SCIENCE TEACHERS' PERCEPTIONS OF THE ELEMENTARY SCIENCE AND TECHNOLOGY CURRICULUM

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Approval of the Graduate School of Sciences

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ABSTRACT

SCIENCE TEACHERS' PERCEPTIONS
OF THE ELEMENTARY SCIENCE AND TECHNOLOGY CURRICULUM

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The aim of this study is to reveal the teachers' perceptions of the Elementary Science and Technology curriculum in 6^{th}, 7^{th} and 8^{th} grade levels and the level of consistency of these perceptions with the content of the curriculum. In order to achieve this aim, an exploratory qualitative research was operated through in-depth interviews with 9 science and technology teachers. In this study, in order to directly deal with ego-threat, a relatively new technique, which is named game activity, was developed by the researcher as the data gathering tool, inspired by "game therapy." The data gathered was analyzed using content analysis.

The result of this study can be summarized as, although the teachers spend an effort to implement the curriculum, since they did not examine the curriculum closely, their efforts go in vain. The only real novelty that the new curriculum is able to incorporate into the classroom environment is that learning activities are given more time in the class than they were in the past. Still, it is seen that the aim of educating students as scientifically and technologically literate person was not taken into consideration and students are not put at the center during these activities.

Keywords: Elementary, Science, Curriculum, Teacher, Perception.

ÖZ

FEN ÖĞRETMENLERİNİN İLKÖĞRETİM FEN VE TEKNOLOJİ DERSİ ÖĞRETİM PROGRAMINA İLİŞKİN ALGILARI

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Bu çalışmanın amacı öğretmenlerin 6., 7. ve 8. sınıf İlköğretim Fen ve Teknoloji programına ilişkin algılarını ve bu algıların programın içeriğiyle örtüşme düzeyini ortaya koymaktır. Bu amacı gerçekleştirmek için, 9 Fen ve Teknoloji öğretmeniyle yapılan derinlemesine mülakatlar yoluyla keşif odaklı niteliksel bir araştırma yürütülmüştür. Bu çalışmada, ego-tehdidi ile baş etmek için, araştırmacı tarafından veri toplama aracı olarak oyun etkinliği adı verilen ve "oyun terapisi"nden esinlenilen görece yeni bir teknik geliştirilmiştir. Toplanan veri, içerik analizi kullanılarak analiz edilmiştir.

Bu çalışmanın sonucu, öğretmenlerin programı uygulamak için çaba sarf ediyor olmalarına rağmen, programı dikkatli bir şekilde incelememelerinden kaynaklı olarak, bu çabalarının boşa gittiği şeklinde özetlenebilir. Yeni programın sınıf ortamına dahil etmekte başarılı olduğu tek gerçek yenilik, öğrenme etkinliklerine eskisine göre sınıfta daha çok zaman ayrılmasıdır. Yine de, öğrencileri fen ve teknoloji okuryazarı olarak yetiştirme amacının dikkate alınmadığı ve öğrencilerin bu aktiviteler süresince merkeze konmadığı görülmektedir.

Anahtar sözcükler: İlköğretim, Fen, Program, Öğretmen, Algı.

To My Family

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CHAPTER 1

INTRODUCTION

If you don't know where you will arrive,

places you arrive do not have any importance.

Mohandas Karamchand Gandhi

The quote above can be interpreted as expressing the importance of the relationship between the curriculum and the teacher. In this case, the curriculum shows the destinations of the teaching and learning process and the teacher is the person who should know where to go. Therefore, a teaching process ignoring the curriculum fails. In addition to this, the misconceptions in the teacher's perceptions of the curriculum hinder the quality of education.

Since the teacher, who is the most significant figure in interaction with students in educational settings, is directly responsible for attaining the general aims of the curriculum, their perceptions of what they are supposed to do in the class and what their role is in teaching and learning process are of utmost importance. This issue should always be taken into consideration; however, especially in the periods when educational reforms take place, the examination of this issue in detail gains greater importance because with these reforms, a lot of changes and developments regarding education take place. In order for the reforms to be successful, teachers should interpret these changes and developments in the right way.

In Turkey, in 2004, a great reform took place and new science and technology curriculum has been developed. With this reform, many changes, especially in approaches towards teaching and learning process, occurred. In the successful

implementation of this new curriculum, how teachers perceive these changes is one of the key factors. In fact, in the curriculum teachers are advised to understand the philosophy of the curriculum, suggestions about both teaching and learning process and assessment and evaluation, and the organizational structure of the units and the curriculum before implementing it (MNE, 2006, p.66).

After the 2004 reform, the number of studies regarding new curriculum has increased in Turkey. For now, there are 22 thesis studies, registered to Higher Education Council (HEC), directly examining this issue. At first, the studies covered only the 4^{th} and 5^{th} grades Science and Technology curriculum and generally conducted with primary school teachers. However, in the literature there have also been some studies covering 6^{th}, 7^{th} and 8^{th} grade level Science and Technology curriculum for the last two years. Almost all the studies on this issue are basically quantitative studies and they were conducted through questionnaires and rarely supplemented by interviews. Thanks to these studies, at first a huge data were gathered and the first reflexes of teachers toward the new curriculum were successfully revealed. In these studies, it is shown that teachers generally appreciate the curriculum in terms of its content and approach to teaching and learning process (e.g. Aydın, 2007; Değirmenci, 2007; Kara, 2008; Şeker, 2007; Tatar, 2007). However, in the studies that are based on interview data (e.g. Battal, 2008) it is revealed that teachers do not have a good command of the content of the curriculum and its approach to teaching and learning process as much as quantitative results showed. In addition to this, many research studies showed that teachers have some serious problem with the implementation of the curriculum and thus, many teachers cannot implement the curriculum at a satisfactory level (e.g. Gökçe 2006; Yangın, 2007).

In this study, it is aimed to deepen the studies carried out in this field before and to take them a step further. In the present study, the field of research and discussion is aimed to carry from 'teachers' opinion' level to 'teachers' perception' level. In order to fulfill these expectations, a relatively new qualitative interview technique, the details of which are given in the method section, was developed.

1.1 Purpose of the study

The aim of this study is to reveal the teachers' perceptions of the Elementary Science and Technology curriculum in 6^{th}, 7^{th} and 8^{th} grade levels and the level of consistency of these perceptions with the content of the curriculum. In order to achieve this aim, this study focused on the following research questions:

1. What are the teachers' general opinions about the Science and Technology Curriculum and its implementation?
2. What are the teachers' perceptions of Foundations of the Science and Technology Curriculum?
   - 2.1. What are the teachers' perceptions of scientific and technological literacy?
   - 2.2. What are the teachers' perceptions of general aims of the curriculum?
   - 2.3. What are the teachers' perceptions of the philosophy of the curriculum?
   - 2.4. What are the teachers' perceptions of teaching and learning process?
   - 2.5. What are the teachers' perceptions of assessment and evaluation?
   - 2.6. What are the teachers' perceptions of taking all students' needs into consideration?
   - 2.7. What are the teachers' perceptions of seven learning areas which are Living Organisms and Life, Matter and Change, Physical Phenomena and Earth, Science-Technology-Society-Environment Relationships (STSE), Science Process Skills (SPS) and Attitudes and Values (AV) Universe in the curriculum?
   - 2.8. What are the teachers' perceptions of implementers (teachers, parents and inspectors) of the curriculum?

Within the framework of the research questions above, both the teachers' self-perceptions and the ways they perceive the curriculum were analyzed.

1.2 Significance of the study

The main purpose of curriculum evaluation is to reach a conclusion regarding the effectiveness of the curriculum and to deal with the shortcomings of it after they are identified (Güngör & Yılmaz, 2002 cited in Aksu, 2008). Teachers help to overcome the problems with the theory and implementation of the curriculum and they are the key person to fill this gap (Elbaz, 1991). Research studies show that teachers are important agents of curriculum change (Fullan 2007; McLaughlin 2004). In fact, understanding teachers' attitudes and beliefs has an important role in the successful implementation of the curriculum in the classroom (Crawley & Salyer, 1995; Olson, 1981; Tobin, 1987). Huinker and Madison (1997), in one of their studies on science education, stated that teachers' attitudes and beliefs about science and science education play an important role in the way their behaviors in science teaching take shape. The present study has an importance in terms of reflecting teachers' perceptions of 6^{th}, 7^{th} and 8^{th} grade levels of Elementary Science and Technology curriculum and in line with this, generating new ideas, discussions and research topics regarding the implementation of the curriculum. In addition to this, it is expected that the findings that this research study puts forth will be useful for curriculum development professionals, academicians and teachers, and will contribute to the studies conducted by Ministry of National Education.

According to Şimşek and Yıldırım (1999), by using qualitative study, perceptions and events are set forth in their natural settings in a realistic and holistic way. Although qualitative study is a suitable method for researching perceptions, it is understood that, especially in Turkey, most of the studies on teachers' perceptions of the curriculum were conducted through quantitative methods. Therefore, it is assumed that the current study will contribute to the efforts to overcome the lack of qualitative studies in this area and by doing this, it is assumed that this study will provide detailed data regarding teachers' perceptions of curriculum. In this study, an in-depth interview method which was conducted through game activity was used.

In addition to this, in studies on teachers' perceptions of the curriculum conducted with qualitative methods, no significant precautions were taken in order to deal with ego-threat, which is one of most important threats in qualitative research. Regarding ego-threat, Gorden (1956) states that:

> The strongest tendency to withhold information is often referred to as "repression." The respondent not only refuses to admit the information to the interviewer but also hides it from himself, to preserve his self-esteem and escape a guilty conscience. He is perfectly honest when he says that he does not know or that he has forgotten. This dimension has primarily occupied the psychiatrist, psychoanalyst, and clinical psychologists…. If he [the interviewee] is made to feel confident that the interviewer will not condemn him, he may welcome the opportunity to "tell all" (p. 159).

In order to deal with this ego-threat, these three groups of experts developed "play therapy," which is also known as "game therapy." Axline (2002) states that:

> Play therapy is based upon the fact that play is the child's natural medium of self-expression. It is an opportunity which is given to the child to 'play out' his feelings and problems just as, in certain types of adult therapy, an individual 'talks out' his difficulties (p.8).

In the current study, in order to directly deal with ego-threat, a relatively new technique, which is named game activity, was developed by the researcher as the data gathering tool, inspired by "game therapy." These game activities do not have a single solution and they were designed in a way that this characteristic of the game activities could easily be recognized by the interviewees. By this way, the pressure that the interviewees might feel during the interviews was substantially minimized. In addition to this, in the interviews conducted through these game activities, the interviewees were not asked direct questions and they were provided with an environment where they can easily "tell all."

1.3 Definitions of Terms

Teachers: Teachers who have been working in 6^{th}, 7^{th} and 8^{th} elementary grade levels.

Current/New Elementary Science and Technology Curriculum: Current elementary science and technology curriculum in 6^{th}, 7^{th} and 8^{th} elementary grade level which was prepared by Ministry of National Education in 2006.

Opinion: A teacher's judgment about the curriculum and its implementation.

Perception: A teacher's awareness of the curriculum and its contents. Perception involves both the way a teacher regard the curriculum and his/her beliefs about what it is like.

Game Activity: A technique developed in order to collect data in this qualitative study. Using this technique it was expected to minimize the ego-threat while collecting data.

Learning Outcomes: What learners will have gained as a result of learning. They should be linked directly to the knowledge, understanding, skills, capabilities and values that a student will have gained after completing a curriculum.

CHAPTER 2

LITERATURE REVIEW

This chapter includes the literature review of both the underlying theory which constitutes a base for the study, and the methods and results of the previous studies. There are four sections in this chapter: In the first section, definition of curriculum is presented.. In the second section, historical background of the curriculum development in Turkey is given. In the third section, terms which are emphasized in the current elementary science and technology curriculum are focused on. In the last section, previous studies about the curriculum in Turkey is given.

2.1 What is Curriculum?

Curriculum is derived from a Latin word, the root of which means "race-course." Following this origin, curriculum is generally defined as a course of subject matter studies. On the other hand, in the modern curriculum literature there has been wide criticism for this notion. Furthermore, this notion has undergone some modifications and replacements. For this reason, today there is no one agreed upon definition for the term curriculum (Lewy, 1991, p.15).

In addition to this, when the literature is examined, it is understood that the curriculum aspects change simultaneously whenever a great development exists in science, technology and society because the developments in these areas have influenced the expectations from the school and education. It should not be surprising that there is a huge emphasis in the literature on the great changes in science education appeared after World War II and during the cold war between the USA and Russia. When the course of history is considered, it is seen that there are 4 main trends following each other under the name of curriculum theory.

These trends are curriculum as a body of knowledge to be transmitted, curriculum as a product, curriculum as a process and curriculum as praxis.

Curriculum as body of knowledge to be transmited

In this old aspect, curriculum is defined as a list of subjects like syllabus or a body of knowledge to be transmitted. Education in this sense is the process by which this body of knowledge is transmitted or 'delivered' to students by the most effective methods that can be devised (Blenkin et al., 1992). This aspect dominated the area until the 20th century.

Curriculum as a product (as an attempt to achieve certain ends in students)

In this aspect, education is seen as a technical exercise and the objectives are seen as a product which can be measured. It is the work of two American writers Franklin Bobbitt (1918; 1928) and Ralph W. Tyler (1949) that dominated theory and practice within this tradition (Kumari & Srivastava, 2005). According to Bobbitt, the curriculum is the series of experiences which children and youth must have by way of obtaining those objectives (Bobbitt, 1918). Considering the curriculum theory and practice in this way was heavily influenced by the development of management thinking and practice, the rise of which is often associated with F. W. Taylor, the main advocate of scientific management (Kumari & Srivastava, 2005). Taylor's all three elements in management which are greater division of labour with jobs being simplified; an extension of managerial control over all elements of the workplace; and cost accounting based on systematic time-and-motion study were involved in this conception of curriculum theory and practice, especially in many training programmes (Kumari & Srivastava, 2005).

In addition to this, Ralph W. Tyler shared Bobbitt's emphasis on rationality and relative simplicity in his curriculum theory and he based his theory on four fundamental questions as follows:

1. What educational purposes should the school seek to attain?

2. What educational experiences can be provided that are likely to attain these purposes?

3. How can these educational experiences be effectively organized?

4. How can we determine whether these purposes are being attained? (Tyler, 1949, p.1)

Like Bobbitt, he also placed an emphasis on the formulation of behavioural objectives.

> Since the real purpose of education is not to have the instructor perform certain activities but to bring about significant changes in the students' pattern of behaviour, it becomes important to recognize that any statements of objectives of the school should be a statement of changes to take place in the students (Tyler, 1949, p.44).

After the fundemantal concerns of a curriculum were described with four questions above, Taba translated these concerns into a nicely-ordered procedure. According to Taba, 7 steps which are diagnosis of needs, formulation of objectives, selection of content, organization of content, selection of learning experiences, organization of learning experiences and determination of what to evaluate and of the ways and means of doing it are essential for preparing a curriculum (Taba, 1962).

Although within this aspect curriculum is no longer considered as a syllabus and there has been a great jump in describing and managing education since behavioral objectives are included, later on it became the target of certain criticism. The most important one of these critical approaches was of Stenhouse (1976).

> I believe there is a tendency, recurrent enough to suggest that it may be endemic in the approach, for academics in education to use the objectives model as a stick with which to beat teachers. 'What are your objectives?' is more often asked in a tone of challenge than one of interested and helpful inquiry. The demand for objectives is a demand for justification rather than a description of ends... It is not about curriculum design, but rather an expression of irritation in the problems of accountability in education (Stenhouse, 1976, p.77).

Curriculum as process

According to Lawrence Stenhouse, a curriculum is an attempt to convey the main principles and characteristics of an educational proposal in a form which makes it open to critical scrutiny and capable of effective translation into practice. He thinks that, as a minimum, a curriculum should provide a basis for planning a course, studying it empirically and considering the grounds of its justification.

The perspectives of this curriculum aspect include some contrasts when it is compared with the previous aspects. In this curriculum aspect, curriculum is not a package of materials or a syllabus of ground to be covered. "It is a way of translating any educational idea into a hypothesis testable in practice. It invites critical testing rather than acceptance" (Stenhouse, 1976, p. 142). According to Stenhouse, curriculum is not like a package which is designed to be delivered almost anywhere, because each classroom is unique by its setting. Moreover, outcomes are no longer the central and defining feature. Rather than tightly specifying behavioural objectives and methods in advance, what happens in this model of curriculum theory and practice is that content and means develop as teachers and students work together (Kumari & Srivastava, 2005). Finally, while the product model tends to draw attention to teaching, according to this aspect the attention shifts from teaching to learning. By this way, students are not passive receivers of the teacher's acts because they have a say in the way that lessons evolve. Moreover, the focus is on interactions (Kumari & Srivastava, 2005). Therefore, a process approach to curriculum theory and practice answers the question of "how can this information be got over?" by making the process of learning the central concern of the teacher. The reason of this is the fact that interpretation and meaning-making are emphasized. According to process approach, one classroom is different from another and it should be made sense of (Kumari & Srivastava, 2005).

Curriculum as praxis

Grundy states that "[T]he curriculum is not simply a set of plans to be implemented, but rather is constituted through an active process in which

planning, acting and evaluating are all reciprocally related and integrated into the process" (Grundy, 2006, p.115).

Curriculum as praxis can be considered as a development of the process model. The important point is that in process model there are some unclear statements about the interests it serves even though it relies on general principles and emphasizes judgment and meaning making. For this reason, process model differs from praxis model as it can result in some problems in the collective well-being and emancipation of human spirit. On the other hand, praxis model puts these concerns at the center of the process, making explicit reference to emancipation. Therefore, action is not simply informed, it is also committed. It is praxis. (Srivastava & Kumari, 2005, p.14)

2.2. Historical Background of the Science Curriculum Development in Turkey

Systematical changes on science curriculum in Turkey started to be seen just after the declaration of the republic in 1923, 29th October (Okan, 1993). The main reason of this situation was that Atatürk, the founder of Turkish Republic, predicted that the main contribution to the development of the Republic would come from education (Güneş, 2007). The desire to base the new Turkish Republic on national bases resulted in the needs to educate generations who adopted national sovereignty as their life style, to promote national culture, to achieve national unity and to realize the sovereignty of the nation (Güneş, 2007). Therefore, on 3rd March 1924 Tevhidi Tedrisat Law, which provided the unity in education and teaching, was enforced (Akyüz, 1992). With this law, all the schools in Turkey were put under the monitoring and surveillance of the Ministry of National Education and a step towards an educational system which depended on the principles of secularism and nationalism was taken (Büyükkarcı, 2002). Tevhidi Tedrisat Law is also important in terms of the development of Turkish science curriculum. In 1924 the science lesson named "nature etude" was included in the educational curriculum and the subjects were separated into the sections

under the topic of “stuff lessons” (Okan, 1993). In 1934, the name of the lesson was changed to “the nature studies”.

In the 1948 curriculum, the topics related to the science lesson were given within the units of Life Studies lesson in the first level primary education classes and within the units of Nature Studies, Family Studies, and Agriculture Studies in the second level primary education classes. In the curriculum, aims and explanations were given before the units and in the explanations part, with regard to the course of the lesson, the opinion that “the topics to be given in this lesson will always be taught in relation to human beings. Children’s acquiring information directly through observation and experimentation will be given importance.” was dominating (Gücüm & Kaptan, 1992, p.253). According to Gücüm and Kaptan, in the 1948 Primary School Life Studies curriculum, social benefit was given priority over science.

In 1962 a draft curriculum was prepared and then pilot studies were conducted. In addition to this, three different lessons, the nature knowledge, the family knowledge and the agricultural knowledge, which were given in the first level classes as an extension of Life Studies lesson were brought together in one lesson named “the science and nature knowledge” as the general objectives of these three lessons were common. (Tekışık 1980, cited in Özdemir, 2006).

After the pilots studies of the 1962 draft curriculum, some necessary changes were made and it was put into practice all over the country (Demirel, 2007). 1968 curriculum corresponded with the unit approach but behavioral objectives for general objectives were not given (Gücüm & Kaptan, 1992). Moreover, activities regarding problem solving, analysis and research, and project studies were given some space to a great extent (Özdemir, 2006). Thus, it is seen that in the curriculum a teaching promoting active student involvement was recommended (Gücüm & Kaptan, 1992).

The 1968 Science and Nature Studies curriculum underwent two changes in 1974 and 1977. In 1974, the science and nature studies lesson was renamed as science studies. In addition to this, some shanges were made in the scopes of the units

(Gücüm & Kaptan, 1992). According to Çilenti, in the 1974 curriculum, ideas regarding social benefit philosophy and ideas highlighting technology and the principle of getting students acquire information through scientific processes were given priority (Gücüm & Kaptan, 1992). On the other hand, Gücüm and Kaptan (1992) draw attention to the fact that there was not an independent science lesson in 3rd grade in primary education in the 1974 curriculum and just a few science topics were given only within the topics of life studies lesson. In addition to this, Gücüm and Kaptan (1992) cricitized the curriculum claiming that it is impossible for a philosophy which gives priority to social benefit over scientific methods in 3rd grade to prepare students for a science lesson based on scientific processes in 4th and 5th grade levels. When the 1977 curriculum is compared with the 1974 curriculum, it is seen that although the places of some units were changed, its scope remained almost the same. The 1977 curriculum was practiced until 1991 (Gücüm & Kaptan, 1992).

In 90s it was seen that the curriculum development and assessment and evaluation gained a higher importance ever than before (Demirel, 2007). After compulsory education was increased from 5 years to 8 years in 1992, it became necessary to handle with science knowledge lesson as an entire issue (MNE, 1992). Hereby, the science curriculum of 1992 was designed as including the general and behavioral objectives for each topic in the science lesson (MNE, 1995).

The final extensive reform was accrued by science curriculum of 2004. The lesson name was changed to science and technology and after a pilot study in 2004, it has been started to use gradually according to the class level since 2005 (MNE, 2005). By this new curriculum, relatively new concepts such as scientific and technological literacy, constructivism and student-centered teaching strategies appeared in both teachers' and students' agendas.

2.3. The Emphases in the Curriculum

In this section, scientific and technological literacy, constructivism, student-centered teaching strategies and alternative assessment, which emerge as relatively new emphases when the curriculum is analyzed are focused on.

2.3.1 Scientific and technological literacy

The 1990 UNESCO World Conference on Education for All maintains that science education should aim at forming a world community which consists of scientifically and technologically literate citizens (UNESCO, 1999; see also Donnelly, Jenkins & Layton, 1994). In Turkish Elementary Science and Technology curriculum, where the idea above is frequently emphasized as the vision, goal and one of the main principles, scientific literacy and technological literacy seem to be a single, combined concept. On the other hand, when the literature is considered, though scientific literacy and technological literacy appear to be in a mutually transitional and close relationship, the definitions which differentiate these two concepts are used more frequently.

Scientific literacy

According to BouJaoude (2002) "defining scientific literacy is a complex task. This definition should reflect current understandings of the nature of science and its purposes. Moreover, it has to befit the social and cultural environments in which science is constructed and taught" (p.141). The difficulty with defining scientific literacy makes it a concept over which an intensive controversy still takes place. Therefore, there is not any widely accepted definition for scientific literacy.

The Centre of Unified Science Education (CUSE, 1974) provides one of the earliest detailed frameworks of scientific literacy. According to CUSE (1974), there are 7 dimensions of scientific literacy. These 7 dimensions are considered in Turkish Science and Technology curriculum in terms of both scientifically and technologically literate person.

