, mahalanobis distance was used to detect whether there are any influential outliers in the data set. Results revealed that five cases exceeded the critical value, $F(31,748) = 31.75$, $p<.05$ (Appendix B). The analyses were done with and without deleting outliers. As there were no differences between the results, complete data set was used throughout the study.

4.1.3. Multivariate Normality

Multivariate normality is an assumption on whether data set comes from a multivariate normal population (Rencher, 2002). Mardia's test was used to examine multivariate normality. The test revealed a significant result indicating non-normal multivariate distribution. However, the F statistics is robust with respect to Type I error against non-normality (Stevens, 2002); and the sample size is very large to carry out the MANOVA analysis. The sample size requirement for each cell is at least the number of dependent variables. For this study, graduation field is among the independent variable. Teachers who graduated from elementary classroom teaching, teachers who graduated from elementary science teaching, teachers who graduated from the faculty of arts and sciences, and teachers who graduated from fields other than the first three groups, and each is defined as one cell. Exact recommendations for sample size range from a minimum of 20 observations per cell to one in which the sample size of the smallest group is somewhere between 6 and 10 times the number of dependent variables (Swanson & Holton, 2006). For this study, in each cell more than 20 participants exist as prescribed by Swanson and Holton (2006). Additionally, there are 3 dependent variables which are attainments-content, learning-teaching process and assessment. When calculating the smallest number which should be greater than 6-10 times of the dependent variables, 18-30 participants should exist in each cell. In the study, graduation field (elementary classroom teaching [n=412], elementary science teaching [n=218], faculty of arts and sciences [n=118], and other fields [n=203]), Teaching Fields (Classroom teachers [n=601] and science and technology teachers [n=359]), gender (female [n=504] and males [n=454]) and teaching experiences (0-3 years [n=177], 4-6 years [n=146], 7-18 years [n=434], 19-30 years [n=160] and 31 and more years [n=34]) are the independent variables and the number of participants in each cell was presented in the parenthesis. As the sample size is 960 and the smallest number of sample size in each cell is 34 in the current study, it is assumed that the non-normal distribution of data would not affect the results of the MANOVA analyses.

4.2. Characteristics of the Participants

In order to investigate the characteristics of the participants in terms of gender, teaching field, graduation field, and teaching experience descriptive statistics was performed. The characteristics of the participants were already presented in Method Part (Chapter III) and summarized in this section.

Among 960 teachers who voluntarily participated in this study, 504 were female (52.5%), and 454 (47.3%) were male teachers, and two teachers did not specify their gender (0.2%).

As for teaching field, 601 teachers (62.6%) were classroom teachers teaching in 4^{th} or 5^{th} grades and 359 teachers (37.4%) were science and technology teachers. Although one teacher specified his teaching field as science and technology, he emphasized that he was teaching science and technology courses in 4^{th} and 5^{th} grades as well.

As for the graduation field, participants were grouped into four; the first group was composed of teachers who graduated from elementary classroom teaching (43.3%, *n*=412). The second group was formed of participants who graduated from elementary science teaching (22.9%, *n*=218), the third group consisted of participants who graduated from the faculty of art and science (12.4%, *n*=118), and the last group was comprised of participants who graduated from fields other than these stated in the first three groups (21.3%, *n*=203), namely the *other group*.

In relation to the teachers' teaching experiences, the average years of teaching were 11.6 and the standard deviation of 8.5 of the whole group. In this study, 177 participants were in the first stage, in other words in the Career Entry Stage (0-3 years teaching experience) of teaching cycle, 146 participants were in the Stabilization Stage (4-6 years of teaching experience); 434 participants were in the Experimentation-Diversification Stage (7-18 years of experience). There were 160 participants in the Serenity Stage (19-30 years of experience), and 34 participants were in the Disengagement Stage (30 or more years of experience). The numbers and percentages presented in Table 4.1 summarize the distribution of participants according to their career stages. As seen in Table 4.1, most of the teachers were in the Experimentation-Diversification Stage (7-18 years of experience).

Table 4.1.

Frequency and Percentages of Teaching Experience (n=960)

Teaching experience	*Name of the Stage*	*n*	%
0-3 years	Career Entry Stage	177	18.4
4-6 years	Stabilization Stage	146	15.2
7-18 years	Experimentation-Diversification Stage	434	45.2
19-30 years	Serenity Stage	160	16.7
30 and above	Disengagement Stage	34	3.5
Missing		9	.9

Whether there was a usable laboratory in their schools were also asked to participants. While 687 (71.6%) teachers stated that there was a usable laboratory in their schools, 264 (27.5%) teachers stated that their schools did not have a usable laboratory. Nine (9%) teachers did not specify the existence of usable laboratory in their schools.

4.3. Teachers' Views on Science and Technology Curriculum

The first research question of the study was stated as; what are the teachers' views on science and technology curriculum? This question was broken into five sub-questions: What are the teachers' views on the attainments-content of science and technology curriculum? b) What are the teachers' views on the learning-teaching process of science and technology curriculum? c) What are the teachers' views on the assessment procedure of science and technology curriculum? d) How could the science and technology curriculum be improved? Overall results regarding the first research question, presented as mean and standard deviation, are summarized in Table 4.2. The results indicated that teachers had positive views (agree and totally agree) on attainments-content, learning-teaching process and assessment. Results for each sub-question are presented under separate sub-title.

Table 4.2.

*Mean and Standard Deviations of the Subscales of Teachers' Views on STC** (n=960)*

	M^*	SD
learning-teaching process	4.42	.60
assessment	3.58	.83
attainments and content	3.99	.64

*calculated out of 5.
**Science and Technology Curriculum

4.3.1. Teachers' Views on Attainments and Content

The first sub-question of the first research question was stated as: "What are the teachers' views on attainment-content component of STC (Science and Technology Curriculum)." This component included 16 items (1, 2, 3, 4, 5, 8, 13, 14, 15, 16, 17, 18, 24, 25, 26, and 27). Descriptive data analysis indicated that, overall, teachers' views were positive (agree) (*M = 3.99, SD = .64, n = 960)* about the attainments and content of STC. General mean of attainment-content was *M*=3.99 showing that participants agree with the aspects of the attainments. Table 4.4 shows descriptive analysis results for each item in attainment-content component.

The participants „totally agree' that "attainments of the curriculum have been clearly expressed" (item 27) (*M=4.21, SD=.93, n=940*). The participants who agree (42.4%, *n*=397*)*, and totally agree (*44.4%, n=417)* constituted the majority of the respondents. Overall, most of the participants (86.8%, *n*=814) found the attainments clearly expressed. On the contrary, 8.4% (*n*=79) of the participants disagree (strongly disagree and disagree), and 5% of the participants (*n*=47) neither agree nor disagree about clarity of the attainments.

The results of items 26 showed that teachers agree that "the attainments are feasible" (*M=4.16, SD=.87, n=955*). Slightly less than half of the participants agree (*49.5%, n = 473*) and 37.2% of the participants (*n=355*) totally agree on the feasibility of the attainments. In other words, 86.8% (*n=828*) of the participants have positive views (agree and totally agree) while 6.8% (*n=65*) of the participants disagree (strongly disagree and disagree) and 6.5% (*n=62*) of the participants neither agree nor disagree on feasibility of attainments.

Result of item 1 showed that 86.3% (*n=817*) of the participants agree (agree and totally agree) that experiments were determined in accordance with the attainments (*M=4.08, SD=.97, n=947*). On the other hand, 11.5% (*n=109*) of the participants disagree (totally disagree and disagree), and 2.2% (*n*=21) of them neither agree nor disagree about the harmony of experiments and the attainment.

Teachers 'agree' on that „it is possible to assess to what degree students' achieve the attainments' (item 8) (*M=4.04, SD=.85, n=949*). Among all of the participants who answer the question, *85.2% (n*=809) of the teachers agree (totally agree and agree) that it is possible to assess what degree students' achieve the attainments. On the hand, 7.5% (*n*=71) of the participants disagree (strongly disagree and disagree) and 7.3% (*n*=69*)* of the teachers neither agree nor disagree about the possibility of assessing to what degree students achieve the attainments.

Next, item (item 18) was related to appropriateness of the attainments for students' level. Overall, teachers agree that attainments are appropriate for students' developmental stages (*M =4.18, SD=.91, n=953*). In general, the result indicated that most of the participants (*85.3%, n*=813) agree with the appropriateness of attainments for students' level. On the other hand, 7.4% (*n*=70) of the participants disagree (totally disagree and disagree) and 7.4% (*n*=70) of the participants stated their views as neither agree nor disagree.

Table 4.3
Attainments-Content Component of STC

Item	*n*	Strongly Disagree		Disagree		Neither agree nor disagree		Agree		Strongly Agree		*M*	*SD*
		f	%	*f*	%	*f*	%	*f*	%	*f*	%		
1. The experiments in science and technology curriculum are determined in accordance with the attainments.	947	21	2.2	88	9.3	21	2.2	478	50.5	339	35.8	4.08	.97
2. The activities are beneficial for learning	948	19	2	94	9.9	40	4.2	421	44.4	374	39.5	4.09	1
3. School facilitates are enough to achieve the attainments	946	179	18.9	216	22.8	70	7.4	332	35.1	149	15.8	3.06	1.4
4. Subjects of science and technology course can be covered in the suggested time	959	91	9.5	153	16	42	4.4	340	35.5	333	34.7	3.70	1.34
5. The content of the science and technology curriculum is sufficient	957	39	4.1	113	11.8	70	7.3	456	47.6	279	29.2	3.86	1.09
8. It is possible to assess to what degree students' achieve the attainments	949	15	1.6	56	5.9	69	7.3	546	57.5	263	27.7	4.04	.85
13. The content of the curriculum are appropriate for students' level	955	22	2.3	76	8	46	4.8	384	40.2	427	44.2	4.17	1
14. Science and technology curriculum is associated with the other courses sufficiently	952	17	1.8	98	10.3	103	10.8	483	50.7	251	26.4	3.9	.97
15. Science and technology are integrated sufficiently in the curriculum.	941	15	1.6	84	8.9	100	10.6	512	54.4	230	24.4	3.9	.92
16. The experiments are determined in accordance with the content	954	13	1.4	55	5.8	76	8	456	47.8	354	37.1	4.14	.89

Table 4.3 (continued)

Item	*n*	Strongly Disagree		Disagree		Neither agree nor disagree		Agree		Strongly Agree		*M*	*SD*
		f	%	*f*	%	*f*	%	*f*	%	*f*	%		
17. Time flexibility characteristic of the curriculum is appropriate to cover the subjects	956	27	2.8	59	6.2	79	8.3	351	36.7	440	46	4.17	1
18.Attainments are appropriate for students' level	953	16	1.7	54	5.7	70	7.3	418	43.9	395	41.4	4.18	.91
24.Activities in science and technology curriculum are appropriate for the students' level	950	11	1.2	64	6.7	64	6.7	453	47.7	358	37.7	4.14	.89
25. The sequences of the science and technology subjects is appropriate	953	28	2.9	80	8.4	74	7.8	428	44.9	343	36	4.03	1.02
26.The attainments are feasible	955	13	1.4	52	5.4	62	6.5	473	49.5	355	37.2	4.16	.87
27. Attainments of the curriculum have been clearly expressed	940	14	1.5	65	6.9	47	5	397	42.4	417	44.4	4.21	.93

The lowest mean in the attainments-content factor belongs to item 3 which states that „school facilitates are enough to achieve the attainments' (*M=3.06, SD=1.4, n=946*). The results showed that slightly more than half of the participants (50.9%, *n*=481) agree (totally agree and agree) while 41.8% of the participants (*n=395*) disagree (totally disagree and disagree) about the sufficiency of school facilities. Only 7.4% (*n*=70) of the teachers stated their views as neither agree nor disagree.

In addition to quantitative descriptive analysis, a qualitative analysis was conducted with open ended questions asked at the end of the questionnaire. These qualitative analysis responses related to attainments and content reveal that limited or insufficient number of materials and equipments restrict teachers' teaching endeavors (Appendix C). Lack of or inadequate number of materials or equipment school facilities (72.2%, *n*=131), and insufficient number of laboratory equipment (*n*=20) were stated as basic limitations. Teachers wrote that their schools did not have a laboratory, they used usual classroom as laboratory, but it did not have any sink, stable tables or materials like microscopes, microscope slides, models, posters, and experiment materials. The participants expressed that equipments are provided by the Ministry of National Education whereas they were debited to teachers who feel anxious the equipment may be broken. For this reason, they do not allow students to conduct experiments themselves and teachers do the experiments in front of the students by using demonstration technique. The participants said that if the students had a chance for conducting experiments in the laboratories, they could achieve the attainments in a more effective and permanent way.

> *We do not have a usable science laboratory, yet we should cover the class in the science and technology laboratory even if the experiments are not conducted so as to teach subjects as curriculum suggests. I have a lot of criticism. When I was a teacher candidate the name of this course was Science and Natural History. We seeded, irrigated and observed how the*

crops grow. We can follow the same way in the unit 'Growing living organism'. (T 881).

Similar to item 18, which were realated to appropriateness of attainments for students' level, teachers' views were also asked for the item "The content is appropriate for students' level" (item 13) (*M=4.17, SD=1, n=955*). Overall, 84.9% (*n*=811) of the participants have positive (totally agree and agree) views on the appropriateness of the content to students' level. Slightly less than half of the participants totally agree (*n*=427). On the other hand, 10.3% (*n=98*) of the participants disagree (disagree and totally disagree), and 4.8% (*n*=46) of the participants neither agree nor disagree.

The coherence between the experiments and content were asked to participants. Results showed that teachers agree that „the experiments were determined in accordance with the content' (item 16) (*M=4.14, SD=.89, n=954*). Slightly less than half of the participants „agree' (47.8*%*, n = 456*)* and almost two of every five participants (37.1*%, n*=354) totally agree on coherence of experiments and content. On the other hand, 7.2% of the participants disagree (totally disagree and disagree) and 8% (*n*=76) of the participants neither agree nor disagree.

Teachers views on the benefits of the activities were also asked (item 2) (*M=4.09, SD=1, n=948*). In total, 795 participants (83.9*%)* had positive views (totally agree and agree) on the benefits of activities. Indeed, 44.4% (*n*=421) of the participants agree and 39.5% (*n*=374) of the participants totally agree. On the other hand, 11.9% of the participants disagree (totally disagree and disagree) and 4.2% of the participants neither agree nor disagree on benefits of activities included in the STC. In the qualitative part of the study, the participants expressed their positive views as well.

I think, the activities are very beneficial for learning; I really like the activities which are related to vitamins. All of the students were willing to *make the tasks in the activities. All of students raise their hands to express their thoughts and they joined in the activities (T 116). I like the activities. Especially I like the activities related to nutrition. The activity of kilocalories and calories of a slice of bread was fun for students" (T 284). "The activities are very beneficial and effective but there are too many activities. This situation leads to time problem (T 83).*

Findings of the study showed that the participants have positive (totally agree and agree) views (80.9%, *n*=771) that „the sequence of the science and technology subject is appropriate' (item 25) (*M=4.03, SD=1.02, n*=953). On the other hand 11.3% (*n*=108) of the participants disagree (totally disagree and disagree) about the appropriateness of subject sequences. Furthermore, 7.8% (*n*=74) of the participants expressed their views as neither agree nor disagree. Indeed, teachers (7.6%, *n=18*) responses to open ended questions showed that they suggest change in sequencing of units. For example, the "electricity" unit can be covered in the beginning of the semester; since the unit was difficult for students. Another teacher (*T 87*) stated that

I think the sequence of the subjects is wrong. I think subjects related to environments must be covered first because they are concrete. Then, our bodies, the earth, matter and change, heat and light can be covered. I tried to teach density but I cannot teach the volume since in the teachers' handbook we were warned not to teach. Heat exchange was another abstract subject and most of the students had difficulty in understanding it. They watched with great interest how water boils and what happen when the cold plate come very near to boiling water; whereas they could not answer the questions after the activity. I think there should be more activities on density and matter and change topics and the sequence of the subjects can be changed.

Another item (item 14) was related STC's horizontal organization which engages with arranging content from the separate subjects. Teachers agree that „science and technology curriculum associated with the other courses sufficiently' (*M=3.90, SD=.97, n=952*). More than half of the participants (50.7%, *n*=483) agree and more than one fourth (26.4%, *n*=251) of the participants strongly agree about the association among the courses. In sum, 77.1% (*n*=734) of the participants agree (totally agree and agree) while 12.1% (*n*=115) of the participants disagree (strongly disagree and disagree), and 10.8% (*n*=103) of the participants neither agree nor disagree that STC is associated with other courses. Qualitative analysis of open ended questions showed that participants (8%, *n*=24) had been encountered some problems because science and technology attainments and content are not in harmony with attainments and contents of other courses, especially mathematics course's attainments and content. They stated that certain science topics require certain mathematical attainments, which have not yet been covered in the mathematics course. This makes it difficult for students to achieve the attainments. Especially science and technology teachers claimed that they suffer from this situation. Additionally, according to science and technology teachers (2%, *n*=6) some of the topics are not appropriate for the science and technology courses. Although these topics were not specifically identified, they suggest that these topics be covered in the social studies courses. They believe that these topics prevent the transition between science and technology course and social studies course.

> *The unit 'Earth's Crust' is the subjects of social studies. The same subject is covered in Geography course in 10th grade but in 8th grade we cover the subject as physics subject. In the same vein, 'Landforms' should be covered in social sciences classes (T 895).*

Next, the result of item 5 showed that teachers agree that „the content of the science and technology curriculum is sufficient' (*M=3.86, SD = 1.09, n=957*). While 76.8% (*n*=735) of the participants agree (totally agree and agree), 15.9% (*n*=152) of the participants disagree. Totally *7.3% (n*=70) of the participants stated their views as neither agree nor disagree. The result of the open-ended questions illustrated that some teachers (23.4%, *n*=59) complained about the difficulties regarding shallow content. They stated that the science and technology curriculum did not include enough information to comprehend the subjects effectively. Additionally, since the students were not used to doing research by using internet or reading various books, the content could not be comprehended effectively. Furthermore, teachers stated that textbooks, in this case, are accepted as the only source of information but they do not include enough information.

The result of item 4 showed that teachers agree (totally agree and agree) on that „topics of science and technology course can be covered in the suggested time" (*M=3.7, SD=1.34, n=959*). While 70.2% (*n*=673) of the participants agree with the appropriateness of suggested time to cover the topics, 25.5% (*n*=244) of the participants disagree (totally disagree and disagree). In other words, one fourth of the participants disagree about the appropriateness of suggested time. Only 4.4% (*n*=42) of the participants were neutral. In the qualitative part of the study, time constraints were stated as an important limitation in all components of the curriculum beside content component. In total, 51% (*n*=80) of the participants who responded the open-ended question related to content, expressed time constraints as a limitation to teach the topics.

> *To cover the subjects I go over some units without any recap. We have to cover the units before the end of a semester. Sometimes I skipped the activities or the experiments (T 136).*

4.3.2. Teachers' Views on Learning-Teaching Process

The second sub-question of the first question was stated as: "What are the teachers' views on learning-teaching process component of STC (Science and Technology Curriculum)." This component included nine items (6, 7, 9, 12, 19, 20, 28, 30, and 31) (Table 4.4). Descriptive data analysis indicated that, overall, teachers were positive (agree) (*M=4.42, SD=.60, n=960)* about the learning-teaching process component of STC (Table 4.5). Furthermore, descriptive analysis was conducted for each item constituting the learning-teaching process component.

The result of item 7 showed that teachers totally agree that „active participation of students make science and technology courses more interesting and enjoyable' (*M=4.76, SD=.82, n=958*). Among all participants answering the question, 95.1% *(n=911*) of the teachers agree or totally agree with this view. Only 4.4% (*n=42*) of the participants disagree (strongly disagree and disagree) and .5% (*n=5*) of the participants neither agree nor disagree. The analysis of open-ended questions revealed that making students active participants was viewed as a positive aspect of the STC (*12.4%*, *n*=95).

Next, the results showed that the methods students use to evaluate their progress are subjective (item 9) (*M=3.91, SD=.99, n=930*). Almost 74% (*n*=692) of the teachers agree (totally agree and agree) that "self-evaluation on self progress is subjective". On the other hand, 9.6% (*n*=89) of teachers disagree (totally disagree and disagree) about the subjectivity; and 16% (*n*=149) of the teachers neither agree nor disagree on the subjectivity of self evaluation process. However, the analysis of open-ended questions indicated that some teachers perceive students as very young to evaluate their success' (3.1%, *n*=24) or teachers believe that students cannot evaluate the attainments to assess their success' (1.4%, *n*=11). In contrast, few teachers (*.5%*, *n*=4) stated that if the students learn self-evaluation and peer evaluation in the early ages, they can easily assess their success and can be more objective in assessing their class-mates.

Item 12 of learning-teaching process was about "time allocated for meet the achievement" (*M=3.35, SD=1.4, n=945*). More than half of the participants (58.5%, *n*= 553*)* agree (totally agree and agree) on the appropriateness of allocated time to achieve the attainments. However, 35% (*n*=331) of the participants disagree (totally disagree and disagree) and 6.5% (*n*=61) of them were neutral about the time. Analysis of open ended questions showed that teachers perceive that time is one of the constraints for learning teaching process as well as for the whole STC. According to participants, in order to achieve an attainment, at least one activity or experiment needs to be conducted; so allocating time to each activity leads to time constraints. In the open ended questions, some teachers compare science and technology curriculum with other courses and stated that time allocating for STC is more appropriate from the other courses.

The result of item 19 "cooperation with other science and technology teachers is important for effective education" showed that teachers strongly agree on role of cooperation for effective education (*M =4.63, SD= .81, n =955*). The participants totally agree with the item (76.6*%, n=732*). Indeed, 92.3% (*n*=882) of the participants agree (totally agree and agree). On this issue, only 3.7% (*n*=35) of the teachers disagree (strongly disagree and disagree) and 4% (*n*=38) of them neither agree nor disagree that cooperation with science and technology teachers is needed for effective education.

> *When we come together with other science and technology teachers at least two times in a semester, we talk about the topics that we had difficulty and discuss on the solutions. Each teacher might encounter different problems when teaching a subject.*

Result of item 20 revealed that 84.4% (*n=808)* of the teachers totally agree that laboratory activities are indispensible for science and technology course (*M=4.73, SD = .79, n=957*). When the total number of „agree' and „totally agree' are aggregated, it is shown that 95.1% (*n=910*) of the teachers agree about the importance of laboratory activities in science and technology classes. Only 4.2% (*n*=40) of the teachers disagree (totally disagree and disagree), and .7% (*n*=7) of the participants neither agree nor disagree. In the qualitative part of the study, teachers' views on learning teaching process were asked as well and time tables of the laboratories and insufficient numbers of laboratory equipments were mentioned as a limitation.

Especially classroom teachers complained about the time tables of the laboratories while answering the open ended questions that result of the open ended questions' results was presented in Appendix D. They noted that there is a belief concerning the use of laboratories belonging to only science and technology teachers, and the classroom teachers could conduct the experiments in the class. This belief makes classroom teachers' practices difficult (2.5%, *n*=19). A classroom teacher expressed her experiences as,

> *In my school, double shift is applied. In the morning, the laboratory is used as a usual classroom by the 3rd graders. In the afternoon, we can use the laboratory as it is, whereas the science and technology teachers believed the priority belongs to them because science is their field and classroom teachers seem to have the second priority. This situation force classroom teachers to conduct experiments in the classes (T561).*

Results of teachers' responses showed that instructional technology is a need for STC (item 31) (*M =4.69, SD=.79, n=939*). In other words, 81.2% (*n*=762) of the participants totally agree and 13.4% (*n*=126) of the participants agree about the need for the instructional technologies. In brief, 94.6% of the participants (*n*=888) have positive views about the need for instructional technology. Only 4% (*n*=38) of the participants disagree (totally disagree and disagree) and 1.4% (*n*=13) of them neither agree nor disagree.