This framework defines a scientifically literate person as one who:

1. understands the nature of scientific knowledge,
2. applies appropriate science concepts, principles, laws, and theories in interacting with his/her universe,
3. uses processes of science in solving problems, making decisions, and furthering his/her own understanding of the universe,
4. interacts with the various aspects of his/her universe in a way that is consistent with the values that underlie science,
5. understands and appreciates the joint enterprise of science and technology and the interrelationships of these with each other and with other aspects of society,
6. develops a richer, more satisfying, and more exciting view of the universe as a result of his/her science education and continues to extend this education throughout his/her life,
7. develops numerous manipulative skills associated with science and technology. (CUSE, 1974, p.1, cited in UNESCO, 2008)

In addition to the traits above, National Science Teachers Association (1982) suggests that a scientifically literate person has to understand both the limitations and the usefulness of science and technology. Also he or she needs to know sources of scientific and technological information and how to use this information while making decisions (BouJaoude, 2002).

Different from the efforts mentioned, some researchers try to define a scientifically literate person from a very different perspective by associating scientific literacy with language literacy. For example, Eckstein and Koch (1995) emphasize that scientific literacy makes it necessary for the reader to be actively and critically engaged in the interpretation of the meaning of a given science text. A scientifically literate person has to adopt a critical stance toward science texts

and improve his or her ability to interpret these texts from a theoretical perspective (Eckstein & Koch 1995).

When the literature is analyzed, it is seen that the definition of scientific literacy has been generally made through the traits of scientifically literate person. Still, there have been some efforts to define scientific literacy. Hurd (1985) defines scientific literacy as "the intellectual skills and knowledge essential for one to make responsible decisions or take cognitive action in situations that require an understanding of science and technology" (p.88). Sutman (1996, cited in Akgül, 2004) argues that scientific literacy is not dependent upon any specific science content or process knowledge. Scientific literacy covers the abilities and willingness of a person to continue to learn science content, to develop science processes by him- or herself, and to communicate the results of this learning experience to other people. In contrast to Sutman, Mayer (1997) argues that scientific literacy is dependent upon specific amounts of science content knowledge. Mayer (1997) defines scientific literacy as the knowledge of the substantive content of science which is related particularly to understanding the interrelationships among people and how their activities influence the world around them (Mayer, 1997).

So far, with a general look, it is clear that while scientific literate person is defined through a broad set of characteristic traits, scientific literacy as a term is generally defined in a rather limited way. This relative limitedness in the definition of scientific literacy has been overcome with the help of current reform efforts. Scientific literacy is defined by Project 2061 (American Association for the Advancement of Science (AAAS), 1990) as the ability to use scientific knowledge and ways of thinking for personal and social purposes. According to Project 2061:

> Scientific literacy has many facets. These include being familiar with the natural world and respecting its unity; being aware of some of the important ways in which mathematics, technology, and the sciences depend upon one another; understanding some of key concepts and principles of science; having a capacity for scientific ways of thinking; knowing that science, mathematics, and technology are human enterprises, and knowing what that implies about their strengths and limitations (AAAS, 1990).

In a similar vein, the National Science Education Standards in the US define scientific literacy as "the knowledge and understanding of scientific concepts and processes required for personal decision making, participation in civic and cultural affairs and economic productivity" (National Research Council (NRC), 1996, p.22). In addition, NRC standards both describe a vision of the scientifically literate person and set criteria for science education, which emphasize the inquiry nature of science within the science content standards.

Technological Literacy

It is stated in several sources that another dimension of scientific literacy, which is accepted as one of the most important aims of modern science education, is an individual's understanding of technology and of the mutual interaction between technology and science and society (AAAS, 1993; Bauer, 1996; Chiappetta & Collette, 1989; Hurd, 1998; Murphy, 2001; NRC, 1996).

Gagel (1997), after studying on a large amount of information on technological literacy from several fields, provides common elements of a long-lasting and inherent technological literacy that can keep up with the fast and constant changes in technology. Technological literacy from Gagel's perspective includes knowledge about the details of individual technologies and about the process of technology development. Moreover, it includes a holistic understanding of the context of technology in terms of history and culture and its adaptability based on initiative and resourceful thinking. Finally, it includes four generalized competencies:

> (a) accommodate and cope with rapid and continuous technological change, (b) generate creative and innovative solutions for technological problems, (c) act through technological knowledge both effectively and efficiently, and (d) assess technology and its involvement with the human lifeworld judiciously. (p. 25).

The elements provided by Gagel can be seen in other technological literacy descriptions. According to Prime (1998), technological literacy consists of knowledge and skills. Problems that might be solved with the help of technology, important technologies, social and cultural effects of technology, prerequisite

knowledge from other disciplines such as mathematics, and the form or structure of technological knowledge are the basic knowledge areas. In addition to this, technological literacy includes three skills, which are manipulative and cognitive skills such as evaluation, analytical thinking, creativity, problem solving, research, analysis, design and affective skills such as the capacity to act for the right reason and exhibit concern for moral and ethical implications of technological choice, and attitudes (e.g. independence and interdependence, caring, environmental concern, social responsibility, and positive work habits).

Just as technology involves more than computers and the Internet, technological literacy involves more than hands-on skill in using technology (Bugliarello, 2000). In line with this idea, the International Technology Education Association (ITEA) (2007) provides another definition. According to ITEA, technological literacy is much more than the ability to use technological tools. Technologically literate individuals use systems-oriented thinking when they come into contact with the technological world and they are conscious of the effects of that contact on individuals, society and the environment. Moreover, technological literacy means the ability to use, manage, assess and understand technology. In addition, the North Central Regional Educational Laboratory (NCREL) (2003) defines technological literacy as, knowledge about what technology is, how it works, what purposes it can serve, and how it can be used efficiently and effectively to achieve specific goals (Bunkhardt et al., 2003).

Through technology education, it is possible to make an individual technologically literate. In the studies by ITEA named *Standards of Technology Literacy: Content for Technological Studies* and *A Technology Project for all Americans,* what a technologically literate person should know and do is identified (ITEA, 2007). According to these studies, a technologically literate person is the one who:

a) knows what technology is, how it is developed, how it shapes society and how it is shaped by society. This individual finds a piece of news on technology that

he or she has seen on television or has read in a newspaper very interesting, acquires that knowledge, acts on it and forms an idea about it.

b) is objective and comfortable while using technology. To understand why technology and its use is important for the country is necessary for all individuals.

2.3.2 Constructivism

In the curriculum it is stated that although other learning approaches such as behaviorist approach and cognitive approach are not rejected, in order for students to achieve learning outcomes in the curriculum, teaching strategies and learning experiences should concentrate on the constructivist approaches as much as possible (MNE, 2006, p.12). Constructivism is a theory of learning established as a reaction to the faulty aspects of behaviorist and cognitive learning theories. Before defining constructivism, it is necessary to explain these two previous theories briefly.

Behaviorist approach

Behaviorist theories that dominated the psychology during the first half of the 20th century are based on the philosophical views of Aristotle, Descartes, Lock and Rousseau on the nature of learning. These theories emphasize that by changing the environment the desired behavior can be achieved. In addition to the names above, among the pioneers of behaviorist approach are Pavlov, Watson, Thorndike and Skinner (Demirel, 2007).

In this approach, learning is explained on the basis of action-reaction principle. Cognitive processes are not given much importance. Therefore, according to this approach, there is no difference among learners in terms of understanding. In the universe there is stable knowledge and the aim of education is to transfer this knowledge exactly to students and students are supposed to receive this knowledge without questioning. In addition to this, according to behaviorist approach, learning is an observable change in the behaviors of the individual. Objectives are determined for students and they are expected to fulfill these

objectives and organize their behaviors accordingly. Moreover, education focuses on external conditioning (Deryakulu, 2001).

Cognitive Approach

The theorists of cognitive approach, in which Piaget, Bruner, Vygotsky and Guilford are the pioneers, by emphasizing the complexity of human behavior, claim that "action-reaction" principle in the behaviorist approach is unsatisfactory in explaining learning (Demirel, 2007).

According to this approach, knowledge, which is perceived through sensory organs from outside environment, is processed in the brain just like a computer processing data. This knowledge processing has 2 main elements: The first one is knowledge storages formed in the memory and the other one is cognitive processes that help the knowledge to be transmitted to other memories (sensory, short-term and long-term) and that involve cognitive activities (Senemoğlu, 2010).

The psychologists in favor of this opinion believe that learning is the result of our effort to give meaning to the events and situations around us and thus we use all mental tools we have (Demirel, 2007). Demirel states that, according to this approach, the basic opinions below are adopted:

1. Learner is not a passive receiver of external stimuli but he/she is the one who assimilates them and actively forms behaviors.

2. Learner is the one who takes the responsibility of his/her own learning, and he/she does not receive what is given as it is but discovers the meaning of what is given.

3. Learner is the person who chooses the suitable ones among the different pieces of knowledge and processes them.

4. Learner, even if it is a principle that is aimed to be acquired by him/her, has to give meaning to that principle by trying to find the meaning of it,

relating it to other principles and associating it with the principles he/she has learnt before.

Constructivism

"Constructivism" means that students construct the knowledge; they do not receive it as it is but they re-form it again. They learn the new knowledge by adapting it to the existing knowledge and their own situations. Brooks and Brooks (1993) state that when a learner comes across a new piece of knowledge, he/she uses the rules he/she has formed before in order to define and explain the world or forms new rules in order to explain better the knowledge he/she perceived. In addition to this, a learner puts into practice the knowledge he/she has constructed by bringing the already learnt knowledge and newly learnt knowledge together in order to solve the problems in life (Perkins, 1999).

In this approach, the aim is not to pre-determine what learners will do, but to provide individuals with the opportunity to direct their own learning process through tools and learning materials (Erdem, 2001).

According to Wilson (1993) in general terms constructivism is based on:

1. the nature of reality: mental representation refers to "real" world
2. the nature of knowledge: knowledge is constructed in individuals' minds
3. the nature of human interaction: meanings are shared; that is, they are cooperative rather than being authoritative or manipulative
4. the nature of science: meaning is made after it passes through the individual's own filters

In general, the comparison of behaviorist, cognitive and constructivist learning approaches are listed in Table 2.1.

Table 2.1 General characteristics of behaviorist, cognitive and constructivist learning (Seels 1989; Scheurman 1998; cited in Deryakulu 2001).

Basic characteristics	Behaviorist	Cognitive	Constructivist
quality of knowledge	based on objective reality, independent from the knower	based on objective reality, depends on the knower's pre-knowledge	based on subjective reality constructed individually and socially
role of the teacher	knowledge transfer	managing the knowledge acquisition process	helping students, being in cooperation with them
role of the student	passive	partially active	active
learning	change in the open behavior as a result of conditioning	knowledge processing	individual discovery and construction of knowledge
teaching type	separation, generalization, association,	processing knowledge in short-term memory,storing knowledge in long-term memory	problem solving based on real life situations
teaching type	inductive	inductive	deductive
teaching strategies	presenting knowledge, providing exercise, giving feedback	triggering student's cognitive learning strategies	effective, with self-control and internal motivation, research based learning
education environments	several traditional environments (programmed teaching, computer aided teaching etc.)	teaching based on teacher and computer	interactive environments requiring students to show physical/mental reactions to improve
assessment and evaluation	separate from teaching process and based on a measure	separate from teaching process and based on a measure	within teaching process and independent from a measure

Immanual Kant, Lev Vygostsky, John Dewey, Jean Piaget, Jerome Bruner and Howard Gardner are all important figures in the development of constructivism (Glickman et al., 2004). In addition to this, educationalists such as Wund, Ausubel and Titchener and philosophers such as Saussure, Jakapson and Levi-Strauss have all contributed to the systematization of constructivist approach (Oğuzkan, 1993).

According to Şimşek and Yıldırım, today individuals are expected to produce knowledge rather than consuming it. In the contemporary world, an individual should not accept all knowledge that is conveyed to him/her and should not wait

to be guided and shaped. He/she should actively be involved in the process of creation of knowledge by interpreting that knowledge (Şimşek & Yıldırım, 1999).

The expectation of individual's producing knowledge, which has gained popularity today, was not fulfilled immediately; on the contrary, the history of constructivism is older than it is thought to be. The rise of constructivism in modern science/psychology starts with Piaget. Driver et al. (1994) mention that although Piaget did never call himself as constructivist, he is the first person to say that knowledge is constructed by the individuals in their minds. There are other philosophers who might have influenced the development of constructivism even before Piaget. Philosopher Vico's statement in the 18th century that "the person who knows something is the person who can explain it" is in fact related to constructivism (Glasersfeld, 1989). Later on, Immanuel Kant stated that individuals are active in receiving knowledge, that they associate the new knowledge with the old one and construct the knowledge by adding their interpretation to it. According to Kant, an individual receives knowledge actively, ties it to the ones he had assimilated before, and makes this knowledge his/her own creation (Cheek, 1992).

In constructivism there are 3 different tendencies which are cognitive, social and radical:

Cognitive Constructivism

Cognitive constructivism uses Piaget's theory of learning to explain how knowledge is formed and Piaget's assimilation, organization and cognitive balance theories to explain learning (Baker & Piburn, 1997). According to this approach, at the center of learning there is a cognitive structure formed by previous knowledge and experiences of the learner and this structure is at a balance. When the person learns a new piece of knowledge, he/she assimilates it if it fits his/her cognitive structure. If he/she cannot make an association with his/her cognitive structure, the equilibrium is damaged and this structure is organized according to new piece of knowledge and then a new balance is achieved (Kılıç, 2001).

Social Constructivism

According to Driver et al. (1994), the individual construction of knowledge perspective gives priority to physical experiences and their importance in learning science, while a social constructivist perspective recognizes that learning includes being introduced to a symbolic world. According to this approach, knowledge is formed in social settings and language is very important since it facilitates socialization.

The learning theories in this approach are based on Vygotsky's ideas. According to Vygotsky, personal development lasts till death. The person continuously faces with problems and when he/she solves these problems, his/her skills develop; so he/she becomes skillful to solve new problems. His/her development continues in this way.

Kılıç (2001) states that social constructivism based on Vygotsky's theories supports the ideas below:

1. Learning and development are social activities. Learner forms his/her knowledge in his/her own way.
2. Teacher is a facilitator in learning process.
3. Discussing, talking about and sharing new piece of knowledge in social settings are necessary for the student to make meaning out of it.

Both social constructivism and cognitive constructivism claim that knowledge is not absolute truth, but it is formed by the individual. However, in the construction of knowledge, social constructivism emphasizes language and society, whereas cognitive constructivism emphasizes perception and individual.

Radical Constructivism

Glasersfeld is the first person to form a ground for radical constructivism (Holtorf, 1997). In this approach, knowledge is formed actively in a social environment by

the individual through interaction and as a result of perception (Kavak & Köseoğlu, 2001).

Radical constructivism sets forth two main claims (Glasersfeld 1995, p.18):

(a) knowledge is not passively received but actively built up by the cognizing subject;

(b) the function of cognition is adaptive and serves the organization of the experiential world, not the discovery of ontological reality.

2.3.3 Student-centered teaching strategies

In the Elementary Science and Technology Curriculum, both teacher-centered and student-centered teaching strategies to be used by teachers are listed in Table 2.2 (MNE, 2006, p.14). In addition to this, in the curriculum teachers are expected to focus on student-centered strategies. However, it is seen that in the curriculum student-centered teaching strategies are not well defined. On the other hand, there are some explanations regarding the importance of student-centered teaching strategies in teaching-learning process and the roles that the teacher is expected to take on. In this section, the importance of student-centered teaching strategies, the teacher's role in these strategies and the advantages and limitations of them are mentioned.

Table 2.2 Teaching strategies presented in the curriculum

Teacher-centered strategies			Student-centered strategies		
Traditional Instruction	Presentation	Whole Class Discussion	Role play	Project	Independent Study
	Story telling	Video Display	Small Group Discussion (Peer Teaching)	Library Survey	Learning Centers
	Programmed one to one learning	Simulation	Field Trip	Inquiry	Programmed Learning
		Drill and Practice	Cooperative Learning	Discovery	Personalized Learning Systems
			Drama	Problem-Based Learning	
			Game Playing		

When the literature is considered, student-centered teaching strategies emerge as a requirement of constructivist approach. The fact that especially constructivist approach makes students active in learning process required the re-organization of teaching strategies accordingly. Planning a lesson and deciding which teaching strategies will be employed consists of a series of educational decisions. Parallel to this, the teacher has to specify the content and the processes according to students' needs and interests considering effective teaching strategies. At this point, specifying the educational decisions is a deliberate, conscious and critical process (Atıcı & Taşpınar, 2002). Although in the curriculum the teachers are given full authority to choose the teaching methods that they think are suitable for learning and teaching process, student-centered strategies have been suggested since they are suitable for the constructivist approaches and they provide learning opportunities to reveal and develop high level thinking skills such as critical and creative thinking, analyzing and evaluating (MNE, 2006, p.13). Just as Glickman (1991) highlighted, effective teachers prefer to use various techniques depending on students' learning situations instead of using similar techniques in every lesson. Teachers are responsible for adopting the best model, identifying

appropriate strategies, choosing the right method parallel to the aims of the lesson and implementing them. While doing this, factors such as the teacher's familiarity with the strategy, time and physical facilities, financial cost, size of the student group, characteristics of the topic, qualities that the students expected to develop and classroom atmosphere are influential (Küçükahmet, 2001). In the curriculum, the role of the teacher in teaching process is determines as the role of a guide and the suggestions for teachers regarding teaching strategies are mentioned as follows (MNE, 2006, p.14). The teachers should:

1. provide a suitable and supporting environment for science learning,
2. take into consideration students' individual differences such as motivation, interests, skills and learning styles,
3. consider students' previous knowledge and understanding regarding the topic and to make them be aware of their own knowledge,
4. identify the strengths and weaknesses of students and then provide appropriate in-class and out-of-class learning environment, methods and activities and should lead the implementation process (act as a education coach),
5. encourage the students to think on, discuss and evaluate the alternative opinions that the students come up with,
6. direct the discussions and activities in such a way that it enables students construct scientifically accepted knowledge by themselves,
7. provide the students with the opportunity to use newly constructed science concepts in various contexts,
8. encourage students to form a hypothesis in order to explain a phenomena and to produce alternative opinions,
9. make the students feel his/her willingness to study and learn science and technology topics and be a "role model" for them.

From a general look at student-centered strategies, it is seen that all of them provide the opportunity for students to actively participate in the science lessons and, if applied properly by the teacher, they all support meaningful learning to various extents. In the curriculum, meaningful learning is described as a student's activities aiming at revealing the necessary knowledge and evaluating it just like a scientist, his/her efforts to produce and acquire knowledge actively and to put this under discussion in proper ways (MNE, 2006, p.17). Moreover, every student-centered teaching strategy has its own additional advantages. For example, some student-centered strategies, especially role play, field trip, drama, projects, cooperative learning and game playing provide students with an environment where their motivation increases and their creativity, communication skills and socialization develop and with real life experiences (Küçükahmet, 2001; Sağlam, 2005; Savaş, 2007). Another example is that some student-centered teaching strategies such as inquiry and problem solving increase students' critical thinking and problem solving skills (Branch & Solowan, 2003; Sönmez, 2008). On the other hand, student-centered teaching strategies have some limitations as well. For instance, some student-centered teaching strategies such as role play, field trip and problem solving need a lot of time, careful preparation and management and relatively more material and money. In addition to this, in these teaching strategies there is a possibility that all these efforts might easily become meaningless if the strategies are not applied properly (Küçükahmet, 2001; Sağlam, 2005; Savaş, 2007; Sönmez, 2008).

2.3.4 Alternative assessments

In the Elementary Science and Technology Curriculum, based on constructivist approach, it is stated that students should be given the opportunity to be assessed from a wide variety of assessment techniques and thus the teacher are recommended to use alternative assessment techniques. In the curriculum, performance assessment, portfolio, concept map, structured grid, diagnostic branched tree, word association, project, drama, interview, written report, demonstration, group/peer assessment and self-assessment are given as the types of alternative assessment. In the curriculum, almost all of them are explained in

detail and some examples are given as well. However, in the literature it is seen that teachers generally do not use and adopt alternative assessment techniques at a satisfactory level. As for Turkey, it is known that alternative assessment techniques are not fully understood by teachers and hence they feel themselves insufficient regarding use of these assessment techiques (Çoruhlu et al., 2008). In order to shed light on why the teachers do not prefer alternative assessment techniques and use them actively despite the detailed explanations in the curriculum, in this section, instead of an introduction alternative assessment techniques, alternative assessment as a concept is dealth with in detail by giving brief information. In addition to this, a discussion of the strengths and weaknesses of alternative assessment techniques in comparison with the traditional ones is given.

NCREL defines alternative assessment as any type of assessment in which students *create* a response to a question or task. In addition to this, NCREL states that in traditional assessment techniques, students *choose* a response from a given list, such as multiple-choice, true/false, or matching. Moreover, Gronlund (2006) indicates that traditional assessment methods use paper-and-pencil tests to measure students' performance. However, alternative assessment is needed when performance skills cannot be assessed adequately with paper-and-pencil tests. Furthermore, according to Al-Sadaawi (2007), achievement should be regarded as a qualitative change in a student's conceptions rather than as the amount of knowledge that a student has and counting the number of correct answers on a test is not enough to assess a student's performance. Another important point is that changes in the approaches of educational methods due to constructivism have required the changes in assessment techniques, too. The most dramatic change may be to include performance assessment in education. Actually, performance assessment approach looks like a summative of all alternative assessment techniques. In the literature, it is seen that sometimes performance assessment is used instead of alternative assessment (Bekiroğlu, 2008). The basic reasoning of both of them is to show the usage areas of knowledge and the skills in a different

context. In this study, the expression of alternative assessment is used in order to be consistent with the curriculum.

Changes in teaching approaches are not complete and even meaningful without changes in assessment. This means that to achieve a higher improvement in educational system, alternative assessment techniques are seen to be vitally necessary, too. Education and assessment are the mirrors of each other so that assessment and education direct each other at the same time. There is a relationship between the technique used in the assessment of the students and the content; therefore, student's learning has a tendency to go in the same direction with assessment (Bekiroğlu, 2008).

A student who has constructed his/her knowledge should have the right to create his/her own answer, which is provided by alternative assessment techniques, rather than choosing one of the existing answers as in traditional assessment techniques. Therefore, cognitive and constructivist theory lead us to develop alternative assessment techniques instead of traditional ones. Popham (2006) indicates that in traditional approaches, the teacher tests students' learning as assessment *of* learning. In contrast, the other is a more instructionally oriented approach, in which testing plays a vital role in helping students learn, the teacher regards it as assessment *for* learning. Çimer (2007) explains the difference between traditional assessment and alternative assessment through an analogy. According to this analogy, students are regarded as plants. From a traditional assessment perspective, the teacher enters the garden and measures how much the length of the plant has increased. This does not directly affect the positive development of the plant. However, in alternative assessment, the teacher tries to determine how much water and nutrient the plant needs to better develop (cited in Çepni & Çil, 2009, p.209). As it is clearly understood from this analogy, traditional approach is result oriented and the aim is to determine quantitatively how much the student has learnt. However, in alternative assessment the main aim is to make a contribution to students' learning.