Table 4.4

Learning Teaching Process Component of STC

Item	*n*	Strongly Disagree		Disagree		Neither agree nor disagree		Agree		Strongly Agree		*M*	*SD*
		f	%	*f*	%	*f*	%	*f*	%	*f*	%		
6. The use of outside learning environments apart from usual classrooms (e.g. laboratory, trips, observation) has an indispensible importance	958	28	2.9	28	2.9	18	1.9	157	16.4	727	75.9	4.59	.9
7. Active participation of students make science and technology courses more interesting and enjoyable	958	35	3.7	7	.7	5	.5	60	6.3	851	88.8	4.76	.82
9. The methods that students evaluate their progress are subjective	930	27	2.9	62	6.7	149	16	422	45.4	270	29	3.91	.99
12. Time is enough to cover the content	945	146	15.4	185	19.6	61	6.5	298	31.5	255	27	3.35	1.4
19. Cooperation with other science and technology teachers is important for effective education	955	20	2.1	15	1.6	38	4	150	15.7	732	76.6	4.63	.81
20. Laboratory activities are indispensible parts of the science and technology course.	957	25	2.6	15	1.6	7	.7	102	10.7	808	84.4	4.73	.79
28. Parent-teacher cooperation is necessary to achieve the attainments in the curriculum.	938	29	3.1	13	1.4	30	3.2	157	16.7	709	75.6	4.6	.87
30 I encourage students to use various resources for learning	936	21	2.2	23	2.5	31	3.3	248	26.5	613	65.5	4.51	.86
31. Science and technology curriculum requires use of instructional technologies (e.g. Projector, overhead)	939	21	2.2	17	1.8	13	1.4	126	13.4	762	81.2	4.69	.79

4.3.2.1. Teachers' Views on Constructivism

As a part of the study, the participants were asked for their views on the constructivist approach in the open-ended questions (Appendix E). As it is stated in previous chapters, constructivism is the main approach in the STC and in this study teachers' views on constructivist approach were researched under learning-teaching process. Among 283 fourth grade teachers, 210 teachers answered the question. In other words, 74.2% of the participants who are teaching 4th grade science and technology curriculum share their views (*74.2%, n=210*). Among 289 5th grade teachers participating in the study, 211 teachers answered the question (73%, *n*=211). As for combination classroom teachers, among 29 teachers 17 teachers answered the question (58.6%, *n*=17). Among 356 science and technology teachers, 326 teachers answered the question (91.5%, *n*=326). In total, among 960 teachers, 764 teachers answered the question (79.5%).

When the participants were asked for their views on constructivism, they responded by emphasizing the same positive aspects and limitations. Some teachers preferred to wrote only „I am using constructivist approach in my classes' (*n*=64). Some teachers wrote „if it is necessary I use constructivist approach' or „sometimes' (*n*=75). The other teachers expressed that they did not use constructivism (*n*=14) in their classes and explained the reasons. They frequently reported crowded classrooms as the major reason (*n*=127). Additionally, according to teachers, crowded classrooms do not let the teachers use constructivism (*n*=287). According to teachers, classroom size must be no more than 25 students so as to practice constructivist approach in the classes (n=27).

Second limitation for using constructivism in the classes was related to lack of equipment, laboratories, or insufficient number of materials and a space in the classrooms for physical activities of students (*n*=100). According to them, if these deficiencies are met by Ministry of National Education, they would use constructivism in the classes. Some teachers listed their needs specifically. One combination classroom teacher criticized the inadequacies in school and said,

> *Our priorities are very different from other schools. The physical constraints are the major problem. So as to use constructivism, we are in need of laboratory and visual materials. While the students do not have enough textbooks, how can I say "we are in need of computer and internet connection?" (T 293).*

Classroom teachers and science and technology teachers expressed that students do not have research skills. Even if schools have various information sources and offer research opportunities to students, students prefer to use easy way and they find the subject on the internet and print the pages and submit these pages as homework without reading (n=23). While science and technology teachers believed research skills could be developed in 4^{th} and 5^{th} grades, classroom teachers expressed that the students were reluctant to prepare for classes in advance. Furthermore, science and technology teachers hold classroom teachers responsible for making students familiar with and developing research skills, some teachers hold families responsible for it and added that the parents do not encourage students to study. According to participant teachers the parents' socio-economic status forces them to avoid providing basic opportunities for research.

Some teachers (n=14) highlighted that the parents want to transfer knowledge from teachers to students. The parents believe that their children do not know anything because of the constructivist approach, whereas the students would take national exams and it could be more practical to use lecturing. One 17 year experienced female 5^{th} grade classroom teacher wrote their experience.

> *"One parent came to meeting in school and she said you do not teach anything to children. What they can learn by cutting paper boxes, by making models" (T 660).*

In total, 64 teachers stated that they use constructivist approach in the classrooms. Furthermore teachers added that they think the constructivist approach is very effective and make the students more active (n=9). Two of these teachers criticized the regional differences for using constructivism. According to them the schools locating in rural areas might not have a chance of using constructivism because it requires visual materials, supplementary information sources and instructional equipment. Although they believe they use constructivism very effectively, they become concerned about their colleagues working in rural areas.

Similarly, 75 teachers touched upon the necessity of using constructivism. Without writing any explanation they preferred to write „if it is necessary I use constructivist approach' or just wrote „sometimes'. They did not write any insight information about in what cases they are in need of using constructivism or when they believe that the students are in need of constructivist classes, or in what units they preferred to use.

Totally, 14 teachers stated that they do not use constructivism because of lack of materials-equipment or non-existence of laboratories, ineffective in-service education and lack of pre-requisite knowledge of students. Only 5th grade teachers (n=5) stated that if they got the effective in-service teacher training, they would use constructivism effectively in the classes. One female 5th grade classroom teacher who attended an in-service training program criticizing the instructors who did not show how teachers can apply constructivism:

> *The training on the new curriculum lasted 5 days and the time spent was ineffective. The instructors wrote the information on the transparency and he read this text to us by explaining the constructivist approach. We struggled to understand. The successful implementation of constructivism depends on teachers' endeavors (T 502).*

Some teachers (n=71) criticized the time constraints. According to them, using constructivism, which is underlining student centered methods, requires more time than teacher centered methods and preparing materials for the experiments or the activities (n=71) accordingly require more time. They believe that waiting for students' answers to questions written at the end of each unit is worth the time and the effort; however, teachers reported that the students did not believe that the time and effort they spend on the other types of activities was worth (n=16). Students are reluctant to answer or participate in the activities. Some teachers (n=15) claimed that they can use student-centered process only with the successful students because they can benefit from that. Especially science and technology teachers (n=11) said that they preferred to use student-centered activities in the classrooms with ready to learn students because they study on the subject before coming to class and their existing knowledge is enough to use it. In this way, teachers do not spend more time and students can show reactions to teachers' endeavors so teachers are satisfied with the effective and permanent learning.

4.3.3. Teachers' Views on Assessment

The third sub-question of the first question was stated as: "What are the teachers' views on assessment procedures component of STC (Science and Technology Curriculum)." This component included five items (10, 11, 21, 22, and 29) (Table 4.6). Descriptive data analysis indicated that, overall, teachers were positive (agree) ($M = 3.58$, $SD = .83$, $n = 960$) about the assessment procedures included in STC. Furthermore, descriptive analysis was conducted for each item constituting the assessment component (Table 4.6)

Effectiveness of alternative assessment techniques were asked in the item 10. The result illustrated that the participants agree with the effectiveness of alternative assessment techniques (M=3.72, SD=1.15, n=955). In total 67.6% (n=646) of the teachers agree (strongly agree and agree) and 14.5% (n=138) of the participants neither agree nor disagree about the effectiveness. On the other hand, 17.9% (*n*=171) teachers disagree (totally disagree and disagree) regarding the appropriateness of the alternative assessment techniques.

Similar to effectiveness, the appropriateness of alternative assessment techniques, overall, the teachers agree that they were appropriate (item 11) (*M=3.66, SD=1.18, n=958*). In other words 65.6% (*n=628*) of the teachers agree with the appropriateness of alternative assessment; whereas, 19.7% (*n=188*) disagree about the appropriateness and the remaining 14.8% (*n*=142) neither agree nor disagree about the appropriateness.

Descriptive analysis of item 21 the assessment component showed that teachers' views on projects were positive (*M=3.51, SD=1.27, n=952*). In total, 60.8% of the participants (*n*=579) agree (totally agree and agree) about that projects are good tool for assessing students' performances views, and 14.4% (*n=137*) of the participant were neutral. However, 24.8% of the teachers (*n*=236) disagree about the idea.

Results on the benefits of portfolio assessment indicating that teachers find it beneficial (item 22) (*M=3.56, SD=1.27, n=949*). Indeed, 64.4% of the participants (*n*=611) agree (strongly agree and agree) on the benefits of the portfolio assessment while 23.5% (*n*=223) of the teachers disagree. The remaining 12.1% (*n*=115) of the participants who respond item 22 stated their views as neither agree nor disagree.

The lowest mean in the assessment component belongs to the item 29 which states that "process-based assessment is applicable" (*M=3.47, SD=1.08, n=922*). The result showed that 59.4% (n=*548)* of the teachers agree (strongly agree and agree) about the applicability of process based assessment. On the other hand 21%, *(n=194*) of the teachers disagree (strongly disagree and disagree), and 19.5%

(*n=180*) neither agree nor disagree about the applicability of process based assessment.

In addition to descriptive analysis of the item related to the assessment component of STC, teachers were asked to answer open ended question. These questions were qualitatively analyzed and the results were presented in Appendix F. Results of this analysis showed that the teachers stated that they use performance tasks (*n*=85), projects (*n*=81), portfolio assessments (*n*=56), peer evaluation (*n*=11), self-evaluation (*n*=10), and rubrics (*n*=2). As they reported; while they use performance task, projects and portfolio assessment, they use rubrics, peer or self evaluation less than the others. In the same open-ended question, some teachers expressed that they use different kinds of questions in the exams without referring to complementary assessment techniques. They stated that they use open ended questions, fill-in-the blanks, true-false, and multiple choices questions. They believed that these various types of questions were enough to evaluate students' success in the exams and it was not necessary to use complementary assessment techniques.

> *I think there are lots of assessment techniques to evaluate students' success. Various assessment techniques were offered in the curricula and using all of them is time consuming. Time is limited and some assessment techniques should be omitted (T 603).*

Teachers also noted their views on portfolio assessment. Teachers thought that specifically portfolio assessments (*n*=29) take long time. Instead of using portfolio, some teachers (*n*=8) prefer to pay attention to students progress. While two teachers asserted that portfolio assessment was dissipation of paper, twelve teachers highlighted the positive aspects of portfolio assessments and named it „a good way to get feedback about students' progress'.

Like the other components of the curriculum, time constraints was again stated as a limitation to use complementary evaluation techniques (17.5%, n=138). Among 786 teachers who responded to the open ended question related to assessment, 4th grade classroom teachers (n=40), 5th grade classroom teachers (n=44) and science and technology teachers (n=31) agreed on the time constraints for evaluating students' success. Therefore, time constraints emerged as one of the most frequently expressed limitation in the assessment as well. Teachers expressed their reluctance to allocate time for evaluating complementary assessment techniques. One another limitation regarding assessment component was objectivity of evaluating the students' works. One 17 year experienced male 4th grade teacher criticized the portfolio assessment techniques and offer a suggestion to evaluate students' performances effectively in project tasks. He also believes that project works was prepared by the parents' like his colleagues (n=38), therefore an objective assessment cannot be performed and suggest that "the students do their works in the classes".

> *Evaluation of students' portfolios takes long time. I am obliged to allocate time for portfolios even at home. When a teacher enter the grades to the computerized grading system, it is impossible to change the grade. I cannot use my performance grade. Some students making their parents do their project works could take higher score than the students who struggle to do works. The parents' works are visually better than the students' and this situation might affect my grading naturally. It would be better if the students could do their performance works in the class. However, the time-constraints and overcrowded classrooms are the two major obstacles to put this alternative into practice (T 921).*

> *I feel I evaluate the parents' success. If we have time to make the project and performance tasks in the class, it can be instructive. While a student at 4th grade cannot keep the scissors correctly or cut the picture and paste it, how can she make the project work on her own? We warn parents a lot of times that they should not do the project tasks, students should (T 17).*

In brief, the teachers criticized that the evaluation techniques take a long time to evaluate. Instead of spending time to evaluate these works, some teachers expressed that they opt for evaluating students' learning process carefully. Especially 4^{th} grade teachers (n=16) and 5^{th} grade teachers (n=8) claimed that they already know their students' skills and existing knowledge level.

Table 4.5

Assessment Component of STC

Item	*n*	Strongly Disagree		Disagree		Neither agree nor disagree		Agree		Strongly Agree		*M*	*SD*
		f	%	*f*	%	*f*	%	*f*	%	*f*	%		
10. It is effective to practice the assessment methods (e.g. portfolios, performance tasks) suggested by science and technology curriculum	955	53	5.5	118	12.4	138	14.5	381	39.9	265	27.7	3.72	1.15
11. It is appropriate to practice alternative assessment techniques (Peer evaluation, portfolios) suggested in science and technology curriculum by adding to traditional pencil paper tests.	958	61	6.4	127	13.3	142	14.8	378	39.5	250	26.1	3.66	1.18
21.Projects are good tool for assessing students' performances	952	92	9.7	144	15.1	137	14.4	347	36.4	232	24.4	3.51	1.27
22. Although evaluation of portfolios takes time, it is beneficial.	949	93	9.8	130	13.7	115	12.1	370	39	241	25.4	3.56	1.27
29.Process-based assessment is applicable	922	51	5.5	143	15.5	180	19.5	419	45.4	129	14	3.47	1.08

4.3.4. Teachers' Suggestions to Improve the Curriculum

The fourth and last sub-question of the first research question was "how the science and technology curriculum could be improved?" The teachers offered some suggestions to make science and technology curriculum more effective and these suggestions were presented in Appendix G. The teachers suggested that visual materials be sent to teachers like CDs (n=16). These CDs can be related to experiments or activities. In this situation, the teachers would save time and also they did not spend extra efforts to prepare laboratories and arrange materials. Furthermore, visual learning would be offered to students as well. According to teachers, CDs would help students to achieve attainments, cover subjects in an effective way and visual learning would provide permanent learning.

Need for laboratory materials, in-class materials, equipment, were frequently stressed by the teachers; and some teachers (n=52) suggested those needs be met by Ministry of National Education. Additionally, physical constraints of schools were argued by the teachers and they suggested that employees in Ministry of National Education examine the schools and report the situation to authorized people. By this way, the schools can make up the deficiencies.

Taking into account regional differences was another suggestion during the curriculum development process. They mentioned the need for considering regional differences of socio-economic status in terms of availability of equipments and materials for the opportunities to use constructivism. According to teachers, since economic status of the students living in urban areas is higher than the students living in rural areas, they could participate in trips, observations, or get extra books which eventually make the content be covered effectively. Therefore, the content could be covered effectively, attainments can be achieved and permanent learning can be realized due to higher economic status. Neglecting the regional differences was accepted as a limitation by the teachers and they suggest that different characteristics of the areas where students live be taken into consideration.

> *My students are very lucky because they live in urban cities. Overhead projectors are out of date. Television, video CDs are also outdated. We have a projector in the class which we can use it whenever we want. Whereas, I think the students living in rural areas cannot use these types of equipments and instructional materials (T195).*

Another suggestion was related to teaching formulas (n=24). Especially science and technology teachers expressed that if the formulas are taught to students, they would get more satisfied with the classes. However, the science and technology curriculum restrict them from teaching formulations although the students demand for approval of the formulas after they construct the knowledge. According to them, formulations could be taught to students.

> *We have to revise the same subjects every year. Spiral curriculum characteristic is important, but it is time-consuming to remind students the same subjects each year. I do not like the fact that the program limits teaching of formulas either. When students ask for the formulas after meaningful questions, I tend to teach the formulas (T28).*

The textbooks were criticized and the teachers suggested more colorful textbooks to attract students' attentions (n=21). Some teachers suggested more examples in the textbooks to make them more interesting. They also argued why textbooks do not include in-detail explanations on the subjects and information (n=36). They believed that if the textbooks include more information, the students could be more successful.

Time constraints were one of the most frequently expressed limitation in the components of the science and technology curriculum. The teachers (n=49) suggested that the time allocated for science and technology course be increased from 4 to 5 or 6 to cover the curriculum as it is. By this way, they would solve some problems especially in learning-teaching process and assessment.

Teachers (n=7) suggested that a separate laboratory course could be added to curriculum. They explained that a separate laboratory course existed in the curriculum besides science courses, and laboratory teaching fields existed as a teaching field in educational institutions many years ago. The experiments were conducted by laboratory teachers. They claimed that it is better to be conducted experiments by laboratory teachers, by this way these teachers can prepare materials and mechanism necessary for the experiments.

4.4. Effect of Teachers' Backgrounds on their Views on Current Science and Technology Curriculum

Bivariate correlations were calculated to investigate the relationships among the components. Results demonstrated that there was a significant moderate relationship among all three subscales (Table 4.7).

Table 4.6

Bivariate Correlations (n=960)

	Attainment-content	Learning-teaching process	Assessment
Attainment-content	1		
Learning-Teaching Process	.56*	1	
Assessment	.38*	.40*	1

*p<.05

4.4.1. Effect of Graduation Field on Teachers' Views on Current Science and Technology Curriculum

Inferential statistics was used to investigate the second research questions of the study. SPSS15 Software was used to run multivariate analysis of variance (MANOVA) analyses. Alpha level was set at the .05 level for the significance test of all the analyses which is an acceptable criterion for a minimum basis for rejecting the null hypothesis in behavioral sciences (Cohen, 1988). A multivariate analysis of variance (MANOVA) was conducted to test whether there were any difference between teachers' views on current science and technology curriculum with regard to their graduation fields which were grouped into 4.

Overall, there were 77 different graduation fields. These fields were grouped into 4: graduation from science education, graduation from classroom teaching, graduation from faculty of arts and sciences, and the others.

Results revealed that overall teachers' fields of bachelor degrees had statistically significant effect on their views of science and technology curriculum (attainment-content, learning-teaching process and evaluation components), Pillai's trace = .03, $F(9,2841)= 3.06$, $p<.05$.

The effect of graduation fields on each dependent variable (attainment-content, learning-teaching process, evaluation) was examined. Results showed that graduate field had statistically significant effect on teachers views on attainment-content, $F(3,947)=6.55$, $p<.05$, explaining 2% of the variance in attainment-content variable, and on evaluation, $F(3,947)=3.67$, $p<.05$, explaining 1% of the variance in evaluation variable. However graduate field did not have any statistically significant effect on learning-teaching process (Table 4.8).

Table 4.7

The Effect of Graduation Field on Views on STC (n=784)

Source	Dependent Variable	*SS*	*df*	*MS*	*F*	Partial η^2
gradfield	attainment-content	7.89	3	2.63	6.55*	.02
	learning-teaching p.	2.10	3	.70	1.94	.01
	assessment	7.54	3	2.51	3.67*	.01
Error	attainment-content	379.98	947	.40		
	learning-teaching p.	342.60	947	.36		
	assessment	648.79	947	.69		
Total	attainment-content	387.87	950			
	learning-teaching p.	344.70	950			
	assessment	656.33	950			

*p<.05

In order to examine the differences between teachers' views on attainment-content and evaluation in terms of their field of graduations post hoc analysis was performed. As homogeneity of variances assumption was not met, Dunnet C test was used to compare the groups. With regard to the attainment–content component, Dunnet C test demonstrated that there were statistically significant differences between the views of teachers who graduated from elementary science education (*M*=3.82, *SD*=.65), classroom teacher training programs (*M*=4.03, *SD*=.62), art and science faculty programs (*M*=4.06, *SD*=.69), and from other programs (*M*=4.05, *SD*=.61). This result showed that teachers who graduated from elementary school science education had less positive views on attainment-content component than teachers who graduated from other programs.

With regard to the assessment component, Dunnet C test demonstrated that there were statistically significant differences between the views of teachers who graduated from science and technology programs (*M*=3.45, *SD*=.82) and from classroom teacher training programs (*M*=3.67, *SD*=.80). This result showed that teachers who graduated from classroom teacher training programs had more positive views on evaluation than the teachers who graduated from elementary school science education.

4.4.2. Effect of Gender and Teaching Experience on their Views on Current Science and Technology Curriculum

A multivariate analysis of variance (MANOVA) was conducted to test whether there were any difference between teachers' views on current science and technology curriculum with regard to their gender and teaching experiences. Teaching experiences were divided into 5 categorical variables and each category can be named as cell. All cells do not have equal participants. Cell size of 30 is acceptable and the minimum number is determined as 7 per cell (Van Voorhish & Morgan, 2007). Another resource shows that the minimum cell size is 20 observations (Ferroni & Becattini, 2007). If the cell size is greater than .30, assumptions of normality and equal variances are of less concern (Philips, 2001).

Results showed that, overall, teaching experience had statistically significant effect on their views of science and technology curriculum (attainment-content, learning-teaching process and evaluation components), Pillai's trace = .09, $F(12,2823)= 7.46$, $p<.05$. However, teachers' views on science and technology curriculum were not statistically different between male and female teachers.

The effect of teaching experience on each dependent variable (attainment-content, learning-teaching process, evaluation) was examined. Results indicated that teaching experience had statistically significant effect on teachers' views on attainment-content, $F(4,941)=4.33$, $p<.05$, explaining 2% of the variance in attainment-content variable, and on evaluation, $F(4,941)=6.74$, $p<.05$, explaining 4% of the variance in evaluation variable. However teaching experience did not have any statistically significant effect on learning-teaching process. In addition, the interaction between teaching experience and gender on teachers' views on science and technology curriculum was not statistically significant. Additionally, gender was not statistically significant (Table 4.8).

Table 4.8
Interaction between variables

Source	*Dependent Variable*	*SS*	*df*	*MS*	*F*	*Partial* η^2
experience	attainment-content	6.88	4	1.72	4.33*	.02
	learning-teaching p.	2.65	4	.66	1.89	.01
	assessment	26.96	4	6.74	10.22*	.04
gender	attainment-content	1.18	1	1.18	2.98	.00
	learning-teaching p.	1.23	1	1.23	3.50	.00
	assessment	1.21	1	1.21	1.83	.00
experience * gender	attainment-content	1.09	4	.27	.69	.00
	learning-teaching p.	1.10	4	.28	.78	.00
	evaluation	5.68	4	1.42	2.15	.01
Error	attainment-content	373.35	941	.40		
	learning-teaching p	329.77	941	.35		
	evaluation	620.79	941	.66		
Total	attainment-content	385.15	950			
	learning-teaching p	335.67	950			
	evaluation	656.18	950			

*p<.05

In order to examine the differences between teachers' views on attainment-content and assessment in terms teaching experiences, post hoc analysis was performed. Since the homogeneity of variances assumption was not met, Dunnet C test was used to compare teaching experience groups.

Dunnet C test demonstrated that there was statistically significant difference between the teachers with 0-3 years (*M*=3.89, *SD*=.61) and 7-18 years (*M*=4.08, *SD*=.56) of experiences in terms of their views on attainment-content component of the curriculum, indicating that teachers with 7-18 years of experiences had more positive views on attainment-content of the curriculum than the teachers with 0-3 years of experience. Similarly, there was statistically significant difference between the teachers with 4-6 years of experience and 7-18 years of experience in terms of attainment component of the curriculum. This results show that 7-18 years (*M*=4.08, *SD*=.56) of experienced teachers were more positive than the teachers with 4-6 years (*M*=3.59, *SD*=.61) of experience. This result showed that teachers who have 7-18 years of experience had more positive views on attainment-content component than the 4-6 years of experience.

The teachers with 7-18 years (*M*=3.50, *SD*=.83) of experience had statistically significant different views on evaluation component of curriculum from the teachers with 0-3 years (*M*=3.85, *SD*=.78) and 4-6 years (*M*=3.77, *SD*=.71) of experience, indicating that teachers with 0-3 years of experience had more positive views on evaluation component of the curriculum than the teachers with 4-6 years of experience followed by teachers with 7-18 years of experience.

The teachers with 19-30 years (*M*=3.40, *SD*=.84) of experience had statistically significant views on evaluation component of curriculum from the teachers with 0-3 years (*M*=3.85, *SD*=.78) and 4-6 years (*M*=3.77, *SD*=.71) of experience, indicating that teachers with 0-3 years of experience had more positive views on evaluation component of the curriculum than the teachers with 4-6 years of experience followed by teachers with 19-30 years of experience.

4.5. Effect of Teaching Fields on their Views on Science and Technology Curriculum

A multivariate analysis of variance (MANOVA) was conducted to test whether there were any difference between teachers' views on current science and technology curriculum with regard to their teaching areas (classroom teaching and elementary school science teaching). Results showed that, overall, teaching fields had statistically significant effect on their views of science and technology curriculum (attainment-content, learning-teaching process and evaluation components), Pillai's trace = .02, $F(3,953)= 7.58$, $p<.05$.

The effect of teaching fields on each dependent variable (attainment-content, learning-teaching process, evaluation) was examined. Results indicated that teaching fields had statistically significant effect on teachers views on attainment-content, F(1,955)=10.09, p<.05, explaining 1% of the variance in attainment-content variable, and on evaluation, F(1,955)=18.04, p<.05, explaining 2% of the variance in evaluation variable. However teaching field did not have any statistically significant effect on learning-teaching process (Table 4.9). Results demonstrated that classroom teachers (*M*=4.04, *SD*=.64) had more positive views on attainment-content than elementary school science teachers (*M*=3.90, *SD*=.64). Classroom teachers (*M*=3.67, *SD*=.83) also had more positive views on evaluation component of the curriculum than elementary school science teachers (*M*=3.43, *SD*=.82).

Table 4.9
The Effect of Teaching Field on Views on STC (n=957)

Source	*Dependent Variable*	*SS*	*df*	*MS*	*F*	*Partial* η^2
Teaching field	attainment-content	4.09	1	4.09	10.09*	.01
	learning-teaching p.	.68	1	.68	1.88	.00
	assessment	12.32	1	12.32	18.04*	.02
Error	attainment-content	386.88	955	.41		
	learning-teaching p.	346.05	955	.36		
	assessment	652.21	955	.68		
Total	attainment-content	390.96	956			
	learning-teaching p.	346.73	956			
	assessment	664.52	956			

*p <.05

4.6. Summary of the Results

Descriptive analyses indicated that participants of the study had positive views towards attainments-content, learning-teaching process and assessment component of the science and technology curriculum. Results of MANOVA demonstrated that graduation fields affect teachers' views towards attainments-content and assessment component of the STC; whereas the results showed that graduation field did not affect teachers' views towards learning-teaching process. Similarly, teaching experiences affect teachers' views towards attainments-content and assessment component of the curriculum. As for teaching field, the results showed that teaching field affects teachers' views towards attainments-content and assessment component of the curriculum and classroom teachers had more positive views on these components. Gender did not illustrate statistically significant results on teachers' views on science and technology curriculum components.

Overall, the most frequently expressed limitations based on the results of open-ended questions were lack of equipment and materials, crowded classrooms, and time constraints. Reducing the classroom size, allocating more time for science and technology teachers, removal of restrictions on teaching formulas, laboratory equipment and material support were demanded by the participants for more effective implementations.

CHAPTER 5

DISCUSSION

This chapter presents the discussion of the results drawn from this study. In this part, the results are discussed with regard to the results of other research studies. Furthermore, implications for practice and suggestions for further studies are presented.

5.1. Discussion of Results

The purpose of the study was to determine classroom teachers' and science and technology teachers' views on science and technology curriculum. In this regard, teachers' views on the components of Science and Technology Curriculum (STC), the effect of teachers' graduation fields, teaching fields, teaching experiences, and gender on their views of the components of the curriculum were examined. These components were attainments, content, learning-teaching process and assessment. These components of the curriculum and background variables of teachers were discussed separately based on the results of this study and were compared with the results of other studies.

5.1.1. Discussion of Results on the Components of Science and Technology Curriculum

The results showed that teachers have positive views towards the components of the STC. Each component was discussed separetely. As for the results of open-ended questions, it was shown that some limitations affect all the components of the curriculum. In other words, some basic limitations were stated when teachers' views on attainments, content, learning-teaching process and assessment components were separately asked. These limitations mentioned under each component were crowded classrooms, insufficient number of/lack of materials, laboratories, or equipment, and time constraints. Several studies underlined the importance of these limitations; *time constraints* (Acat & Demir, 2007; Adal, 2011; Boyacı, 2010; Çengelci, 2008; Demirci-Güler & Laçin-ġimsek, 2007; ErÇahan, 2007; Gelbal & Kelecioğlu, 2007; Güven, 2008; Kaptan, 2005; Karaer, 2006; Kesercioğlu et al, 2006; Özmen, 2003; Sağlam, 2009; Selvi, 2006; Dindar & Yangın, 2007), *crowded classrooms* (Boyacı, 2010; Dursun, 2006; Özmen, 2003; Sağlam, 2009; Dindar & Yangın, 2007; YaÇar et al., 2005; Unayağyol, 2010), *lack of/ insufficient number of materials* (Acat & Demir, 2007; Bağcı-Kılıç, 2003; Çengelci, 2008; Ekici, 2002; Gelbal & Kelecioğlu, 2007; Gömleksiz & Bulut, 2006; Kurtdede-Fidan, 2008; Tekbıyık & Akdeniz, 2008;) and *insufficient number of laboratories* in a school (Demiraslan, 2008; Ekici, 2002; Gözütok, 2005). As the above mentioned studies put forward, time constraint is among the major problems. When this study was conducted, science and technology courses were 4 class hours in a week; however, hours of science and technology courses decreased to three class hours in a week in 2010 (MONE, 2010), meaning that the problem of time constraint was increased.

As for crowded classrooms which was a limitation according to the results of the study and as it was expressed in various studies, it affected all components of the curriculum especially learning-teaching activities (Balkı, 2003; Blatchford, Bassett & Brown, 2005; Blatchford, Basset, Goldstein & Martin, 2010; Çınar, Teyfur & Teyfur, 2006; Hattie, 2005; Kartallıoğlu, 2005; Konur, Ayas & Konur, 2010; Korkmaz, 2006; ÖğülmüÇ,& Özdemir, 1995). While curriculum required more teacher-student interaction and learner-learner attention, providing feedback, spending more time on students with different skills in a class and laboratory activities, the real classroom situation had limitations to implement these processes. Insufficient materials or equipment were among the various limitations of crowded classrooms (Çelik, 2002; Güçlü, 2002; Jin & Cortazzi, 2006; O'Sullivan & Zielinski, 1988; Yaman, 2006; Yaman, 2009). In Denmark, a classroom consists of maximum 28 students, in Italy 10-25 students, and there are 18-26 students in a classroom in Luxembourg (Alcı & Akarsu, 2006; Eurydice, 2008). Blatchford and Mortimore (1994) highlighted the importance of lower number of students in a class to facilitate material use and assessment. If insufficient number of materials in classes was taken into consideration, the effect of insufficient number of materials and crowded classrooms can be accepted as a more critical issue. Furthermore, as the results of this study illustrate, some schools did not have a laboratory; or a classroom which could be designed and used as a laboratory. In addition, physical conditions of some schools did not let people design a class as a laboratory. At this point, it is essential to suggest projects or provide cooperation to enable schools to implement curricula as it was required (Gömleksiz & Dilci, 2007; Gömleksiz, 2005; Konur, Ayas & Konur, 2010).

5.1.1.1. Discussion of Results on Attainments-Content

According to the results of the study, teachers had positive views on attainments, and the attainments are appropriate for the students' level. Similarly, EĢ(2010) investigated science and technology curriculum in terms of students' attainments and teachers' views. The results of his study showed that teachers had positive views on attainments and students could achieve the attainments because attainments were appropriate for students' level. More than four of every five teachers agree with the appropriateness of the attainemnts for students' level. Likewise, other studies' results (Aydın, 2007; Çengelci, 2008; Değirmenci, 2007) showed that science and technology teachers believed that attainments were appropriate for students' level. Another similar study conducted by Adal (2011) to investigate science and technology teachers' perception on the curriculum also showed that teachers had positive views on the aims and objectives of science and technology curriculum. As it was supported by other studies (Adal, 2011; Aydın, 2007; Çengelci, 2008; Değirmenci, 2007), attainments were appropriate for students' level and teachers had positive views on the attainments. Nevertheless, some teachers complained about the difficulty levels of the attainments, and in order to assess to what degree students achieve the aims and objectives of the course, EĢ(2010) suggested that the attainments can be grouped according to difficulty level based on individual differences of students. In this way, teachers can evaluate the success of the units or subjects. These suggestion was also supported in this study because some teachers stated that too many attainments existed in the curriculum and especially combination classroom teachers criticized the the fact that regional differences in Turkiye and students' individual differences in a class were ignored by curriculum development teams in Turkiye. In other words, combination classroom teachers underlined the importance of decentralized curriculum. Initially, determination of different attainments and grouping them into difficulty levels can help teachers and students.

Feasibility of the attainments and connection of them with daily life have been stated as positive aspects, through which, permanent learning is provided. Adal's (2011) and Ayvacı and Devecioğlu's (2009) study confirmed this finding. As for the number of attainments, teachers in all grades stated the number of attainments as one of the reasons for time constraints. While some teachers suggested more class hours for science and technology course in a week, some teachers suggested reduction in the number of the attainments. The same views were proposed by ġahin, Turan, & Apak, (2005), Kaptan (2005), EĢ(2010) and Boyacı (2010) as well.

The results illustrated that science and technology curriculum was sufficiently associated with the other courses. More than half of the participants agreed with this idea; that showed teachers had positive views on the vertical organization of the curriculum. Although teachers expressed their positive vews in the scale, in the open ended questions, few teachers stated that they had difficulties to realize science course attainments due to the curricula of mathematics course. The attainments of science and technology curriculum were not in harmony with the attainments of other courses, especially mathematics. Teachers stated that certain science topics require certain mathematical attainments that have not yet been covered in mathematics course. Unsynchronizations among the units of SCT and mathematics course cause problems for science and technology teachers. The in-harmony between curricula was also underlined by Kaptan (2005), who called attention on the disconnection between mathematics and science and technology curricula. If the integration is provided, attainments in both curricula can be realized and permanent and effective learning can be provided.

One of the results of this study was that attainments were clearly stated. Similarly, according to Çengelci's (2008) and Ayvacı and Devecioğlu's (2009) study, teachers believed the attainments were written clearly.

Determination of experiments accordance with the attainments and content was another positive view according to result of the study. Similarly, experiments were found as positive aspects of the curriculum in other studies (DemirbaĢ 2008; Doğan, 2010). Kara (2008) highlighted that the experiments could be conducted with materials which were available at home or school. According to Kaptan (1999) if schools have laboratories, geyser, and electrical system to show electric circuits, the experiments could be beneficial for learning.

The teachers expressed that they had positive views regarding the content component of the science and technology curriculum. While the teachers listed their suggestions to make the science and technology courses better, they criticized the shallow content as a limitation. They generally thought that the content of the science and technology curriculum was sufficient; whereas it could be better. They stated that content did not include enough information to comprehend the subjects. The content could not be comprehended effectively because the students were not used to doing research by using internet or reading various books. When researchers expressed their opinions on new curricula and its requirements, one of the frequently stated positive aspects was students' acquiring research skills, as specified in Çengelci's study (2008). However, students were unmotivated for research and the schools or their homes have limited resources to reach information.

Teachers had positive views on the sequences of the science and technology subjects. As a limitation, teachers, especially science and technology teachers expressed the restriction on formulas. The same restriction was criticized by Boyacı (2010) as well. Teachers wanted to explain and teach formulas because their students construct the formulas; then demand for the approval of teachers and ask for further explanation. Science and technology teachers wanted to teach and explain the formulas, but the curriculum did not let them teach formulas. When the teachers' guide book is examined, this expression attracts attention in some units such as force and movement at 6th grade: "mathematical equations should not be taught". This warning resulted in confusion in teachers' mind. Whether they would teach the formulas or equations after students constructed formulas themselves or teachers would ignore the formulas at all.

As it was stated, teachers generally had positive views on the units and sequence of them. However, 5th grade teachers had same suggestions. Fifth grade classroom teachers suggested that the units titled „Matter and Change' and "Light and Sound' should be changed because the students have difficulties in making meaning for abstract terms. The subject of "density" was very difficult to teach students. According to classroom teachers, abstract terminology makes the content above students' level. Kartal and Urtekin (2010) conducted a study to investigate whether a statistically significant difference exists between two classrooms, one of which had covered the unit "Light and Sound" with the classroom teacher and the other one with the science and technology teacher. The results showed that science and technology teacher's class had become more successful in this unit. According to the results of the present study, classroom teachers demanded that science and technology course was taught by science and technology teachers. It is obvious that if this course is taught by science and technology teachers, the units involving abstract terms can be taught more successfully.

Spiral curriculum characteristics were criticized by some science and technology teachers. The teachers thought that teaching or revising same subjects each year leaded to waste of time, whereas teachers agreed that revising same subjects helped students learn and remember important or basic information. In the same vein, Boyacı's (2010) study showed that spiral curriculum characteristics were good for teaching fundamental knowledge and this characteristic of the curriculum provided permanent learning for students.

5.1.1.2. Disscussion of Results on Learning-Teaching Process

The results showed that teachers had positive views concerning learning-teaching process. The most frequently expressed positive view was „to make students active participants' during the learning teaching process, which was also determined by BuluÇKırıkkaya (2009). In the present study, almost all of the participants (95.1%) reported positive views on the student-centered learning-teaching process. Teachers' views showed that constructivism was an important and an effective nature of the curriculum. However, how to put constructivism into practice is an important question mark in teachers' mind. When the results of the open ended question were examined, it was shown that teachers preferred to answer the open ended question that the books include. Instead of explaining the process with their own words, they opted for defining constructivism. This situation might indicate that teachers had theoretical information, but they did not really know how to implement this approach. Fullan (1982) called attention to understanding what teachers should think and how they implement the program, teachers' thoughts and the reasons behind these thoughts. In the present study, what teachers think was tried to be attained, but participants preferred to define constructivism and expressed the limitations that affect all components of the curriculum. According to Özmen's (2003) study, teachers believed that students could not decide on their own learning. A study conducted by Guven (2008) underlined the importance of teachers' responsibility on implementation rather than knowing the requirements. In the other studies, the results illustrated that teachers have positive views towards constructivism (Hevanlı et al., 2009), whereas they feel incompetent in using constructivism (Kartallıoğlu, 2005). Altun and Büyükduman (2007) criticized that teachers were educated with traditional instructional methods and they were expected to implement constructivism although they had not experienced constructivist implementations. From this point of view, several studies criticized in-service and pre-service teacher training programs (Hazır-Bıkmaz, 2006; Ercan & Akbaba-Altun, 2005; Karaer, 2006).

Ignorance of regional differences was also criticized by the teachers. According to participants, content was determined considering urban schools' students who had various opportunities to go on trips, observe, find materials for experiments and had access to visual equipment. Çiftcioğlu's (2009) study showed that the location where teachers work had a statistically significant effect on views regarding science and technology curriculum.

Teachers had positive views on experiments, laboratory activities and experiments, using various resources. These positive aspects were also emphasized in other studies (Doğan, 2010; Küçükmert-Ertekin, 2010; Kara, 2008).

5.1.1.3. Disscussion of Results on Assessment

Teachers' views on the assessment component of science and technology curriculum were tried to be determined by using 5 items and one open-ended question. The results of open ended questions showed that the participants opted for writing "I use" without any further explanation. Some participants opted for listing what kind of assessment techniques they use, while some teachers opted for writing „sometimes' without further explanation. This situation can be interpreted as teachers' not wanting to give examples of their implications or having negative attitudes towards complementary assessment techniques as other studies also indicate (Çengelci, 2008; Seker, 2007; Aydın & Çakıroğlu, 2010). Aydın (2007) conducted a study to investigate classroom teachers' views on the components of science and technology curriculum and she found that some participants use complementary assessment methods and they listed these methods as questioning, multiple choice exams or fill in the blanks questions. Similarly, different types of questions that teachers ask in the exams were stated as complementary evaluation methods in the present study as well. This illustrated that teachers had some misconceptions related to complementary assessment techniques.

As for the other components of the science and technology curriculum, lack of school facilitates, crowded classrooms and time constraints were the limitations to use complementary assessment techniques as indicated in some other studies (Adal, 2011; BuluĢKırıkkaya, 2009; Kasapoğlu, 2010; Sağlam-Arslan, Devecioğlu-Kaymakçı, & Arslan, 2009; ġeker, 2007).

Although there were many kinds of suggested complementary assessment methods in the curriculum, teachers use such methods as performance assessment, project tasks, portfolio assessments, peer evaluation, self-evaluation, and rubrics. Portfolio, performance and project based assessment, peer and self-assessment, presentation, observation, and interviews were complementary assessment methods mentioned in science and technology curriculum. Additionally, rubric, concept map, V-diagram structured grid, diagnosis branch tests were offered and explained as measurement tools in implementation of alternative assessment techniques. As it can be seen, some assessment techniques like structured grid and diagnosis branches tests were not mentioned. Assessment techniques were explained in curriculum, but teachers used certain types of assessment techniques like portfolio assessment or project tasks. That might be related to that teachers were familiar with some kind of techniques and used them frequently or they did not believe that some assessment techniques were effective tools and they were not used in practice. ġeker (2007) stated that assessment techniques were not clear, and Küçükmert-Ertekin (2010) highlighted the importance of teacher training programs to use complementary evaluation techniques. In-service teacher training programs on complementary evaluation techniques and to increase the effectiveness of the programs, alternative assessment techniques can be used with teachers who would be the active participants.

5.1.2. Discussion of Results Regarding Background Variables of Teachers

The second research question of the study was to research effect of background variables on teachers' views towards science and technology curriculum. Graduation field, gender and teaching experience were determined as the background variables.

5.1.2.1. Graduation Field

In the quantitative part of this research study, the items related to attainment and content were integrated and they constituted one component. The departments which teachers graduated from (classroom teacher training, elementary school science teacher training, Faculty of Arts and Sciences and the others) had a statistically significant impact on teachers' views on attainment-content. Sahan's (2010) study investigated the effect of the departments teachers graduated from (Faculty of Education and others). Result of the study showed that the departments which teachers graduated from have a statistically significant effect on the curriculum perceptions of teachers. On the other hand, no important differences were found among teachers who graduated from different departments in Education Faculty. Çiftçioğlu (2009) maintains that graduation field did not have an effect on attainment, content, learning-teaching process or assessment components of the science and technology curriculum.

5.1.2.2. Gender

The effect of gender on teachers' views regarding science and technology curriculum was researched in some studies and the results showed differences. In this study, gender did not have an effect on teachers' views. While some studies show the same results with this study regarding the effect of gender on teachers' views or perception on Science and Technology Curriculum (Gömleksiz & Bulut, 2006; Ercan, 2007; Kara, 2008; Tatar, 2007), some research studies showed that gender has a significant impact on teachers' views on Science and Technology Curriculum (Doğan, 2009; Günay & Yurdabakan, 2011; Tabak, 2007). Yangın's (2007) study might explain theses differences. He conducted the study in the first year of nation-wide implementation of the new curriculum and the pilot schools were excluded from the study. In other words, the first time teachers were practicing the curriculum in his sample. While gender had a statistically significant effect on teachers' views in the beginning of the semester, at the end of the semester gender did not have a statistically significant effect on teachers' views. This result may be related to how long teachers practice the Science and Technology Curriculum. In brief, these differences among the results of the studies could be related participants' characteristics and background variables.

5.1.2.3. Teaching Experience

Results showed that, overall, teaching experience had a statistically significant effect on teachers' views on attainmts-content and evaluation of science and technology curriculum. However, teaching experience did not have any statistically significant effect on teachers' views about learning-teaching process. In contrast to this study, in a study conducted by Günay and Yurdabakan (2011), teaching experiences did not affect teachers' views on the curricula. In Günay and Yurdabakan's (2011) study, teaching experiences were divided into 3 categories. The first group comprised of teachers who have 10-years or less experience. The second group included teachers who have 11-20 year experience and the third group was composed of teachers with 21-year or more experience. According to the results of their study, teaching experiences did not show statistically significant differences regarding teachers' views on the positive aspects of the curricula. Similarly, Çiftçioğlu's (2009) and Gömleksiz and Bulut's study (2006) also showed that there were no statistically significant differences among the views of classroom teachers on science and technology curriculum in terms of their teaching experiences. The reasons behind these different results might be related to the differences in the duration of experience. In other words, in those studies teaching experiences were divided into 10-year- intervals, while the present study divided the teaching experiences based on Huberman's (1989) study. Thus, different experience duration was grouped under different teaching experience levels.

5.1.3. Teaching Fields

The effect of teaching fields (classroom teachers and science and technology teachers) on each dependent variable (attainment-content, learning-teaching process, assessment) was also examined in the present study. The results indicated that teaching fields have a statistically significant effect on teachers' views on attainment-content and on assessment. Çiftçioğlu (2009) conducted a study to investigate teaching fields. When teaching field was taken into consideration, Çiftcioğlu's (2009) study showed that teaching fields (classroom teachers and science and technology teachers) do not have a statistically significant effect on teachers' views on attainments, content, learning-teaching process or assessment. The differences among the results of the studies may be related to participant characteristics. While sample of the present study was classroom teachers and science and technology teachers, sample of Çiftçioğlu's (2009) study was composed of 5^{th} grade classroom teachers working in KahramanmaraĢ. Briefly, the participants of this study was composed of teachers who was teaching 4^{th}, 5^{th}, 6^{th}, 7^{th} and 8^{th} grade science and technology curriculum. So, grade differences may lead to differences in the results. Another possible reason was that while this study was a nation-wide study, Çiftcioğlu's study was conducted in a province and reflected teachers' views working in a city.

5.2. Implications for Practice

In total, 960 classroom teachers and science and technology teachers working in elementary schools participated in the present study. Several recommendations were revealed for science and technology curriculum. The present study reflected the general views of teachers on the curriculum components. The results drawn from the data of the study will shed light on the positive aspects and limitations of science and technology curriculum to reach better curriculum implementations. Briefly, suggestions for practice were offered in this section regarding science and technology curriculum's components and limitations to teach the course as curriculum suggest based on the major findings of the study.

The results showed that teachers' have positive views on the attainments-content, learning-teaching process and assessment components of the curriculum. Since crowded classrooms, limitation of time, insufficient number of materials emerged as the major factors that limits teachers' endeavors and affects teachers' views on science and technology curriculum negatively, the first focus was on these limitations which affect each component of the curriculum.

In order to recognize individual differences of students, provide students' active participations in learning-teaching process, examine students' learning progress in time, evaluate to what degree students achieve the attainments, spare more time on different activities, spare less time for classroom management and allocate more time for students' learning, teachers should be guidance of non-crowded classrooms. Classes with small number of students can have sufficient number of materials; enough spaces for students with different learning skills. As teachers suggests in this study, number of students in each class can be reduced to 25 students. On the other hand, situation is far from ideal in many schools to implement science and technology curriculum in the way it is intended.

As it is stated before, the time expectancies of teachers were among the major findings of the study that need attention. Science and technology course had four class hours in a week when the data were collected; however, hours of science and technology courses decreased to three class hours in a week in 2010. The class hours can be increased to 4 hours again, or laboratory course can be designed as a separate course.

It is expected from schools that they should include all the means necessary for a curriculum to be implemented as it is suggested. In order to conduct experiments, apply constructivism, or offer opportunities for students with different learning skills, teachers should be supported with rich and satisfactory conditions in classrooms and schools. In contrast to this expectancy, the results of the study show that teachers encounter some problems because materials and equipments are usually not available or insufficient. National Educational Directories in each province can demanded for a report from each school about the usable, existence and non-existance of materials and equipments to determine needs of schools. Teachers' suggestions also show that to supplement schools' facilities such as providing usable laboratories in schools, conducting internet unit for students in the classes is essential. Providing usable laboratories is also essential for achieving attainments, cover the content as it is suggested and put into practice experiments as the curriculum suggest.

Teachers also mention textbooks which did not include enough information to use as an information resource. If the information resources such as internet connection, various books can be provided for all schools, textbooks would not be found as a unique information sources. Teachers also demand for more colorful textbooks to attract students' attentions on the topic which is being taught.

Teachers' views on constructivism were also researched in the study in the qualitative part of the study. Teachers opted for defining constructivism instead of explaining how they apply it in their classes. This finding showed that teachers had some question mark in their mind related to constructivist approach and how to apply it in the learning environment. An in-service teacher training program can be developed on constructivist practices. Although they have theoretical information on constructivist approach, they are in need of in-detail explanations on constructivist practices. The results showed that some teachers have not yet to attend an in-service teacher training on new the curriculum and they may have some misconceptuals or they may miss some key points. Some teachers attented in the in-service teacher programs on the new curriculum but they cirticize the ineffectiveness of the in-service teacher training programs. Training and workshops on constructivist practices should be undertaken during in-service education of teachers. Similarly, during pre-service education, teachers should be familiar with the constructivist practices and they can be equipped with the information on constructivism. In other words, it is important to train teacher candidates in line with the intended curriculum characteristics. Both teachers and teacher candidates should discuss on the criticism of constructivism and requirements of constructivism to find answer the questions in their mind. After this process, they can feel more confident related to constructivist practices.

Complementary assessment methods were another important point that teachers need more guidance. Various assessment methods can be practices during in-service teacher trainings and theoretical and practical information can be offered to teachers. Results showed that teachers feel incompetent to use rubrics, diagnosis branches tests and structured grids. The programs should stress the importance of these rarely used complementary methods.

5.3. Recommendations for Further Studies

A new instrument was developed for this study taking the main changes of science and technology curriculum into consideration. The results of the present study are consistent with the literature, especially regarding the limitations teachers encounter. Still, more variables could be added for further studies.

The aim of the study was to reflect general picture of. teachers' views on Science and Technology Curriculum. Some in-detail studies Therefore, research stuides can be conducted to reflect teachers' views on sub-areas of attainments and learning areas.

The aim of the study was to investigate views of teachers, working in different locations with different socio-economic statues, on science and technology curriculum. Views of combination classroom teachers or teachers working in rural or urban areas were taken to draw a general picture. Qualitative research could be conducted to analyze these teachers' views on the curriculum and their needs could be specified.