It is recommended to use alternative methods in education to keep up with the improvement of educational perspectives where higher-order thinking, reasoning, problem solving, and conceptual understanding of scientific knowledge are highly important (Bekiroğlu, 2008). When applied properly, traditional assessment techniques provide huge data about students' outcome of learning. However, with alternative techniques, how much learning students still need is determined as well. With traditional assessment, rather than what students don't know, what students know in educational period is focused (Bekiroğlu, 2008). Mcmillan (1997) summarizes the differences between the foci of traditional and alternative assessment techniques as in the table below:

Table 2.3 Differences between the foci of traditional and alternative techniques

Traditional	Alternative
Importance given to the result	Assesment of the process
Assessment of skills separated from each other	Assessment of skills completing each other
Remembering the learning	Application of learning
Writing based tasks	Authentic tasks
One correct answer	More than one correct answer
Hidden and unclarified criterion	Clear and definite criterion
After learning	During learning
Less feedback	Enough and timely feedback
Traditional exams	Assessments based on performance
Assessment with only one technique	Assessment with many techniques
Occasional assessment	Consistent assessment

Gronlund (2006) mentions major advantages of alternative assessment. First of all, alternative assessment can be used to evaluate complex learning outcomes which cannot be evaluated by traditional assessment. Another advantage is that it provides a more natural assessment of some types of reasoning and physical skills. Still another one is that it provides greater motivation for students and makes learning for these students more meaningful. Finally, it enables students to produce or work on real-life situations. Although alternative assessment has some important advantages, there are some disadvantages of it as well. One

distadvantage is that it is time consuming to administer and score. Secondly, grading can be subjective and demanding. Thirdly, assessment must be done individually and frequently (Gronlund, 2006). In addition to these three disadvantages, adaptation of the alternative teachniques may not be easy for some teachers who are used to using traditional techniques. Furthermore, the students need to be ready for changes of assessment techniques, too. In the literature, it is argued that there needs to be some training about new assessment techniques for both teachers and students.

2.4. Previous Studies in Turkey

With the curriculum reform which took place in Turkey in 2004, it is seen that there has been a significant increase in the number of research studies that aim to set forth teachers' opinions on the new curriculum. When the archive of Higher Education Council (HEC) is examined, it is seen that there are 22 registered thesis studies directly related to this field. 16 of those studies focus on the 4^{th} and/or 5^{th} grade levels Science and Technology curriculum, whereas only 6 of them are on the 6^{th}, 7^{th} and 8^{th} grade levels Science and Technology curriculum. In fact, there is only one research study which puts forth the opinions of teachers on the 8^{th} grade level Science and Technology curriculum.

The purpose of the present study is to reveal the teachers' perceptions of the 6^{th}, 7^{th} and 8^{th} grade level Science and Technology curriculum. For this reason, in this section, the findings of 16 research studies which are related to the 4^{th} and 5^{th} grade levels will be summarized, while 6 research studies which focus on the 6^{th}, 7^{th} and 8^{th} grade levels and are directly related to this research study will be dealt with one by one in detail with their scope, method, data analysis and findings.

Teachers' opinions about 4th and 5th grade Science and Technology Curriculum

In her study, Bağdatlı (2005) examined the effects of 4^{th} grade Science and Technology draft curriculum on student achievement and teachers' opinions about the curriculum. For data gathering, students from 4 different classes in two primary schools in Antakya, Hatay, in one of which the draft curriculum was put

into practice and in the other it was not, were given an achievement test from the Unit 'Let's Visit and Learn about the World of Living Things'. In this study conducted with students, an experimental model with pre- and post-test control group was used. Data analysis was done by descriptive statistics and t-test; as a result, it was found out that this draft curriculum affected student achievement in a positive way. In addition to this, the opinions of 55 primary school teachers who implemented this draft curriculum about 'Let's Visit and Learn about the World of Living Things' unit were gathered through a 3-point Likert Type questionnaire. Data analysis indicated that the teachers expressed positive opinions regarding the curriculum apart from the issue of time needed to implement it. Although Bağdatlı's study contributed to the process of successfully putting the curriculum into practice since it focused on the implementation of the draft version of the curriculum, the fact that this study focused on only one unit and conducted with a small number of students and teachers using restricted techniques made its contribution be confined to a very limited area.

With her study Özdemir (2006) took the area of study and its scope one step further since the study covered all units in 4^{th} and 5^{th} grade level Science and Technology curriculum and administered a 33-item 3-point Likert type questionnaire to 172 teachers in Konya. In this study Özdemir gathered data regarding the purposes of the curriculum, its content, its approach to education process and to assessment and analyzed these data using descriptive statistics. She also used Chi-square test to examine the differences between the opinions of the teachers in terms of their sex. As a result of her study, Özdemir found out that the teachers expressed positive opinions towards the curriculum but they thought that the allocated time for the lessons was not enough, which is in accordance with Bağdatlı's findings. However, different from Bağdatlı's findings, Özdemir revealed that the teachers (more male teachers than female teachers) generally expressed that they needed in-service training and they used alternative assessment techniques in a limited way.

In another study Gökçe (2006) focused on the teachers' problems regarding both the unit structure and the teacher's guide. She gathered the opinions of 104

primary school teachers working in Balıkesir through the administration of 61-item 3-point Likert Type questionnaire and interpreted the data by using descriptive statistics. As a result, it was found out that the teachers generally had positive opinions about the teacher's guide, whereas they complained about the fact that the content was loaded, there was an unbalanced distribution of Scientific Process Skills (SPS) and Science-Technology-Society-Environment (STSE) learning outcomes among the units, there was no space for Attitudes and Values (AV) learning outcomes in the unit structure, no emphasis was placed on some alternative assessment techniques in the unit structure, they have difficulty with using alternative assessment techniques especially because of high population of classes, and there was not enough relationship established between other subjects. Although Gökçe's research study focused on only the unit structure of the curriculum but not on the topics such as the philosophy and vision of the curriculum, even in this limited area she showed that the teachers had some serious difficulties.

In his study Yangın (2007) showed that the teachers also had problems with the content of the curriculum. With the questionnaire he administered to 75 teachers working in Ankara, it was shown that the topics that the teachers gave importance most were within the extent of STSE, but because of economical and individual limitations (lack of material, crowded classes, limited time and teachers' not being informed enough about the curriculum) they had serious problems with these topics during their teaching. This result showed that the teachers' opinions about the curriculum changed to a negative direction during teaching process, which forms a contradiction with the findings of the previous studies.

At this point, a need to put forth the teachers' admiration of the curriculum again by using more detailed techniques. In order to fill this gap, Aydın (2007) and Tatar (2007) conducted two similar studies. Aydın (2007) administered 51-item 5-point Likert type questionnaire to 163 teachers working in Kütahya and used t-test and one-way ANOVA to analyze the data. Moreover, in Tatar's study (2007), 60-item 5-point Likert type questionnaire to 308 teachers working in Ankara was administered and interviews were also conducted and for data analysis t-test and

Kruskal Wallis test were used in addition to descriptive statistics, all of which make her study more comprehensive and intensive when compared with the previous studies. In both of these studies, independent from variables such as how long they had been working, their education level, the socioeconomic environment of the school that they worked and whether they attended in-service training, it was found that the teachers generally expressed positive opinions concerning the curriculum. Aydın (2007) emphasized the fact that there were considerable number of teachers expressing "partially positive" opinion and, different from the previous studies, she stated that in fact the teachers' admiration of the curriculum was not high enough, whereas Tatar (2007), as a result of the findings of her study, found that the teachers admired the curriculum but the real problem resulted from lack of materials and sources and limited time.

Özdemir (2007) intended to put forth the problems concerning the curriculum that the teachers faced in a more detailed way and therefore he administered a questionnaire to 90 teachers working in Afyonkarahisar. As a result of his study, it is found that the teachers had difficulties especially with in-class implementations of constructivist approach, assessment, homework and projects, and being knowledgeable enough about the curriculum independent of their sex, seniority and the university that they graduated from. Ocak (2008), in his study conducted with 224 teachers, obtained results in alignment with Özdemir's study and stated that although the teachers had positive opinions about the curriculum, they also had difficulties with assessment and they needed more in-service training. Moreover, Ocak revealed that senior teachers had more difficulties in implementing the activities more than novice teachers.

In a similar study Yeşilaydın (2008) studied 134 teachers' opinions about the curriculum in the center and villages of Tatvan, Bitlis, and concluded that generally positive opinions about the learning outcomes, content and implementation were expressed by all teachers, among whom female teachers and the teachers working in the center were more positive. Yeşilaydın also stated that independent from their sex and location of school the teachers complained about

time limitations and assessment, which is in alignment with many other research studies.

Battal (2008), by conducting interviews with 20 teachers and making 3-hour class observation with 10 teachers, focused not only on the problems that the teachers face but also the correspondence level of the teachers' opinions with constructivist approach and thus obtained more intensive findings. In Battal's study, it was found that the problems with the implementation of the curriculum not only resulted from crowded classes, lack of materials and time limitations but also from teachers' incompetence regarding constructivism. In fact, when Battal's study is analyzed in detail, it is understood that the main source of the problems in the implementation of the curriculum is the fact that constructivist approach, the dominant theory in the curriculum, was not perceived by the teachers in the right way and thus it was not implemented properly. Moreover, in similar research studies conducted by Erdem (2009) with 115 teachers in Sakarya, Öztürk (2009) with 368 teachers in Denizli and Unayağyol (2009) with 325 teachers Yozgat, the researchers focused directly focused on the problems of the teachers like Battal, Özdemir and Yangın. In these three studies, although the teachers generally expressed positive opinions about the curriculum independent from variables such as sex and education level, they complained about lack of sources and materials, lack of knowledge concerning the curriculum, the high number of steps in assessment, abundance of activities and during the implementation of the curriculum and time limitations during the implementation of the curriculum. In addition, Öztürk emphasized that the teachers working in center schools and in crowded classes perceived themselves as having more problems.

Çiftçioğlu (2009), in her study conducted with 309 teachers in Kahramanmaraş carried out a comparative examination of the teachers' opinions with regards to many variables as the districts they worked, their sex and age, whether they were a primary school teachers or Science and Technology teachers, the type of the school that they graduated, their level of education, their seniority, whether the school they worked had a Science and Technology laboratory and whether they had internet access for educational purposes in the school that they worked; as a

result, she extended the scope of the previous studies to a great extent. Çiftçioğlu stated that there were significant differences among the teachers' opinions when the variables above were taken into consideration, but she has not published the findings of her research study yet. In addition to this, Topal (2009) administered open and closed ended questionnaire to 132 teachers, Likert type questionnaire to 83 teachers and conducted interviews with 20 teachers. Although her study differs from the previous studies in terms of the variety of data gathering techniques, the findings of her study display great parallelism with other studies. According to the results of Topal's study, despite the fact that the teachers generally expressed positive opinions about the curriculum, they complained about the physical infrastructure of the schools and lack of in-service training on the curriculum and they stated that they had difficulty with implementing the alternative assessment techniques.

Among the most recent and the most detailed study on this topic in terms of analysis is the study of Yavuz (2010). Yavuz focused on the opinions about the sufficiency of the curriculum, gathered the opinions of not only the teachers but also the principals and inspectors, and analyzed the data with regards to both their educational position and their seniority and sex. In this study, the teachers stated that they found the assessment dimension of the curriculum satisfactory, but they stated that the dimensions of content, teaching and learning process and aims of the curriculum were unsatisfactory. In addition to this, school principals expressed more positive opinions than the teachers and the inspectors found the curriculum appropriate for its purpose in general. Moreover, the fact that the vice-principals responded to all the questions regarding the dimensions of the curriculum as "undecided" resulted in the comment that the vice-principals were not so interested in the course, content and implementation of the curriculum in the schools. Furthermore, whereas the people took part in the research study remained undecided regarding the sufficiency of the content, teaching and learning process and aims independent of their sex, they expressed more positive opinions regarding the assessment dimension of the curriculum. In this study, the reason for the positive opinions about assessment was explained by the high number of

assessment forms. In addition to this, it was revealed that as the year of work increased, the general admiration of the curriculum decreased and the explanation for this situation was thought to be the tendency of novice teachers to express positive opinions since they did not know the old curriculum.

Teachers' opinions including 6th, 7th and 8th grade Science and Technology Curriculum

Şeker (2007) evaluates the 6th grade level Science and Technology curriculum in the light of teachers' opinions. In this study, a questionnaire incluing 55 questions was administered to 46 Science and Technology teachers working in the center and districts of Gümüşhane and semi-structured interviews were also conducted with 21 of these teachers. Descriptive statistics was employed for data analysis and thematic coding approach was adopted for the analysis of the interviews. Result of this study indicated that according to teachers: the general structure of the curriculum is clear and understandable, the learning outcomes in the curriculum are parallel to the general aims, the curriculum is appropriate for students' cognitive and psychomotor development level, they do not have much difficulty in implementing the curriculum, students participate in in-class activities more than they did in the past, students have the chance to do the activities that enable them to demonstrate their abilities. On the other hand, as a result of this study the teachers reported that they: turn to old teaching strategies from time to time, are not fully aware of the real philosophy and dimensions for implementation of the underlying constructivist and multiple intelligence learning theories of the curriculum, have serious problems with alternative assessment approaches due to a lack of theoretical knowledge and experience, cannot implement the curriculum effectively because of little or no physical infrastructure that is suitable for the nature of new curricula. When Şeker's study is analyzed, it is seen that although the teachers had difficulties in implementation because of time and material limitations and lack of knowledge, they generally had positive opinions about the curriculum in general.

In his study, Değirmenci (2007) obtained results in alignment with Şeker's research study and stated that the teachers generally had positive opinions about the curriculum. Değirmenci extended his area of study including 4th and 5th grade level curriculum in addition to the 6th grade level curriculum, but he only focused on teachers' opinions about the content, aims and teaching and learning process of the curriculum and he did not analyzed the problems of the teachers with the curriculum in detail. In this study, a 5-point likert type questionnaire of 40 questions was applied to 100 teachers working in randomly chosen 20 primary schools in the district of Çankaya, Ankara and descriptive statistics was employed for data anlysis. As a result, the teachers' general opinion about the purposes and content of the curriculum and teaching-learning process is defined as "good."

In his study, although Kara (2008) only focused on the teachers' opinions about the implementation of the 6th grade Science and Technology curriculum, while analyzing the data he used not only descriptive statistics but also t-test and One Way ANOVA for seniority, sex and location of the teachers; therefore, the findings he obtained were far more detailed in her area of study when compared to Değirmenci and Şeker's studies. In this study, a questionnaire of 46 items was applied to 75 Science and Technology teachers working in Afyonkarahisar. According to Kara, even though the teachers complained generally about the fact that they were not informed about the curriculum at a satisfying level, they had positive opinions regarding the curriculum. Her results summarized into three categories: 1. Independent from their seniority all the teachers attended the research study stated that the new curriculum encouraged students to think, established an awareness of environment, caused an interest in science, and do not cause gender discrimination. On the other hand, the teachers thought that this new curriculum was not flexible enough to be used in different conditions and with different students. 2. Although the female and male teachers had similar opinions regarding the curriculum in terms of its units, learning outcomes and teaching and learning activities, male teachers generally had more positive opinions about the curriculum. On the other hand, male and female teachers had different opinions about assessment. Male teachers viewed assessment activities more positive. They

thought that suggested assessment activities in the curriculum were in alignment with the aims of the unit and student learning outcomes. 3. The teachers' location did not make any difference in their general opinions, their opinions about units and student learning outcomes, teaching and learning activities and assessment when they first implemented the new curriculum in 2005. Kara interpreted this as location was not important in curriculum evaluation.

Using similar methodology Çengelci (2008) examined teachers' opinions about both 6^{th} and 7^{th} grade levels Science and Technology curriculum and obtained results which are in alignment with Kara's results. By applying a questionnaire of 44 items to 132 Science and Technology teachers working in Eskişehir, she revealed that the teachers expressed positive opinions regarding the curriculum. When Çengelci's findings are analyzed in detail, independent of any variables (sex, year of work, educational background, class population, taking in-service training or not, benefiting from in-service training or not, and socioeconomic level of the district that they work in), it is seen that the teachers expressed positive opinions regarding the learning outcomes of the curriculum. It is seen that the opinions about the content dimension of the curriculum change in favor of male teachers, the opinions about teaching and learning process change in favor of the teachers who took in-service training and opinions about assessment process change in favor of both male teachers and the teachers who benefitted from in-service training. On the other hand, the findings pointed out that the unity and parallelism among other lessons are not achieved in the curriculum and the individual differences among students are not taken into consideration at a maximum level. In addition to this, teachers stated that number of hours allocated for the activities in the teaching-learning process is not enough, there are time and material limitations with assessment approaches and assessment tools increase the financial burden.

Although he reached far more teachers when compared with the previous studies directly related to this topic, Belli (2009) obtained limited number of findings in his study as he used only descriptive statistics while analyzing the data. In order to

put forth the teachers' opinions regarding the general structure, learning outcomes, content, teaching-learning process and assessment of the 6th and 7th grade levels Science and Technology curriculum, he used a questionnaire of 51 items and he applied it to 225 Science and Technology teachers working in European coast of İstanbul. As a result of the study, it is found that the teachers find the curriculum easy to understand, contemporary, open to development, structured based on constructive approach and student-centered. On the other hand, it is stated that the teachers think that time allocated for the lessons is not enough due to the high number of activities in the curriculum and they have difficulty in implementing the curriculum due to crowded classes.

In her study Boyacı (2010) included 8th grade level Science and Technology curriculum in addition to 6th and 7th grade levels for the first time and different from other studies, she has directly revealed the problems with the curriculum. In this study, a questionnaire of 64 items was applied to 72 Science and Technology teachers working in the center of Antakya, Hatay, and semi-structured interviews were conducted with 11 teachers. In addition to this, she preferred to analyze the data gathered by the questionnaire using descriptive statistics and the data from interviews using thematic coding. As a result, about the strong (positive) features of the curriculum, the teachers stated that the curriculum: (a) is able to make students attain scientific literacy, scientific attitudes and values; (b) is successful in raising curiosity in students towards technological developments; (c) provides active student participation; (d) decreases students' concerns and fears toward science and technology lesson; (e) is student-centered and integrated into life. On the other hand, the teachers stated their opinions regarding the weak (negative) features of the curriculum as follows: (a) it was put into practice very fast; (b) it is not fully understood; (c) teachers' opinions were not reflected in it; (d) time is insufficient to implement it; (e) mathematical formulas related with the lessons were reduced; (f) it is not compatible with higher levels of education; (g) it increased the tendency towards private teaching institutions.

As it is seen above, many research studies were carried out in this area and a lot of data were gathered by these studies in a short period of time; however, these studies consisted only of teachers' opinions about and problems with the curriculum. Moreover, since previous studies were conducted largely by quantitative methods, intensive results in this area were not attained at a satisfactory level. Furthermore, in the limited number of qualitative studies, no precautions were taken in order to deal with ego-threat, which is known as a factor that may risk the reliability of the study. In addition to this, with the help of the findings of the previous studies general opinions about this issue were formed and a need to deepen the findings has emerged. The aim of the present study is to set forth the teachers' perceptions of the Elementary Science and Technology curriculum in 6^{th}, 7^{th} and 8^{th} grade levels and the level of consistency of these perceptions with the content of the curriculum. In this present study, it is aimed to take much further the point that the previous studies in this research area have reached at by intensively examining the issue. Therefore, an exploratory qualitative research, whose details is given in detail in the Method chapter, is operated through in-depth interviews and the data gathered is analyzed using content analysis to make up the gap identified in previous studies.

CHAPTER 3

METHODOLOGY OF THE STUDY

The aim of this study was to determine the level of consistency between the teachers' perceptions of the current science and technology curriculum in Turkey and the curriculum itself. In order to reach the aim of the study, the method that was used throughout the research will be explained in this section.

3.1 Research Design

This study is a qualitative research study. The gap in the qualitative studies in this study area and the opportunities to develop a deeper sense about teachers' perceptions and beliefs on the elementary science curriculum, including their response to the elementary science curriculum, are the reasons why a qualitative method rather than quantitative research methods was used. In this study, an exploratory qualitative research was operated through in-depth interviews. With the help of qualitative research method accompanied with in-depth interviews, the researcher can understand people's experiences and focus on the parts that need to be elaborated. Rubin and Rubin (2005) put this idea in this way: "If what you need to find out cannot be answered simply or briefly, if you anticipate that you may need to ask people to explain their answers or give examples or describe their experiences, then you rely on in-depth interviews" (p. 2). In addition to this, the aim of the researcher in in-depth interviews is to explore the emotions, the viewpoints and the perspectives of the interviewees (Akturan & Baş, 2008).

In addition to the aim of the interviewer, the role that he/she has taken on throughout the interview research is also of great importance. At this point it is necessary to mention how Kvale (1996) makes a differentiation between the two different roles of the interviewer through two metaphors: the interviewer as a

miner and the interviewer as a traveler. In the miner metaphor, the reason why the interviewer is perceived as a miner who tries to dig out the valuable metal under the ground is that the knowledge is thought to be hidden inside the subject waiting to be uncovered by the researcher. This understanding of the knowledge is very common in modern social sciences. In the alternative metaphor, the interviewer is considered as a traveler on a journey, which is closer to postmodern understanding of knowledge. This alternative understanding puts the interviewer and the interviewee at a more interactive position where they can communicate with each other, just like the positions of the traveler and the local inhabitants of a country that the traveler visits. Moreover, it provides the people with the opportunity to tell their own stories of their lived world. Kvale brings together the advantages of these two metaphoric understandings of the interviewer, the interviewee and knowledge as well, and suggests a "semi-structured life world interview," which means conversation as a research tool. The most important point here is that conversation has a structure and a purpose, which makes it different from the daily conversations where the interlocutors do not only exchange views spontaneously. Moreover, the interviewer and the interviewee do not have equal positions since the interviewer designs and controls the situation and supports his/her questioning with follow-up questions according to the answers that the interviewee provides.

The interviewer role that I preferred to take on was the composition of the miner and the traveler, which was suggested by Kvale above. This role requires an interviewer position where he/she establishes conversations with the interviewees with a structure and purpose in his/her mind. To put the interview research in harmony with this joint role, I developed game activities to be implemented through in-depth interviews, which are explained in data gathering method and tools section. Still, the reason why I developed game activities can be summarized in the idea that the simple rules of the games have made the interviews more structured and the curriculum-based foci of the games made them more purposeful, which is consistent with miner role. Moreover, to provide an opportunity to conversation, the games were designed around some specific

scenarios, which is consistent with traveler role. In addition to all these, the game itself, which has some general characteristics such as having a solvent and relaxing effect on people, helps the interviewer to provide an environment for the interviewee where he/she can express his/her emotions, viewpoints and perspectives more easily, which is consistent with the aim of in-depth interviews.

3.2. General Profile of the Interviewer

Conducting a qualitative research, where the interaction between the interviewer and the interviewees is an important factor, it is necessary to draw a general profile of the interviewer. I have been an elementary teacher for six years. In my career, I found the chance to work as an elementary teacher in a public school in Ankara for 5 months, to give unofficial seminars about the latest reform of the elementary science curriculum to small groups of teachers who were working at over 35 schools in 25 different cities in Turkey, and to discuss the latest reform of the elementary science curriculum with many elementary science teachers all over the country, with many supervisors and district administrators of education. I hope that those experiences have made me gain a deep sense about the interaction with elementary teachers and understanding their educational perspectives.

3.3. General Profile of the Interviewees

In this study, convenience and purposive sampling strategies were used to select the teachers to be interviewed. In other words, elementary science teachers working at public schools in Çankaya district of Ankara were got in contact with because of the availability of the schools for the researcher. Among these teachers, the ones who declared that they read and implement the curriculum were selected for the interviews. Then, individual meetings were held with a lot of teachers and appointments were made. After that, the interviews were started and the interviews were stopped when it was realized that the information provided by the teachers started to be repetitive. As a result, interviews were operated with 9 elementary science and technology teachers. In order to develop a better sense for the next chapter, it is important to draw the general profiles of the interviewees.

All the teachers were between the ages 35-60 and 5 of them were female and 4 of them were male. 6 of the teachers graduated from various subject areas and the remaining 3 teachers started teaching after they completed the necessary education courses for teaching profession. Detailed information about the background of the interviewees is listed in Table 3.1. Although only two of them were educated directly for the elementary science education, all of them can be classified as enough experienced in elementary science education except the fourth interviewee. His over 30 years of secondary education experience and his perspective related with his experiences helped me to gain some sense of understanding about the connection between the elementary science curriculum and its reflections on the secondary education. Although, because of the position of Çankaya, the teachers might have had more opportunities to attend the trainings which were conducted by the Ministry of Education, the teachers I interviewed did not seem to have made use of this possible opportunity. Five of them had never attended such kind of trainings and three of them had attended only once. Although the sixth interviewee mentioned that he had attended those trainings for 5-6 times, he could not remember what was given in those seminars clearly. On the other hand, apart from the fourth interviewee, they all mentioned that they had been informed about the elementary science curriculum by the supervisors. The interviewees seemed to be uninterested in any kind of in-service training but the seventh interviewee. He seemed very willing to attend any in-service training that would develop his teaching carrier:

Teacher 7: … I applied for and attended wherever a seminar takes place. I mean I do not say "I won't go, I won't do," I mean I do not see them as a burden. I took 5-6 seminars related with computer; even out of my major… I took maybe 5-10 seminars related with psychology… I attended all seminars which could facilitate my career.

He also shared his detailed memories with me about the seminar of the latest elementary science curriculum. The other reason for selecting the district of my study was the availability of the area for me as I have been living in Ankara for over ten years. All interviewees declared that they read the new elementary science curriculum. In addition to this, all interviewees except for the fourth

interviewee declared that they have been teaching science at 6-7-8 grade levels for the last five years.

Table 3.1 General profile of the interviewees

No.	Gender	Age	Education	Experience in Teaching	Experience in Elementary Science Teaching	In-service Training About The Curriculum	Other In-service Training
1	Female	50	Chemistry Educ.	20 years	7-8 years	No	None
2	Female	37	Chemistry	15 years	6-7 years	No	Laboratory Techniques
3	Female	51	Science and Nature Educ.[1]	30 years	30 years	No	Computer, Cardiac Health
4	Male	56	Physics	34 years	1 years	No	Computer, Modern Physics
5	Female	37	Chemistry Educ.	14 years	5 years	No	None
6	Male	60	Science and Nature Educ.[2]	over 30 years	over 30 years	5-6 times	Writing and Speaking
7	Male	44	Biology	7 years	4 years	once	Laboratory Techniques, Computer, and many others
8	Male	45	Chemistry Educ.	15 years	15 years	once	None
9	Female	43	Biology Educ.	20 years	15 years	once	Traffic and First Aid, Project Making

[1] Fen ve Tabiat Bilgisi Öğretmenliği

[2] Fen ve Tabiat Bilgisi Öğretmenliği

3.4 Data Gathering Method

In this study, in-depth interview method conducted through game activity was used. The reasons why game activities were chosen and the development process of these activities are mentioned below respectively.

3.4.1 Determining the Data Gathering Method

When the related literature was considered, the most important person who transformed the idea that games are only for children and included adults in the target group by explaining the reasons was Huizinga. In fact, the book by Huizinga named *Homo Ludens: A Study of the Play-Element in Culture* written in 1944 has been a turning point in the literature on this issue. Huizinga himself in the "Preface" section of his book named *Homo Ludens* also complains about the fact that the existing terminology in related scientific areas before him was not satisfactory (Huizinga 1995, p.15). Moreover, most of his ideas in this book are still valid in our time.

The reason why in-depth interviews were conducted through game activities was that the nature of game activities both reflects the role of the interviewer and games facilitate the interviews to serve the aim of in-depth interviews. In the present study, the joint role of the interviewer, as it was mentioned in Research Design part of the study, is the combination of miner and traveler roles. This role requires an interviewer position where he/she establishes conversations with the interviewees with a structure and purpose in his/her mind.

Firstly, some general characteristics of playing games activities have made the interviews more structured and the curriculum-based foci of the games made them more purposeful, which is consistent with the miner role.

The characteristics of playing games which are still valid are stated by Huizinga (Huizinga 1995, p.26-27) related with the miner role as below:

- ✓ A game starts and it "ends" at a certain moment. It is played till the end.

- ✓ A play has spatial limitations. Each play takes place within the borders of a predetermined spatial area. These areas are temporary worlds designed to achieve a certain act in the middle of the world we know.
- ✓ There is a unique and absolute order within the borders of the play. Plays form an order, and the play is the order itself.

In addition to all these characteristics, Huizinga claims that plays form the origin of thinking. He emphasizes the permanency of the ideas of the philosophers and he mentions that philosophy is considered as a youth play by giving Plato as an example for whom philosophy was a noble play (Huizinga 1995).

From the characteristics of playing game activities mentioned above, it can be understood that they provide an opportunity to approach a topic within a certain order in a meaningful way. Within the framework of this study, with the help of game activities, 9 dimensions could be chosen as separate foci and the teachers were provided with an opportunity to think within the borders of these foci, which made it possible to reach the meanings lying in the interiors of the individual.

Secondly, to provide an opportunity to conversation, the games were designed around some specific scenarios, which is consistent with traveler role.

Below are the characteristics of playing games which are still valid are stated by Huizinga (Huizinga 1995, p.25-27) related to traveler role:

- ✓ Within the interior structure of plays and in its entirety, they provide opportunities for repetition.

- ✓ Each play can totally involve the player at any moment.

When these two characteristics of playing game activities are taken into consideration, these game activities both provided an opportunity for both parties to express themselves during the conversation with the repetitions in them and helped the conversations to continue smoothly with their involving characteristic. In addition to this, Plato claims that with the help of plays more information can be gathered than it could be in usual conversations. He stated that “you can

discover more about a person in an hour of play than in a year of conversation." (Garner, 2009).

Finally, the game itself, which has some general characteristics such as having a solvent and relaxing effect on people, helps the interviewer to provide an environment for the interviewee where he/she can express his/her emotions, viewpoints and perspectives more easily, which is consistent with the aim of in-depth interviews.

In addition to this, when the related psychology literature is considered, it is seen that games has given importance, especially in play therapy (Axline, 2002, p.8).

> Play therapy is based upon the fact that play is the child's natural medium of self-expression. It is an opportunity which is given to the child to 'play out' his feelings and problems just as, in certain types of adult therapy, an individual 'talks out' his difficulties.

Although in the literature it is emphasized that play therapy has a positive effect on children only, today there is a general assumption which is associated with the nature of the play that it gives happiness and relaxation[3].

In addition to this, Freud focuses on the functional aspect of games. According to him, with the help of games, one can overcome their fears, blockages and social conflicts. Similarly, Fredrich Guts Muths (German educator) states that since playing games reveal the real personality of people, they are the most suitable tools to overcome or at least to minimize personality weakness, susceptibility, selfishness[4].

In the light of the ideas above, when the relaxing effect of playing games is taken into consideration, with the help of this activity it is thought that some real discourses which the teachers could avoid to state would be easy to be put into

[3] Source: http://sivasram.gov.tr/dosyalar/terst-anket/oyunterapi.htm

[4] Source: http://www.pdrciyiz.biz/oyuntanimiozellikleriamaclarivs-t5425.html

words by the help of game activities and for the interviewee where he/she can express his/her emotions, viewpoints and perspectives more easily.

3.4.2 Developing the Data Gathering Method

The game activities in the interviews were designed as they cover 9 dimensions of Fundamentals of the Curriculum as stated in the elementary science and technology curriculum.

Those dimensions are, Teachers' General Ideas About the Curriculum, The Vision of the Curriculum: Scientific and Technological Literacy, The Fundamental Approaches of the Curriculum-Scientific Knowledge and General Aims of the Curriculum, The Principle of 'Little but Essential Knowledge', Learning and Teaching Process, Assessment and Evaluation, Taking all Students' Need into Consideration, The Organizational Structure of the Curriculum: Seven Learning Areas and Implementers of the Curriculum (Teacher-Parent-Inspector). The names of the game activities in the interviews and their focus regarding these 9 dimensions are listed in Table 3.3. For the scenarios and the questions of all the game activities are listed in Appendix B. Each game activity was constructed so as to focus on certain dimensions of the curriculum but they are not limited to its own dimensions. For each game activity, the interviewees were free to state solutions by their own alternative scenarios if they want.

Although the general designs of the game activities were structured in less than a week, the development period of them took approximately 5 months. Two pilot studies were operated in the development period. The first one was conducted with an elementary science teacher for their functional structure. The second one was conducted with an English Language teacher, whose native language is Turkish, for their comprehensiveness. In addition to those pilot studies, they were checked by the experts from science education department. With all information gathered from the teachers and the experts, the game activities took their final version for the interviews.

3.5 Data Gathering Tools

The main aim in the game activities was to provide the teachers with an environment where they could talk about the dimensions in the curriculum. Within the framework of the research study, the teachers were supplied with opportunities to talk about the topics such as the role of the teacher spontaneously rather than having them answer direct questions such as "What is the role of the teacher?"

3.5.1 The School Alive

In this game activity, the three dimensions of the curriculum, which are listed in Table 3.3, were taken as the focus. Firstly, it was aimed to put forward the general adoption level of the teachers. Secondly, it was aimed to find out the attitudes of the teachers especially towards student-centered approach in terms of the relationship between the teacher and the student in teaching process. Thirdly, it was aimed to put forward whether the teachers internalized or not the roles of parents, students, school principals, inspectors, teachers and the society within the framework of the curriculum. In this game activity, the teachers were asked to place the slips symbolizing the parent, student, school principal, inspector, teacher and the society into the school layout, the aim of which was to give them an opportunity to make direct associations with learning-teaching process, according to their own views and by explaining the reasons (Figure 3.1).

Figure 3.1 A snapshot from a teacher's placement in the *School Alive* game activity

After this placement was completed, the slip symbolizing the teacher was removed from the picture and the teachers were asked to put other slips to fill up the space of the teacher. Lastly, the teachers were asked to place all the slips again according to the curriculum after all the slips were removed from the picture. As a result, both the teachers' perceptions of the parents, student, school principal, inspector, teacher and the society and their perceptions of the references in the curriculum regarding the interrelationships among these, and thus the correspondence level of their perceptions with the curriculum were understood.

3.4.2 The Education Balloon

This game activity was designed with the two dimensions of the curriculum which is listed in Table 3.2 as its focus. Firstly, it was aimed at putting forward the curriculum adoption level of the teachers and the level of the need they feel towards the curriculum. Secondly, it was aimed to find out the teachers' perceptions of the teacher's role in education. In this game activity, according to the scenario where the education balloon was falling down, the teachers had to 'save' the balloon by throwing 4 weights symbolizing the school, curriculum, teacher and course book one by one (Figure 3.2).

Figure 3.2 A snapshot from a teacher's way of saving the balloon by throwing the weight symbolizing the school in the *Education Balloon* game activity.

In this game activity, the teachers were provided with an environment where they were expected to make a priority order among the school, curriculum, teacher and course book. By this way, how these teachers perceive the relationship among the concepts above, how much and for what they need the curriculum and how they perceive the role of the teacher in education and teaching were understood.

3.5.3 The Warriors

This game activity had the 4 dimensions of the curriculum, which are listed in Table 3.3, as its focus. It was aimed to find out the teachers perceptions of these three dimensions which are Nature of Science and Scientific Knowledge, The Principle of 'Little but Essential Knowledge' and Learning Process, especially constructivist approach and therefore their ideas about the internal consistency of the curriculum regarding these three dimensions. In the scenario of this game activity, 2 warriors in green and blue color supporting different views met in the battlefield three times. The warriors and the discourses supported by the warriors are given in Table 3.2. The discourses of the blue warrior were directly taken from the curriculum and the discourses of the green warrior were organized in opposition to the discourses of the blue warrior.

Table 3.2 The discourses that the warriors supported in the *Warriors* game activity

Round	Green warrior	Blue warrior
Round I	Detailed knowledge is essential!	Little but essential knowledge!
Round II	Science is a collection of stable and certain pieces of knowledge!	Science is not a collection of stable and certain pieces of knowledge!
Round III	Students receive the knowledge as it is!	Students cannot receive the knowledge as it is!

At first the teachers were expected to take the side of the warrior that they supported and then they were asked of which warrior the curriculum takes the side (Figure 3.3).

Figure 3.3 A snapshot of the moment that a teacher was making an explanation regarding the warrior that she supported in the *Warriors* game activity

As a result, the teachers provided information especially on how they perceived Scientific Knowledge, The Principle of 'Little but Essential Knowledge' and constructivism and they questioned the internal consistency of the curriculum concerning these.

3.5.4 The Meal for a Year

This game activity had the four dimensions which are listed in Table 3.3 as its focus. Firstly, it was aimed to put forward the perceptions of the teachers regarding science and technological literacy. Secondly, it was tried to find out the teachers' perceptions of the problems in learning process and the sources of these problems. Thirdly, it was aimed to understand the teachers' perceptions of the 7 learning areas in the curriculum and especially of the relationship between the learning areas which are presented as units and the others. In the curriculum, 4 learning areas that are presented as units, which are Living Organisms and Life, Matter and Change, Physical Phenomena and Earth and Universe, come together under the topic of "knowledge". In addition to this, the remaining three, which are Science-Technology-Society-Environment Relationships (STSE), Science Process Skills (SPS) and Attitudes and Values (AV), are not presented as units because it is stated that predicted skills from these three learning areas are acquired through very long processes (MNE, 2006, p.59). In this game activity, the teachers were asked to match 4 types of bread with a group of 3 ingredients (tomato, cheese,

salami) with one learning area and prepare 4 different sandwiches (Figure 3.4). In this game activity, there were two reasons why bread and ingredients were chosen to symbolize the learning areas. The first one was that the idea that students are nourished by this knowledge was aimed to refer. The second one was that a sandwich's general outlook is like a structure covering other structures in it, which corresponds with the organizational structure of the curriculum where the learning areas of STSE, SPS and AV, which are not presented as units, are sprinkled over other learning areas collected under the title of "knowledge."

Figure 3.4 A snapshot from the *Meal for a Year* game activity when a teacher was matching learning areas with the ingredients

Here four types of bread were supposed to symbolize 4 learning areas that are presented as units in the curriculum and the ingredients were supposed to symbolize 3 learning areas that are not presented as units. After the teachers completed their matching, they were asked the reason why these 7 learning areas are brought together in the curriculum and some questions regarding science and technological literacy in order to find out their perceptions of science and technological literacy. After this part was over, the teachers were given two scenarios and they were expected to solve them. In the first scenario, the students did not want to eat the sandwiches that their teacher prepared for them, which was to reveal the attitudes of the teachers towards students' need of learning. In the second scenario, the students got sick after they had eaten the sandwiches, which was to put forward the teachers' perceptions of the problems in learning process and the sources of these problems. With the help of this game activity, it was

possible to find out both the teachers' familiarity level with these 7 learning areas and their perceptions of their contents (especially STSE, SPS and AV). Moreover, whether or not the teachers recognize the main reason why the learning areas mentioned in the organizational structure of the curriculum are chosen and brought together is science and technological literacy was revealed. Furthermore, the teachers' perceptions of science and technological literacy, especially whether they considered this as an aim for all students as it is mentioned in the curriculum, were understood. In addition to this, again in this game activity, the teachers' perceptions of the problems in learning process and the sources of them, especially their attitudes towards uninterested students, were found out.

3.5.5 The Card Game

In this game activity, 3 dimensions which are listed in Table 3.3 were chosen as the focus. Firstly, it was aimed to get the opinions of the teachers about the 11 general aims of science and technology course mentioned in the curriculum. Secondly, it was aimed to find out the teachers' frequently used teaching strategies and to get their opinions about these strategies, especially about student-centered ones. Finally, it was aimed to determine the teachers' frequently used assessment and evaluation techniques and to gather their opinions regarding these techniques, especially the alternative ones. In this game activity, the general aims of the curriculum with their numbers were written on separate red cards, teaching strategies on green cards and assessment and evaluation strategies on blue cards. The teachers firstly were asked to examine the aims on the red cards one by one and tell whether or not they found them meaningful and thought the curriculum satisfactorily covers these aims with their reasons. Then, they were expected to choose appropriate teaching strategies and assessment and evaluation techniques accordingly in order to achieve those aims (Figure 3.5). If the strategies and techniques that the teachers pronounced written on the cards, they were put on the table.

Figure 3.5 A snapshot from the *Card Game* game activity when a teacher is thinking the appropriate assessment techniques for the teaching strategies he has chosen

With the help of the game activity, the teachers' perceptions of the 11 general aims, their tendency towards teaching strategies, teacher or student-centered, and their tendency towards assessment and evaluation techniques, traditional or alternative, were revealed.

3.5.6 The Free Throw

In this game activity, there were 3 dimensions regarding the curriculum, which are listed in Table 3.3, chosen as the focus. The aim was to find out the situations when they need to use professional competency areas, especially the ones concerning assessment and evaluation and knowing students, to what extent they need these areas and their perceptions of them. In the game activity, with the help of the literature, 7 professional competency areas, which are knowledge of students, content knowledge, knowledge of teaching strategies, pedagogical content knowledge, assessment and evaluation, mastery of the curriculum and context knowledge, were selected. Within the framework of this game activity, competency areas were represented by arrows and the teachers were asked to diagnose and eradicate a misconception that they had chosen beforehand and placed at the target board using the arrows (Figure 3.6).

Figure 3.6 A snapshot from the *Free Throw* game activity when a teacher is trying to hit the misconception she has identified by the professional competency she has chosen in order to eradicate the misconception

The scenario required the teachers firstly to choose the arrow that represents the competency area that they feel confident with. After they made their own explanations on this first competency area, regardless of whichever arrow it was, the teachers were told that there was a wind which made the teachers fail to hit the target, so they had to choose another arrow. During the game activity the teachers were asked several questions regarding the competency areas. With the help of this game activity, it was possible to understand how the teachers perceive professional competency areas and in which situations, how often and how they use them.

Table 3.3 Dimensions of the curriculum related with the game activities

Game Activity	Foci for Curriculum Dimension
School Alive	Teachers' General Ideas about the Curriculum Learning and Teaching Process Implementers of the Curriculum (Teacher-Parent-Inspector)
Education Balloon	Teachers' General Ideas about the Curriculum Implementers of the Curriculum (Teacher)
Warriors	Teachers' General Ideas about the Curriculum The Fundamental Approaches of the Curriculum (Scientific Knowledge) The Principle of ' Little but Essential Knowledge' Learning and Teaching Process (Learning Process)
Meal for a Year	The Vision of the Curriculum: Scientific and Technological Literacy Learning and Teaching Process Taking All Students' Need into Consideration The Organizational Structure of the Curriculum: Seven Learning Areas
Card Game	The Fundamental Approaches of the Curriculum (General Aims) Learning and Teaching Process (Teaching Process) Assessment and Evaluation
Free Throw	Assessment and Evaluation Taking All Students' Need into Consideration Implementers of the Curriculum (Teacher)

3.6 The Implementation Process of Data Gathering Tools

All interviews were operated in the teacher's own school, especially in science laboratories and empty classrooms. They generally took one and a half or two hours per interview. Although there occurred some little problems such as time limitations for teachers and outside noise in the operation periods of the game activities, the interviewees stated that the game activities were enjoyable and intriguing in general. However, the "Meal for a Year" was not easily understood and played by the interviewees. The reason may be the unfamiliarity of the teachers with the learning fields in the elementary science education, which was mentioned by many interviewees. For all explanations for the game activities are listed in Appendix B.

3.7 Analysis of the Data

In this study, the content analysis was used for the data. Neuendorf (2002) offers a six-part definition of content analysis: "Content analysis is a summarizing, quantitative analysis of messages that relies on the scientific method (including attention to objectivity, intersubjectivity, a priori design, reliability, validity, generalizability, replicability, and hypothesis testing) and is not limited as to the types of variables that may be measured or the context in which the messages are created or presented." (p. 10). The aim of using content analysis is to reach the concepts and the connections which are successful in explaining the data. In order to achieve intercoder reliability, I randomly chose 25-page data which form more than 10 % of the 202-page data obtained from interview transcription and I conceptualized the collected data, and then I rationally organized the data by appeared concepts using a qualitative research program named NVivo 7.0. and finally I established the themes that explain the data. After that, a second coder followed the same procedure with the same sample of data on her own. Then, the established themes were brought together for comparison. In general, it was observed that there was a high level of consistency between the data analyses. In

addition to this, some of the themes that were constructed differently were discussed and an agreement was settled. By this way, the reliability of the study was checked and it was decided to continue the analysis with the rest of the data.

CHAPTER 4

RESULT

In this chapter, the data gathered through in-depth interview was analyzed using content analysis in order to understand the teachers' opinions about and perceptions of the curriculum.

4.1 Teachers' General Opinions about the Curriculum

In order to conduct a content analysis properly, knowing the teachers' attitudes towards the subject was important. For this aim, while some game activities were being prepared, it was tried to provide the teachers with an environment where they could express their opinions about and perceptions of the curriculum. For the same reason, the *School Alive* and the *Warriors* activities conducted in two steps where the teachers would express their own world view and then their perceptions of the curriculum. Moreover, in the *Education Balloon* game activity, the teachers had to make a priority order among the curriculum, teacher, course book and school and thus by this activity important data concerning the teachers' adoption level of the curriculum was revealed. When the analyses of these game activities mentioned above were brought together with the analyses of the other activities, it is revealed that 5 of 9 teachers generally liked the curriculum whereas the remaining 4 teachers generally did not like the curriculum. The polarity between the teachers was destabilized when it came to the implementation of the curriculum and it is understood that 7 of 9 teachers have been spending an effort to implement the curriculum as much as possible. At this point it is observed that some of the teachers spent an effort to implement the curriculum although they heavily criticized it. The teachers' critical statements and positive attitudes regarding the curriculum are given in Table 4.1 and Table 4.2 respectively. On the other hand, 2 of 9 teachers stated that they liked the curriculum but they could not implement it completely. In addition to this, it is seen that both of these two

teachers display negative attitude towards the alternative techniques suggested in the curriculum in their assessment and evaluation approach. One of them stated that she did not feel the need to be consistent with the curriculum as a whole:

> Teacher 1: The curriculum is just a means for me. I can use it wherever and in whichever way I like.

The other one of these two teachers emphasized that he feels more comfortable with teacher-centered approach although he generally approves of the student-centered approach in the curriculum:

> Teacher 9: You cannot organize the students well in terms of [learning activities]. Maybe you try to involve them in the activities but there is a time limitation. One hour, or let's say now 4 hours a week for science and technology course, is not enough. In order for the curriculum to be student-centered, in my opinion it should both be teacher and student-centered. I mean we should not pass the business to the student directly. It is a bit manipulating but I feel more confident with it [teacher-centered approach]. I should be involved in the topic and the student should be as well. But we cannot provide much opportunity for the students. This is because of our efforts not to fall behind the curriculum. But the activities are very enjoyable and it would be better if the students did them. Maybe some other visual materials … what we do is that some students do something and the others watch them. It would be more effective if we assigned different roles to each student but we cannot do this for the time being.