The integration of science and technology curriculum with the other courses, especially mathematics, could be investigated. Unsynchronizations among the units cause problems for science and technology teachers. The units in the courses can be rearranged. Additionally, research on teachers' views about sequences of the topics in science and technology curriculum is needed to be conducted.

Goodlad (1979) defined different curricula those are ideological curricula, formal curricula, perceived curricula, operational curricula, and experiential curricula. The differences among perceived, operational and experiential curricula can be researched. Especially, studies on experiential curricula can give a chance of evaluating the practices from sudents' point of view and learning students' views.

The results of the study showed that combination classroom teachers underline the importance of decentralized curriculum. Conducting research on views of teachers who are working in different provinces, on decentralized curriculum by asking the reasons is suggested in this study.

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APPENDIX A

TEACHERS' VIEWS on SCIENCE and TECHNOLOGY CURRICULUM QUESTIONNAIRE

Sayın MeslektaĢım,

Bu araĢtırmanın amacı, fen ve teknoloji öğretmenlerinin fen ve teknoloji öğretim programına yönelik öğretmen görüĢlerini belirlemektir. Elde edilen bulgular, sadece bu araĢtırma kapsamında kullanılacaktır. Lütfen bu ankete adınızı yazmayınız. Üç bölümden oluĢan bu veri toplama aracı, demografik bilgiler, programa yönelik öğretmen algıları ölçeği ve açık uçlu sorular olmak üzere üç bölümden oluĢmaktadır.
Ankete vermiĢ olduğunuz cevaplar gizli tutulacak ve sadece araĢtıma amacı ile kullanılacaktır. Tüm soruları yanıtlamanız araĢtırmanın amacına ulaĢması için çok önemlidir. Katılımınız ve katkılarınız için Ģimdiden çok teĢekkür ederim.

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I. DEMOGRAFİK BİLGİLER

Bu bölüm sizin meslekî ve kişisel bilgilerinizi kapsamaktadır.

1. Cinsiyetiniz: ☐ Kadın ☐ Erkek
2. Mezun Olduğunuz

Fakülte/Yüksek Okul (Lütfen tam adını yazınız):…………………………………………
Bölüm/BranĢ ………………………………………………………………………………..

3. Kaç yıldır öğretmen olarak görev yapıyorsunuz: ....
4. Görev yapmakta olduğunuz il: ………………………………..........................
5. Görev Yaptığınız BranĢınız:

   ☐ Sınıf Öğretmeni ☐ Fen ve Teknoloji Öğretmeni

6. Fen ve Teknoloji öğretim programlarına yönelik hizmet-içi eğitim aldınız mı?

   ☐ Evet ☐ Hayır

7. Okulunuzda <u>kullanılabilir</u> durumda bir fen ve teknoloji laboratuvarı var mı?

   ☐ Evet ☐ Hayır

8. Bu dönem hangi sınıflara fen ve teknoloji dersi vermektesiniz?

   ☐ 4. sınıf ☐ 5. sınıf ☐ 6.sınıf ☐ 7.sınıf ☐ 8.sınıf

II. Fen ve Teknoloji Öğretim Programlarına Yönelik Öğretmen Görüşleri Ölçeği

Bu bölüm, sizin fen ve teknoloji programlarına yönelik görüÇlerinizi belirlemek üzere hazırlanmıÇtır. Lütfen her bir maddeyi dikkatlice okuyup, sizin görüÇlerinize uygun derecedeki kutucuğu (X ile) iÇaretleyiniz.

	Kesinlikle katılmıyorum	Kısmen Katılmıyorum	Ne katılıyorum Ne katılmıyorum	Kısmen Katılıyorum	Tamamen katılıyorum
1. Fen ve teknoloji öğretim programındaki deneyler, kazanımlara uygun biçimde belirlenmiÇtir.	1	2	3	4	5
2. Fen ve teknoloji öğretim programında önerilen etkinlikleri faydalı bulurum.	1	2	3	4	5
3. Okulun imkanları (lab., materyaller vb.) kazanımların gerçekleÇtirilmesi için yeterlidir.	1	2	3	4	5
4. Fen ve teknoloji konuları, programda önerilen sürede bitirilebilir.	1	2	3	4	5
5. Fen ve teknoloji öğretim programı içerik bakımından yeterlidir.	1	2	3	4	5
6. Sınıf dıÇı öğrenme ortamlarının kullanılması (laboratuvar etkinlikleri, gezi, gözlem vs) fen ve teknoloji dersi için vazgeçilmez bir öneme sahiptir.	1	2	3	4	5
7. Öğrencinin derse aktif katılımı, fen bilgisi öğretimini daha zevkli hale getirir.	1	2	3	4	5
8. Öğrencilerin kazanımlara ne düzeyde ulaÇtığını belirlemek mümkündür.	1	2	3	4	5
9. Öğrencinin kendi kendini değerlendirdiği yöntemler özneldir.	1	2	3	4	5
10. Öğretim programında önerilen değerlendirme yöntemlerini (öğrenci ürün dosyası, performans değerlendirme gibi) uygulamak etkilidir.	1	2	3	4	5
11. Fen ve Teknoloji öğretim programında önerilen (sözlü-yazılı sınavlara ek olarak) alternatif değerlendirme yöntemlerinin (akran değerlendirmesi,öğrenci ürün dosyası) kullanılması uygundur.	1	2	3	4	5
12. Programda kazanımların gerçekleÇtirilebilmesi için önerilen süre azdır.	1	2	3	4	5
13. Programdaki konular, öğrencilerin seviyesine uygundur	1	2	3	4	5

	Kesinlikle katılmıyorum	Kısmen Katılmıyorum	Ne katılıyorum Ne katılmıyorum	Kısmen Katılıyorum	Tamamen katılıyorum
14. Fen ve teknoloji dersi programda diğer derslerle yeterli düzeyde ilişkilendirilmektedir.	1	2	3	4	5
15. Fen bilimleri ile teknoloji mevcut öğretim programında yeterince bütünleştirilmiştir.	1	2	3	4	5
16. Fen ve teknoloji öğretim programındaki deneyler, içeriğe uygun biçimde belirlenmiştir.	1	2	3	4	5
17. Konuların işlenmesi için, programda tanınan zaman esnekliği uygun bir yaklaşımdır.	1	2	3	4	5
18. Öğretim programındaki kazanımlar, öğrencilerin gelişimsel seviyelerine uygundur.	1	2	3	4	5
19. Diğer fen ve teknoloji öğretmenleriyle işbirliği etkili eğitim için önemlidir.	1	2	3	4	5
20. Laboratuvar etkinlikleri fen ve teknoloji dersinin ayrılmaz bir parçasıdır.	1	2	3	4	5
21. Proje ödevleri öğrencilerin performansını ölçmek için iyi bir araçtır.	1	2	3	4	5
22. Öğrenci ürün dosyalarını değerlendirmek zaman alsa da, yararlıdır.	1	2	3	4	5
23. Merkezi sınavlar (SBS gibi) ile programda önerilen değerlendirme yöntemleri uyumludur.	1	2	3	4	5
24. Programda önerilen etkinlikler, öğrencilerin seviyesine uygundur	1	2	3	4	5
25. Konuların sıralanış biçimi uygundur.	1	2	3	4	5
26. Fen ve teknoloji öğretim programındaki kazanımlar gerçekleştirilebilir niteliktedir.	1	2	3	4	5
27. Öğretim programında yer alan kazanımlar açık bir biçimde ifade edilmiştir.	1	2	3	4	5
28. Programda kazanımların gerçekleşmesi için veli-okul işbirliği önemlidir.	1	2	3	4	5
29. Ürün odaklı ölçme ve değerlendirme yöntemi uygulanabilir değildir.	1	2	3	4	5
30. Öğrencilerin farklı kaynaklardan yararlanarak öğrenmelerini teşvik ederim.	1	2	3	4	5
31. Fen ve teknoloji öğretim programı sınıfta öğretim teknolojilerinin (tepegöz, projektör, cd) kullanılmasını gerektirir.	1	2	3	4	5

III. KATILIMCI GÖRÜŞLERİ

Bu bölümün amacı, öğretmenlerin fen ve teknoloji öğretim programına iliĢkin görüĢlerini almaktır. GörüĢlerinizi paylaĢmanız araĢtırmanın amacına ulaĢması için büyük önem taĢımaktadır.

1. Fen ve Teknoloji Öğretim Programında belirtilen kazanımlar hakkındaki görüĢleriniz nelerdir?

....

....

....

2. Fen ve Teknoloji Öğretim Programlarının içeriğinin olumlu ve var ise iyileĢtirilmesi gereken yönlerini yazınız.

....

....

....

3. Fen ve Teknoloji öğretim Programlarının önerdiği yapılandırmacı yöntemleri derslerinizde ne ölçüde kullanıyorsunuz/kullanmıyorsunuz. Lütfen nedenleriyle birlikte ayrı ayrı örnekler yazınız.

....

....

....

4. Fen ve Teknoloji Öğretim Programlarında önerilen ölçme ve değerlendirme yöntemlerini ne ölçüde uygulamaktasınız? Lütfen nedenleriyle birlikte yazınız.

....

....

....

5. Fen ve Teknoloji dersi öğrenme-öğretme sürecinde ne tür sorunlar yaÇamaktasınız, lütfen yazınız.

6. Fen ve teknoloji dersi uygulamalarınızı olumlu etkileyecek etkenler neler olabilir? Lütfen önerilerinizi yazınız.

7. Genel olarak, eklemek istediklerinizi lütfen yazınız.

Katkılarınız için çok teşekkür ederim.

APPENDIX B

Syntax

```
include 'C:\Users\yeliz\Desktop\chapter4\normtest.sps'.
normtest vars =
g1,g2,g3,g4,g5,g6,g7,g8,g9,g10,g11,g12,g13,g14,g15,g16,g17,g18,g19,g20,g21,g22,g23
,g24,g25,g26,g27,g28,g29,g30,g31.
```

Output

```
Critical values (Bonferroni) for a single multivar. outlier:



  critical F(.05/n) =68.80  df = 31, 748
  critical F(.01/n) =73.62  df = 31, 748

5 observations with largest Mahalanobis distances:
  rank = 1  case# = 495  Mahal D sq =    139.44
  rank = 2  case# = 442  Mahal D sq =    130.29
  rank = 3  case# = 331  Mahal D sq =    129.33
  rank = 4  case# =  21  Mahal D sq =    118.87
  rank = 5  case# =  17  Mahal D sq =    117.09
```

APPENDIX C

Positive Views on Attainments

Teachers' Views on Attainments	**4th grade teachers frequencies f**	**Percent %**	**5th grade teachers' frequencies f**	**Percent %**	**Combination Classroom Teachers' frequencies**	**Percent %**	**Science and Technology Teachers' frequencies f**	**Percent %**
Appropriate for students' level	120	51.9	132	54.5	7	35	95	30.9
Feasible	35	15	36	14.9	1	5	66	21.4
Appropriateness to content	21	9	-	-	-	-	38	12.3
Comprehensible	18	7.8	18	7.4	-	-	-	-
Related to real life	15	6.5	5	2	-	-	5	1.6
The difficulty levels of attainments	4	1.7	-	-	-	-	-	-
Appropriate number of attainment	1	.4	23	9.5	-	-	-	-
Provide basic information for the future grades	-	-	18	7.4	-	-	-	-
Effective	-	-	-	-	-	-	25	8.1
Difficulty in achieving abstract content's attainments	-		9	3.7	-	-	-	-

Limitations of Attainments

Teachers' Views on Attainments	**4th grade teachers frequencies f**	**Percent %**	**5th grade teachers' frequencies f**	**Percent %**	**Combination Classroom Teachers' frequencies**	**Percent %**	**Science and Technology Teachers' frequencies f**	**Percent %**
Time constraints	24	10.3	5	2	3	15	19	6.1
Above the students' level	18	7.8	14	5.8	3	15	28	9.1
Too many attainments	7	3	11	4.5	1	5	27	8.8
Unclear expression of attainments	7	3	-	-	8	40	-	-
Obstacles faced due to individual differences of students	6	2.6	-	-	-	-	-	-
Lack of laboratory materials/equipment	6	2.6	5	2	1	5	14	4.6
Dislike	4	1.7	-	-	4	20	3	1
Vague	4	1.7	-	-	2	10	11	3.5
Difficulty in achieving abstract content's attainments	-	-	12	5	-	-	-	-
Based on students' imagination	-	-	-	-	3	15	-	-
Need for ordering attainments from easy to difficult	4	1.7		-	2	10	3	1
Neglecting the regional differences	-	-	-	-	9	45	14	4.6
Restriction on the teaching of formulas	-	-	-	-	-	-	8	2.6
Below the students level	-	-	-	-	-	-	5	1.6
Having difficulty in assessing some of the attainments	-	-	-	-	-	-	7	2.3
Lack of pre-requisite of students	-	-	-	-	-	-	13	4.2

APPENDIX D

Positive Aspects of Content

Teachers' Views on Content	**4th grade teachers frequencies**	**Percent %**	**5th grade teachers' frequencies**	**Percent %**	**Combination Classroom Teachers' frequencies**	**Percent %**	**Science and Technology Teachers' frequencies**	**Percent %**
Positive views	46	20.2	33	14	2	11.1	62	20.8
Appropriacy to students level	10	4.4	28	11.9	2	11.1	9	3
Connection to daily life	4	1.8	6	2.5	-	-	-	-
Efficient teacher guidebook	3	1.3	4	1.7	-	-	11	3.7
Effective Experiments	3	1.3	10	4.2	-	-	-	-
Preparation for the upper grades	-	-	3	1.2	-	-	-	-
The best curriculum among the others	3	1.3	3	1.2	-	-	-	-
Effective experiments	-	-	-		1	5.5	-	-
Restriction in teaching formulas	-	-	-		-		26	8.7

Limitations of Content

Teachers' Views on Content	4th grade teachers frequencies	Percent %	5th grade teachers' frequencies	Percent %	Compound Classroom Teachers' frequencies	Percent %	Science and Technology Teachers' frequencies	Percent %
Inadequate materials/ equipment/ laboratories	36	15.8	42	17.8	4	22.2	49	16.4
Time constraints	31	13.6	11	4.7	4	22.2	34	11.4
Shallow content	27	11.9	9	3.8	-	-	23	7.7
Neglect of regional differences	15	6.6	2	0.8	3	16.6	10	3.3
Inadequate explanations of the subjects	12	5.2	21	8.9	-	-	-	-
Constraints in laboratory	7	3	11	4.7	2	11.1	-	-
Need for Simple experiments	7	3	2	0.8	-	-	-	-
Need for visual materials (CDs)	6	2.6	13	5.5	2	11.1	-	-
Vague explanations for the experiments	4	1.8	3	1.2	-	-	-	-
Crowded classrooms	4	1.8	-	-	-	-	21	7
Difficulty in understanding abstract terminology	4	1.8	3	1.2		-	-	-
Negative effects of spiral curriculum	1	0.4	-	-	-	-	5	1.7
Boring textbooks for students	1	0.4	8	3.4	-	-	-	-
Above students' level	-	-	7	3	-	-	-	-
Need for changes in sequence of the topics	-	-	18	7.6	-	-	-	-
Restriction in teaching formulas	-	-	-		-		26	8.7
Inappropriacy between science and technology course and mathematics' course	-	-	-		-		24	8

APPENDIX E

Positive Aspects of Learning-Teaching Process

Teachers' Views on Learning-Teaching Process	4th grade teachers frequencies	Percent %	5th grade teachers' frequencies	Percent %	Compound Classroom Teachers' frequencies	Percent %	Science and Technology Teachers' frequencies	Percent %
Practicing as curriculum suggest	42	19.1	23	10.1	1	4.5	41	13.6
Making students active participants students	42	19.1	23	10.1	-	-	30	10

Limitations of Learning-Teaching Process

Teachers' Views on Learning-Teaching Process	4th grade teachers frequencies	Percent %	5th grade teachers' frequencies	Percent %	Compound Classroom Teachers' frequencies	Percent %	Science and Technology Teachers' frequencies	Percent %
Crowded Classrooms	33	15	31	13.7	8	36.3	39	13
Lack of materials/ equipments/ laboratory	39	18	31	13.7	3	13.6	25	8.3
Time constraints	21	9.6	5	2.2	2	9	19	6.3
Need for more experiments	5	2.3	4	1.8	-	-	-	-
Need for basic requirements	2	0.9	2	0.9	9.1	-	-	-

APPENDIX F

Positive Aspects of Constructivism

Teachers' Views on Constructivism	4th grade teachers frequencies	Percent %	5th grade teachers' frequencies	Percent %	Compound Classroom Teachers' frequencies	Percent %	Science and Technology Teachers' frequencies	Percent %
Make students more active	68	32.2	36	17	-	-	51	15.6
Sometimes I use	25	12	28	13.3	1	5.9	21	6.4
I use Constructivism	18	8.6	15	7.1	-	-	39	12
Enough to use questioning for constructivist implementations	12	5.7	3	1.4	-	-	-	-
If the attainments requires I use	4	1.9	4	1.9	-	-	-	-

Limitations of Constructivism

Teachers' Views on Constructivism	**4th grade teachers frequencies**	**Percent %**	**5th grade teachers' frequencies**	**Percent %**	**Compound Classroom Teachers' frequencies**	**Percent %**	**Science and Technology Teachers' frequencies**	**Percent %**
Crowded Classrooms	31	14.8	24	11.4	4	23.5	77	23.6
Lack of materials/ equipment-ineffective laboratory	22	10.5	33	15.6	5	29.4	40	12.3
Time constraints	16	7.6	5	2.4	-	-	44	13.5
Limitations on research opportunities	16	7.6	11	5.2	-	-	7	2.1
Appropriate for only private schools	11	5.2	-	-	3	17.6	-	-
Existing of unmotivated students	9	4.3	9	4.3	-	-	9	2.8
Using in advance classes	8	3.8	4	1.9	-	-	9	2.8
Not using	7	3.3	4	1.9	2	11.8	5	1.5
Conducting experiments in the classrooms	4	1.9	2	0.9	-	-	-	-
Lack of pre-requisite knowledge	4	1.9	8	3.8	-	-	-	-
Difficulties in conducting experiments in the classroom effectively	4	1.9	-	-	-	-	-	-
Financial problems of parents	3	1.4	8	3.8	-	-	-	-
Need for in-service education	-	-	5	2.4	-	-	-	-
Using Traditional teacher-centered methods	-	-	9	4.3	-	-	30	9.2

APPENDIX G

Positive Aspects of Assessment Techniques

Teachers' Views on Assessment	4th grade teachers frequencies	Percent %	5th grade teachers' frequencies	Percent %	Compound Classroom Teachers' frequencies	Percent %	Science and Technology Teachers' frequencies	Percent %
Using of complementary evaluation techniques	43	18.8	34	15.2	2	11.8	51	16
Project assessment	31	13.5	26	11.6	-	-	31	9.8
Performance Assessment	30	13.1	24	10.8	-	-	29	9.1
Sometimes I use	27	11.8	21	9.4	2	11.8	37	11.7
Portfolio Assessment	21	9.2	19	8.5	-	-	16	5.0
Peer evaluation	3	1.3	2	0.9	1	5.9	5	1.6
Questioning	3	1.3	-	-	1	5.9	-	-
Self-evaluation	2	0.9	4	1.8	2	11.8	5	1.6
Presentation	2	0.9	-	-	-	-	-	-
Providing effective feedbacks	2	0.9	5	2.2	2	11.8	14	4.4
Rubrics	1	0.4	1	0.4	-	-	-	-

Limitations of Assessment Techniques

Teachers' Views on Assessment	4th grade teachers frequencies	Percent %	5th grade teachers' frequencies	Percent %	Compound Classroom Teachers' frequencies	Percent %	Science and Technology Teachers' frequencies	Percent %
Time constraints	40	17.5	47	21	-	-	65	20.5
Crowded classrooms	31	13.5	27	12.1	3	17.6	49	15.4
Not applicable	2	0.9	2	0.9	4	23.5	-	-
Ineffective questionnaires	2	0.9	2	0.9	-	-	-	-

APPENDIX H
TEZ FOTOKOPİSİ İZİN FORMU

ENSTİTÜ

Sosyal Bilimler Enstitüsü

YAZARIN

Soyadı : Temli

Adı : Yeliz

Bölümü : Eğitim Bilimleri Bölümü

TEZİN ADI (İngilizce) : Classroom Teachers' and Science and Technology Teachers' Views on Science and Technology Curriculum

TEZİN TÜRÜ : Doktora

1. Tezimin tamamından kaynak gösterilmek şartıyla fotokopi alınabilir. ☐
2. Tezimin içindekiler sayfası, özet, indeks sayfalarından ve/veya bir bölümünden kaynak gösterilmek şartıyla fotokopi alınabilir. .**X**
3. Tezimden bir bir (1) yıl süreyle fotokopi alınamaz. **X**

TEZİN KÜTÜPHANEYE TESLİM TARİHİ: 15 Mart 2012

APPENDIX I

TURKISH SUMMARY

TÜRKÇE ÖZET

SINIF ÖĞRETMENLERĠ VE FEN VE TEKNOLOJĠ ÖĞRETMENLERĠNĠN FEN VE TEKNOLOJĠ ÖĞRETĠM PROGRAMINA YÖNELĠK GÖRÜġLERĠ

GİRİŞ

Fen bilimlerinin etkili öğretimini geliĢtime birçok ülkede önemli önerilerle ilerleyen bir çalıĢma alanıdır. Özellikle son yıllarda oluĢturmacı yaklaĢım üzerine birçok çalıĢma yapılmıĢ ve fen bilgisi öğretmine etkisi araĢtırılmıĢtır (Cobb, 2011; Sanchez & Valcarcel, 1999). Ġngilizce constructivist approach terimine karĢılık olarak bazı araĢtırmacılar yapılandırmacı yaklaĢım termini kullanmayı tercih ederken bazı araĢtırmacılar oluĢturma fiilinin kuramla daha iyi örtüĢtüğü düĢüncesiyle oluĢturmacı yaklaĢım ifadesini kullanmaktadırlar. OluĢturmacı yaklaĢım, öğrenenlerin nasıl öğrendiği ya da nasıl anlam ürettikleri ve oluĢturduklarıyla ilgili br kuramdır (Brooks & Brooks, 1999). Öğrenenler aktif olarak bilgiyi alır, önceki bilgileriyle bağlantı kurar ve kendi yorumlarını katarak kendi bilgilerini oluĢtururlar (Cheek, 1992). Kısaca, oluĢturmacı yaklaĢım öğretmeni bilgi aktaran, öğreneni pasif alıcı olarak görmez, öğreneni etkili öğrenme sürecinin merkezine koyar (Bruner, 1973). Benzer bir anlayıĢla, Yager (2000) fen bilgisi öğreniminde öğrenenin ve aktif olarak öğrenmenin önemini vurgular. OluĢtumacı yaklaĢıma yönelik bir çok araĢtırma bulunmasına ve birçok program geliĢtime uzmanı geliĢtirdikleri programları oluĢturmacı yaklaĢım temeline dayanarak hazırlamalarına rağmen, uygulamada öğrenenlerin bilgiyi alan ve öğretmenin de bilgiyi aktaran rollerini yükleyen geleneksel ve alıĢılmıĢ öğretim yöntemleriyle uygulamalara devam edilmektedir (Blooser, 1999).

Bilim ve teknolojideki hızlı geliĢmeler, geleceği yakalayan fen bilgisi öğretim programları hazırlanmasını gerekli kılmaktadır (Tok, 2008). Ġlköğretimden üniversite yıllarına kadar fen bilgisi temel çalıĢma alanlarından biri olmuĢtur ve fen bilgisi öğretim programları incelendiğinde, bilimsel süreç becerilerini kullanma yeteneği kazanmıĢ ve fen bilimlerine yönelik olumlu görüĢ ve eğilimler geliĢtirmiĢ bireylerin yetiĢtirilmesi temel amaç olmuĢtur (Türkmen, 2007). ÇalıĢmaların ortaya koyduğu en önemli bulgulardan biri, öğretmenin fen bilgisine yönelik görüĢ ve tutumlarının öğrencinin baĢarısını etkilediğidir (Moore, 1973; Brichouse, 1997).