Table 4.1 Teachers' critical statements about the curriculum

Curriculum is not sufficient because:	Frequency
Students do not understand without formulas	3
There are unnecessary details in some topics	3
Time is limited for the implementation	3
Students do not do their homework by themselves and become dependent on their parents	2
It puts more weight on the students' shoulder than they are able to lift	2
Its approach to learning is not functional; students have difficulty with SBS	2
Alternative assessment techniques take too much time and cause waste of paper	2
The number of units are more than necessary	2
It leaves the teacher out of the system	2
It causes some misconceptions	1
It does not take the society into consideration	1
It is not suitable for Turkish educational system	1

On the other hand, one of the teachers (Teacher 6) stated for several times that he does not like the curriculum although he spends a lot of effort to implement it. This teacher was the only one who did not throw the weight symbolizing the curriculum in the *Education Balloon* and he pointed out that it is the curriculum that teachers should be consistent with and even without the teacher, the society can achieve development with the help of the curriculum.

Again during the same activity, another teacher did not seem to hesitate much to throw the weights symbolizing the course book and school; however, he had a great difficulty to decide whether to throw the teacher or the curriculum. In order to keep the education balloon in a safe position, this teacher finally decided to keep the weight symbolizing the teacher in the balloon and to throw the weight symbolizing the curriculum and sadly said that:

> Teacher 8: Now we are not tied to anywhere. The teacher will determine the route. She manages the wheel, and she does not have a guide book to look at. She has whole control of everything.

Table 4.2 Teachers' positive attitudes towards the curriculum

Curriculum has sufficient quality because	Frequency
The activities are suitable for daily life and they are prepared in a way that they would cover the essence of the topic	4
It lessens the burden on the teacher in class	3
It discourages students from learning based on memorizing	1
It provides the opportunity for students to be creative in learning process	1
It provides students with many alternatives in terms of learning	1

In addition to this, the explanation below that one teacher made concerning his admiration and criticism regarding the curriculum reflects the general tendency of the teachers to a certain extent:

> Teacher 4: To be honest, I like the curriculum. This current curriculum pleased me. Especially the idea of preparing a teacher's book, which shows everything a teacher should do step by step. But there are some lacks of course. For example, content based lacks. For example, it says don't give any formulas when teaching heat and temperature. However, we have a real difficulty while teaching that topic to the student without formulas. Let's say

> specific heat. If you teach this topic the child will have difficulty to understand. If we had formulas it would be better. But in general I liked the curriculum; it is well-prepared.

On the other hand, when I analyzed the data gathered by the *Education Balloon*, it is understood that the teachers think that the importance of the curriculum in educational system is less than the importance of both the school and the teacher, whereas it is more than only that of the textbook. In fact, 4 of 9 teachers firstly threw the curriculum and while doing this, they did not have much difficulty. This situation shows that the degree of curriculum adoption of majority of the teachers is low although they still try to implement it.

4.2 The Vision of the Curriculum: The Scientific and Technological Literacy

Scientific literacy and technological literacy are considered together as a single concept in Turkish elementary science and technology curriculum. In line with the current reforms in education, three main reasons regarding the necessity of the scientific and technological literacy are stated in the curriculum. The first reason is the changes in our life style caused by the rapid changes in economical, social and especially scientific and technological developments. The second reason is the continuity of these changes in our life style caused by globalization, international economical competition and scientific and technological developments. The third reason is the establishment of a powerful future by the help of the developments which are stated above (MNE, 2006, p.5). Together with these three reasons, whatever their personal differences are, educating all students as a scientifically and technologically literate person is expressed as the vision (MNE, 2006, p.5), goal (MNE, 2006, p.8) and one of the main principles of the curriculum (MNE, 2006, p.11). In the curriculum scientific and technological literacy is defined as a composition of skill, attitude, value, mentality and knowledge which is necessary for the individuals in order to develop skills of inquiry, critical thinking, problem solving, decision making, in order to become life-long learners and in order to maintain the sense of curiosity about their

environment and the world (MNE, 2006, p.5). Description of the characteristics of scientifically and technologically literate person in the science curriculum is listed in Table 4.3.

Table 4.3 Characteristics of a scientifically and technologically literate person

A scientifically and technologically literate person
understands and uses correctly the nature of science and scientific knowledge, basic scientific concepts, principles, laws and theories
employs scientific process skills for problem solving and decision making
understands the interactions among science, technology, society and environment
improves scientific and technical psychomotor skills
shows that he/she has scientific attitudes and values
becomes actively involved in accessing and using knowledge, problem-solving, decision making through critical thinking

In addition to this, in the curriculum, there are 7 dimensions of scientific and technological literacy which are nature of science and technology, key scientific concepts, scientific process skills, science-technology-society-environment relations, scientific and technical psychomotor skills, values which construct the essence of science, and attitudes and values regarding science (MNE, 2006, p.5). It is also stated that during the design process of the curriculum, these 7 dimensions are taken into consideration while selecting the objectives and the activities (MNE, 2006, p.11). Three of the dimensions above, which are scientific process skills, science-technology-society-environment relations and attitudes and values, are directly embedded into seven learning areas in the curriculum, all for scientific and technological literacy (MNE, 2006, p.59), and these are mentioned in detail in the following sections. The overt guidelines for establishing scientific and technological literacy are located only in two sections of the curriculum, which are Learning and Teaching Process and Taking All Students' Needs into Consideration. Although the number of overt guidelines for scientific and technological literacy are not many in the curriculum, it is important to keep in mind that all the decisions, selections, other guidelines and the approaches in the curriculum are designed in order to achieve the goal of scientific and technological literacy, which is mentioned for several times in the curriculum.

In the current study in order to understand the participating teachers' perceptions of the scientific and technological literacy, some direct questions such as "how can you identify a scientifically and technologically literate" were asked to the teachers in the *Meal for a Year* game activity. When the teachers' opinions are considered, it seems that there is not much variation in their statements related with scientific and technological literacy. In fact, they sometimes seem to be equally polarized between two different certain sides. By looking at their first reactions, it is figured out that 6 of 9 teachers easily remembered the concept of scientific and technological literacy. Only three of them seemed as if they heard the term for the first time. 4 of the teachers declared that scientific and technological literacy is a necessity for all students. For example, one of the teachers, who completed a lot of in-service training, stated the importance of scientific and technological literacy as an answer to the question of "Is scientific and technological literacy necessary for all students?":

> Teacher 7: Of course, there should be [a necessity for all students]. Because we said it just a while ago: each and every student should learn the life, they are in the life itself, an element of the society, and the members of the society have to know the changes happening within its own body. He or she has to know what is happening around him… the experts would deal with the details, it is not our business. But being a scientifically and technologically literate is not in terms of dwelling on the details.

On the other hand, five of the teachers did not agree with the idea that scientific and technological literacy is a necessity for all students. The explanations of the teachers regarding the issue are listed in Table 4.4. They usually mentioned that it is directly related with students' interest. For example, one of the science teachers with over 30 years teaching experiences expressed his opinions by giving the reasons as follows:

> Teacher 6: No, it [scientific and technological literacy for all students] is not necessary. In my opinion, everybody should be guided towards their own interest. You cannot make a student who doesn't like science like science by forcing him. Some have ability towards science, some have towards mathematics, some have towards history… I mean not every person can be a scientifically and technologically literate, not every person can be a mathematician. You should guide them towards whatever their interest is.

Table 4.4 Teachers' opinions why scientific and technological literacy is not necessary for all students

Scientific and technological literacy is not necessary because it is	Frequency
related with student's interest	4
related with student's capacity	2
only for the researchers	1

Whether they seem to remember the term scientific and technological literacy at first or not, all teachers tried to put some meanings for scientific and technological literacy by reflecting on it for a long time during their speeches. After the analysis of the speeches, some associations about scientific and technological literacy which are listed in Table 4.5 were formed.

Table 4.5 Teachers opinions for the meaning of scientific and technological literacy

Associations for scientific and technological literacy	Frequency
an ability	4
reading scientific articles	2
following scientific and technological improvements	2
a thing which is done by everyone whether consciously or not	2
making investigation	1
readiness and problem solving	1
a consciousness	1
a competency	1
a process	1
sensitiveness for the environment	1
consciousness about the environment	1
the learning techniques based on observation and using these learning techniques	1

The analysis of the answers to the question of "How do you recognize a scientifically and technologically literate person?" helped to form some personal qualifications of a scientific and technological literate person from the viewpoints of the teachers and they are listed in Table 4.6. Three representative quotes are given in the following:

> Teacher 2: Firstly, his being a researcher would influence me. Within their area of work, towards whichever area their interest is, making me satisfied with his knowledge regarding that subject… I mean he should have the ability to make me say "yes, really" with whatever he provides.

> Teacher 8: Of course, rather than his physical traits, his looks, his view of the environment, his view of an object, his comment would take us to the knowledge… Of course, it might

be in his behaviors, sometimes people might give us clues in their way of walking, his reactions to events… If he does not step on the grass, if he turns down fast-flowing water, if he keeps a distance between him and objects that might explode, then I can say [he is a scientifically and technologically literate person]. If a man does not touch a material that he does not know, then I can say that he is. Because it might be a harmful material, he is aware of that.

Teacher 9: If he applies what he has learnt, I may think that he is a good scientifically and technologically literate. If he asks why, how questions, I may think that he is. "Why did I do this?" for example.

Table 4.6 Characteristics of scientifically and technologically literate person from the viewpoints of teachers

Characteristics of scientifically and technologically literate person	Frequency
doing research	3
having knowledge	3
sensitiveness to the environment	3
making inquiry	3
letting himself/herself on through his/her own perspective	2
letting himself/herself on through his/her own speeches	2
having awareness	2
accessing correct knowledge	1
doing experiments	1
expressing himself/herself correctly	1
having an ability of persuasion	1
investigating the improvements	1
creative	1
problem solver	1
letting himself/herself on through his/her own reactions to situations	1
making observations	1
practicing his/her own learning	1
serving the knowledge in his/her own formation	1

When the teachers' opinions of the relationships between the 7 learning areas presented in the curriculum and scientific and technological literacy are analyzed, it is seen that 7 of 9 teachers find all learning areas necessary for scientific and technological literacy. Among those seven, one of the teachers emphasized that science-technology-society-environment relations and scientific process skills are directly related with scientific and technological literacy. 2 of 9 teachers did not agree that all learning areas presented in the curriculum are necessary for

scientific and technological literacy. Of these two teachers, while one of them stated that both scientific process skills and attitudes and values are not necessary, the other one counted only attitudes and values as irrelevant and she defined scientific process skills as the most important characteristic for scientific and technological literacy.

When both science curriculum and teachers' perceptions of scientific and technological literacy are considered, it is realized that teachers' perceptions are not fully aligned with what is stated in the curriculum. Although the teachers generally seem to be familiar with the concept of scientific and technological literacy, they have some difficulty defining the term. While scientific and technological literacy in the curriculum is defined as, in general, a composition of skill, attitude, value and knowledge which would ease the life and improve it, the teachers define the term predominantly as an innate ability and intention of reading magazines related with science and technology and doing research. Only two teachers' perceptions are consistent with the curriculum since they define scientific and technological literacy as things about life and related with science done unconsciously or deliberately. On the other hand, although the teachers' statements do not fully cover and provide a satisfactory definition of the profile of scientifically and technologically literate person that is given in the curriculum, most of them seem to adopt the term as it is in the curriculum. For example, majority of the teachers mentioned the traits related with scientific process skills such as making observations, research, and inquiry; the traits related with science-technology-society-environment relations such as showing sensitivity to the environment; the traits related with attitudes and behavior such as broad perspective, positive behavior and reactions in their descriptions of scientifically and technologically literate person. On the other hand, the greatest difference lies in their views about whether they think that scientific and technological literacy is a goal for each student or not. While nearly half of the teachers correctly stated the goal of the curriculum, which is making students achieve scientific and technological literacy, the other half of them do not seem to internalize this goal since they said that it is not necessary for each student to be a scientifically and

technologically literate person. The teachers thought that it is not necessary to draw a connection between scientific and technological literacy and students' interest. Two of these teachers also had difficulty to define the term of attitudes and values, which is one the seven dimensions mentioned in the curriculum, and thought that it is irrelevant to scientific and technology literacy. In addition to this, most of the teachers stated that those seven learning areas are necessary for scientific and technological literacy.

4.3 The Fundamental Approaches of the Curriculum

In this section, science teachers' perceptions of the fundamental approaches of the curriculum which are related with scientific knowledge and general aims of science and technology education are presented.

4.3.1 Scientific Knowledge

In the elementary science and technology curriculum science is defined as a body of knowledge about the world and a way of thinking. It is emphasized that science is not the compilation of pieces of stable and certain knowledge. Scientific knowledge is continuously revised and improved for better explanations for physical and biological world with the help of new evidence. The more stable dimension of science is not the scientific content but the scientific methods. In the curriculum, the sense that scientific knowledge is not stable truths but the most valid explanation for reality is tried to be constructed. In addition to this, in the curriculum the adoption of scientific methods which is necessary for scientific literacy is taken into consideration (MNE, 2006, p.7).

When the teachers' perceptions, which were collected mostly through one of the scenarios of the *Warriors Round II* game activity, are analyzed it is seen that all the teachers define science as an area of science which revises and improves itself continuously. While most of the teachers stated that scientific knowledge is not stable and certain as an initial reaction, only two of them were able to maintain this first reaction by giving consistent explanations and the others found

themselves supporting the idea that scientific knowledge includes both certain and uncertain components[5] during activity. Furthermore, only one teacher, who has 30 years of experience in science teaching, stated that scientific knowledge is stable as an initial reaction and then, she changed her mind after thinking on her own explanations and said that scientific knowledge includes both certain and uncertain components. She answered the question of "Do these two warriors collide with each other" by holding the paper showing the picture in Figure 4.1 as:

Figure 4.1 The Warriors Round II

> Teacher 3: Sure they do. Because, for example, we grew up this way and have been giving education this way for several years. I educated my students [that science is a compilation of certain pieces of knowledge]. However, recently it has been shown by the scientists again that what we thought correct in the past is wrong now. [She is thinking for a while looking at the warrior card] Then, these two should go hand in hand rather than colliding or arguing with each other.

At the end, 7 of 9 teachers, five of whom changed their reactions, continued their speeches by supporting the opinion that scientific knowledge includes both certain and uncertain components. Most of these teachers supported their opinions by comparing the scientific laws and theories. They stated that while the scientific laws such as gravity, heredity and principals of Archimedes are stable and do not change in time, the scientific theories such as the origin of the humankind, the

[5] There are some differences between the teachers' first reactions and their final comments. One of the main reasons for this is the nature of the game activities which allow forming awareness during the interview. Not only in this scenario but also in other two scenarios, the *Warrior* game activity stands out because of its quality of raising awareness.

evolution and models of the atom are not stable and will change in time. On the other hand, as it is mentioned above, the other two teachers kept their previous opinion that scientific knowledge is not stable and certain. The characteristics of scientific knowledge according to the teacher are listed in Table 4.7. Especially the perception of one of these two teachers about scientific knowledge is almost fully aligned with the explanations about scientific knowledge stated in the curriculum as it is seen in the following quotation:

> Teacher 8 (who has 15 years of experience in science teaching): I think science is not a compilation of certain pieces of knowledge. There is nothing like certain, everything in the nature is in a process of transformation. The reason why science says that it is certain is that it considers everything by experiments, observations and by analyzing and touching. In that respect science is correct, but saying that it is certain knowledge is wrong. But basing on science, scientific information, results of research and experiments is all right.

Table 4.7 Teachers' perceptions of characteristics of scientific knowledge

Characteristic	Frequency	Teachers' Explanations	Frequency
It includes both certain and uncertain components	7	Science and Technology is in a continuous transformation.	7
		Some knowledge is stable and some knowledge is not stable.	7
		Scientific laws are stable.	4
		Theories are not stable.	3
		Accessing certain knowledge is the aim.	1
		Knowledge is added in science after gaining certainty.	1
		Some knowledge is still in a research process.	1
It is unstable and uncertain	2	Science and Technology is in a continuous transformation.	2
		What is certain and stable is basing on scientific methods.	1

While the teachers were explaining their opinions about scientific knowledge, they often gave some examples for stable/unstable and certain/uncertain knowledge. These examples listed in Table 4.8 and Table 4.9.

Table 4.8 Examples of stable and certain knowledge given by the teachers

Example	Frequency
Mendel's Heredity	2
Sexual and asexual reproduction	2
No knowledge is stable!	2
Formation of living cells	1
Principle of Archimedes	1
Calculation of the magnitude of the electrical circuit	1
Molecular formation of water	1
The role of the chromosomes	1
The relationship between cross sectional area of the conductive wire and the resistance	1

Table 4.9 Examples of unstable and uncertain knowledge given by the teachers

Example	Frequency
Space Science	3
Atomic Theory	2
Bing Bang Theory	2
Origin of the Humankind	2
Evolution Theory	2
States of the Matter	1
Genetic Clones	1

When asked about how scientific knowledge is defined in the curriculum, half of the teachers said that scientific knowledge is stated as unstable and uncertain in the curriculum by referring to the notification about ongoing scientific research studies in the curriculum. In fact, two of them declared that the curriculum itself was constructed in the light of this idea. For example, one of them explained her opinion as scientific knowledge is defined as unstable and uncertain in the curriculum as in the following quote:

> Teacher 5: It does not present it as certain knowledge, does it? According to recent opinions, I mean opinions of scientists are given. They are given as comments. It sounds to me like the curriculum supports this one [it is not a compilation of certain pieces of knowledge]. According to the book I read, I mean the curriculum… about a topic, for

> example the creation of the world, the universe phenomenon, we continuously learn new things. What we learnt in our childhood and what we learn now are not the same because it is continuously changing. Therefore, [the curriculum] makes comments according to the opinions of scientists. It is like what this latest scientist says is true. It follows a road to the idea that science is not a compilation of stable and certain pieces of knowledge.

On the other hand, 3 of 9 teachers stated that there is stable knowledge in the curriculum and it is aimed that students should access that stable knowledge. For this reason, these teachers mentioned that there is an attitude in the curriculum as the scientific knowledge is stable and certain. One of these teachers also stated that there is no notification for the developments regarding scientific research studies in the curriculum as follows:

> Teacher 2 (who has 15 years experience in science teaching): Now, it doesn't matter whether it is the old curriculum or the latest one, all curricula say that science is a compilation of stable and certain pieces of knowledge because it doesn't leave any space for openness. For example, in the course books it is still stated that there are three physical states of the matter; however, this has changed now. There should have been a sentence that would make it changeable. They should have stated that as well. A statement like "this year students will learn three physical states of the matter but apart from these three there are other physical states of the matter" would cover that part, which is science is not a compilation of stable and certain pieces of knowledge. But for the time being, the statement in the curriculum shows this [science is a compilation of stable and certain pieces of knowledge].

Finally, 2 of 9 teachers stated that there is no overt sign in the curriculum related with the certainty and stability of scientific knowledge, and there is an unbiased attitude in the curriculum. In other words, they mentioned that both certain and uncertain knowledge have a place in the curriculum. However, one of these 2 teachers declared that this unbiased attitude sometimes can be damaged by imposing some uncertain knowledge as reality:

> Teacher 7: Both of them are mentioned, but when whether or not the curriculum takes sides is considered, for example, I think that evolution book, regarding the part on evolution in the 8^{th} grade curriculum, mutations I mean, it seems as if the curriculum imposes something, I mean it seems as if it says evolution exists; however, it should be respectful to both. It gives us the laws that Mendel put forth as a result of the experiments he had done

on beans. Similarly, for example, regarding the formation of a cell, reproduction of living organisms etc. it gives us again opinions that are accepted as laws. Till today what we have as certain knowledge is included in the curriculum. However, together with these, in the curriculum theorems regarding the occurrence of evolution, space science like planets, stars, the movements on the surface of the earth are mentioned as well.

When we take a general look, although all teachers considered science as a branch of science which continuously develops, it is seen that they do not adopt one of the fundamental approach of the curriculum that science is not a compilation of stable and certain pieces of knowledge and the relatively unchangeable part of it is scientific methods since they associated certainty with scientific laws and uncertainty with theories. In addition to this, while the majority of the teachers perceived this fundamental approach regarding scientific knowledge as it is stated in the curriculum by calling attention to the notifications in the curriculum about ongoing research studies, an important portion of the teachers perceived the approach in the curriculum as if science is a compilation of stable and certain pieces of knowledge, which forms a great opposition to the fundamental approach stated in the curriculum itself.

4.3.2 General Aims of the Curriculum

The scientific and technological literacy is the overall goal of the Turkish Elementary Science and Technology Curriculum. In order to achieve this goal, 11 general aims[6] are listed in the curriculum (MNE, 2006, p.9) as follows:

1. To make students learn and understand the natural world and experience the intellectual richness and excitement of it,

2. To encourage students to develop a sense of curiosity towards scientific and technological developments and events at each grade level,

3. To make students understand the nature of science and technology; the mutual interaction among science, technology, society and environment,

[6] Due to the length of the sentences on the cards, in the following sections these aims will be referred to with their numbers in the list.

4. To make students acquire the skills to construct new knowledge through research, reading and discussions,

5. To provide a background for students which will help them develop information, experience, interest about topics like education and career choice, professions based on science and technology,

6. To make students learn how to learn and by this way to make them develop the capacity that will enable them to keep pace with changing nature of professions,

7. To make students use science and technology in unusual situations that they might come across and in obtaining new information,

8. To make students use appropriate scientific processes and principles while making personal decisions,

9. To make students realize social, economic and ethical values regarding science and technology, personal health and environmental issues, and to make them take the responsibility regarding these and make conscious decisions,

10. To make students have scientific values such as being willing to know and understand, valuing reason, thinking about the consequences of their actions, and in their relations regarding the society and environment to make them act in accordance with these values,

11. To make students increase their economic efficiency in their professional lives by using their knowledge, understanding and skills.

In order to understand the teachers' opinions about and attitudes towards these 11 general aims stated in the curriculum a game activity named the *Card Game* was employed. The *Card Game* helps teachers easily focus on each aim because the aims are written on single cards which are numbered according to the order in the list. In addition to this, it is important to mention that teachers were not informed about the fact that these general aims are already listed in the curriculum. Thus, it

is assumed that all teachers' opinions about these aims show their real perceptions about them. When the teachers' perceptions are analyzed, it is seen that 6 of 9 teachers found all general aims as meaningful for science and technology education. However, 3 of 9 teachers stated that some of the aims on the cards are irrelevant to science and technology education. The aims which were found to be irrelevant by the teachers are numbered as 4, 5, 6, 8, and especially 11. Interestingly, 5th, 6th and 11th aims have a commonality as they are the only three aims out of 11 related with students' career development. 3 of 9 teachers declared that especially the 11th aim is totally out of the boundaries of the elementary science and technology education. They mentioned that this aim is not meaningful for the elementary students because elementary students usually do not have a job and it is not necessary to make them gain such kind of consciousness because it is much more related with the secondary education. For example, one of these teachers, who has more experiences in secondary science education than the others, took out the 11th card among the other cards and explained his reason as follows:

> Teacher 4: these children's [elementary students'] career choices haven't settled down yet. I leave it to high school.

In contrast, one of the teachers, who is not included in those three teachers and who has experience of elementary science education over 30 years, raised the 11th card during the game activity and stated that this is the real aim of the elementary science and technology education.

In addition to these, 2nd aim stated in the curriculum is also found to be much more important than the other aims generally by all 9 teachers. During their speech related with the 2nd aim, the majority of them frequently pointed out the necessity of the sense of curiosity among students for their lives. On the other hand, the majority of the teachers also mentioned that there are some limitations, which are especially limited time and lack of equipment, to achieve these general aims. Furthermore, they often stated that they can partially cover these aims in their lessons. For example, one of the teachers, who seemed to centralize the

students' curiosity toward science and technology for her lessons, explained the importance of students' curiosity as following:

> Teacher 1: Firstly, it is necessary to uncover the topic that the student is interested in. I mean firstly the students have to bring to class the topics they are interested in. What do they have in their minds, what do they wonder, what do they want to search. Everybody, let's say in a one-month period, each and every student –although it is not possible for the time being- may present a topic in the class that he or she is interested in after he/she has searched for it. It might be something free. However, I for example don't prefer to have students make presentations. I mean I can't. If only I had more time, then I might have them present something. I would choose interesting topics. Let's see together whether it happened this way or that way. I would depart from these.

After the teachers looked at the cards, 8 of 9 teachers declared that these all 11 general aims are already written in the curriculum. In addition to this, although the remaining one teacher stated that he applies the curriculum point by point, he declared that 4^{th}, 6^{th}, 8^{th}, 11^{th} aims are not listed in the curriculum. However, only 4 of 8 teachers mentioned that these 11 aims are covered in the curriculum. For example, one teacher answered the question of "Are these 11 aims taken into account in the curriculum?" as following:

> Teacher 7: If the curriculum does not take these into account, then why should we? What do you mean by advocating? For example, the aim making students understand the mutual interactions among science, technology, society and environment. Let's start thinking from this one. For example, in a tree planting event [with students]… This is an example of a mutual interaction between the society and environment. For example, rubbish collection, putting wastes like batteries into battery boxes since they are harmful to the nature.

He goes on speaking by answering the question "Are there any notifications that support your explanations in the curriculum?" as following:

> Teacher 7: Sure. For example, the fact that waste batteries give harm to the soil. What does it say: making students learn and understand the natural world and experience the intellectual richness and excitement. For example, it says space puzzle. Or it talks about the layers of our world and about happenings like snow, mist that take place in it. If our child knows these, if he/she knows science, then it is possible for that child to write a beautiful story, or to dream and go somewhere else with it.

On the other hand, the other 4 of 8 teachers stated that 11 general aims are partially covered in the curriculum. They mentioned that no additional importance to these general aims is given in the curriculum apart from just being written in the curriculum. These 4 teachers supported their opinion by stating that there are not sufficient guidelines for these general aims. Two representative quotes are given in the following:

> Teacher 5: According to what is stated here, it [curriculum] seems unsatisfactory I guess. It might encourage [students] a bit more, it might provide examples that would develop their curiosity.

> Teacher 6: They [these aims] are in it. But the latest curriculum is not comprehensive. It should be revised. Yes these are in the curriculum but they are just written there. This does not mean that they are fully functioning.

Although almost all teachers recognized that 11 general aims for science and technology education are listed in the curriculum, it is seen that some teachers do not internalize some aims, which are especially related with "students' career development", because they believed that those aims are not suitable for elementary level. Moreover, most of the teachers complained about limited time for achieving these goals in their lessons. In addition to this, almost half of the teachers indicated that the curriculum is insufficient in representing these 11 general aims of science and technology education. As a result of all the information above, it can be stated that there is a partial consistency between teachers' perceptions and the approaches in the curriculum related with the general aims of the elementary science and technology education.

4.4 The Principle of 'Little but Essential Knowledge'

In the curriculum with the aim of scientific and technological literacy, 7 learning areas are determined, 4 of which are presented as units and 3 of which are scattered among the units. Moreover, while organizing the units some basic understandings and departure points were determined and the activities and learning outputs were chosen in accordance with these main principles as much as possible (MNE, 2006, p.10). The principle of 'Little but essential knowledge' is

one of these 7 principles which can be summarized as educating students as scientifically and technologically literate people, giving priority to constructivist approach, focusing on alternative assessment and evaluation techniques, considering students' individual differences. In the curriculum it is stated that consistent with the principle of 'Little but essential knowledge', the suggested learning outcomes in the units were selected in a way that would provide students with meaningful learning as this principle includes fewer concepts rather than a lot of concepts and knowledge presented in a superficial and separate way (MNE, 2006, p. 11).

In order to collect the teachers' opinions, a game activity named the *Warriors Round I* was employed. In this game activity, the teachers answered the question of "Which warrior would be able to win the war, if there is a war, according to your world view?" by looking at the two warriors, each of whom claims a different discourse shown in Figure 4.2.

Figure 4.2 The Warriors Round I

7 of 9 teachers declared that the warrior who says "Little but essential knowledge" would win since he is right. The reasons for giving this answer by the teachers are listed in Table 4.10. The teachers generally made explanations regarding the opinion that detailed knowledge is boring for students and it is easily forgotten whereas "little but essential knowledge" increases the success of all students and it is necessary and satisfactory for elementary education. For example, a teacher with 30 years of experience says that:

> Teacher 4: Little knowledge is essential, it is easy to keep in mind and it is easy to apply. If the knowledge is very detailed, or maybe if you tell the topic in the class in a very detailed way, not all that knowledge remains in the student. The child gets the amount he/she need or he/she can use, and forgets the rest.

On the other hand, 2 of 9 teachers, both of whom have 30 years of experience in science teaching, supported the opinion that detailed knowledge is necessary by saying that little knowledge might be insufficient and wrong; however, a student with detailed knowledge will probably be more successful. For example, one of these two teachers expressed his opinion regarding the necessity of detailed knowledge by saying that:

> Teacher 6: Little knowledge does not make a person happy, but essential knowledge does. You should have some research skills. The person who has little knowledge produces less. There is a saying: Benefit is like a chair; if you put it under your feet you will be higher; if you put it on your head, you will be shorter. If the person wants to live well and be happy, he/she should have detailed knowledge about all topics.

Table 4.10 Teachers' opinions about "Little but essential knowledge"

Teachers' Opinion	Teachers' Explanations	Frequency
Little but essential knowledge is necessary	Little but essential knowledge is necessary especially for elementary education	3
	With little but essential knowledge, all students' success increases	3
	Detailed knowledge is easily forgotten	3
	Detailed knowledge confuses students / makes them get bored	3
	Little but essential knowledge is more permanent	2
	Little but essential knowledge is necessary / satisfactory	2
	Little but essential knowledge is headed towards a target; it is not superficial	2
	A student dwelling on the details might miss the essence	2
	One who knows the essence can access to the details	2
Detailed knowledge is necessary	Detailed knowledge is necessary for intelligent students	2
	One who has detailed knowledge becomes more successful	2
	Details are important	2
	Little but essential knowledge atrophies creativity	1
	Little knowledge is insufficient/wrong knowledge	1
	With the help of details technology develops and standard of living increases	1

In addition to this, 5 of 9 teachers mentioned that in the curriculum the idea that detailed knowledge is necessary is dominant. 3 of these 5 teachers also mentioned that in fact there is the principle of 'little but essential knowledge' in the curriculum but while they are trying to implement it they feel that the curriculum is far from being supportive of this principle. For example, one teacher thought that the opinion of 'detailed knowledge is necessary' is in fact dominant in the curriculum:

> Teacher 2: When we analyze the curriculum, we can see that there is nothing there in terms of content, there is really little knowledge there. However, when you want to do the activities suggested in the curriculum with the students, you have to give detailed information to the child because the child gets confused with the activity and cannot do the activity, or performance, or project with his/her limited knowledge. You feel you have to give the details. Therefore, the time is not enough for you.

On the other hand, 4 of 9 teachers declared that the opinion of 'little but essential knowledge' is dominant in the curriculum by saying that especially the experiments and activities in the curriculum were designed in a way that they would become suitable for daily life and cover the essence of the topic. The teachers' opinions about the tendency of the curriculum regarding this issue are listed in Table 4.11.

Table 4.11 Teachers' opinions about the tendency of the curriculum regarding 'Little but essential knowledge'

The Tendency of the Curriculum	Teachers' Explanations	Frequency
Little but essential knowledge	Experiments and activities are designed in a way that they would become suitable for daily life and cover the essence of the topic	4
	It is not based on memorizing	1
	The examination system increases the distance between students and details	1
Detailed knowledge	This examination system leads students to details	2
	There are too many topics	1
	There are too many activities and there are unnecessary details in these activities	1
	The topics cannot be given without dwelling on the details	1

Furthermore, the teachers generally associated ‘detail’ with definitions such as overcoming the insufficiencies of knowledge and depth of knowledge. In addition to this, when the teachers were asked to give examples from the detailed knowledge that the curriculum contains, they said that the topics such as Atom, Electricity, Sound and Movements of the Earths Cover contains detailed knowledge. However, one teacher insisted on the opinion that none of the knowledge in the curriculum is detailed knowledge.

In conclusion, it is found that most of the teachers generally adopted the understanding of ‘little but essential knowledge’ as it is stated in the curriculum and that they were aware of the fact that it was tried to take this principle into consideration during the preparation of the curriculum, but the teachers stated that this principle is not successfully highlighted in the curriculum.

4.5 Learning and Teaching Process

In this section, teachers’ perceptions and opinions about learning and teaching process in comparison with the approaches in the curriculum are included.

4.5.1 Learning Process Approach

In the curriculum it is stated that although other learning approaches such as behaviorist approach and cognitive approach are not rejected, in order for students to achieve learning outcomes in the curriculum, teaching strategies and learning experiences should concentrate on the constructivist approaches as much as possible (MNE, 2006, p.12). According to constructivism mentioned in the curriculum, knowledge cannot be transferred directly from the teacher to the student and the student actively reshapes the knowledge in his/her mind by using his/her own schemas of consciousness already existing in them. In addition, seven acceptances which are said to be adopted from the constructivism are listed in the curriculum (MNE, 2006, p.13).

- The relationship between teaching and learning is not always linear and one to one. Knowledge and skills cannot be directly transferred from the teacher to the student through teaching activities.
- Students' previously acquired personal knowledge, perspectives, beliefs, attitudes and aims influence their learning in learning process.
- There are students in the class that need to receive education in a different way. These students can learn through different learning strategies, and internalize that knowledge by sharing it with their friends.
- Learning is not a passive process; it is an effective, continuous and developmental process that requires the student to participate in the learning process. Therefore, the fact that teaching process should predominantly be "student-centered" is widely accepted.
- Knowledge and understandings are personally and socially constructed by each individual. However, in common physical experiences, there are some common aspects in meaning codes caused by the language and social interactions and the convergence of these meaning codes can be provided in school environment as well.
- Science education is not an addition to or an extension of already existing concepts and may require a radical rearrangement of these concepts.
- Human beings can absorb, organize or refuse the knowledge that they have recently constructed while trying to make sense of the world.

In order to understand the teachers' perceptions about learning process in the students basically the *Warriors Round III* game activity was employed. In this game activity, teachers answered the question of "Which warriors will be able to win the war, if there is a war, according to your worldview?" by looking at the two warriors, each of whom defends a different discourse as shown in Figure 4.3.

Figure 4.3 The Warriors Round III

Although most of the teachers started their talk by saying that "students cannot receive the knowledge as it is," some of these teachers declared that they would not take sides and these warriors should not conflict with each other saying that "in fact, both of the warriors have something true in their discourses." As a result, 5 of 9 teachers, generally by emphasizing the capacity of students, stated that some students receive the knowledge as it is and some do not. For example, one of the teachers made an explanation regarding the students who receive the knowledge as it is and the students who do not:

> Teacher 2: Because it is related to the student's capacity. The one with a high capacity receives the knowledge as it is but some students, because of their capacity and carelessness, cannot receive the knowledge as it is.

Moreover, 3 of 9 teachers insisted on their own opinions. Two of these teachers attributed the reason for not receiving the knowledge as it is to a failure in the transfer of knowledge or students' forgetfulness. For example, one teacher with an experience of 30 years in science teaching made the following explanation:

> Teacher 6: The student cannot receive the knowledge as it is. Every time there is something lacking. You write something on the board, but he/she writes it down incorrectly. The students who are really intelligent can receive up to 90-95 % the knowledge as it is.

Only one of three teachers who said that the student cannot receive the knowledge as it is made an explanation regarding this issue which was in alignment with the constructivist approach to a great extent:

> Teacher 1: It depends on whatever he/she has in his/her mind, as his/her feelings or thoughts.

On the other hand, only 1 of 9 teachers stated that students receive knowledge as it is as in the following quote:

> Teacher 7: The student first receives the knowledge but he/she does not study that knowledge or interpret it as we said. The student just gets the information part of it because that part is what is necessary for him/her. If he/she is to interpret, she/he does it later on when he/she is forming her/his background. What is the responsibility of the student? Education, isn't it? Therefore, it is learning. So the student has to get the information first. This is his/her primary duty. Therefore, he/she does not question at the beginning. However, when he/she shares that knowledge with somebody else, he/she might feel the need to question it.

In Table 4.12, the teachers' opinions regarding students' learning process with their explanations are given.

Table 4.12 Teachers' opinions regarding students' learning process

Teachers' Opinions	Teachers' Explanations	Frequency
The student cannot receive knowledge as it is	Previous experiences influence learning process	3
	He/she queries	3
	There are students with a low capacity	3
	Knowledge cannot be received as it is; it is possible to make mistakes	2
	Emotions and thoughts affect learning process	1
	What you use in daily life is permanent	1
	Each student stores and uses knowledge in a different way	1
	It depends on the capacity of the teacher	1
The student receives knowledge as it is	The ones that receives knowledge as it is become successful in the exams.	3
	There are students with a high capacity	3
	There are students who learn through memorizing	2
	In elementary level students cannot make interpretations; they receive it as it is	1

Moreover, when the teachers' opinions concerning learning process were completely analyzed, the profile of the students regarding learning process from

the perspective of the teachers has become clear (Table 4.13). It is understood that the student profile put forward by the teachers is far from the student profile aimed at in the curriculum.

Table 4.13 Teachers' perceptions of general student profile in learning

Consistency with the Curriculum	Perceptions of General Student Profile	Frequency
inconsistent	Students obtain knowledge in an unexpected way	3
	When they become unsuccessful they put the blame on the teacher	3
	They are dependent on the teacher when learning is concerned	2
	They are afraid of science, especially physics	2
	They have a tendency to memorize	2
	They cannot do their homework by themselves; they get help from their parents	2
	They learn better through formulas	2
	They accept what they have learnt as absolute truths	1
	They get confused since they do not know what to do in education system	1
consistent	They learn according to their own needs	3
	They learn better when something is presented visually	2
	They learn better through doing and experiencing	2

Considering how the teachers approach learning process from their own perspective, 6 of 9 teachers declared that in the curriculum the opinion that the student cannot receive knowledge as it is is dominant. For example, one teacher with 30 years of experience expressed his opinion regarding the issue with this reasons as in the following quote:

> Teacher 4: There are activities in the teacher's book, activities that the student can make interpretations or researches. It says the student is supposed to write his/her own sentences and the teacher might check the answers and accept the logical ones. It's true I think. It provides the student with an opportunity to do some research on his/her knowledge and to express his/her opinion on this topic.

On the other hand, remaining 3 of 9 teachers stated that in the curriculum the opinion that the student cannot receive knowledge as it is is dominant. For

example, one teacher who said that she likes the curriculum explained her reasons in this way:

> Teacher 5: Yes, the curriculum gives as much [knowledge] as possible. I really like its book. It tries to give the knowledge as it is and makes the student do some activities. It is not contradictory I mean. Yes, it presents the knowledge as it is and it says the student can receive the knowledge as it is as well.

All the perceptions of the teachers' regarding the dominant learning approach of the curriculum are listed in Table 4.14.

Table 4.14 Teachers' perceptions regarding the dominant learning approach in the curriculum

Curriculum	Teachers' Explanations	Frequency
The student cannot receive knowledge as it is	Students are required to inquiry	2
	The curriculum focuses on learning by experiencing and doing	2
	The examination system determines the differences among students	1
	The curriculum includes some activities which require inquiry	1
	If it was possible to receive knowledge as it is, there would be no need for the curriculum	1
The student receives knowledge as it is	The curriculum presents knowledge as it is	1
	The curriculum puts a lot of pressure on the student; there are too many topics	1
	The education system leads students to memorizing	1

In addition to this, in the *School Alive* game activity, which was also designed to determine whether the curriculum is perceived as student-centered by the teachers, majority of the teachers although they were not asked a direct question, they put the figure symbolizing the student at the center of the picture and declared that the curriculum was prepared as student-centered. Moreover, when all the interviews were analyzed completely, it is seen that all teachers without any exceptions considered the curriculum as student-centered. However, almost half of the teachers associated this active role of the student in learning process

frequently with students' doing exercises and their presenting the topics in the classroom. For example, a male teacher who said that he does not like the curriculum but he approves of student-centered education made the explanation below regarding this issue:

> Teacher 6: In my lessons first I want my students to come to school prepared. Secondly, I want them to present the topics of the day, [which is] student-centered. When they cannot present the topics, I try to present them by both doing some experiments and asking them some questions. If they haven't understood, I feel the need to explain the topic again because our students usually come to school unprepared.

On the other hand, half of the teachers declared that they like the student-centered approach in the curriculum and they implement it by taking the suggestions and notifications into consideration. For example, one of the teachers who said that he exactly implements the curriculum in the classroom while he was placing the student at the middle of the school in the picture during the *School Alive* game activity after he was asked to place the figures from the perspective of the curriculum, he made the following explanation concerning this issue:

> Teacher 4: [The curriculum] is student-centered. I mean the student will do everything. The teacher will be the guide only. The teacher now should tell his/her students what they are going to do when he/she enters the class. Then the students will do some research. They will do the activities together in the class and then the teacher will get every student's opinion and finally, he/she will make a final comment or a presentation. This is what is written in the teacher's book. The answers from the students should be accepted, it says. The most logical ones, of course.

However, 3 of 9 teachers also declared that it would be better if the teacher was given a more active role by the curriculum, because students cannot do anything without a teacher. For example, again another teacher, after he finished his own placement regarding the teacher, realized that he could not explain the reasons of his placement and then said that it was just an example and did not reflect the reality:

> Teacher 9: The teacher should be more active because the students cannot do anything without the teacher. In my opinion, the focus is the teacher, but in the new system it is tried

> to be student-centered. We cannot achieve this all time. We are trying to make it student-centered but again the teacher is at the front.

In addition to this, while they were explaining the placement they made from the perspective of the curriculum during the *School Alive* game activity, 2 of 9 teachers criticized student-centered learning as presented in the curriculum for the reason that students especially have difficulty with doing their homework and have to get help from their parents. For instance, a female teacher who said that she did not like the curriculum but she approves of student-centered approach said that:

> Teacher 1: The curriculum says now it is student-centered. But it makes the parent also study. The students cannot do the activities that they are supposed to do by themselves. There are students who cannot do the activities but the parents do not let the student. Therefore, [the curriculum] makes the parent work as much as the student.

Although some of the teachers pointed out that previous experiences and making queries do not allow students to receive knowledge as it is, almost all the teachers associated receiving knowledge as it is with receiving correct knowledge, which shows that the perceptions of the teachers are far from the constructivist approach. Interestingly, when the teachers were asked questions about the approach in the curriculum towards learning process, most of the teachers made explanations consistent with the curriculum by emphasizing the importance of learning through doing and experiencing and stated that in the curriculum the opinion that the student cannot receive knowledge as it is is dominant. At this point, it can be said that most of the teachers have information regarding constructivism, but they have not adopted it. In addition to this, all the teachers defined the curriculum as student-centered; however, it is seen that half of the teachers talked about the active role of the student in student-centered approach by using statements far from what is stated in the curriculum. Moreover, some of the teachers criticized the student-centered approach for putting the teacher in the second place and requiring the involvement of the parents in teaching-learning process more than necessary. Furthermore, it is clear that the teachers' perceptions of the general profile of the student in learning process and the student profile aimed at in the

curriculum are far from each other. Still, it is understood that almost half of the teachers try to be in consistency with the student-centered approaches as stated in the curriculum.

4.5.2 Approaches towards Teaching Strategies

In the curriculum, teaching strategies are listed in a hierarchical order from teacher-centered to student-centered. Although in the curriculum the teachers are given full authority to choose the teaching methods that they think are suitable for learning and teaching process, student-centered strategies are suggested since they are suitable for the constructivist theory and they provide learning opportunities to reveal and develop high level thinking skills such as critical and creative thinking, analyzing and evaluating (MNE, 2006, p.13). In addition to this, at several points in the curriculum, it is stated that it is necessary to consider all students' learning needs in the selection of teaching strategies.

In order to understand which teaching strategies that the teachers frequently use, a game activity named the *Card Game* was employed. In this game activity, the teachers determined teaching strategies in order to transfer the general aims stated in the curriculum to the classroom. The teaching strategies were determined through the general aims of the elementary science and technology curriculum, which do not exist in the annual plans, rather than through unit titles. The reason for this was to make the teachers talk as much as possible about the strategies that they really use rather than the strategies that they do not use but remember to be suggested in the curriculum. It is thought that they would face with a situation like this for the first time, which would be perceived as surprising. At the end of the *Card Game* activity, the teachers were asked how often they use the teaching strategies that they talked about during the game activity. It is observed that in the game activity the teachers tended to talk about the strategies that they really use in the classroom.

For example, a teacher listed the teaching strategies in order to transfer the general aim of "To encourage students to develop a sense of curiosity towards scientific and technological developments and events at each grade level" as follows:

> Teacher 4: There are good examples in the textbook. I make the students read these examples in the classroom. Then, I ask them to do some research regarding these. It might be another topic as well. For example, this year they researched all infantile diseases: reasons for these diseases, how they spread, what the possible treatments are. Then, I make them prepare posters or bulletin boards. Moreover, they do presentations in the class for their performance grade.

Another teacher stated that from time to time he uses games as a teaching strategy while determining the teaching strategies regarding the general aim of "To make students acquire the skills to construct new knowledge through research, reading and discussions":

> Teacher 2: The children do not have much interest in research and motivation. To make students gain these, I prefer to make them play games in the class. While playing, they also do some questioning. Why does he play a game? To have fun. But it is not like that here in our case. For example, we play ear-to-ear in order to show how fast our nervous system is in transmitting signals.

When the teaching strategies that all 9 teachers mentioned were analyzed, it is seen that they use teacher-centered and student-centered teaching strategies equally in their lessons (Table 4.15).