Milli Eğitim Bakanlığı tarafından 2004 yılında yapılandırmacı yaklaĢım temeline dayalı yeni bir eğitim programı tanıtılmıĢ ve 2005- 2006 eğitim öğretim yılından itibaren uygulanmaya konulmuĢtur(Türkiye Bilimler Akademisi, 2004). Eğitim programlarında yeni bir yaklaĢımı uygulamaya koymak, bir paradigma değiĢiminin yanında, alıĢılagelmiĢ uygulamaları aĢmayı ve yeni perspektiflerin uyarlanmasını gerekli kılmaktadır (Brooks & Brooks, 1999, s. 25). Fakat eğitim programlarının değiĢtirilmesi, uygulamaların da değiĢtiği anlamını taĢımamaktadır (Wilson & Berne, 1997). Eğitim programlarının uygulayıcıları olarak, öğretmenler program değiĢikliklerinde önemli bir rol oynamaktadırlar (Duffee & Aikenhead, 1992) ve öğretmenlerin değiĢime yönelik inançları ve bilgileri yenilenmiĢ programların uygulanmasını etkileyebilmektedir (van Driel, Beijaard & Verloop, 2001).

OluĢturmacı öğrenmenin baĢarıyla gerçekleĢtirilmesi, çeĢitli uygulamaları da beraberinde getirmektedir. Örneğin demokratik bir öğrenim yaratmak (Akar, 2003), aktif öğrenci katılımı sağlamak (ġahin, 2008), tamamlayıcı değerlendirme yöntemlerini kullanmak (Erdoğan, 2007), sınıflarda klasik oturma düzeninin ötesine geçebilmek, örneğin U Ģekilli oturma düzeni gibi oturma Ģekillerinin kullanılması (MEB, 2003) önerilmektedir. Özellikle öğretmen adaylarının pratik kazanmaları için, hizmet öncesi eğitim süresince aldıkları derslerde oluĢturmacı bir öğrenim ortamında bulunmalarının gerekliliği vurgulanmaktadır (Richardson, 2003).

Yeni öğretim programlarının uygulanmasıyla birlikte, "hedefler" yerine "kazanımlar" belirlenmiĢ ve alt alanlara ayrılmıĢ (bilimsel süreç becerisi, tutumlar gibi) ünite sayılarında ve bazı konuların içeriğinde değiĢikliğe gidilmiĢ ve programların sarmal yapıları vurgulanmıĢ, öğrenme-öğretme sürecinde oluĢturmacı yaklaĢım temel alınarak bireysel farklılıklar ön plana çıkarılmıĢ, farklı etkinliklere ve öğrenci merkezli uygulamalara yer verilmiĢ ve değerlendirmede tamamlayıcı değerlendirme yöntemleri ve süreç değerlendirmesinin önemi sıklıkla vurgulanmıĢtır (Bayrak & Erden, 2007; Ercan & Akbaba-Altun, 2004; Metin & Cansüngü-Koray, 2007). Yeni programın uygulanmaya baĢlamasıyla birlikte farklı görüĢler ve sorunlar ortaya çıkmıĢtır.

Sağlam (2008) bir programın uygulanmasında öğretmenlerin görev yaptığı okulun bulunduğu yerin sosyo-ekonomik durumunun önemine dikkat çekmiĢtir. Öğretmenlerin programın uygulanmasına yönelik görüĢlerinin olumlu olması için okulda laboratuvar bulunmalı, öğretim teknolojileri açısından yeterli olmalı ve gerekli araç-gereçlerin sağlanmıĢ olmalıdır (Day, 1999). Öğretmenlerin görüĢlerinin eğitim uygulamalarını direkt etkileyen bir etken olduğu göz önünde bulundurulduğunda, farklı yerlerde, farklı koĢullarda çalıĢan öğretmenlerin farklı görüĢlere sahip olması kaçınılmaz bir gerçektir (Day, 1999; Fullan 1997; Nias, 1989).

GeliĢtirilen parogramlar, dört temel ve birbiriyle etkileĢim halinde olan boyuta sahiptir. Bunlar, hedefler, içerik, öğrenme-öğretme süreci ve değerlendirmedir (Demirel, 2000). Milli Eğitim Bakanlığı tarafından 2004 yılında pilot uygulaması baĢlanan yeni ilköğretim programlarında hedefler sözcüğü yerine kazanımlar sözcüğü kullanılmıĢtır. Fen-teknoloji-toplum-çevre (FTTÇ), bilimsel süreç becerileri, tutum ve değerler, dört temel öğrenme alanıyla ilişkilendirilmiştir. Dört temel öğrenme alanı ise, “Canlılar ve Hayat”, “Madde ve Değişim”, “Fiziksel Olaylar” ve “Dünya ve Evren” olarak belirlenmiştir (MEB, 2005). 2000 yılında uygulamaya konulan Fen Bilgisi Öğretim Programıyla karşılaştırıldığında ünite sayısı ve içerik değişmiştir. Oluşturmacı yaklaşım temel yaklaşım olarak belirlenmiş, bireysel farklılıklara önem verilmiş ve tamamlayıcı değerlendirme yöntemleri vurgulanmıştır (Bayrak & Erden, 2007; Ercan & Akbaba-Altun, 2004; Metin & Cansüngü-Koray, 2007).

Yeni Fen ve Teknoloji Öğretim Programının pilot uygulamalarında birçok çalışma gerçekleştirilmiştir. Akpınar, Ünal ve Ergin (2005) tarafından yapılan bir çalışmada, farklı alanlardan mezun olan fen ve teknoloji öğretmenlerinin fen ve teknoloji dersine yönelik görüşlerini araştırılmıştır. Ortaöğretim fen ve matematik öğretimi bölümünden mezun olup fen ve teknoloji öğretmeni olarak atanan öğretmenlerin, temel fen kavramlarını ilköğretim düzeyinde anlatmanın zor olduğunu vurgulamışlardır. Hizmet-öncesi dönemde aldıkları derslerin içeriklerinin farklı olması ve ilköğretim kademesindeki öğrencilerin bilişsel seviyelerinin farklı olmasının zorluk yaşamalarındaki temel etkenler olduğu belirtilmiştir. Aynı çalışmada, mezuniyet alanlarının, öğrenme öğretme sürecindeki etkileri de araştırılmış, eğitim fakültesi biyoloji öğretmenliği bölümü mezunu ve fen edebiyat biyoloji bölümü mezunu fen ve teknoloji öğretmenlerinin biyoloji konularını öğretirken daha istekli oldukları fakat kimya ve fizik konularında zorluk çektiklerini ortaya konulmuştur (Akpınar, Ünal, & Ergin, 2005). Türkiye’nin bir gerçeği olan birleştirilmiş sınıflarda da öğretmenler çeşitli zorluklarla karşılaşmaktadır (Akpınar, Turan, & Gözler, 2006; Dalka, 2006, Taneri, 2004). Dursun’un (2006) 33 birleştirilmiş sınıf öğretmeninin katılımıyla gerçekleştiği araştırmanın sonucu, yeni ilköğretim programlarının gerektirdiği uygulamaları yapmanın zorluğunu ortaya koymuştur Mezuniyet alanı gibi cinsiyet veya öğretmenlik deneyimi gibi özelliklerin öğretmenlerin görüşlerinde istatistiksel olarak anlamlı bir etkisi olup olmadığı sınırlı sayıda araştırmada incelenmiş ve örneklem farklılıklaından dolayı farklı sonuçlara ulaşılmıştır.

Çalışmanın Amacı

Çalışmanın amacı, sınıf öğretmenleri ve fen ve teknoloji öğretmenlerinin fen ve teknoloji öğretim programına yönelik görüşlerini belirlemektir. Kazanım, içerik, öğrenme-öğretme süreci ve değerlendirme boyutlarına yönelik öğretmen görüşlerini belirlemek, programın olumlu yönlerini ve sınırlılıklarını ortaya koymaktır. Üç araştırma sorusu ve bunların alt soruları, bu çalışmanın şeklini belirlemiştir:

1. Öğretmenlerin fen ve teknoloji öğretim programına yönelik görüşleri nelerdir?

1.1 Öğretmenlerin Fen ve Teknoloji Öğretim Programı kazanım-içerik boyutuna ilişkin görüşleri nelerdir?

1.2 Öğretmenlerin Fen ve Teknoloji Öğretim Programı öğrenme-öğretme süreci boyutuna ilişkin görüşleri nelerdir?

1.3 Öğretmenlerin Fen ve Teknoloji Öğretim Programı ölçe-değerlendirme boyutuna ilişkin görüşleri nelerdir?

1.4 Fen ve Teknoloji Öğretim Programının hangi yönlerinin geliştirilmeye ihtiyacı vardır?

2. Farklı demografik özelliklere sahip öğretmenlerin Fen ve Teknoloji Öğretim Programına yönelik görüşleriarasında istatistiksel olarak anlamlı bir farklılık var mıdır?

2.1 İlköğretim bölümü fen bilgisi öğretmenliği, ilköğretim bölümü sınıf öğretmenliği, Fen-Edebiyat Fakültesi ve diğer alanlardan mezun öğretmenlerin Fen ve Teknoloj Öğretim Programına yönelik görüşleri arasında istatistiksel olarak anlamlı bir farklılık var mıdır?

2.2 Erkek ve kadın öğretmelerin Fen ve Teknoloj Öğretim Programına yönelik görüşleri arasında istatiksel olarak anlamlı bir farklılık var mıdır?

2.3 Öğretim kariyerinn farklı basamaklaında olan öğretmenlerin Fen ve Teknoloj Öğretim Programına yönelik görüşleri arasında istatistiksel olarak anlamlı bir farklılık var mıdır?

3. Sınıf öğretmenleri ve fen ve teknoloji öğretmenlerinin Fen ve Teknoloj Öğretim Programına yönelik görüşleri arasında istatiksel olarak anlamlı bir farklılık var mıdır?

Çalışmanın Önemi

Küreselleşme, fen ve teknolojideki ilerlemeler, TIMMS ve PISA gibi uluslararası sınavlarda Türkiye'nin sıralamada geri planlarda kalması programlarda değişimi zorunlu kılmıştır. Bu etkilerin bir sonucu olarak, 2004 yılında yeni ilköğretim programı hazırlanmıştır (MEB, 2006). Yeni öğretim programının başarıyla uygulanabilmesi için, öncelikle öğretmenlerin yeni rolleri ve sorumlulukları hakkında bilgi sahibi olması gerekmektedir (Ornstein & Hunkins, 1998). Bu bilgi edinme süreci ve program uygulamalarının başlamasıyla, öğretmenlerin görüşleri oluşacak ve bu görüşler sınıf içi uygulamaları doğrudan etkileyecektir (Ornstein & Hunkins, 1998). Fullan (1982) aynı önemli noktaya dikkat çekmiş ve etkili eğitim-öğretim uygulamaları için öncelikle yeni programın öğretmenler tarafından kabul edilip benimsenmesinin önemini vurgulamıştır.

Bu çalışmanın amacı sınıf öğretmenleri ve fen ve teknoloji öğretmenlerinin fen ve teknoloji öğretim programına yönelik görüşlerini araştırmaktır. Çalışmanın önemi ve alana katkısı farklı yönleriyle tartışılabilir.Öncelikle, öğretmenlerden yeni bir yaklaşımın sınıflarda uygulanması beklenmektedir ve bu yaklaşım öğretim programlaının bütün boyutlarını, özellikle de öğrenme-öğretme süreci ve değerlendirme boyutlarını etkilemektedir. Bu ulusal çalışmanın, programın uygulayıcıları olan öğretmenlerin programa dair görüşlerini, programın olumlu yanlarını ve sınırlılıklarını ortaya koyacaktır. Ulusal bir çalışma olması, genel tablonun ortaya konmasını sağlayacaktır. Yeni programda kazanımlar ve alt alanlar geliştirilmiş,tamamlayıcı değerlendirme yöntemlerine geniş yer verilmiş, örnek formlar açıklamalara sunulmuştur Bu çalışma, öğretmenlerin programın kazanım, içerik, öğrenme-öğretme süreci ve değerlendirme boyutlarına ilişkin görüşlerini ortaya koyacaktır.

Fen ve Teknoloji Öğretim Programı analizi (Bozyılmaz & Bağcı-Kılıç, 2005; Erdoğan, 2007; Temli, 2009); değerlendirmesi (Bayrak & Erden, 2007; Kutlu, 2005; ġahin, 2008), geliĢtirilme süreci (Çalık, Ayas, & Coll, 2008) ile ilgili çalıĢmalar yapılmıĢtır. Ancak alanyazında farklı sosyo-ekonomik düzeylerde bulunan illerde görev yapan öğretmenlerin görüĢleribir bütün olarak alınmamıĢ bir Ģehir ya da bir okulda çalıĢan öğretmenlerin katılımıyla çalıĢmalar gerçekleĢtirilmiĢtir. Örneğin, sınıf öğretmenlerinin fen ve teknoloji programına yönelik görüĢlerinibelirlemeyi amaçlayan bir çalıĢmaya bir il merkezinde çalıĢan toplam 19 öğretmen katılmıĢtır (Ercan & Akbaba-Altun, 2005). BaĢka bir çalıĢmada yine belirlenmiĢ bir Ģehirde bulunan 10 okulda görevli 100 sınıf öğretmenin katılımıyla gerçekleĢtirilmiĢtir. Alanyazına katkı sağlayan birçok çalıĢmanın pilot uygulama sırasında yapıldığı dikkat çeken bir özelliktir. Ornstein ve Hunkins'in de (1998) belirttiği gibi yeni bir programın bir anda bütün öğretmenler tarafından uygulamaya konulabilmesi mümkün değildir. Öğretmenlerin yeniliklere uyum sağlaması zaman gerektirir. Yeni programın gereklerini benimsenip alıĢıldıkça, hedefler daha kolay gerçekleĢtirilebilecektir (Ornstein & Hunkins, 1998).

Bu çalıĢmanın amacı farklı koĢullarda,farklı sosyo-ekonomik düzeydeki illerde çalıĢan öğretmenlerin ortak görüĢlerini yansıtabilmektir. Bir baĢka deyiĢle, Türkiye'nin farklı Ģehirlerinde çalıĢan, farklı eğitim ve gelir seviyesine sahip velilerin çocuklarına eğitim veren, eĢit olmayan koĢullarda, farklı imkanlara sahip okullarda görev yapan öğretmenlerin görüĢlerini almak bu çalıĢmanın amacıdır. Bundan dolayı, bu çalıĢmanın sonuçları Fen ve Teknoloji Öğretim Programını uygulayam bütün uygulayıcıların yani öğretmenlerin görüĢlerini yansıtabilecektir. Farklı sosyo-ekonomik düzeydeki illerde görev yapan öğretmenlerin görüĢlerinin bir bütün olarak yansıtıldığı çalıĢmalar oldukça sınırlıdır. Bağımsız değiĢkenlerin, örneğin öğretmenlik deneyimi, mezun olunan alanın öğretmen görüĢlerine etkisi sınırlı sayıda çalıĢmada araĢtırılmıĢtır. En önemli noktalardan biri ise öğretmenlerin Fen ve Teknoloji Öğretim Programını 5 yıldır uyguluyor olmalarıdır. Böylece, görüĢleri artık çok daha somut ve eleĢtirileri çok daha açık olabilmektedir. Bu çalışmanın bulgularının gelecekteki program geliştirme çalışmalarına katkı sağlayacağı, daha güçlü bir altyapı sağlayacağı umulmaktadır.

Öğretim Programlarının Değişimi ve Öğretmen

Öğretmenler programın uygulayıcıları olarak, eğitim reformlarında önemli bir rol oynarlar (Duffee & Aikenhead, 1992) ve performansları programın başarısını doğrudan etkiler (van Driel, Beijaard, & Verloop, 2001). Öğretmenlerin rolleri ve programın başarısı arasında çok yakın bir ilişki mevcuttur (Scott, 1994). Scott (1994) eğitimde değişimi kontrol eden, uygulayan ve gerçek sınıf ortamına bu değişimi yansıtmanın derecesini belirleyen insanlar olarak öğretmenlerin görüşlerinin ve uygulamadaki anahtar rollerinin önemini dikkat çeker. Program geliştirme takımlarının geliştirme sürecinde öğretmenlerin tasarlanan değişikleri ne ölçüde gerçekleştirebilecekleri, öğretmenlik deneyimlerinin buna ne derece izin vereceğini tartışmaları gerekmektedir (Scott, 1994). Kuramsal altyapının yanında, planlanan değişikliklerin ne derece uygulamaya konulabileceği tartışılmalıdır (Ponder & Doyle, 1977). Öğretmenlerin geçmiş deneyimi ve okulların imkanları mutlaka göz önünde bulundurulmalıdır (Clarke, Clarke & Sullivan, 1996).

Öğretmenler yeni bir program uygulanmaya konduktan sonra, eski öğretim alışkanlıkların terk edilmesi, yeni uygulamaların pratiğinin yapılması ve açıklanması gibi konularda yardıma ihtiyaç duyabilirler. Bunun için hizmet-içi ve hizmet öncesi eğitimin programların öğretmenlerden beklentileriyle tutarlı olması ve öğretmenlerin sürekli destek alabilecekleri uzmanların olması gerekmektedir (Scott, 1994). Diğer öğretmenlerle program hakkında bilgi alışverişinde bulunmak, fikirler üzerine tartışmak ve gerekli gereçlerin hazırlanmasında işbirliğine gitmek başarılı bir uygulama için gereklidir. Meslektaşlarının yanı sıra okul yönetiminin de değişim sürecinde destek olma görevini yerine getirmesi beklenmektedir. Yeni bir programın uygulamaya konulmasıyla birlikte, öğretmenlerin programın gerekleri hakkında deneyim ve bilgi sahibi olduğu varsayımıyla hareket edilir, ancak bu değişim sürecinin sorumluluğu tamamen öğretmene bırakılır ve öğretmen kendini yalnız hisseder (Gallagher & Tobin, 1987). Öğretmenlerin algıları ve görüĢlerinide olumsuz etkiyebilecek bu durum doğrudan programın baĢarısını da etkileyebilecektir (Motshekga, 2009).

Eğitim programlarıyla ilgili bir değiĢme gidilmeden önce, bir sınıfta neler yapıldığı, sorunlar ve etkili öğrenmeyi engelleyen ya da destekleyen etkenler mutlaka araĢtırılmalıdır (Strage & Bol, 1996a). Programda yer alan uygulamalar ile sınıfta uygulanan program arasındaki farklar öngörülebilir ve bu konudaki çalıĢmalar değiĢimin uygulanmaya baĢlamasından sonra da devam edebilir. Bu hem eski öğretim alıĢkanlıklarının bırakılmasına yardımcı olacak, hem de yeni programın ilkelerinin benimsenmesine yardımcı olacaktır (Strage & Bol, 1996a).

Yeni Fen ve Teknoloji Öğretim Programlarının Temel Özellikleri

Fen ve Teknoloji Öğretim Programının içeriği 2 temel bölümde sunulmuĢtur.Ġlk bölüm Fen ve Teknoloji Dersi Öğretim Programının temelleri olarak isimlendirilmiĢ,ikinci bölüm ise Fen ve Teknoloji Dersi öğrenme alanı ve üniteler olarak isimlendirilmiĢtir (TTKB, 2004). Bu temel yapı, 4 sınıftan 8. sınıfa kadar tüm sınıflar için ortak bir yapıdır. Birinci bölüm, programa giriĢ, programın vizyonu, temel yaklaĢımı, temel yapısı, öğrenme-öğretme süreci, ölçme ve değerlendirme, tüm öğrencilerin ihtiyacını dikkate alma, programın organizasyon yapısı ve uygulayıcılarına öneriler baĢlıkları altında sunulmuĢtur Ġkinci bölüm ise, öğrenme alanı ve kazanımlarla ilgili esaslar, ünite organizayonu ile ilgili esaslar, ünite organizasyonu, kazanımlar ile eĢleĢen ara disiplin alan kazanımları tablosu, kazanımlar ile eĢleĢen Atatürkçülükle ilgili konular tablosu alt baĢlıklarını içermektedir. Fen ve Teknoloji Öğretm Programının vizyonu bireysel farklılıkları ne olursa olsun, bütün öğrencilerin fen okuryazarı olarak yetiĢtirilmesidir (MEB, 2005, p.5). Fen ve teknoloji okuryazarlığı için 7 boyut düĢünülmüĢtür: Fen bilimleri ve teknolojinin doğası, anahtar fen kavramları, bilimsel süreç becerileri, fen-teknoloji-toplum-çevre (FTTÇ) iliĢkileri, bilimsel ve teknik psikomotor beceriler, bilimin özünü oluĢturan değerler ve fene iliĢkin tutum ve değerler (TD).

Dört temel öğrenme alanı “canlılar ve hayat”, “madde ve değiĢim”, “fiziksel olaylar” ve “dünya ve evren” olarak belirlenmiĢtir Üniteler bu belirtilen öğrenme alanlarından seçilmiĢtir. Fen-teknoloji-toplum-çevre (FTTÇ), bilimsel süreç becerileri, tutum ve değerler öğrenme alanlarına iliĢkin kazanımlar, diğer dört temel öğrenme alanından seçilen ünitelerdeki kazanım ve etkinliklerle harmanlanmıĢtır.Bu nedenle bu üç öğrenme alanıyla ilgili ayrı ünite söz konusu değildir.

Programın en temel özelliklerinden biri de radikal yapılandırmacılık (oluĢturmacılık) yaklaĢımının temel olarak benimsenmiĢ olmasıdır. Bilginin subjektif boyutunu vurgulayan bu yaklaĢım, programın içeriği ve stratejileri belirlenirken temel alınmıĢtır. Ölçme değerlendirme boyutunda da radikal yapılandırmacı yaklaĢımın gerekleri ölçme metotlarına Ģekil vermiĢtir.

Ornstein and Hunkins (1998) hedefleri, son nokta ve beklenen sonuç göstergesi olarak tanımlar. Popham (1993) hedefler ve baĢarı arasındaki iliĢkinin önemini vurgular. Çünkü hedeflerin belirlenmesi kadar ulaĢılıp ulaĢılmaması, bir baĢka deyiĢle baĢarılıp baĢarılamaması önem taĢımaktadır.

GiriĢ bölümünde de belirtildiği gibi, fen ve teknoloji öğretim programında hedefler ya da hedef davranıĢlarsözcüğü yerine kazanımlar sözcüğü kullanılmıĢ bu değiĢikliğin nedeni de programın temel yaklaĢımına atıfta bulunarak açıklanmıĢtır (Temli, 2009).

Ġçerik, dört temel öğrenme alanına bağlı olarak belirlenmiĢtir Dördüncü, beĢinci ve yedinci sınıfta dört farklı öğrenme alanından 7 ünite içerik olarak belirlenmiĢtir. Altıncı ve sekizinci sınıfta ise 8 ünite belirlenmiĢtir. Ünitelerin dağılımı aĢağıdaki tabloda sunulmuĢtur (Tablo 1).

Tablo 1

Öğrenme alanları ve üniteler

Öğrenme Alanları	*4. Sınıf üniteleri*	*5.Sınıf üniteleri*	*6.Sınıf üniteleri*	*7.Sınıf üniteleri*	*8.Sınıf üniteleri*
Canlılar ve Hayat	Vücumuz Bilmecesini Çözelim	Vücumuz Bilmecesini Çözelim	Canlılarda Üreme, Büyüme ve GeliĢme	Vücumuzda Sistemler	Hücre Bölünmesi ve Kalıtım
	Canlılar Dünyasını Gezelim, Tanıyalım	Canlılar Dünyasını Gezelim, Tanıyalım	Vücudumuzda Sistemler	Ġnsan ve Çevre	Canlılar ve Enerji ĠliĢkileri
Madde ve DeğiĢim	Maddeyi Tanıyalım	Maddenin DeğiĢimi ve Tanınması	Maddenin Tanecikli Yapısı	Maddenin Yapısı ve Özellikleri	Maddenin Yapısı ve Özellikleri
			Madde ve Isı		Maddenin Halleri ve Isı
Fiziksel Olaylar	Kuvvet ve Hareket	Kuvvet ve Hareket	Kuvvet ve Hareket	Kuvvet ve Hareket	Kuvvet ve Hareket
	IĢık ve Ses	YaĢamımızdaki Elektrik	YaĢamımızdaki Elektrik	YaĢamımızdaki Elektrik	YaĢamımızdaki Elektrik
	YaĢamımızdaki Elektrik	IĢık ve Ses	IĢık ve Ses	IĢık	Ses
Dünya ve Evren	Gezegenemiz Dünya	Dünya, GüneĢ ve Ay	Yer Kabuğu nelerden oluĢur?	GüneĢ Sistemi ve Ötesi: Uzay Bilmecesi	Doğal Süreçler

Küçükmert-Ertekin (2010) Ġstanbul'da görev yapan 304 öğretmenin katılımıyla yaptığı bir araĢtırmada sınıf öğretmenleri ve fen ve teknoloji öğretmenlerinin fen ve teknoloji programını uygularken nelere ihtiyaç duyduklarını araĢtırmıĢtır. Sonuçlar, özellikle Fiziksel Olaylar öğrenme alanında öğretmenlerin rehberliğe ihtiyaç duyduğunu göstermiĢtir. Fizik konularında, atomun yapısı ve elektronların dağılımı, genetik, hücre ve laboratuvar etkinlikleri konularında öğretmenler eğitim ihtiyaçlarını vurgulamıĢlardır.

Öğrenme-Öğretme Süreci

Öğrenme-öğretme sürecinde, eski öğretim alışkanlıklarının terk edilerek, oluşturmacı yaklaşımın benimsenmesi büyük önem taşımaktadır. Öğretmenlerin, yeni programın gereklerini uygulayarak benimsemesine gereken önem verilmeli, hizmet-içi ve hizmet öncesi eğitimlerle desteklenmelidir (Kwakman, 2003; Davis, 2002). Bu yolla, zihinlerine takılan sorulara yanıt, karşılaştıkları problemlere çözüm bulabileceklerdir (Davis, 2002).

Unayağyol (2010) kendisinin geliştirdiği bir ölçek ile sınıf öğretmenleri ve fen ve teknoloji öğretmenlerinin öğrenci merkezli öğrenme sürecinde karşılaştıkları problemleri araştırmıştır. Yozgat ilinde yapılan çalışmaya 255 sınıf öğretmeni ve 70 fen ve teknoloji öğretmeni katılmıştır. Özellikle kalabalık sınıfların programda önerilen ölçme değerlendirme yöntemlerinin uygulanması için büyük bir engel olarak görüldüğü, öğretmenlerin çoklu zeka kuramı, beyin fırtınası ve işbirlikli öğrenme yöntemlerini kullanmaya eğilimli oldukları belirlenmiştir.

Bazı çalışmalar, oluşturmacı yaklaşımın yeterince doğru uygulanmadığını ve öğretmenlerin zihninde hala soru işareti bulunduğunu göstermektedir (Akar, 2003; Gomleksiz & Dilci, 2007; Williams, 2008). Oluşturmacı yaklaşımın gereklerinin uygulanması için öğretmenlerin eğitime ihtiyaç duydukları saptanmış (Akar, 2003), öğretmen eğitiminde sonuç odaklı değerlendirmeler yerine sürecin vurgulanmasına yönelik daha fazla uygulama yapılması gerektiği ortaya konulmuştur (Altun & Büyükduman, 2007)

Ölçme-Değerlendirme

Süreç değerlendirmesi yeni programın önemli gereklerinden biridir (Altun & Büyükduman, 2007). Öğrencilerin birbirleriyle ve öğretmenle etkileşimi, araç-gereç kullanılması, öğrenme-öğretme sürecinin başında öğrencinin seviyesinin belirlenmesi, öğrencinin süreç içerisindeki ilerlemesini ölçmeye yardımcı olacaktır (Graffam, 2003).

Yeni programda tamamlayıcı ölçme-değerlendirme yöntemleri önerilmiĢ, öğrencilerin öğrenmelerinin geliĢiminin bu önerilen metotlarla yapılması tavsiye edilmiĢtir (MEB, 2005). Programda geleneksel ölçme değerlendirme yöntemleri, çoktan seçmeli sorular, boĢluk doldurma ve açık uçlu sorular olarak sıralanmıĢtır (MEB, 2005). Tamamlayıcı ölçme-değerlendirme yöntemleri arasında öğrenci ürün dosyası, kavram haritası, yapılandırılmıĢ grid, proje, performans değerlendirme, görüĢme, sözlü sunum, öz değerlendirme gibi metotlar açıklanmıĢ ve örnekler verilmiĢtir (MEB, 2005).

Öğrencilerin öğrenme seviyelerini belirlemede, kazanımların gerçekleĢtirilip gerçekleĢtirilmediğini belirlemede, etkili geri bildirim sağlamada tamamlayıcı ölçme-değerlendrime yöntemleri kullanılabilir (MEB, 2005). Programda, öğrencilerin ihtiyaçlarını belirlemede tamamlayıcı yöntemlerin etkililiği vurgulanmıĢtır.

Performans temelli ölçme değerlendirmede, ölçme kriterleri öğretmen tarafından açıkça belirlenir ve bu kriterler öğrenme sürecinde uygulanır (Richards, 1995). Performans temelli ölçmenin iki önemli Ģekli vardır; biri performans görevi diğeri ise rubriktir (Popham, 1997). Akran değerlendirme, değerlendirme ve baĢkaları tarafından değerlendirilme temelinde açıklanır (Cartney, 2010). Ġki önemli kriteri ise değerlendirme kriterlerinin belirlenmesi ve dönüt verme olarak belirlenmiĢtir (Black & William, 1998 akt. Koç, 2011).

Fen ve Teknoloji Öğretim Programı Üzerine Çalışmalar

Güven (2008) 20 sınıf öğretmeniyle görüĢme yapmıĢ ve fen ve teknoloji öğretim programıyla ilgili 4 soru yöneltmiĢtir. öğrenme sürecinde rehber olma rolünün arttığını, öğretmenlerin sürekli öğrenen konumunda yer aldığını, velilerle etkili iletiĢim yakalamanın gerektiği,nin altını çizmiĢtir. Öğrencilerin öğrenme sürecine aktif katılımı, akranlarıyla iĢbirliği yapması, bilgileri günlük hayattla iliĢkilendirmesi, sunum becerilerinin kazandırılması yeni programın öğrenci açısından bakıldığında önemli özellikleridir. Zaman yetersizliği ise programın sınırlılılığı olarak ifade edilmiĢtir.

ġeker (2007) GümüĢhane ilinde, 6.sınıf okutan 46 fen ve teknoloji öğretmenin programa yönelik görüĢlerini araĢtırmıĢtır. Ayrıca okul yapısının etkisi ve öğretmenlerin karĢılaĢtıkları problemleri net olarak ortaya koymak için 21 öğretmenle görüĢme yapmıĢtır. Sonuçlar, kazanımların öğrenci seviyesine uygun olduğunu, programın gerekliklerini uygularken zorluk çekmediklerini ancak bazen eski alıĢkanlıklarına döndüklerini ortaya koymuĢtur. OluĢturmacı yaklaĢımla ilgili yetersiz kuramsal bilgiye sahip olduklarını belirten öğretmenler, çoklu zeka kuramı ve tamamlayıcı değerlendirme yöntemleriyle ilgili de uygulama sorunları yaĢadıklarını belirtmiĢlerdir.

Ayvacı ve Devecioğlu (2009) öğretmenlerin fen ve teknoloji öğretim programına yönelik görüĢlerini araĢtırmak için Trabzon ilinde görev yapan 20 öğretmenle görüĢmüĢtür Bulgular, kazanımların açık ve anlaĢılır olduğunu, günlük hayatla bağlantılı olduğunu ve ulaĢılacak noktayı bilme açısından öğretmene rehberlik ettiğini ortaya koymuĢtur. Genel olarak program uygulanabilir, güncel, öğrenci merkezli ve öğrenci seviyesine uygun olarak özetlenmiĢtir. Kalabalık içerik bir engel olarak görülmekte, bireysel farklılıkların dikkate alınmasında ise zorluk yaĢandığı tespit edilmiĢtir. Velilerin sosyo-ekonomik düzeyleri, araç-gereç yetersizliği, kalabalık sınıflar önemli engeller olarak belirtilmiĢtir.

Çiftçioğlu (2009) 5. sınıf okutan sınıf öğretmenlerinin Fen ve Teknoloji Öğretim Programına yönelik görüĢlerini araĢtırmıĢtır. Toplam 309 öğretmen dört boyuttan oluĢan ölçek aracılığıyla görüĢlerini belirtmiĢtir. Sonuçlar, programda kazanımların, içeriğinin ve değerlendirme boyutlarının öğretmenlerce "az etkili" bulunduğu, öğrenim durumları olarak adlandırılan boyutun ise "orta derecede etkili" bulunduğunu ortaya koymuĢtur.

Gömleksiz ve Bulut (2006) da sınıf öğretmenlerinin Fen ve Teknoloji Öğretim Programına yönelik görüşlerini araştırmıştır. Pilot uygulama sürecinde gerçekleştirilen çalışmaya, 8 ilden toplam 383 öğretmen katılmıştır. Araştırmacılar tarafından geliştirilen ölçeğin güvenirlik katsayısı .98 bulunmuş ve 4 boyut kazanım, içerik, eğitim durumları ve değerlendirme olarak isimlendirilmiştir. Öğretmenler kazanım, içerik ve değerlendirmenin gereklerini programın öngördüğü şekilde yerine getirdiklerini belirtmişlerdir.

Aydın (2007) 4. ve 5. sınıf öğretmenlerinin Fen ve Teknoloji Öğretim Programına yönelik görüşlerini araştırmıştır. Veriler Kütahya'da görev yapan 192 sınıf öğretmeninden toplanmıştır. Geçerlik katsayısı .95 olan ölçek araştırmacı tarafından geliştirilmiştir Sonuçlar öğretmenlerin Fen ve Teknolloji Öğretim Programının kazanım, içerik, öğrenme-öğretme süreci ve ölçme değerlendirme boyutlarına yönelik olumlu görüşleri olduğunu göstermiştir. Katılımcıların "katılmıyorum" ifadesini işaretledikleri maddeler arasında "etkinlikleri gerçekleştimek için önerilen süre yeterlidir" ve "ölçme değerlendirme için önerilen süre uygundur" bulunmaktadır.

Yangın (2007) Fen ve Teknoloji Öğretim Programına yönelik öğretmen ve öğrenci görüşleriniaraştırmıştır. Bu nicel çalışmaya 4. ve 5. sınıf okutan 75 sınıf öğretmeni ve 1672 4. ve 5. sınıf öğrencisi katılmıştır. Öğretmen ve öğrenciler hava kirliliği, insan sağlığı, savaş silahları ve nükleer teknoloji konularını en önemli konular arasında sıralamışlardır. Araç-gereç yetersizliği, öğretmenlerin kuramsal bilgi yeterliği ve sınıfların kalabalığı eleştirilmiştir.

Tabak (2007) okul yöneticileri, program geliştirme uzmanları, 5. sınıf öğretmen ve öğrencilerinin katılımıyla Fen ve Teknoloji Öğretim Programında önerilen ölçme değerlendirme yöntemlerinin ve öğrenme-öğretme sürecinin ne derece gerçekleştirildiğini belirlemek amacıyla bir çalışma yapmıştır. Sonuçlar, zaman yetersizliğinin ve araç gereç eksikliğinin öğrenme-öğretme sürecinde sorunlar yarattığını ortaya koymuştur. Tamamlayıcı ölçme yöntemleri konusunda yeterli bilgiye sahip olmadığına inanan öğretmenlerin geleneksel ölçme değerlendirme yöntemlerini kullandığı da çalışmanın önemli bulguları arasındadır. Öğretmenler ayrıca oluşturmacı yaklaşımı kullanma alışkanlığı edindiklerini belirtmiş ancak sınıf içinde önerilen şekilde uygulanmadığı belirlenmiştir.

YÖNTEM

Bu çalışma ülke genelini kapsayan bir tarama çalışmasıdır. Özelleşmiş bir konu hakkında geniş bir populasyonun görüşlerini almak için tarama yöntemi kullanılır (Fraenkel & Wallen, 2003; Gay, Mills, & Airasian, 2006). Tablo.2'de sunulduğu gibi, bu çalışma alanyazın temelli kuramsal çerçevenin oluşturulmasıyla başlamıştır. Cinsiyet, öğretmenlik deneyimi, branş, mezuniyet alanı gibi kategorik değişkenlerin belirlenmesinden sonra örneklem seçiminin nasıl belirleneceğine karar verilmiştir. Daha sonra, veri toplama aracı geliştirilmiş ve demografik bilgiler, fen ve teknoloji öğretmenlerinin Fen ve Teknololi Öğretim Programına yönelik görüşlerive açık uçlu sorulardan oluşanKatılımcı Görüşleri olmak üzere üç temel bölümden oluşmasına karar verilmiştir. Ölçek maddeleri oluşturulurken Fen ve Teknololi Öğretim Programında yapılan ana değişikler göz önüne alınmıştır. Ankara ilinde 96 devlet okulunda 290 öğretmenin katılımıyla gerçekleştirilen pilot çalışma tamamlandıktan sonra geçerlik ve güvenirlik çalışmaları yapılmıştır. Devlet Planlama Teşkilatı (2003) verilerine dayanılarak EARGED ten alınan izin ve destek ile Türkiyenin 26 iline veri toplama aracı gönderilmiştir. Seçkisiz belirlenen illerde bulunan 332 devlet okulundan 1328 fen ve teknoloji programı uygulayan öğretmene ulaşmak hedeflenmiştir. Bir başka deyişle, 664 sınıf öğretmeni ve 664 fen ve teknoloji öğretmenine ulaşılması planlanmıştır. Gönüllülük prensibine bağlı olarak 601 sınıf öğretmeni ve 359 fen ve teknoloji öğretmeni çalışmaya katılmıştır. Toplam 1167 doldurulmuş ölçek seçkisiz belirlenmiş illerin İlçe Milli Eğitim Müdürlükleri tarafından EARGED'e geri gönderilmiştir. Araştımacı tarafından alınan ölçeklerden alınan veriler SPSS 15. sürüme aktarılmış ve istatistiksel analiz için hazırlanmıştır. Mplus 5.21 öğrenci versiyonu kullanılarak onaylayıcı faktör analizi yapılmış, güvenirlik çalıĢması yapılmıĢtır. MANOVA için gerekli sayıltılar kontrol edildikten sonra MANOVA yapılmıĢtır.

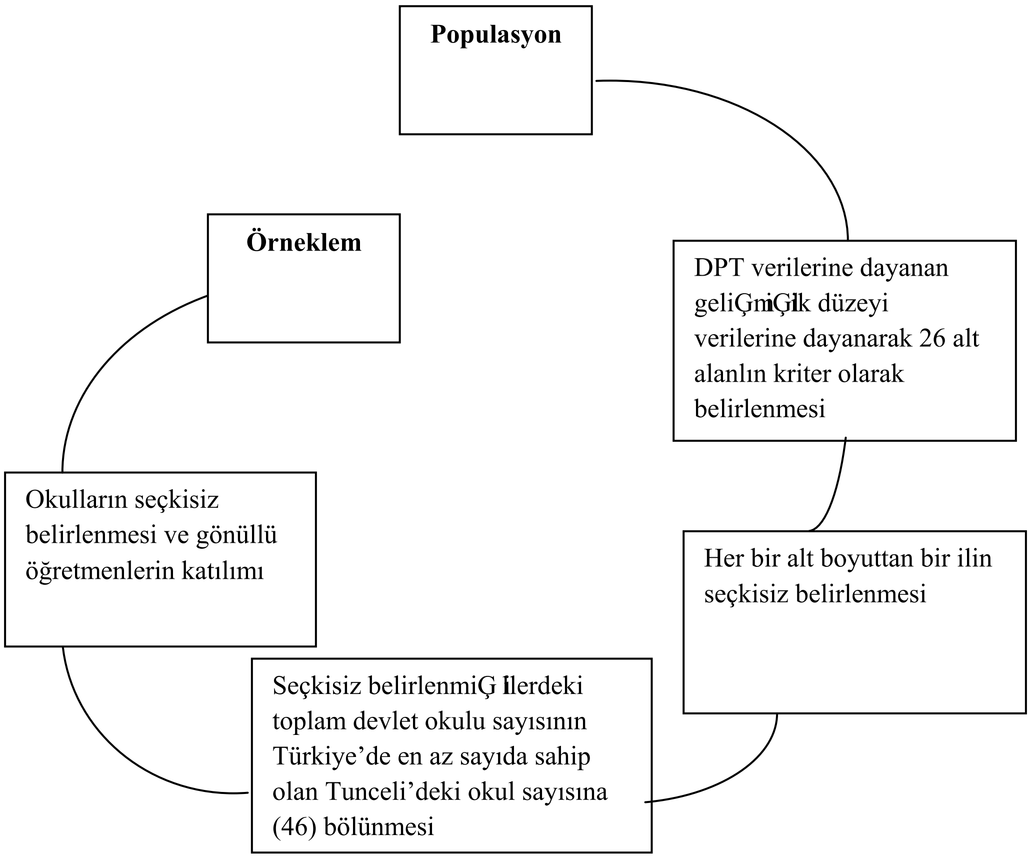
Tablo 2

Bölgelere göre seçilmiş iller listesi

Alt-bölgenin Adı	Alt bölgedeki iller	Seçkisiz belirlenmiĢ iller	Ġlköğretim Okulu Sayısı	
			Toplam Sayı	Örnekleme dahil edilecek okul sayısı
1. Ġstanbul alt-bölgesi	Ġstanbul	Ġstanbul	1616	35
2. Ankara alt-bölgesi	Ankara	Ankara	966	21
3. Konya alt-bölgesi	Konya, Karaman	Konya	951	20
4. Bursa alt-bölgesi	Bursa, EskiĢehir, Bilecik	EskiĢehir	237	5
5. Kocaeli alt-bölgesi	Kocaeli, Düzce, Sakarya, Bolu, Yalova	Yalova	65	1
6. Ġzmir alt-bölgesi	Ġzmir	Ġzmir	967	21
7. Aydın alt-bölgesi	Aydın, Denizli, Muğla	Aydın	481	10
8. Manisa alt-bölgesi	Manisa, Afyon, Kütahya, UĢak	UĢak	182	3
9. Tekirdağ alt-bölgesi	Tekirdağ, Edirne, Kırklareli	Edirne	153	3
10. Balıkesir alt-bölgesi	Balıkesir, Çanakkale	Balıkesir	538	11
11. Antalya alt-bölgesi	Antalya, Isparta, Burdur	Antalya	681	14
12. Adana alt-bölgesi	Adana, Mersin	Mersin	560	12
13. Hatay alt-bölgesi	Hatay, KahramanmaraĢ, Osmaniye	Kahraman-maraĢ	777	16
14. Zonguldak alt-bölgesi	Zonguldak, Karabük, Bartın	Zonguldak	307	6
15. Kastamonu alt-bölgesi	Kastamonu, Çankırı, Sinop	Sinop	185	4
16. Samsun alt-bölgesi	Samsun, Tokat, Çorum, Amasya	Samsun	953	20
17. Kırıkkale alt-bölgesi	Kırıkkale, Aksaray, Niğde, NevĢehir, KırĢehir	Niğde	214	4
18. Kayseri alt-bölgesi	Kayseri, Sivas, Yozgat	Kayseri	558	12
19. Trabzon alt-bölgesi	Trabzon, Ordu, Giresun, Rize, Artvin, GümüĢhane	Ordu	455	9
20. Gaziantep alt-bölgesi	Gaziantep, Adıyaman, Kilis	Gaziantep	625	13
21. ġanlıurfa alt-bölgesi	ġanlıurfa, Diyarbakır	Diyarbakır	1127	24
22. Mardin alt-bölgesi	Mardin, Batman, ġırnak, Siirt	Mardin	672	14
23. Malatya alt-bölgesi	Malatya, Elazığ, Bingöl, Tunceli	Malatya	570	12
24. Van Alt Bölgesi	Van, MuĢ,Bitlis, Hakkari	Van	855	18
25. Erzurum alt-bölgesi	Erzurum, Erzincan, Bayburt	Erzurum	985	21
26. Ağrı alt-bölgesi	Ağrı, Kars, Iğdır, Ardahan	Iğdır	167	3
Toplam		26 il	14855	332

Türkiye'de bulunan bütün öğretmenlerin görüşlerini temsil edebilecek bir örnekleme ulaşabilmek için bazı kriterler belirlenmiştir. Sağlam (2009) sosyoekonomik ve kültürel özelliklerin program uygulamalarında önemli rol oynadığını belirtmiştir. Kırsal alanda bulunan okullarda eğitim öğretim gören öğrencilerin dönemsel tarım işçisi olarak çalıştırılması (Sağlam, 2009), okulların farklı fiziksel özelliklerinin ve alt yapısına sahip olması (Beydoğan & Can, 2010), bazı okullarda fen bilgisi laboratuvarı bulunmazken (Ekici, 2002) bazı okullarda sınıflar laboratuvar olarak düzenlenmiştir (Temli, 2009).

Çalışmanın örneklemi, Devlet Planlama Teşkilatının (DPT) 2003 yılı verilerine dayanarak İstatistiki Bölge Birim Sıralamasına göre belirlenmiştir. Üç düzeyde belirtilen sosyo-ekonomik gelişmişlik sıralamasında, Düzey 2 esas alınarak 26 alt bölgeden birer il seçkisiz olarak belirlenmiştir. Belirtilen illerde bulunan ilköğretim okullarının sayısı Milli Eğitim Bakanlığı, Milli Eğitim İstatistikleri Örgün Eğitim 2008-2009 verilerinden alınmıştır. Türkiye'de en az sayıda devlet ilköğretim okulu 46 okul ile Tunceli ili sahiptir. Örneklemimizde bulunan illerdeki toplam devlet ilköğretim okulu sayısı 46'ya bölünerek (seçkisiz belirlenen ildeki devlet okulu sayısı/46), her ilden kaç okulun örnekleme katılacağı belirlenmiştir. Örneklem seçimi Şekil 1'de sunulmuştur



ġekil 1 *Örneklem Seçimi*

Toplam 1328 öğretmenden veri toplamak için ölçek okullara gönderilmiÇ,1167'si doldurulak gönderilmiÇtir. Bir baÇka deyiÇle geri dönüÇ oranı %87.8'dir. Bazı ölçekler uygun Çekilde doldurulmadığı için veri setine alınmamıÇ, toplam 960 ölçekten alınan veriler analize tabii tutulmuÇtur Tablo 4'te de belirtildiği gibi 504 (%52.5) kadın ve 454 (%47.3) erkek öğretmen çalıÇmaya katılmıÇtır. Öğretmenlerin deneyimlerini kategorik değiÇken olarak belirlemek için Huberman (1989)'ın Öğretmen Meslek Döngüsü kuramsal temel olarak belirlenmiÇtir. Bu modele göre öğretmenlik yaÇam boyu sürecek bir süreçtir ve birbirini takip eden birçok aÇamadan oluÇur. Mesleğe giriÇ (Career Entry Stage) ilk aÇamadır ve 0-3 yıl deneyimli öğretmenleri kapsar. Bu çalıÇmanın katılımcıları arasında 177 (%18.4) öğretmen ilk aÇamadadır. Ġkinci basamak, öğretmenlik deneyimi 4 ile 6 yıl arasında olan öğretmeleri kapsayan Dengeleme AÇaması dır (Stabilization stage). ve bu basamakta bulunan 146 (%15.2) öğretmen çalıÇmaya katılmıÇtır. Deneyleme veya ÇeÇitleme aÇaması (Experimentation or Diversification) öğretmenlik deneyiminin 7 ile 18. yıllarını kapsar ve 434 (%45.2) katılımcı bu basamakta yer almaktadır. Dinginlik Safhası (Serenity phase) öğretmenlik mesleğinin 19. yılında baÇlar ve 30. yılında sona erer. Katılımcıların 160'ı (%16.7) bu basamaktadır ve bu basamağı son aÇama olan Geri Çekilme AÇaması (Disengagement Stage) takip eder. Toplam 34 katılımcı (%3.5) bu basamaktadır.

Veri Toplama Aracında, demografik bilgilerin yanı sıra katılımcılara okullarında kullanılabilir durumda fen laboratuvarı var mı sorusu da yöneltilmiÇtir. Toplam 687 (%71.6) öğretmen okullarında kullanılabilir durumda fen laboratuvarı olduğunu belirtirken, 264 öğretmen (%27.5) bulunmadığını belirtmiÇtir. Bir baÇka soru ise yeni program hakkında hizmet-içi eğitim alıp alınmadığıyla ilgiliydi. Hizmet-içi eğitim alan katılımcıların sayısı 368 (38.3%) iken 580 (60.4%) katılımcı hizmet-içi eğitim almamıÇtır.

Veri Toplama Aracı

Veri toplama aracı araÇtırmacı tarafından geliÇtirilmiÇ, pilot çalıÇma Milli Eğitim Bakanlığından gerekli resmi izinler alınarak, Ankara ilinin 6 ilçesinde gerçekleÇtirilmiÇtir. Pilot çalıÇmadan sonra, geçerlik ve güvenirlik hesaplanmıÇtır. Fen ve Teknoloji Öğretim Programına Yönelik Öğretmen GörüÇleri anketi 3 bölümden oluÇmaktadır. AÇağıdaher bölümde yer alan maddelerin kısa bir özeti verilmektedir.

Veri toplama aracı geliÇtirme süreci 5 temel adımda gerçekleÇtirilmiÇtir. Ġlk adımda kuramsal çerçeve belirlenmiÇ, alanyazın taraması yapılmıÇtır. Ġkinci adımda, araÇtırmanın baÇladığı yıl yut çapında uygulanan 6. Sınıf Fen ve Teknoloji Öğretim Programının Posner'in (1995) program analiz sorularıyla analiz edilmiÇtir. 3. adımda maddeler oluÇturulmuÇtur Dördüncü basamakta uzman görüÇü alınmıÇ; beÇinci adımda pilot verileri toplanmıÇ, analiz edilmiÇ ve ölçeğe son Çekli verilmiÇtir.