Table 4.15 Types of teaching strategies that the teachers use

		Teaching Strategies	Frequency	Example
Teacher-centered strategies	(Total Frequency 16)	Classical Instruction	4	I introduce the concepts I inform them about the topic
		Presentation	4	I do experiments I present a Powerpoint presentation
		Story telling	1	I mention interesting events
		Programmed one to one teaching	0	
		Whole class discussion	4	Brainstorming I want examples from daily life We discuss current events
		Video display	2	I make them watch VCDs
		Simulation	0	
		Exercises	1	I make them solve problems
Student-centered strategies	(Total Frequency 18)	Role play	0	
		Small group discussion (peer teaching)	1	They ask questions to each other and answer them
		Field trip	1	We go on a trip
		Cooperative learning	0	
		Drama	1	They make dramas by themselves
		Game playing	1	I make them play games
		Project	3	They make interviews
		Library Survey	3	They do research
		Inquiry	3	They form the question of an answer
		Discovery	4	They do experiments
		Problem-based learning	1	They try to find out the reasons of a problem and find solution to it
		Independent study	0	
		Learning centers	0	
		Programmed learning	0	
		Personalized learning systems	0	

In addition to this, it is understood that most of the teachers conduct their lessons through examples from daily life and with questioning strategies (Table 4.16). For example, one teacher talked about the rituals in his lessons as in the following quote:

> Teacher 1: In the class, I talk about interesting events, interesting information. How it happened, what happened, where it went, what you would do. I talk about all the things that the students might be interested in. This might be something I heard on TV news or read from the newspaper. I tell them anything that might influence them or arouse their attention.

Table 4.16 The methods that teachers frequently use in their science lessons

During the lesson I frequently:	Frequency
give examples from daily life	5
ask questions and expect answers	5
make the students do presentations	4
ask the students to find examples from their own lives	3
ask the students bring something on recent events	2
make the students make activities	2
have the students to look up the words that they do not understand in a dictionary	1
have the students read the course book in the class	1
try to provide an environment that the students can put their imagination forward	1
try to provide an environment that the students can put their abilities forward	1
show the same thing for several times	1

Interestingly, although the teachers allocate almost equal space to student-centered strategies and teacher-centered strategies, nearly all the teachers stated that the situation where learning process does not take place successfully originates from a problem based on the student; however, when it comes to the problems that might arise in learning process, they immediately displayed an attitude in consistency with "student-centered" approach. Only one teacher declared that the reason for a failure in learning process might be arising from the teacher's use of wrong teaching strategies (Table 4.17).[7]

[7] The data on this issue were gathered through *The Meal for a Year* game activity. In this game activity, the scenario where the students get sick after they have eaten the sandwiches that their teacher prepared for them was employed in order gather information concerning the student failure.

Table 4.17 The sources of failure in learning process according to the teachers

Source	Explanation	Frequency
	He/she has an individual difference.	3
	He/she could not reconcile the lesson with daily life	2
	He/she might have left all the topics to the last day. He/she might have tried to learn everything at the same time	2
	He/she might have thought that learning regarding the issue was unnecessary	1
Student-based	He/she was not able to understand	1
	His/her cognitive development might have fallen behind the average level	1
	He/she might have felt that the content was loaded	1
	He/she has a psychological problem	1
	He/she did not question it	1
	He/she forgot it.	1
Teacher-based	The teacher might have made a mistake in her teaching-learning methods	1

When the teaching strategies that the teachers use were analyzed, it is found that although the teachers do not abandon teacher-centered teaching strategies such as direct instruction, presentation and whole class discussion, they frequently use middle level student-centered strategies such as project, library work and discovery. However, it is clear that the teachers never use higher level student-centered strategies such as independent study and programmed learning. In addition to this, it is shown that when the teachers could not get the desired outcome in learning process through the teaching strategies they have chosen, they did not question the teaching strategies they have used and thus they did not consider the students' needs in their teaching strategies. In conclusion, it seems that the teachers generally allocated space to student-centered teaching strategies considering the suggestions mentioned in the curriculum, but it is clear that they did not use these strategies by putting the student at the center.

4.6 Assessment and Evaluation

According to the curriculum, evaluation is a systematical process with multiple steps which includes collection and interpretation of data related with education in order to make a decision concerning the efficiency level of learning and teaching process. In addition to this, evaluation is mentioned as one of the main factors affecting learning teaching and planning process (MNE, 2006, p.21). Table 4.18 presents some different areas for the use of evaluation listed in the curriculum.

Table 4.18 The purpose of assessment and evaluation stated in the curriculum

Evaluation can be used for:
determining the level of acquisition of the learning outcomes mentioned in the curriculum by diagnosing the level of students' learning in science topics,
providing feedback in order to make learning more meaningful and deeper for the students,
determining students' future learning needs,
informing the parents about their children's learning,
monitoring whether teaching strategies and the content of the curriculum are balanced and effective.

In the curriculum it is stated that there has been a shift in learning and teaching strategies from teacher-centered education to student-centered education, which is parallel to the constructivist approach, should be taken into consideration, and evaluation should be constructed in accordance with this change as well (MNE, 2006, p.22). Moreover, it is stated that in the constructivist approach individual differences in learning are taken into consideration, and it is claimed that learner constructs their existing and newly learnt knowledge in a unique way by putting their unique characteristics forward and thus it is emphasized that teaching methods and techniques should be varied as much as possible (MNE, 2006, p.14). In this approach, it is also emphasized that in assessment and evaluation, opportunities for multiple evaluations where students can present their knowledge, skills and attitudes should be provided as well (MNE, 2006, p.22) (Table 4.19).

Table 4.19 Characteristics of assessment and evaluation stated in the curriculum

Less	More
traditional methods of assessment and evaluation	alternative methods of assessment and evaluation
assessment and evaluation is independent from teaching and learning	assessment and evaluation which is part of teaching and learning
assessment and evaluation of knowledge which is easy to memorize/learn	assessment and evaluation of meaningful and profound knowledge
assessment and evaluation of knowledge which is independently scattered	assessment and evaluation of a web of knowledge which is connected and well-constructed
assessment and evaluation of scientific knowledge	assessment and evaluation of scientific understanding and logic
assessment and evaluation in order to understand what the student does not know	assessment and evaluation in order to understand what the student has understood
assessment and evaluation activities at the end of the semester	assessment and evaluation activities during the whole semester
only the evaluation of the teacher	group evaluation together with the teacher and self-evaluation

Moreover, in the curriculum traditional and alternative techniques which are shown in Table 4.20 are separated from each other within a list (MNE, 2006, p.23) and there are detailed explanations for all alternative techniques and some of the traditional techniques in the following section of the curriculum.

Table 4.20 Traditional and alternative assessment and evaluation techniques

Traditional	Alternative
Multiple choice tests	Performance assessment
True/False questions	Student portfolio
Matching questions	Concept maps
Fill in the blanks/completion questions	Structured grid
Examinations requiring short answers	Descriptive branched tree
Examinations requiring long answers	Word association
Question answer	Project
	Drama
	Interview
	Written reports
	Presentation
	Poster
	Group and/or peer evaluation
	Self-evaluation

In order to understand the teachers' routines for assessment and evaluation, basically two game activities were employed. One is the *Card Game* which was designed for determining which assessment and evaluation techniques that the teachers generally use. In this game activity, teachers were expected to choose the suitable assessment and evaluation techniques related with the general aims of the curriculum. After that, the teachers answered the question of which assessment and evaluation techniques they usually use in the teaching-learning process. The other game activity is the *Free Throw* which was designed to understand how much the teachers feel the need for assessment and evaluation in the teaching-learning process and what assessment and evaluation techniques they use. In this game activity, the teachers were asked which assessment and evaluation technique they primarily use in order to diagnose and overcome a misconception in science. After that the teachers gave a general explanation of how much and for what they usually need assessment and evaluation techniques in the teaching-learning process. It was seen that most of the teachers used assessment and evaluation techniques in order to determine the students' mistakes or cognition levels related with the subjects they have taught (Table 4.21). However, only 2 of 9 teachers stated that they use assessment and evaluation techniques in order to give some feedback to their students for correcting their own mistakes during the lessons. For example, a teacher who frequently encourages his students to form questions and to query stated that by using assessment and evaluation techniques he gave some feedback to the students. He made connections between student comments and the topic of the lesson in order to give the students a chance to correct their own mistakes as follows:

> Teacher 2: I want them to find up-to-date examples. I ask them the events around them which are related to the topic they have just seen or by reading a text I ask them how much related it is with science, technology and society and the topic. I did this in my lessons. I make connections with the topic and I get their comments, and want them to find similar examples.

Table 4.21 Teachers' opinions about of the purpose of assessment and evaluation

Teachers' Opinions	Frequency
I diagnose the mistakes of the students regarding the topic	7
I determine at what level the students comprehended the topic	2
I provide the students with an environment where they can correct their own mistakes	2

In addition to this, it is observed that all the teachers frequently mentioned questioning as an assessment technique for learning process. It is also seen that some of the teachers even almost never mentioned any technique other than question and answer. A teacher with an experience of over 30 years in science teaching emphasized that the questioning technique he uses is satisfactory for him:

> Teacher 6: To be honest, my best evaluation technique is this one: I assign some topics to students and if I cannot get any answers for the questions about the topics I have given, I understand that the student came to class unprepared, without studying. We have years of experience, is it possible for me not to understand that? When I ask 2-3 questions to the student, I can understand how much he/she knows about that topic.

All assessment techniques that the teachers said to be using are listed in Table 4.22.

Table 4.22 Assessment techniques that teachers frequently use

Assessment Technique	Frequency
Question-answer (giving examples, making comments, summarizing)	9
Multiple choice questions	3
Asking students to construct questions or problems	3
Students' presentations	2
Fill in the blanks/completion questions	1
Matching questions	1

Moreover, it is realized that majority of the teachers, in a very subjective way, make their evaluations only on their own without using any assessment and evaluations tools. In fact, 2 of 9 teachers directly stated that they understood everything "from the eyes of the student" with the help of many years of

experience. For example, one of the teachers who advocated importance of the constructivism in teaching-learning process seems to be far from alternative assessment techniques:

> Teacher 1: I cannot go even one step further unless I see what's happening in the eyes of the student. If the student understands and then I understand that he learns something, I can go one step further. I can also understand what he has understood and what he hasn't.

In addition to this, it is seen that most of the teachers were result-oriented, which is a feature of traditional assessment, during assessment and evaluation process. Their basic expectation from students is to give logical answers to the teacher's questions. It is also realized that in fact most of the teachers were well aware of alternative assessment techniques, but they did not prefer to use these techniques since they found them unnecessary and demanding. Two representative quotes are given as follows:

> Teacher 1: Just think of it: I have 5 classes. Let's say 30 students for each class on average. Here 30 students is ideal in fact. For example, at the school I came from in Gölbaşı there were 50 students per class. Firstly, it is not possible for me to apply this to 250 students because what should I do for each activity, for each situation where I have to make an evaluation? At least I have to make 250 copies, not to mention its environmental consequences, and then what! I can do it in my mind; I'm a practical person; some of things do not make sense to me. It says he can do this to this extent and that to some extent. These are the things that have had in my mind for 20 years.

> Teacher 9: In terms of assessment and evaluation, [the teacher] can evaluate by his own strategies I think. [Assessment and evaluation] is very important; maybe it is not so much important on paper I think. It cannot be done without assessment and evaluation. It might not be exactly in the same format that the curriculum determines. We don't have the chance to employ [alternative] techniques [because of time limitations]. I don't think that [alternative] techniques are of great necessity; I think I can diagnose something in this way as well. For example, they say the evaluation of learning outputs. But I cannot apply this on paper. I mean I can determine how many students answered which questions and talk about it in the class but I don't write report on it. Am I clear?

On the other hand, while talking about assessment and evaluation, only 2 of 9 teachers made a reference to the curriculum and declared that they use

performance assessment and they take the suggestions provided in the curriculum into consideration. For example, a teacher who gives priority to student-centered teaching strategies such as drama and discussion in the classroom stated that he conducts assessment and evaluation predominantly by getting help from the curriculum and explains that:

> Teacher 8: In our curriculum, there are evaluation measures; we can benefit from them. Even though we may not use them exactly in the same way, I develop my own measures out of them. Let's say there are 10 criteria there, but I increase it to 12 or decrease it to 5. Depending on my situation, sometimes I use it exactly in the same way; usually we benefit from them.

In addition to this, only 1 of 9 teachers mentioned that she take students' differences into consideration during assessment and evaluation process. During the *Card Game,* this teacher who has an experience of 30 years explained her general approach to assessment and evaluation as follows:

> Teacher 3: While doing my assessment and evaluation, firstly I think that every student is different I think. I make a conclusion depending on the student. When the student accesses to the truth, whether orally or using equipment, or in written form, drawing some shapes let's say, it means that I make my evaluation depending on the student himself.

This teacher was the only one who drew attention to student differences in the constructivist approach. Interestingly, while she was talking about the importance of a teacher's being competent in assessment and evaluation during the *Free Throw* game, she stated that she had not attended a course on assessment and evaluation in her education life.

> Teacher 3: Of course there should be the knowledge on assessment and evaluation. Let me give an example from myself: we didn't take any courses on these during our education… We are fast graduates… [We graduated from] science and nature… But from a condensed education… Have you ever heard of it? I am a graduate of 79'. Your mother and father might know that… There was a conflict between the Right and the Left. We completed 3rd and the 4th years of our education in 45 plus 45, 90 days… Now in assessment and evaluation while I am preparing my exam questions, when I want to evaluate the student orally, I think of my own teachers [in elementary and secondary education], in my classes as well. When I evaluated the student, I gave priority to the psychology of the student as

well, and evaluated accordingly. I think a lot in order to make the right decision; I mean in order to make a decision in favor of the child, I educated myself.

In the previous section, it is understood that the teachers generally tried to focus on student-centered strategies by referring to the curriculum although some of them did not understand these strategies in the right way. However, in this section it is clear that whichever teaching strategy they employed, the majority of the teachers insisted on using traditional assessment and evaluation techniques and allocated almost no space to alternative assessment and evaluation techniques which are consistent with student-centered structure in teaching and learning process. Therefore, it is concluded that this situation results not from their lack of knowledge but from the fact that they find alternative assessment and evaluation techniques unnecessary and demanding. As a result, it is understood that in assessment and evaluation process the teachers displayed an attitude far from what is suggested in the curriculum and that they were aware of it.

4.7 Taking All Students' Need into Consideration

In this section 4 issues which are Knowing Students, Students' Gender and Science, Gifted Students in Science and Integrate Students in Science are considered. Teachers' opinions about these three issues were collected mostly through the game activity named the *Free Throw*[8] and the game activity named the *Meal For a Year*[9].

4.7.1 Teachers' Knowledge of Their Students

In the curriculum, it is stated that there might be differences depending on personal characteristics among the students (MNE, 2006, p. 55) because of their gender, socio-economical situation, culture, learning difficulties, special abilities,

[8] In this game activity, when the teachers selected the arrow "knowing the students," the questions related with students differences were asked to the teachers.

[9] In this game activity, the scenario where the students refuse to eat the sandwiches that their teacher has prepared for them was employed in order to understand the teachers' attitude towards indifferent students.

ability of using the language and some deficiencies such as mental, emotional and physical deficiencies (MNE, 2006, p.56). In the curriculum, there are some suggestions to teachers regarding these differences (MNE, 2006, p.56):

- The fact that students' learning styles and speed of learning might be different should be paid attention,
- Teaching materials and methods should be suitable for students' development level and their learning styles,
- Learning and teaching strategies that are suitable for all students' needs and abilities should be selected,
- Non-sexist materials and materials that are sensitive to students' competence level and their situations such as having special abilities, being handicapped or having learning difficulties should be developed and used.

In order to take all students' individual differences into consideration, the teacher has to know the student very well. When the teachers were asked whether there is a practical and easy way to know the students, 3 of 9 teachers stated that this is easy since they do not have any difficulty, whereas 6 of 9 teachers stated that knowing the students is generally a difficult job by giving the reasons listed in Table 4.23. For example, one teacher regarding the issue said that:

> Teacher 7: It might not be very easy for the teacher to know his/her students because students can change all the time. He/she is different at home, different in society, but in the long-term you definitely get to know him/her. But this again does not mean that he/she won't change his behavior in the following years.

Table 4.23 Teachers' opinions about why it is difficult to know the students

Knowing the students is difficult because:	Frequency
The student can conceal himself/herself easily	3
The student changes continuously	2
It is possible to observe only the school life of the student at school	2
The number of students in the classes is very high; time is limited	1

In addition to this, the teachers emphasized the importance of spending more time with the students and forming close relationships with them in knowing the students. All the techniques that the teachers provided concerning how to get to know a student are listed in Table 4.24. Interestingly, although most of the teachers frequently pointed out the cooperation between the teacher and the parents, while talking about the importance of knowing the students, only 2 teachers mentioned the importance of parents.

Table 4.24 The methods that teachers mentioned regarding knowing students

In order to know the students closely it is necessary to:	Frequency
form close relationships	5
spend more time with the students	4
love the students	2
use information forms	2
get into contact with their parent	2
spend an effort	1
have powerful intuitions	1
make the student feel that the teacher values him/her	1
know the characteristics of the region where the student lives in	1
have a talent about this	1

With the help of the methods in Table 4.24, teachers were able to tell many characteristics of students. However, when the interviews were analyzed completely, it is realized that the teachers did not mentioned any good characteristics of students other than intelligence of some students (Table 4.25). The teachers frequently emphasized the students' lack of interest in the lessons by giving the reason that the students do not like the school and they have a tendency to entertainment. With the help of the data gathered by the *Meal for a Year* activity, it is shown that 5 of 9 teachers perceived the lack of interest of the student in the lessons as student-based origin, 3 of 9 teachers as both student-based and teacher-based origins, and 1 of 9 teachers as only teacher-centered origin. The reasons for students' lack of interest in the lessons are listed in Table 4.26.

Table 4.25 Teachers' opinions about general characteristics of students

Students:	Frequency
do not share their problems	4
like moving around and playing games more than the lessons	3
do not want to come to school	3
are alone at home	2
are different from each other	2
do not think of their future	2
are dependent on their parents in terms of their desires and expectations	2
are forgetful	2
think quite differently from adults	1
are influenced by each other	1
cannot make right decisions concerning themselves	1
are degenerate	1
are the most harmful group of the society	1
have average, even low, capacities	1
cannot differentiate real from imaginary	1
want to abandon the school	1
do not have the habit of reading (newspaper, magazine)	1
do not know how to program their time	1

Table 4.26 Teachers' opinions about the reasons for students' lack of interest in lessons

Source	Reasons	Frequency
Student-based	The content of the lesson might be too loaded for the student.	5
	The student might have different areas of interest.	2
	They might not have a healthy diet and this might affect their capacity.	1
	They might be displaying a psychological reaction to teachers.	1
	The student might not have had a good education in primary education; he/she might have weak background knowledge.	1
	They might be displaying a psychological reaction to their parents.	1
Teacher-based	They may not be interested in the teachers.	3
	The teachers might not have professional competency.	1

Moreover, it is seen that in order to increase students' motivation, the teachers use a limited range of methods and even some teachers do not do anything special to attract the attention of uninterested student in the lesson. All the techniques that the teachers use in order to deal with an uninterested student are listed in Table 4.27.

Table 4.27 The techniques that teachers use in order to deal with an uninterested student

To deal with an uninterested student:	Frequency
I try to draw their attention by a game activity.	2
I do nothing.	2
I try different teaching and learning methods	2
I try to convince him/her by talking about the importance of the lesson	2
I deal with him/her one to one, I try to understand the underlying problems	1

4.7.2 Students' Gender and Science

In the curriculum it is stated that there is a difference in scientific achievements between girls and boys in Turkey (MNE, 2006, p.56). According to the statements in the curriculum, the origin of this difference is sourced from the society arising from the differences in attitudes and guidance of the society towards girls and boys in their developmental period. Therefore, it is mentioned that many female students see the scientific subjects outside of their own experiences and they think that they will need to use their scientific knowledge and understandings very little in their futures. Moreover, it is stated that the ratio of the female students who select a job related with science and technology is lower than the ratio of male students. In addition, in the curriculum it is mentioned by the research that in many countries, various written and visual materials used in science lessons in the schools are in favor of boys by the numbers of male figures and the kinds of roles and jobs of the male figures so that these materials do not support the girls to construct a positive attitude towards science and technology. By the all information above, in the curriculum, it is emphasized that it is important to give girls and boys equal opportunities for gaining positive experience in science by providing some extra opportunities (MNE, 2006, p.57) in order to deal with the

gender difference in attitudes towards science and technology which are listed below:

- In the materials used, there should be as many female figures as male figures who study in the field of science and technology and who improve it.
- In classroom environment and in course books, equal space should be allocated to both women and men in oral and visual descriptions.
- Teachers should provide both female and male students with equal opportunities to speak both in-class and out-of-class.
- Efforts should be spent and various opportunities should be provided at home and at school with the help of parents and teachers in order to eliminate the experience formed against girls and to satisfy the lack of positive attitude towards them.

3 of 9 teachers, 2 of whom were female and one of whom was male, stated that there is not any difference in scientific achievements, attitudes toward science and interest in science between girls and boys. All these 3 teachers mentioned that being successful and interested in science and having positive attitudes towards science are directly related with the students' characteristics and abilities which are not related with the students' gender. One of the female teachers answered the question of "Do you recognize any difference between female and male students regarding their scientific achievements, attitudes toward science and interest in science?" as follows:

> Teacher 1: There are really successful female students and there are very successful male students as well… Because that [success, attitude and interest] depends on the person, person's personal characteristics.

On the other hand, 2 of these 3 teachers stated that boys may fall behind girls in the scientific achievement as girls are more systematic than boys. By this way, it is understood that although some teachers did not recognize any difference between girls and boys regarding scientific achievement, they still thought that there are some differences which are originated from both nature and the society

between boys and girls in their interests which shape the students' educational life. For example, one female teacher explained her opinions about why boys may fall behind the girls as in the following quote:

> Teacher 2: The interest areas for boys of this age period are tendency to sports, being outside… Social rules direct them to these areas as well. However, girls have a tendency to lessons independent from what happens, partially because of the society's value judgments and partially because they stay at home I guess.

However, remaining 6 of 9 teachers, half of whom were female, stated that there is a difference in scientific achievements, attitudes toward science and interest in science between girls and boys. All of these 6 teachers stated that female students' interests in science lesson and attitudes towards science are higher than those of male students. In addition to this, 4 of these 6 teachers mentioned that the scientific achievements of the girls are higher than that of boys. On the other hand, although remaining 2 of these 6 teachers avoided mentioning the scientific achievements, they stated that boys are more intelligent than the girls and the boys need less study to become successful in science. For examples, 2 of the male teachers explained the differences between boys and girls as in the following quote:

> Teacher 6: To be honest, girls are more successful and they behave more appropriately. I argue with the parents: they don't value their daughters and consider their sons as their heirs. This is wrong. They think that [their sons] are the members of the household that would spend money without any effort.

> Teacher 7: Boys, usually of course, have higher kinetic energy, whereas girls are more rule oriented and they don't make any concessions of some of their rules. They obey these rules, in this case rules regarding students, completely. Boys are not like that. A female student who has just started school and a male student at the same age are not the same. The male student continuously stands up, whereas girls sit still in an order. There's something like an emotion sourcing from being a female… In some specific stages girls are more successful and in some stages boys are, but I'm sure that boys are very intelligent. Boys go to a destination by walking; however, girls go there by scratching. Only by studying very hard they can hardly reach that point but boys go there without any difficulties.

When all the teachers' opinions are coming together, it is seen that the girls have more relatively positive qualities than boys. All qualities mentioned for girls and boys are given in Table 4.28.