Birinci Bölüm: Kişisel Bilgiler

Bu bölümdeki sorular çalıĢmaya katılan öğretmenler ile ilgili kiĢisel bilgileri toplamaya yönelik 8 maddeden oluĢmaktadır. Cinsiyet, mezun olunan fakülte/okul türü, öğretmenlik deneyimi, görev yapılmakta olan il, branĢ, hizmet-içi eğitim katılımı, kullanılabilir lab durumu ve hangi sınıflara fen ve teknoloji dersi verilmekte olduğu ile ilgili maddeleri kapsamaktadır.

İkinci Bölüm: Fen ve Teknoloji Ölçeği

Bu bölümdeki maddeler öğretmenlerin fen ve teknoloji öğretim programıyla ilgili goruslerini belirlemeye yöneliktir. Bu maddeler kazanım, içerik, öğrenme-öğretme süreci ve değerlendirme boyutlarıyla ilgili tutum ifadelerini kapsamaktadır. Toplam madde sayısı 31'dir.

Üçüncü Bölüm: Açık Uçlu Sorular

Üçüncü bölüm açık uçlu sorulardan oluĢmaktadır. ÇalıĢmanın amacına uygun bir Ģekilde, öğretmenlerimizin fen ve teknoloji öğretim programına yönelik tutumlarını etkileyen temel özellikleri ortaya koymayı amaçlamaktadır. Toplam, 7 sorudan oluĢmaktadır.

Pilot Çalışma Öncesi

Yeni fen ve teknoloji programı, öncelikle amaç, içerik, öğrenme öğretme süreci ve değerlendirme boyutlarıyla incelenmiĢtir. Ġçerik dıĢında boyutlar için ortak fen ve teknoloji programı analizi yapılmıĢtır. Bu analiz kapsamında, öğretmenlerin yeni program hakkındaki düĢüncelerini öğrenmek için, görüĢme soruları hazırlanmıĢ, sorular hakkında eğitim programları ve öğretim anabilim dalından bir uzmandan görüĢ alınmıĢ ve dört fen ve teknoloji öğretmenine gönderilmiĢ, pilot çalıĢma öncesi fikirleri alınmıĢtır. Farklı eğitim kuruluĢları tarafından yayımlanan araĢtırma ve tartıĢma yazıları, konferans bildiri metinleri ve yeni öğretim programlarına yönelik makaleler taranmıĢtır.

Uzman Görüşünün Alınması

Gerekli alanyazın taraması ulusal ve uluslararası yayınları kapsayacak Ģekilde geniĢletildikten sonra, pilot çalıĢma sürecine baĢlanmıĢtır. Ġlk aĢamada uzman görüĢü alınmıĢtır. Eğitim programları ve öğretim anabilim dalında görev yapmakta olan 5 öğretim üyesi ve 1 öğretim görevlisinden, psikolojik danıĢmanlık ve rehberlik anabilim dalında görevli 2 öğretim görevlisi ölçeği içerik bakımından incelemiĢ ve ilköğretim bölümü fen bilgisi öğretmenliği alanından tutum çalıĢan 2 öğretim görevlisi yine kapsam geçerliği, görünüĢ geçerliği ve tutum ifadelerinin anlaĢılabilirliği ile ilgili dönüt vermiĢtir. Belirtilen alanlarda uzman 10 uzmandan görüĢ alınmıĢtır. Bu dönütler doğrultusunda olumsuz ifadeler olumluya çevrilmiĢ, genel ve öznel ifadeler bir bütünlük sağlayacak Ģekilde genel ifadeler olarak düzeltilmiĢtir (örn. Fen ve Teknoloji Öğretim Programının içeriğinin yetersiz olduğuna inanırım maddesi, fen ve teknoloji öğretim programının içeriği yeterlidir olarak hem olumlu ifade kullanılmıĢ, hem de diğer maddelerle uyum sağlamayan kiĢisel olmayan ifadeler kullanılmıĢtır). Ölçeğin geliĢtirilme aĢamasında, ölçek 5 boyutlu olarak geliĢtirilmiĢtir; bu boyutlar: Kazanımlar, Ġçerik, Öğrenme–Öğretme Süreci, Değerlendirme ve Hizmet-içi eğitimdir.

Pilot Verilerin Toplanması

Pilot çalıĢma, TÜĠK (2007) Mernis çalıĢması istatistiki sonuçlarına dayandırılarak, üç farklı SES (Sosyo-Ekonomik Statü) seviyesine ayrılarak sunulan veriler yardımıyla Ankara ilinde gerçekletirilmiĢtir. Faktör analizi için uygun örneklem büyüklüğünün hesaplanmasında, Hair ve arkadaĢları (2006) tarafından ölçüt alınan kabul edilen, madde x 10 kiĢi esas alınmıĢtır. (N/p> 10). Tabachnick and Fidell (2001) 5 katının uygun görüldüğünü belirtmiĢtir.

Pilot çalıĢma için Ankara ili içinde, üç farklı geliĢmiĢlik düzeyinden 32'şer, toplam 96 okuldan veri toplanmıĢ, böylece yukarıda belirtilen oranlarda katılımcıya ulaĢılmaya çalıĢılmıĢtır. Pilot çalıĢmaya, 201 (%69.3) kadın ve 89

(%30.7) erkek olmak üzere toplam 280 fen ve teknoloji öğretmeni gönüllülük esasına göre katılmışlardır.

Pilot Çalışma Verilerinin Analizi

Faktör analizi uygulamasından önce, gerekli sayıltıların sağlandığı ortaya konmuştur Her değişkenin normalitesi, aykırı değer ve eksik maddeler kontrol edilmiş, soru sayısının %10'undan fazla soruya yanıt verilmediyse (Tabachnick & Fidell, 2001), eksik yanıtlanan anketler analize dahil edilmemiştir.

Araştırmada ankette yer alan her bir maddeden elde edilen yanıtlar ortak faktör analizi ve oblimin dönüştürülmüş faktör çözümlemesi kullanılarak incelenmiştir. Özdeğer grafiği sonucuna ve ölçeğin kuramsal yapısına bakılarak 3 faktörlü yapıya karar verilmiştir. Öz değer 1 kriterine bakıldığında, 3 faktörlü yapının varyansın %44'ünü açıkladığı görülmüştür Ortaya çıkan 3 boyut: kazanımlar ve içerik, öğrenme-öğretme süreci ve değerlendirme olarak adlandırılmıştır. Böylece, bulunduğu faktöre .30'un üstünde yüklenen maddeler, diğer faktörlere yüklenen değerleri de kontrol edilerek (diğer faktörler yükü en az .10 fark olacak şekilde) pilot çalışma sonrası 31 maddelik "Fen ve Teknoloji Öğretmenlerinin Fen ve Teknoloji Öğretim Programına Yönelik Görüşleri" ölçeği oluşturulmuştur. Ölçek maddelerinin faktör yükleri Tablo 3'de sunulmuştur.

Tablo 3'de görüldüğü gibi, kazanım ve içerik olarak adlandırılan birinci faktör 16, Öğrenme öğretme süreci olarak adlandırılan ikinci faktör 9, değerlendirme olarak adlandırılan 3. faktör 5 maddeden oluşmaktadır. Cronbach alpha katsayıları birinci faktör için .89, ikinci faktör için .73 ve üçüncü faktör için .67 bulunmuştur

Tablo 3

Ölçek Maddelerinin Faktör Yükleri

Madde	Faktör Yükleri		
	Faktör 1	*Faktör 2*	*Faktör3*
Madde13(Kazanım ve İçerik)	.75		
Madde1(Kazanım ve İçerik)	.73		
Madde5(Kazanım ve İçerik)	.72		
Madde18 (Kazanım ve İçerik)	.71		
Madde15 (Kazanım ve İçerik)	.68		
Madde26(Kazanım ve İçerik)	.67		
Madde2 (Kazanım ve İçerik)	.66		
Madde24 (Kazanım ve İçerik)	.66		
Madde16 (Kazanım ve İçerik)	.66		
Madde27 (Kazanım ve İçerik)	.65		
Madde14 (Kazanım ve İçerik)	.56		
Madde25 (Kazanım ve İçerik)	.53		
Madde8 (Kazanım ve İçerik)	.42		
Madde4 (Kazanım ve İçerik)	.41		
Madde3 (Kazanım ve İçerik)	.36		
Madde17 (Kazanım ve İçerik)	.34		
Madde20 (Öğrenme-Öğretme Süreci)		.68	
Madde19 (Öğrenme-Öğretme Süreci)		.65	
Madde7 (Öğrenme-Öğretme Süreci)		.52	
Madde30 (Öğrenme-Öğretme Süreci)		.51	
Madde28 (Öğrenme-Öğretme Süreci)		.48	
Madde31 (Öğrenme-Öğretme Süreci)		.46	
Madde6 (Öğrenme-Öğretme Süreci)		.46	
Madde12 (Öğrenme-Öğretme Süreci)		-37	
Madde9 (Öğrenme-Öğretme Süreci)		.35	
Madde22(Değerlendirme)			.85
Madde11(Değerlendirme)			.63
Madde21(Değerlendirme)			.62
Madde29(Değerlendirme)			.33
Madde10(Değerlendirme)			.32

Maddelerin Parsellenmesi ve Onaylayıcı Faktör Analizi

Ana çalışmanın verileri toplandıktan sonra homojen parseller oluşturmak için maddelerin dağılımlarına göre parseller oluşturulmuştur (Bandalos, 2008). Tüm alt boyuttaki maddeler en az iki parsele ayrılmıÇtır Maddelerin parsellenmesinden sonra, onaylayıcı faktör analizi 3 boyutlu ölçek için çalıÇtırılmıÇtır. Bu boyutlar (faktörler) kazanım-içerik, öğrenme-öğretme süreci ve değerlendirmedir. Onaylayıcı faktör analizi için Mplus öğrenci versiyonu 5.21 kullanılmıÇtır. SPSS versiyonu 15.0 Cronbach alpha değerinin belirlenmesinde kullanılmıÇtır.

Analiz sonucu 17 serbestlik derecesiyle model kikare değeri χ^2=97.14 bulunmuÇtur(p<.05). Uyum endeksleri (CFI, RMSEA, SRMR) de kabul edilen değerlerde çıkmıÇtır. Bu değerler CFI= .98, SRMR= .03 ve RMSEA= .07 istatistik uzmanları tarafından kabul edilen değerler aralığında bulunmuÇtur

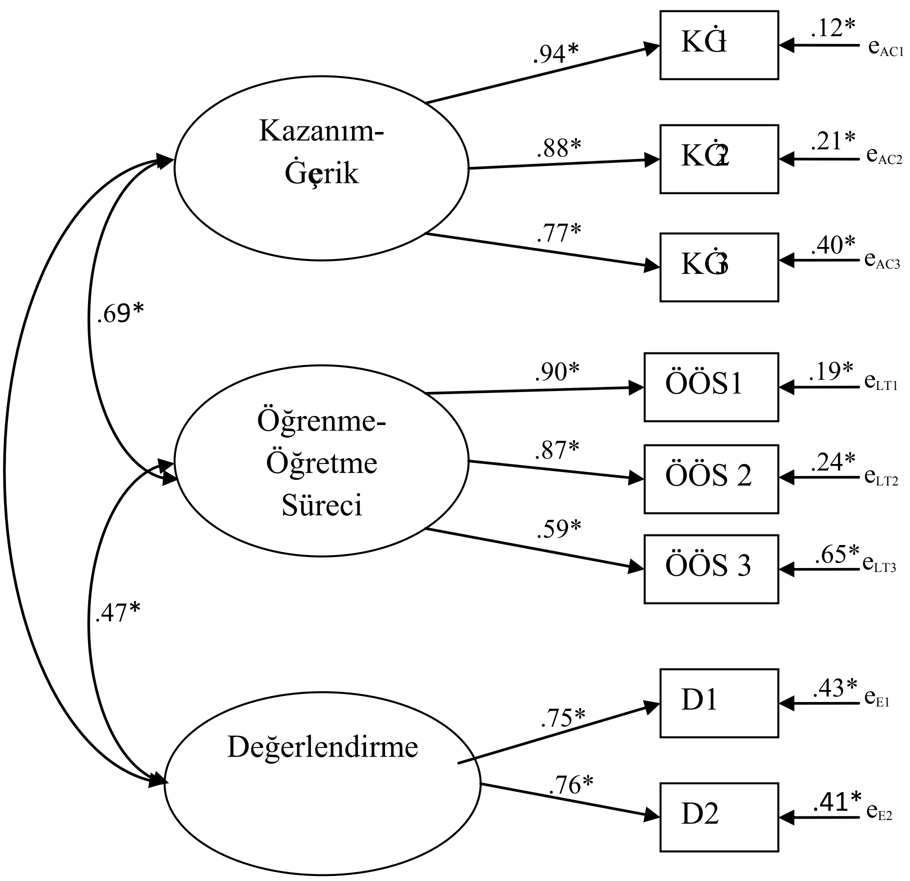


Figure 2 Standardize edilmiÇ değerler, *p<.05

Güvenirlik değerleri kontrol edildiğinde, Kazanım-Ġçerik boyutu için güvenirlik (α) .89, II. boyut için (Öğrenme-Öğretme Süreci) .73 ve III. boyut için (α) (Değerlendirme) .67 bulunmuĢtur Faktörler arası korelasyona bakıldığında Kazanım-Ġçerik boyutu ve Öğrenme-Öğretme Süreci boyutu (r=.13, p<.05) ve değerlendirme boyutu (r=.30, p<.05) arasında istatistiksel olarak anlamlı ve pozitif yönde iliĢki olduğu görülmüĢtür.

Veri Toplama Süreci

Öncelikle, seçkisiz belirlenmiĢ illerdeki okulların adları listelenmiĢ, yeni açılan okulların listeye eklenmesi ve kapanan okulların listeden silinmesi gerçekleĢtirilmiĢtir. Geçerli bir örnekleme ulaĢmak için, il ve ilçe milli eğitim müdürlüklerinin internetteki sayfaları kontrol edilmiĢtir. Bu listeden okullar seçkisiz belirlendikten sonra, öneri Milli Eğitim Bakanlığı Eğitim ve AraĢtırma Dairesi BaĢkanlığına (EARGED)'e öneri sunulmuĢtur Toplam 26 ilde bulunan 332 okula gönüllü 1 4.sınıf, 1 5.sınıf ve 2 fen ve teknoloji öğretmeni tarafından doldurulması için gönderilmiĢtir. Önce ilçe milli eğitim müdürlüklerine gönderilen veri toplama araçları daha sonra 332 okulda çalıĢan öğretmenler ulaĢmıĢtır. Toplam 1328 data toplama aracı ilçe milli eğitim müdürlüklerine gönderilmiĢ, 1167 doldurulmuĢ ölçek geri dönmüĢtür Geri dönüĢ oranı %87.8'dir. Bu ölçekler arasında, sadece 960 ölçek veri setine kaydedilmiĢtir. Ġstanbul ilinden 3 okul ölçeklerin sadece bir yüzünü kullanmıĢ, bazı katılımcılar ise tüm maddelerde sadece bir katılım derecesini iĢaretlemiĢtir. Bu ölçekler çalıĢma dıĢı bırakılmıĢtır.

BULGULAR

Öncelikle gereken sayıltıların sağlanıp sağlanmadıgına bakılmıĢtır. Bu nedenle öncelikle kayıp verilerin miktarı ve dağılımına bakılmıĢtır. Daha sonra verilerdeki uç noktalar tespit edilerek verilerin çoklu normal dağılımına bakılmıĢtır. Verilerin analize uygun olduğu sonucuna varılmıĢtır ve analiz süreci baĢlamıĢtır.

Kazanım-İçeriğe Yönelik Öğretmen Görüşleri

Birinci araştırma sorusunun ilk alt sorusu “Öğretmenlerin Fen ve Teknoloji Öğretim Programının kazanım-içerik boyutuna yönelik görüşleri nelerdir?” idi. Bu boyut 16 madde (1, 2, 3, 4, 5, 8, 13, 14, 15, 16, 17, 18, 24, 25, 26 ve 27. madde) içermektedir (Tablo 4). Betimsel analiz sonuçları, öğretmenlerin kazanım ve içeriğe yönelik görüşlerinin olumlu olduğunu göstermektedir (*M=3.99, SD=.64, n=960).* “Tamamen Katılıyorum” ve “Katılıyorum” görüşünü işaretleyen katılımcılar çalışma boyunca olumlu görüş sahibi olarak tanımlanmıştır.
Katılımcılar “Öğretim programında yer alan kazanımlar açık bir biçimde ifade edilmiştir” maddesine (27. Madde) (*M=4.21, SD=.93, n=940*). katıldıklarını (tamamen katılıyorum ve katılıyorum) belirtmişlerdir (%86.8, *n*=814). Kesinlikle katılmıyorum ve katılmıyorum ifadesini işaretleyen 79 katılımcı, örneklemin %8.4’ünü oluşturmaktadır. Yalnızca 47 katılımcı (%5) ne katılıyorum ne katılmıyorum ifadesini işaretlemişlerdir.

Katılımcıların %86.8’i (*n=828*) “Fen ve teknoloji öğretim programındaki kazanımlar gerçekleştirilebilir niteliktedir” görüşündedir (*M=4.16, SD=.87, n=955*). Bu görüşe katılmayan katılımcılar %6.8 (*n=65*)’dir. Katılımcıların %6.5’i ise (*n=62*) ne katılıyorum ne katılmıyorum şeklinde görüş belirtmişlerdir.

Katılımcıların yüksek oranda olumlu görüş belirttikleri maddelerden biri de 1.maddedir: “Fen ve teknoloji öğretim programındaki deneyler, kazanımlara uygun biçimde belirlenmiştir” (*M=4.08, SD=.97, n=947*). Katılımcıların %86.3’ü (*n=817*) olumlu görüş bildirirken, %11.5’i (*n=109*) katılmadıklarını belirmiştir. Katılımcıların %2.2’si (*n*=21) ise ne katılıyorum ne katılmıyorum derecesini işaretleyerek görüi belirtmiştir.

Tablo 4

Kazanım-İçerik Boyutuna Yönelik Görüşler

Item	*n*	Kesinlikle Katılmıyorum		Katılmıyorum		Ne Katılıyorum Ne Katılmıyorum		Katılıyorum		Kesinlikle Katılıyorum		*M*	*SD*
		f	%	*f*	%	*f*	%	*f*	%	*f*	%		
1. Fen ve teknoloji öğretim programındaki deneyler, kazanımlara uygun biçimde belirlenmiĢtir.	947	21	2.2	88	9.3	21	2.2	478	50.5	339	35.8	4.08	.97
2. Fen ve teknoloji öğretim programında önerilen etkinlikleri faydalı bulurum.	948	19	2	94	9.9	40	4.2	421	44.4	374	39.5	4.09	1
3. Okulun imkanları (lab., materyaller vb.) kazanımların gerçekleĢtirilmesi için yeterlidir.	946	179	18.9	216	22.8	70	7.4	332	35.1	149	15.8	3.06	1.4
4. Fen ve teknoloji konuları, programda önerilen sürede bitirilebilir.	959	91	9.5	153	16	42	4.4	340	35.5	333	34.7	3.70	1.34
5. Fen ve teknoloji öğretim programı içerik bakımından yeterlidir.	957	39	4.1	113	11.8	70	7.3	456	47.6	279	29.2	3.86	1.09
8. Öğrencilerin kazanımlara ne düzeyde ulaĢtığını belirlemek mümkündür.	949	15	1.6	56	5.9	69	7.3	546	57.5	263	27.7	4.04	.85
13. Programdaki konular, öğrencilerin seviyesine uygundur	955	22	2.3	76	8	46	4.8	384	40.2	427	44.2	4.17	1

Tablo 4 (Devamı)

Kazanım-İçerik Boyutuna Yönelik Görüşler

Item	*n*	Kesinlikle Katılmıyorum		Katılmıyorum		Ne Katılıyorum Ne Katılmıyorum		Katılıyorum		Kesinlikle Katılıyorum		*M*	*SD*
		f	%	*f*	%	*f*	%	*f*	%	*f*	%		
14. Fen ve teknoloji dersi programda diğer derslerle yeterli düzeyde iliĢkilendirilmektedir.	952	17	1.8	98	10.3	103	10.8	483	50.7	251	26.4	3.9	.97
15. Fen bilimleri ile teknoloji mevcut öğretim programında yeterince bütünleĢtirilmiĢtir.	941	15	1.6	84	8.9	100	10.6	512	54.4	230	24.4	3.9	.92
16. Fen ve teknoloji öğretim programındaki deneyler, içeriğe uygun biçimde belirlenmiĢtir.	954	13	1.4	55	5.8	76	8	456	47.8	354	37.1	4.14	.89
17. Konuların iĢlenmesi için, programda tanınan zaman esnekliği uygun bir yaklaĢımdır.	956	2.8	27	6.2	59	8.3	79	36.7	351	46	440	4.17	1
18. Öğretim programındaki kazanımlar, öğrencilerin geliĢimsel seviyelerine uygundur.	953	1.7	16	5.7	54	7.3	70	43.9	418	41.4	395	4.18	.91
24. Programda önerilen etkinlikler, öğrencilerin seviyesine uygundur	950	1.2	11	6.7	64	6.7	64	47.7	453	37.7	358	4.14	.89
25. Konuların sıralanıĢ biçimi uygundur.	953	2.9	28	8.4	80	7.8	74	44.9	428	36	343	4.03	1.02
26. Fen ve teknoloji öğretim programındaki kazanımlar gerçekleĢtirilebilir niteliktedir.	955	1.4	13	5.4	52	6.5	62	49.5	473	37.2	355	4.16	.87
27. Öğretim programında yer alan kazanımlar açık bir biçimde ifade edilmiĢtir.	940	1.5	14	6.9	65	5	47	42.4	397	44.4	417	4.21	.93

Öğrenme-Öğretme Süreci

Birinci araĢtırma sorusunun ikinci alt sorusu "Öğretmenlerin Fen ve Teknoloji Öğretim Programı öğrenme-öğretme süreci boyutuna iliĢkin görüĢleri nedir?" idi. Bu boyutta toplam 9 madde bulunmaktadır (6, 7, 9, 12, 19, 20, 28, 30 ve 31.madde). Betimsel analiz sonuçları, öğretmenlerin Fen ve Teknoloji Öğretim Programı öğrenme-öğretme süreci boyutuna iliĢkin görüĢlerinin olumlu olduğunu göstermektedir (*M=4.42, SD=.60, n=960*).

Katılımcılara Öğrencinin derse aktif katılımı, fen bilgisi öğretimini daha zevkli hale getirir (7.madde) maddesine yönelik görüĢleri alındığında (*M=4.76, SD=.82, n=958*), sonuçlar katılımcıların % 95.1'inin (*n=911*) bu görüĢe katıldıklarını (tamamen katılıyorum ve katılıyorum) göstermektedir. Katılımcıların %4.4'ü (*n=42*) katılmadıklarını belirtirken (kesinlikle katılmıyorum ve katılmıyorum) ve %.5'i (*n=5*) ne katılıyorum ne katılmıyorum Ģeklinde görüĢ belirtmiĢlerdir. Açık uçlu sorularda katılımcılar, öğrencilerin öğrenme sürecinde aktif olmasının programın olumlu özelliklerinden biri olduğunu belirtmiĢlerdir (*%12.4*, *n*=95).

Öğrencinin kendi kendini değerlendirdiği yöntemler özneldir görüĢü (9.madde) de katılımcılara bir madde olarak sunulmuĢtur (*M=3.91, SD=.99, n=930*). Katılımcıların %74'ü (*n*=692) öğrencilerin kendi kendilerini değerlendirdikleri yöntemlerin öznel olduğu görüĢüne katılırken (tamamen katılıyorum ve katılıyorum) %9.6'sı (*n*=89) katılmadıklarını belirtmiĢtir. Ne katılıyorum ne katılmıyoorum diyerek görüĢ belirten öğretmenlerin yüzdesi toplam katılımcıların %16'sını (*n*=149) oluĢturmaktadır.

Programda kazanımların gerçekleĢtirilebilmesi için önerilen süre azdır (12. madde) görüĢü de öğretmenlerin değerlendirilmesinin alınması veri toplama aracında yer alan sorulardan biridir (*M=3.35, SD=1.4, n=945*). Katılımcıların yarısından fazlası (*%*58.5*, n*= 553*)* bu görüĢe katıldıklarını (tamamen katılıyorum ve katılıyorum) belirtmiĢlerdir. Kazanımların gerçekleĢtirilmesi için ayrılan sürenin yeterli olduğunu düĢünen öğretmenler katılımcıların %35'ini (*n*=331) oluĢturmaktadır. Katılımcıların %6.5’i ise (n=61) ne katılıyorum ne katılmıyorum Ģeklinde görüĢ belirtmiĢlerdir. Açık uçlu sorularda öğretmenlerin zaman sıkıntısı yaĢadıkları aöıj bir Ģekilde ortaya konulmuĢtur. Bu zaman kısıtlaması programın her boyutunu etkilediği düĢünülmüĢ ve her boyut için farklı sayıda katılımcı zaman sıkıntısını belirtmiĢlerdir.

Tablo 5

Öğrenme-Öğretme Süreci Boyutuna Yönelik Öğretmen Görüşleri

Item	*n*	Kesinlikle Katılmıyorum		Katılmıyorum		Ne Katılıyorum Ne Katılmıyorum		Katılıyorum		Kesinlikle Katılıyorum		*M*	*SD*
		f	%	*f*	%	*f*	%	*f*	%	*f*	%		
6. Sınıf dıĢı öğrenme ortamlarının kullanılması (laboratuvar etkinlikleri, gezi, gözlem vs) fen ve teknoloji dersi için vazgeçilmez bir öneme sahiptir.	958	28	2.9	28	2.9	18	1.9	157	16.4	727	75.9	4.59	.9
7. Öğrencinin derse aktif katılımı, fen bilgisi öğretimini daha zevkli hale getirir.	958	35	3.7	7	.7	5	.5	60	6.3	851	88.8	4.76	.82
9. Öğrencinin kendi kendini değerlendirdiği yöntemler özneldir.	930	27	2.9	62	6.7	149	16	422	45.4	270	29	3.91	.99
12. Programda kazanımların gerçekleĢtirilebilmesi için önerilen süre azdır.	945	146	15.4	185	19.6	61	6.5	298	31.5	255	27	3.35	1.4
19. Diğer fen ve teknoloji öğretmenleriyle iĢbirliği etkili eğitim için önemlidir.	955	20	2.1	15	1.6	38	4	150	15.7	732	76.6	4.63	.81
20. Laboratuvar etkinlikleri fen ve teknoloji dersinin ayrılmaz bir parçasıdır.	957	25	2.6	15	1.6	7	.7	102	10.7	808	84.4	4.73	.79
28. Programda kazanımların gerçekleĢmesi için veli-okul iĢbirliği önemlidir.	938	29	3.1	13	1.4	30	3.2	157	16.7	709	75.6	4.6	.87
30 Öğrencilerin farklı kaynaklardan yararlanarak öğrenmelerini teĢvik ederim.	936	21	2.2	23	2.5	31	3.3	248	26.5	613	65.5	4.51	.86
31. Fen ve teknoloji öğretim programı sınıfta öğretim teknolojilerinin (tepegöz, projektör, cd) kullanılmasını gerektirir	939	21	2.2	17	1.8	13	1.4	126	13.4	762	81.2	4.69	.79

Değerlendirme

Birinci sorunun 3. alt sorusu "Öğretmenlerin Fen ve Teknoloji Öğretim Programı değerlendirme boyutuna ilişkin görüşleri nedir?" idi. Bu boyut 5 madde içermektedir (10, 11, 21, 22 ve 29. madde). Betimsel analiz sonuçları öğretmenlerin değerlendirme boyutuna ilişkin olumlu görüş sahibi olduklarını ortaya koymuştur(*M = 3.58, SD = .83, n = 960)*

Alternatif değerlendirme yöntemleri etkililiği hakkında öğretmen görüşleri 10.maddede sorulmuştur (*M=3.72, SD=1.15, n=955*). Katılımcıların %67.6'sı (*n*=646) "öğretim programında önerilen değerlendirme yöntemlerini (öğrenci ürün dosyası, performans değerlendirme gibi) uygulamak etkilidir" görüşüne tamamen katılıyorum ve katılıyorum görüşünü belirtmişlerdir. Kalıtımcıların %14.5'i (*n*=138) ne katılıyorum ne katılmıyorum görüşünü belirtirken %17.9'u (*n*=171) olumsuz (kesinlikle katılmıyorum ve katılmıyorum) görüş belirtmiştir.

Proje görevlerine yönelik öğretmen görüşleri 21.maddede sorulmuştur. Proje ödevleri öğrencilerin performansını ölçmek için iyi bir araçtır (*M=3.51, SD=1.27, n=952*). Katılımcıların %60.8'i (*n*=579) olumlu görüş belirtirken (tamamen katıldıklarını ve katıldıklarını), katılımcıların %24.8'inin (*n*=236) görüşleri (kesinlikle katılmıyorum ve katılmıyorum) olumsuzdur. Katılımcıların %14.4'ü (*n=137*) ise ne katılıyorum ne katılmıyorum şeklinde görüş belirtmişlerdir.

Öğrenci ürün dosyalarını değerlendirmek zaman alsa da, yararlıdır fikrine yönelik öğretmen görüşleri sorulmuştur (*M=3.56, SD=1.27, n=949*). Katılımcıların %64.4'ü (*n*=611) öğrenci ürün dosyalarının yararına ilişkin olumlu (tamamen katılıyorum ve katılıyorum) görüş belirtirken %23.5'i (*n*=223) olumsuz görüş belirtmişlerdir. Katılımcıların %12.1'i (*n*=115) kararsız kalmışlardır..

Table 6

Değerlendirme Boyutuna İlişkin Öğretmen Görüşleri

Item	*n*	Strongly Disagree		Disagree		Neither agree nor disagree		Agree		Strongly Agree		*M*	*SD*
		f	%	*f*	%	*f*	%	*f*	%	*f*	%		
10. Öğretim programında önerilen değerlendirme yöntemlerini (öğrenci ürün dosyası, performans değerlendirme gibi) uygulamak etkilidir.	955	53	5.5	118	12.4	138	14.5	381	39.9	265	27.7	3.72	1.15
11. Fen ve Teknoloji öğretim programında önerilen (sözlü-yazılı sınavlara ek olarak) alternatif değerlendirme yöntemlerinin (akran değerlendirmesi,öğrenci ürün dosyası) kullanılması uygundur.	958	61	6.4	127	13.3	142	14.8	378	39.5	250	26.1	3.66	1.18
21. Proje ödevleri öğrencilerin performansını ölçmek için iyi bir araçtır.	952	92	9.7	144	15.1	137	14.4	347	36.4	232	24.4	3.51	1.27
22. Öğrenci ürün dosyalarını değerlendirmek zaman alsa da, yararlıdır	949	93	9.8	130	13.7	115	12.1	370	39	241	25.4	3.56	1.27
29. Ürün odaklı ölçme ve değerlendirme yöntemi uygulanabilir değildir.	922	51	5.5	143	15.5	180	19.5	419	45.4	129	14	3.47	1.08

Demografik Değişkenlerin Öğretmen Görüşleri Üzerine Etkisi

Bu çalıĢmaya 77 farklı alandan mezun öğretmen katılmıĢtır. Tüm bu alanlar dört grupta toplanmıĢtır: fen bilgisi eğitimi alanlarından mezun olanlar, sınıf öğretmenliği alanlarından mezun olanlar, fen edebiyat fakültesi mezunları ve diğerleri. Sonuçlar, mezuniyet alanlarının öğretmenlerin Fen ve Teknolloji Öğretim programına yönelik görüĢleri üzerine istatistiksel olarak anlamlı bir etkisi olduğunu göstermiĢtir, Pillai's trace = .03, F(9,2841)= 3.06, p<.05. Mezuniyet alanının Fen ve Teknoloji Öğretim programına yönelik görüĢleri her bir bağımlı değiĢken için incelenmiĢtir (kazanım-içerik, öğrenme-öğretme süreci ve değerlendirme). Sonuçlar, mezuniyet alanının öğretmenlerin kazanım-içerik boyutuna varyansın %2 sini açıklıyan bir etkisi olduğunu F(3,947)=6.55, p<.05 ve değerlendirme boyutuna istatistiksel olarak anlamlı bir etkisi (varyansın %1'ini açıklayan) olduğunu ortaya koymuĢtur. Mazuniyet alanının öğrenme-öğretme sürecine istatistiksel olarak anlamlı bir etkisi bulunmamıĢtır. Post-hoc analiz yapıldığında (Dunnet C), fen bilgisi öğretimi alanından mezun olan öğretmenlerin kazanım-içerik ve değerlendirme boyutuna yönelik görüĢlerinin sınıf öğretmenliği mezunu öğretmenlere göre daha az olumlu görüĢ bildirdikleri bulunmuĢtur

Cinsiyetin Fen ve Teknoloji Öğretim Programına yönelik öğretmen görüĢlerine istatistiksel olarak anlamlı bir etkisi bulunmamıĢtır.Öğretmenlik deneyimi ise 5 kategorık değiĢkene ayrılarak incelenmiĢ, kuramsal olarak Huberman (1989)'ın Öğretmen Meslek Döngüsü kuramsal temel olarak belirlenmiĢtir. Genel olarak, öğretmenlik deneyiminin Fen ve Teknoloji Öğretim Programına (kazanım-içerik, öğrenme-öğretme süreci ve değerlendirme) yönelik öğretmen görüĢlerine istatistiksel olarak anlamlı bir etkisi bulunmuĢtur, Pillai's trace = .09, F(12,2823)= 7.46, p<.05. Sonuçlar, öğretmenlik deneyiminin kazanım-içerik (varyansın %2'sini açıklayan) F(4,941)=4.33, p<.05 ve değerlendirme boyutuna istatistiksel olarak anlamlı bir etkisi olduğunu ortaya koymuĢtur (varyansın %4'ünü açıklayan) F(4,941)=6.74, p<.05. Post hoc analiz çalıĢtırıldığında 7-18 yıl deneyimli (*M*=4.08, *SD*=.56) öğretmenlerin 0-3 yıl deneyimli (*M*=3.89, *SD*=.61) öğretmenlerden kazanım-içerik boyutuna daha olumlu baktıkları ortaya konulmuĢtur Benzer bir Ģekilde, 7-18 yıl deneyimli years (M=4.08, SD=.56) öğretmenlerin 4-6 yıl deneyimli öğretmenlerden kazanım-içerik boyutuna daha olumlu baktıkları ortaya konulmuĢtur. Değerlendirme boyutunda ise 0-3 yıl deneyimli öğretmenlerin (M=3.85, SD=.78) değerlendirme boyutuna iliĢkin görüĢlerinin 4-6 yıl deneyimli öğretmenlerden (M=3.77, SD=.71) ve 7-18 yıl deneyimli (M=3.50, SD=.83) öğretmenlerden daha olumlu baktıkları sonucuna ulaĢılmıĢtır.

Sınıf öğretmenliği ve fen ve teknoloji öğretmenlerinin programa yönelik görüĢleri arasında bir farklılık olup olmadığı araĢtırılmıĢtır. Öğretim alanının Fen ve Teknoloji Programına yönelik görüĢlere istatistiksel olarak anlamlı bir etkisi olduğu bulunmuĢtur, Pillai's trace = .02, $F(3,953)= 7.58$, $p<.05$.

Öğretim alanının programın her alt boyuta (kazanım-içerik, öğrenme-öğretme süreci ve değerlendrirme) iliĢkin etkisi araĢtırılmıĢtır. Öğretim alanının kazanım-içerik varyansın %1'ini açıklayan $F(1,955)=10.09$, $p<.05$ ve değerlendirme boyutlarına, $F(1,955)=18.04$, $p<.05$, varyansın %2'sini açıklayan istatistiksel olarak anlamlı bir etkisi olduğu bulunmuĢtur Sonuçlar, sınıf öğretmenlerinin M=4.04, SD=.64) ilköğretim fen ve teknoloji öğretmenlerinden (M=3.90, SD=.64) kazanım-içerik ve aynı Ģekilde sınıf öğretmenlerinin (M=3.67, SD=.83) fen ve teknoloji öğretmenlerine (M=3.43, SD=.82) göre değerlendirme boyutlarında daha olumlu görüĢte oldukları belirlenmiĢtir

TARTIŞMA

ÇalıĢmanın sonuçları, katılımcıların Fen ve Teknoloji Öğretim Programının kazanım-içerik, öğrenme-öğretme süreci ve değerlendirme boyutlarına iliĢkin olumlu görüĢ sahibi olduklarını ortaya koymuĢtur Sınırlıklara neden olan temel etkenleri ise sınıflraın kalabalık olması, okullarda araç-gereç eksikliği ve zaman sıkıntısı olarak belirtilmiĢtir. *Kalabalık sınıflar* (Boyacı, 2010; Dursun, 2006;

Özmen, 2003; Sağlam, 2009; Dindar & Yangın, 2007; YaÇar et al., 2005; Unayağyol, 2010), *yetersiz araç-gereç* (Acat & Demir, 2007; Bağcı-Kılıç, 2003; Çengelci, 2008; Ekici, 2002; Gelbal & Kelecioğlu, 2007; Gömleksiz & Bulut, 2006; Kurtdede-Fidan, 2008; Tekbıyık & Akdeniz, 2008) ve *zaman sıkıntısı* (Acat & Demir, 2007; Adal, 2011; Boyacı, 2010; Çengelci, 2008; Demirci-Güler & Laçin-ġimsek, 2007; ErÇahan, 2007; Gelbal & Kelecioğlu, 2007; Güven, 2008; Kaptan, 2005; Karaer, 2006; Kesercioğlu et al, 2006; Özmen, 2003; Sağlam, 2009; Selvi, 2006; Dindar & Yangın, 2007) birçok çalıÇmada altı çizilen sıkıntılardır.Bu çalıÇmaların programın bütün boyutlarını (kazanım-içerik, öğrenme-öğretme süreci ve değerlendirme) etkilediği görüÇü belirtilmiÇtir. Bu çalıÇmanın veri toplama sürecinde bir haftalık ders programında fen ve teknoloji dersi 4 saat olaraka yüyütülürken, günümüzde bu süre Milli Eğitim Bakanlığı (2010) tarafından haftalık 3 ders saaatine sınırlamıÇtır. Böylece, rapor edilen zaman sorunu bir miktar daha artmıÇtır.

Öğretmenlerin kazanımlara yönelik olumlu görüÇ belirttikleri bu çalıÇmanın bulguları arasındadır. Benzer Çekilde, Adal (2011) öğretmenlerin kazanımlara yönelik olumlu algılara sahip olduğunu ortaya koymuÇtur Kazanımların öğrenci seviyesine uygun olduğu, baÇka çalıÇmaların da (Aydın, 2007; Çengelci, 2008; Değirmenci, 2007) gösterdiği gibi bu çalıÇmanın da bulguları arasındadır. Kazanımlar uygulanabilir bulunmuÇ, günlük hayatla bağlantılı olmasını olumlu bir özellik olarak değerlendirmiÇtir. Aynı sonuçlar farklı iki çalıÇmanın da bulguları arasındadır (Adal, 2011; Ayvacı & Devecioğlu, 2009).

Katılımcıların yarısından fazlası Fen ve Teknoloji Öğretim Programının diğer derslerle yeterli derecede iliÇkilendirildiği görüÇündedir. Açık uçlu soruların sonuçları, Fen ve Teknoloji dersinin kazanımlarının gerçekleÇtirilebilmesi için, matematik dersinde bazı konuların öğrenilmiÇ olması gerektiğini, ancak ikki ders arasında uyum olmadığı için bu uyumsuzluğun Fen ve Teknoloji dersinin kazanımlarının baÇarılmasını engellediği görüÇü bulunmaktadır. Benzer Çekilde, Kaptan (2005), matematik ve fen ve teknoloji dersi arasındaki uyumsuzluğun altını çizmiÇtir.

Konuların sıralanıÇı öğretmenler tarafından yeterli bulunmuÇtur Formüllerin öğretilmesiyle ilgili ise öğretmenlerin zihninde bir belirsizlik olduğu açık uçlu sorularda belirtilmiÇtir. Aynı sorun Boyacı (2010) tarafından yapılan araÇtırmada da belirlenmiÇtir. Öğretmenler formülleri öğretmek istemektedirler. Nedeni ise öğrencilerin formülleri oluÇturabildiklerini görmeleri ve oluÇturduktan sonra öğretmenden açıklama beklemeleri gösterilmiÇtir. Öğretmenler ise net bir Çekilde formülleri öğretemedikleri, öğretmen el kitabındaki “matematiksel bağıntılar verilmemelidir” ifadesinin net olmadığı görüÇündeler.

Öğretmenler, öğrenme-öğrenme sürecine yönelik olumlu görüÇ bildirmiÇlerdir. BuluÇ-Kırıkkaya (2009)’nın çalıÇmasında vurguladığı gibi, öğrencilerin öğrenme sürecine aktif katılımı olumlu bir özellik olarak vurgulanmıÇtır. Katılımcıların %95.1’i öğrenci merkezli yaklaÇımın olumlu bir özellik olduğu görüÇündedir Ancak, oluÇturmacı yaklaÇımın uygulamaya konulmasıyla ilgili bazı soru iÇaretleri bulunmaktadır. Eski alıÇkanlıklarını bırakmakta zorlandıklarını belirten katılımcılar, oluÇturmacı yaklaÇıma yönelik beklenen uygulamalara yönelik eğitim ihtiyaçlarını vurgulamıÇlardır. ÇalıÇmada oluÇturmacı yaklaÇım hakkında sadece kuramsal (kitabi) bilgilerin verilmesi, uygulamalrın örneklerle açıklanmaması da tartıÇmaya açık bir durumdur.

Öğretmenler, değerlendirme boyutuna iliÇkin olumlu görüÇ belirtmiÇlerdir. Programda birçok değerlendirme yöntemi örneklerle açıklamıÇ olmasına rağmen, öğretmenler sıklıkla performans, proje görevi ve öğrenci ürün dosyası kullanmaktadır. YapılandırılmıÇ grid, tanılayıcı dallanmıÇ araç, kavram haritaları gibi tekniklerin nadir kullandığı hatta göz ardı edildiği belirlenmiÇtir.

Öğretmenlerin mezuniyet alanı, kazanım-içerik ve değerlendirme sürecine istatistiksel olarak anlamlı etkisi bulunmuÇtur ġahan (2010)’ın çalıÇmasında öğretmenler eğitim fakültesi mezunları ve diğerleri diye gruplandırılmıÇ ve aralarında istatistiksel olarak anlamlı bir farklılık bulunmuÇtur Bu çalıÇmada cinsiyetin fen ve teknoloji öğretim programına yönelik görüÇlerine istatistiksel olarak anlamlı bir etkisi bulunmamıÇtır. ÇalıÇmalarda cinsiyetin etkisi üzerine farklı sonuçlar bulunmuÇtur Bazı çalıÇmalar öğretmen görüÇleri üzerine cinsiyetin etkisi olmadığını gösterirken (Gömleksiz & Bulut, 2006; Ercan, 2007; Kara, 2008; Tatar, 2007), bazı çalıÇmalarda anlamlı bir farklılık bulunmuÇtur(Doğan, 2009; Günay & Yurdabakan, 2011; Tabak, 2007). AraÇtırma sonuçlarında bu farklılığın nedeni örneklem büyüklüğündeki farklılıklar olabilir. Bazı çalıÇmalar sadece bir ilçe veya ilde gerçekleÇtirilirken, bu çalıÇma ulusal çaplı bir çalıÇmadır ve örneklem geniÇ tutulmuÇtur Bu çalıÇmada, öğretmenlik deneyiminin öğretmen görğÇleri üzerine istatiksel olarak anlamlı bir etkisi çıkmıÇtır. Bu çalıÇmanın aksine, bazı çalıÇmalarda (Çiftçioğlu, 2009; Gömleksiz & Bulut, 2006; Günay & Yurdabakan, 2011) bir etki saptanamamıÇtır. Bunun nedeni öğretmenlik deneyimi yıllarının farklı aralıklara bölünmesi olabilir. Bu çalıÇmada Huberman'ın (1989) öğretmenlik meslek döngüsü kuramsal temel olarak seçilirken diğer çalıÇmalarda öğretmenlik deneyimleri 10 yıllık aralıklara bölünmüÇtür Öğretim alanlarının (sınıf öğretmenleri ve fen ve teknoloji öğretmenleri) görüÇler üzerine anlamlı bir etkisi olduğu bu çalıÇmanın sonuçlarından biridir. Çiftçioğlu'nun (2009) çalıÇması iki öğretim alanı içinde bir farklılık olmadığını göstermiÇtir. Sonuçlardaki bu farklılık, öğretmenlerin ders verdikleri sınıfların farklılığından kaynaklıyor olabilir. Çiftçioğlu'nun çalıÇmasında sınıf öğretmenleri yalnızca bir ilde çalıÇan 5. sınıf öğretmenlerinden oluÇmuÇtur Okutulan sınıf farklılığı veya katılımcıların özellikleri bu farklı sonuçları nedenleri olabilir.

ÖNERİLER

1. Bu ulusal çaplı çalıÇmanın amacı, sınıf öğretmenleri ve fen ve teknoloji öğretmenlerinin fen ve teknoloji öğretim programına yönelik görüÇlerini belirlemektir. Programda gerçekleÇtirilen temel değiÇikler üzerinde durulmuÇ, kazanım, içerik, öğrenme-öğretme süreci ve değerlendirmeyle

ilgili detaylara inilmemiĢtir. Gelecek çalıĢmalarda, kazanım boyutunda bilimsel süreç becerileri (BSB), fen-teknoloj-toplum-çevre (FTTÇ) iliĢkileri, bilimsel ve teknik psikomotor beceriler, bilimin özünü oluĢturan değerler ve fene iliĢkintutum ve değerler (TD), öğrenme alanları, üniteler hakkında öğretmen görüĢleri üzerine çalıĢmalar yapılabilir.

2. Bu çalıĢmanın amacı, öğretmenlerin genel fikirlerini belirlemektir. Bu nedenle, kentsel ve kırsal alanlarda çalıĢan öğretmenlerin görüĢleri alınmıĢtır. Gelecek çalıĢmalarda, öğretmenlerin programın uygulanmasına yönelik ihtiyaçları nitel bir çalıĢmayla araĢtırılabilir.

3. BirleĢtirilmiĢ sınıf öğretmenlerinin programın uygulanmasına yönelik ihtiyaçları nitel bir çalıĢmayla detaylı incelenebilir.

4. Öğretmenlerin oluĢturmacı yaklaĢımın uygulanmasıyla ilgili akıllarında soru iĢareti bulunmaktadır. Bu uygulamalarla ilgili hizmet-içi eğitime ihtiyaç duyduklarını vurgulanmıĢtır. Gelecek çalıĢmalarda, oluĢturmacı yaklaĢıma yönelik öğretmen ihtiyaçları araĢtırılabilir.

5. OluĢturmacı yaklaĢımın yanısıra tamamlayıcı değerlendirme tekniklerinde de öğretmenlerin akıllarında soru iĢareti olduğu, kuramsal bilgi ve uygulama tecrübelerinin yetersiz olabileceği vurgulanmıĢtır. Öğretmenlerin oluĢturmacı yaklaĢım tanımları, görüĢleri, uygulamaya yönelik ihtiyaçları araĢtırılabilir.

6. Öğretmenler, sınıfların kalabalık olmasının program uygulamalarını sınırladığını belirtmiĢlerdir. Öğrencilerin bireysel farklılıklarının analiz edilebilmesi ve öğrenme süreçlerinin yakından takip edilebilmesi için sınıf mevcudlarının azaltılması gerektiği görüĢü vurgulanmıĢtır. Birçok okulda sınıf mevcudlarının idealin çok üzerinde olduğu vurgulanmıĢtır. Ssınıf

mevcudlarının azaltılması programın uygulanmasını olumlu yönde etkileyecektir.

7. Laboratuvar derslerinde kendini yetersiz hisseden öğretmenler, farklı bir öğretmenin laboratuvar dersi öğretmeni olarak derslere girmesini önermiĢtir. Bir baĢka öneri ise, fen ve teknoloji dersinden ayrı olarak, laboratuvar dersinin programa alınmasıdır. Böylece fen ve teknoloji dersinin yükü azalacak ve zaman sıkıntısı sorununa çözüm getirilmiĢ olacaktır.

APPENDIX J
CURRICULUM VITAE

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EDUCATION

Degree	Institution	Year of Graduation
PhD on MS	METU, Educational Sciences	2012
BS	Dokuz Eylül University, Primary School Education	2003
High School	EskiĢehir Atatürk Lisesi	1997

WORK EXPERIENCE

Year	Place	Enrollment
2003-2012	METU, Department of Educational Sciences	Research Assistant
2007-2008	University of Minnesota, Department of Curriculum & Instruction, USA	Visiting Scholar

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LePage, P., Akar, H., Temli,Y., ġen, D., Hasser, N., & Ivins, I. (2011). Comparing teachers' views on morality and moral education, a comparative study in Turkey and the United States. *Teaching and Teacher Education, 27*(2), 366-375.

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