Table 4.28 Teachers' opinions about qualities of girls and boys

Girls	Frequency	Boys	Frequency
more interested in lessons	4	more active	3
more successful	4	more efficient without hard work	2
more disciplined	3	more spoiled	2
more organized	2	more intelligent	2
more determined	1	more sociable	1
more sensitive	1	undisciplined	1
more tolerant	1	relaxed	1
more adaptable	1		

In addition to this, among 6 teachers who stated that there is a difference in girls and boys, 2 teachers attributed these gender differences to social values and judgments and 4 teachers attributed these gender differences to natural biology and characteristic. However, the interesting thing is that some teachers associated pertness and naughty behaviors of boys with biology and nature instead of social values and judgments (Table 4.29). For instance, a male teacher thought that girls are more interested in the lessons and boys are more spoiled and that this is a natural period for the students. He put his opinion as:

> Teacher 8: Girls are generally more adaptable, more interested and boys are a little bit more spoiled. I consider this as a natural period which has to happen; if it doesn't, then I get worried.

Table 4.29 Teachers' opinions about sources of differences between boys and girls

There is a difference between boys and girls because:	Frequency
Natural differences (girls are interested/adaptable, boys are intelligent/spoiled)	4
Social rules work against girls but in favor of boys	2

Moreover, 4 of these 6 teachers stated that they felt the need to overcome the imbalance between boys and girls. However, 2 of these 4 teachers declared that

they had not done something special to make the situation better. Of these two teachers, the female teacher made her explanation as follows:

> Teacher 9: [eliminating] this imbalance, of course, is a need; there should be a balance.

When it was asked to the male teacher who thought that girls are more interested in the lessons whether he took any precautions to increase the interest of boys in the lesson, he said:

> Teacher 8: Of course, generally speaking, in order to attract their attention, to motivate them, I give some information in terms of the importance of the lesson, I mean the topic I am going to introduce today. Of course, we feel the need. I say "sit still and listen, don't disturb me." I think I have some special strategies.

Upon his explanation above, when the teacher was asked again whether he did what he had just said in order to increase the interest of male students, he said:

> Teacher 8: Nothing specially different. I just address whole class.

In a sum, 4 of 6 teachers declared that they had not done something about the imbalance between boys and girls (Table 4.30). For example, a male teacher who stated that he did not feel the need to eliminate this imbalance said that it was impossible for him to do something about this issue:

> Teacher 7: I cannot do this. In my opinion, this result from, I mean, let's say genetics, their nature. Maybe men have a little bit higher IQs; it is possible, I think this way. Are our women unsuccessful? No, they are successful. Recently women have invaded the public office positions. Here there are 10 men but 30 women. However, still I can say that in order for a woman to reach somewhere she has to do a lot. Let's put this way, in our society this inferiority regarding women has been abolished later on. This inferiority sources from the thirst for success and our patriarchal family system.

Table 4.30 Teachers' attitude towards the unbalance between girls and boys

Attitude	Frequency	Explanation	Frequency
I feel the need to overcome the imbalance between boys and girls,	4	I wouldn't do something special	2
		I talk to the parents	1
		I give priority to girls	1
I do not feel the need to overcome the imbalance between boys and girls	2	I wouldn't do anything special because this is natural	2

When taken a general look at the issue of student gender and science, although both in the curriculum and in the statements of most of the teachers it is stated that there is difference between female and male students' interest, attitude and success in science, it is observed that what is intended to tell by 'difference' is not the same. In the curriculum, difference is taken as originating completely from the society, whereas the teachers emphasized natural and biological differences as well. Nevertheless, it is found out that some characteristics that some of the teachers attributed to nature are again society-based. Although in the curriculum it is mentioned that the difference works against girls, majority of the teachers pointed out that especially social limitations have a positive effect on girls which leads to an increase in their interest and success in the lessons. For these reasons, it is seen that there is little alignment between the curriculum and the teachers' opinions. In addition to this, in terms of the struggle against the difference, it seems that the teachers almost never apply the suggestions given in the curriculum.

4.7.3 Gifted Students in Science

In the curriculum it is stated that some students show great performance in one or more areas with their special skills and these gifted students' higher levels of creativeness, conceptual understandings and skills are different from the other students'. It is also stated that when the curriculum is employed in a flexible ways, the gifted students can speed up and develop. Moreover, some suggestions in order to consider the gifted students are listed in the curriculum (MNE, 2006, p.57) as follows:

- Students' special skills in science should be valued by their peers, teachers and parents,
- They should develop their knowledge and skills at their own pace through alternative learning activities that push their limits,
- They should attend learning activities that promote their high level thinking skills such as analysis, synthesis, and evaluation,

- They should learn through open ended activities that promote imagination, creativity and critical thinking.

Only 3 of 9 teachers declared that they have had some gifted students in their classes. However, remaining 6 of 9 teachers stated that they did not have any gifted students because being very intelligent, making inquiry, getting full score in the exams and having some special abilities are not considered enough to be gifted. One of the teachers with 7 years of his 15 years experience in science teaching stated his opinions regarding gifted students as follows:

> Teacher 2: There hasn't been any student that I said "this student is really gifted." There have been very intelligent students. There have been students that got 100 out of 100 but can this be included in this issue? I don't think I've seen any gifted students.

A teacher with 30 years of experience made the following explanation:

> Teacher 3: I haven't seen any students who had very very special skills because I have been working at ordinary schools.

Characteristics of gifted students which were declared by the teachers are listed in Table 4.31.

Table 4.31 Teacher's descriptions of characteristics of gifted students

Have you ever had a gifted student?	Frequency	Descriptions	Frequency
No	6	having very special abilities	4
		highly intelligent	1
		high performance in different fields	1
Yes	3	highly intelligent	2
		getting top scores in the exams	1
		high performance in different fields	1

When asked whether they have had a gifted student or not, 8 of 9 teachers declared that gifted students should be educated by different educational approaches from other students. Only one teacher who has more experience in secondary education than others stated that educating by different educational

approaches from other students affects gifted students' developmental process negatively. He answered the question of "Should the gifted student be educated by using different educational approaches?" as in the following quote:

> Teacher 4: In my opinion, [gifted students] shouldn't be approached [by using different educational approaches]. Some people suggest this, but psychological development of that child is also important. I mean the student is number one, then put him/her here; however, tomorrow when he becomes unsuccessful, his life will be spoilt.

Although almost all the teachers approved of educating these gifted students by using different educational approaches, only 2 of them stated that these gifted students should be put into a separate class since their special skills would atrophy in regular classrooms. Of these 2 teachers, the one with 30 years of experience stated during the interview that she approves of putting students into different classes according to their levels and she had tried to put this plan into force:

> Teacher 6: I already talked to the school principle. I said we should put highly intelligent students in one class, students with an average level of intelligence into another class and the ones with low intelligence in another class. The principle said this is against the law. I said it is not possible this way in Turkey. What happens now is that the highly intelligent student starts to resemble to the student with low intelligence. I've experienced this. This is the result of many years of experience; students with high intelligence go down, not up. These should be separated from each other.

Another 2 teachers declared that they approve of dealing with gifted students in a special way outside the class rather than inside the class; otherwise, they said that there might be an unfair situation for other students. Here are the representative quotes from these two teachers as an answer to the question of "Do you think gifted students should be educated differently in the class using different educational strategies and different methods?":

> Teacher 2: Not in the class but outside the class I might guide them differently; however, I wouldn't prefer to adopt any different approaches which would make the student special in the class.

> Teacher 7: When you adopt different methods or when you give priority to one of them, you are usurping others' rights. I think this way. Whatever the curriculum is, you ought to

> apply it but of course there will be some extras that you should do; I mean, not in the class, outside the class you will do it.

The tendency of most of the teachers regarding what different approaches they would adopt while dealing with gifted students was towards supporting those students. When they were asked how that support would be, the teachers preferred to explain their view without going into the details. The reason for these superficial explanations might be the fact that most of them thought that they did not have any experience with gifted students yet. One of the teachers who said that she did not have any gifted students answered the question asking how she would support gifted students as follows:

> Teacher 1: If he/she needs economical support, I would provide it. For example, this is not something we don't do, if it is necessary to support the student economically, we do it. Or if there is something problematic with the family, the support would be eliminating that problem.

In addition to this, it is observed that the teachers who said that they had gifted students avoided providing detailed examples. These teachers declared that it is necessary to behave each student according to his/her needs; however, they said that, in reality, for some practical reasons, they could not behave that way so much. One of the teachers who said he had a gifted student answered the question of "Have you ever behaved your gifted students differently?" as follows:

> Teacher 9: To be honest, I cannot say that I behave that way very frequently, but this year in 8th grade I assigned a task to a student with special skills like making models. It was off the topic. Therefore, I cannot say that I do something special so much… Of course, you should behave each and every student depending on their own specialties, but it is very difficult to address each and every student separately.

The teachers' all discourses regarding what they could do for gifted students are given in Table 4.32.

Table 4.32 Teachers' discourses regarding gifted students

What kind of educational approach do you use for gifted students?	Frequency
I would use different educational strategies suitable for them	3
I would support them to eliminate familial problems if there are any	1
I would provide opportunities for them to use their special skills in the lessons	1
I would ask broader questions suitable for their level	1
If necessary, I would broaden the scope of the lesson	1
If necessary, I would provide economical support	1
I would assign them homework within their area of interest	1
I would assign them special tasks in the class and they would help their friends	1
I would join the competitions with them, help them and prepare them	1

When we take a general look, it seems that what the teachers understand from 'gifted' is having very special skills and being highly intelligent. In addition to this, since the teachers did not consider being very intelligent, making inquiry, getting top scores in the exams or having some special abilities as being gifted, it is understood that most of the teachers perceived giftedness as a very rare characteristic. Just like it is mentioned in the curriculum, although the teachers emphasized that there is a need to adopt different educational approaches for gifted students, the examples they gave regarding these different educational approaches were relatively superficial, pointing to a limited alignment with the suggestions mentioned in the curriculum. This situation results from the fact that most of the teachers think that they had never had a gifted student and thus they did not have any experience that would vary their examples. A small number of teachers who said that they had gifted students complained that it is really very difficult to meet the needs of each and every student; and therefore, they stated that they could not put the necessary arrangements into force.

4.7.4 Students with Special Needs and Science

In the curriculum it is stated that some students may have slower developmental process than the others. In addition to this, it is stated that those students with special needs in learning may need more time, exercises, application and learning experiences in order to gain the concepts and skills. Therefore, in the curriculum,

it is stated that teachers, families and the peers should work together while planning and conducting the schedules for considering the learning needs of the students with special needs in learning. Moreover, students with special needs in learning should be encouraged to participate in the learning activities. In addition, suitable materials, sources and technologies should be used for those students (MNE, 2006, p.58).

All teachers declared that they have had many students with special needs in learning. When the teachers' opinions about students with special needs in learning are analyzed, it is seen that the perceptions of the all teachers related with the issue had a particular extremity because the perceptions were oriented by the students with very low learning capacity. In addition to this, 5 of 9 teachers directly used the term 'integrated students' in order to define students with special needs in learning. Moreover, although all 9 teachers argued that there should be different educational approaches for the students with special needs in learning, most of the explanations listed in Table 4.33 related with different educational approaches were superficial and were full of complaints about the difficulties in the issue.

Table 4.33 Different educational strategies teachers adopt for students with special needs

	Frequency
We[10] use different (simple) assessment and evaluation techniques	4
We try to make them feel themselves valuable and increase their self-esteem	2
We behave in a more tolerant way	2
We get into contact with their families as well	1
We try to help them access knowledge at a lower level	1
We focus on visual education	1
We try to spend more time with them	1
We study with them one to one outside the class	1
We applied a separate program within the class	1

[10] The teachers frequently preferred to use the personal pronoun "we" instead of "I" while talking about this topic. The reason for this is the fact that the teachers included themselves, other teachers and experts in the pronoun "we". This shows that they follow the policy of their institution regarding students with special needs.

The complaints, all of which are listed in Table 4.34, can be brought together especially under two topics which are limited time in order to conduct special schedules and the negative effects which students with special needs in learning face in the classrooms. A representative quote from the answer of the question of "Do you adopt any special educational strategies for the students with special needs in learning?" is given below:

> Teacher 8: Yes, we adopted in the past, but the situation is from time to time problematic for both the teacher and the student…The student feels as if he/she is isolated from his friends, as if he/she is a second-class person, and sits still feeling inferior. The teacher is having difficulty to deal with one or two students leaving the others for a while in a limited class hour. Hard. Problematic.

Table 4.34 Teachers' complaints regarding how to overcome the needs of students with special needs in learning

Complaint	Frequency
We need to keep up with the curriculum so we cannot spend enough time with them	6
These kids cannot adapt to the rest of the class, they get lost and feel inferior	3

In fact, 6 of 9 teachers declared that they could not conduct any special educational approaches for those students in the classrooms. For example, 2 female teachers answered the same question above as follows:

> Teacher 1: Yes there are [those kind of students] but I cannot do anything, I couldn't do. Because you know we have a class of 40 students. We have a predetermined curriculum and we have to keep up with that. We have SBS and what will I do know? Leave everything aside, how come? I cannot accept something like this.

> Teacher 9: Of they should be approached differently. But do I do this? I'm not sure. They should be given something specific to them; 5 minutes or 10 maybe should be allocated only to them.

Only 2 male teachers with a teaching experience of over 30 years seemed to spend a real effort for the students with special needs in learning. They answered the same question of "Do you adopt any special educational strategies for the students with special needs in learning?" as follows:

> Teacher 4: We conduct education differently. For example, psychologists write reports to that student. The student comes to our psychological counseling service. We conduct a separate program with that student. We try to keep up with the program we prepared as much as possible and we don't see that kid the same with the others. Both in testing and evaluation and in exam questions we consider that student different from others, and we get into contact with his/her family.

> Teacher 6: Yes, I do [adopt]. I say to them "make a presentation." In fact, we had such kind of student and his self-esteem increased. He said "Miss, can I present the topics?" And then he did it quite successfully. He speaks 10 words or 20; I give him that chance. They already came to the class in order to adapt to it. He is one of our kids as well. I ask them simple questions within their own capacity. If he learns something then he gets pleasure out of it, and if he gets pleasure, then he becomes more adaptable day by day. We have one disabled student, but you would think that he is a normal student. Sometimes they are better than the normal ones.

In addition, except from 2 male teachers with teaching experience for 30 years, all teachers seemed to argue that those students should be educated in special classes by separating them from other students, in fact, 5 of whom directly declared that.

When we take a general look, it is seen that all the teachers had students with special needs in learning throughout their occupational career. It is seen that what the teachers understood from the curriculum's statement of 'using appropriate equipment and technology,' which is not explained in detail in the curriculum itself as well, is making testing and evaluation materials easy for the students with special needs in learning. Moreover, the teachers declared that they consider themselves unsatisfactory in terms of encouraging these students to attend learning activities in the class as stated in the curriculum. When these are brought together with the fact that most of the teachers did not mentioned cooperation with both families and peers regarding these students, it is clear that the perceptions of the teachers are not aligned with the ideas as stated in the curriculum.

4.8 The Organizational Structure of the Curriculum/Seven Learning Areas

In the curriculum, 7 learning areas, all of which are for establishing scientific and technological literacy, are listed (MNE, 2006, p.59). They are separated into 2 main groups according to whether they are presented as units or not. 4 learning areas that are presented as units, which are Living Organisms and Life, Matter and Change, Physical Phenomena and Earth and Universe, come together under the topic "knowledge". In addition to this, the remaining three, which are Science-Technology-Society-Environment Relationships (STSE), Science Process Skills (SPS) and Attitudes and Values (AV), are not presented as units because it is stated that predicted skills from these three learning areas are acquired through very long processes (MNE, 2006, p.59). In this section, these 7 learning areas are considered by including the perceptions of teachers related with the issue. All the information from the teachers was collected through the game activity named *The Meal for a Year.*[11] This section is separated into five topics, which are Knowledge/Science Content, STSE in the Curriculum, SPS in the Curriculum, AV in the Curriculum and the interrelationship between learning areas.

4.8.1 Knowledge/Science Content in the Curriculum

In the curriculum, it is stated that one of the aim of the curriculum is making the students gain basic concepts and understandings in order to learn, understand and explain the world, life and humankind (MNE, 2006, p.60). Those basic concepts and understandings were arranged by the selected units from 4 learning areas and considering the spiral approaches. In the curriculum, it is accepted that by the learning of main concepts presented in 4 learning areas, which are Living Organisms and Life, Matter and Change, Physical Phenomenon and Earth and

[11] In this game activity, the teachers were asked to match 4 types of bread and each of 3 ingredients with one learning area and prepare 4 different sandwiches. In this game activity types of bread are supposed to symbolize 4 learning areas that are presented as units and the ingredients are supposed to symbolize 3 learning areas that are not presented as units. It is necessary to state at this point that majority of the teachers felt the need to change the pairs, one learning area and one type of bread or ingredient, for more than once during the activity. One of the reasons for this situation is that the teachers felt themselves more comfortable when expressing their opinions and had the opportunity to think deeper while concentrating on the game, as a result of which they formed awareness.

Universe, the students will internalize the objectives of STSE, SPS and AV in a deeper way. In addition to this, there are some general explanations listed in Table 4.35 for those 4 learning areas (MNE, 2006, p.60).

Table 4.35 General objectives of four learning areas for the students stated in the curriculum

Learning areas for knowledge	Student
Living Organisms and Life	analyzes and learns unique characteristics of various living organisms, variety in living organisms, reproduction, growth, development and change, the interaction between living organisms and their environment and among each other
Matter and Change	discovers and learns the matter, properties of the matter and changes happening in the matter
Physical Phenomena	analyzes different types of energy such as light, sound, electricity, concepts of movement and force, and the qualities and interactions of these
Earth and Universe	analyzes and learns characteristics and the structure of the world and the universe and changes happening in these

From the perspective of the teachers, it is clear that a majority of the teachers did not recognize the names of learning areas stated in the curriculum. Although the teachers tried to explain 4 learning areas containing knowledge firstly by giving the titles of the units, later on they could not match these titles with learning areas. Table 4.36 presents the teachers' explanations of the learning areas of scientific knowledge. As a result, during the interviews the teachers avoided even giving the titles of the units while explaining learning areas and continued their speech by providing quite superficial information, all of which is listed in Table 4.38. For example, one of the teachers who had received an in-service education on the curriculum answered the question of "Do you think that these seven learning areas stated in the curriculum are satisfactory for Science and Technology lesson?" as below:

> Teacher 7: All of them are necessary I guess; there are the necessary ones here, this one for example, Matter and Change, isn't it possible to include Physical Phenomena in this one? Instead of it let's put another one, for example, Movement, Force and Energy, isn't it

possible to include it? OK, we said Living Organisms and Life, this is applicable for a year maybe, but, this one is OK, this one is as well, it might be a basic topic. Matter and Change might be a basic topic as well. Is Movement and Force in Earth and the Universe? Yes, it is in it, true… [after thinking for a while] … It is not in Earth and the Universe I guess… [again after thinking for a while] … It is enough I guess if we can include Movement and Force in Earth and the Universe. Are these all our learning areas?

Another teacher who had received in-service education on the program made the explanation below before matching the learning areas stated in the curriculum with the food ingredient:

Teacher 9: I believe that I apply them in my learning outcomes but now I am confused about which one is which one… I think the names of what we did in the past have changed. We do these from time to time, but now I confused the names of them; this is the reason.

Table 4.36 Teacher's explanations related with four learning areas

Learning areas for knowledge	Teachers' explanations	Frequency
Living Organisms and Life	How a living organism comes into existence, what kind of structures living organisms have, how many types of living organisms we have, still how they are classified, how they reproduce, what we have as human beings, what systems or organs we have	1
	It is a topic directly concerns human beings	1
	Systems	1
Matter and Change	Chemical phenomena	2
	Interrelationship between matters, transformation that occur in the matter	2
	structural characteristics of the matter	1
Physical Phenomena	unchanging phenomena such as three states of water	1
	happenings that occur continuously around us	1
	Physical changes	1
	How matters transform around us	1
Earth and the Universe	Formation of the Earth, beginning of life	1
	Changes happening in the Universe	1
	Movement and Force take place in the Universe	1
	Learning the place he/she lives and learning where it is	1

Table 4.37 Teachers' opinions about the qualifications of the 4 learning areas

Learning areas for knowledge	Teachers' views about qualifications of learning areas	Frequency
Living Organisms and Life	a learning area of top priority	1
	the most important topic	1
	arouses curiosity	1
	a basic topic	1
Matter and Change	has a very broad scope	1
	arouses curiosity	1
	a basic topic	1
Physical Phenomena	an easy topic	1
	has a limited scope	1
Earth and the Universe	a simple topic	1
	takes time most	1
	arouses curiosity	1
	difficult for students	1

4.8.2 Science - Technology - Society - Environment Relationships (STSE) in the Curriculum

In the curriculum it is stated that science radically has changed and broadened our understanding of the Earth, space, mechanism of human body and the matter, whereas technology has had a revolutionary impact on our way of communication and has affected our lives to a great extent through the discoveries in medicine and materials. Therefore, in the curriculum it is emphasized that students should views science and technology within this broad context and as a result of this, it is of great importance that they should learn to make connections between what they have learnt regarding science and technology and the world outside of the school (MNE, 2006, p.61). There is a figure in the curriculum in order to explain relationships among Science-Technology-Society-Environment (Figure 4.4). The learning outcomes regarding STSE are given in the curriculum (MNE, 2006, p.63) one by one and a short summary of them is given in Table 4.38.

Table 4.38 The summary of the STSE learning outcomes presented in the curriculum

Students should:
understand the nature of science and technology, the relationship between them, and the interactions with the society and the environment,
employ equipment, processes and strategies in the issues regarding science and technology,
develop the necessary knowledge and skills in order to form critical and responsible attitudes towards innovations,
understand the development of scientific discovery within various individual and social contents, transformation of technology, changes occurring in people's knowledge and understanding from past to present,
become aware of the various values, perspectives and decisions in issues regarding science and technology and behave in a responsible way,
research scientific processes and technological solutions by questioning,
develop responsible and creative solutions using science and technology.

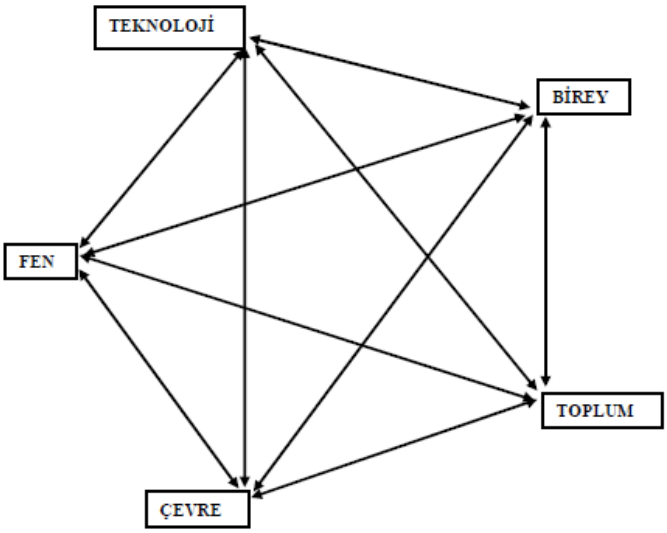

Figure 4.4 Diamond model of science-technology-society-environment-individual relationships

It is understood that most of the teachers view STSE as a natural result of science and technology lessons because of its scope rather than as a learning area. It is observed that during their talk the teachers felt the need to give examples but they

avoided going into the details of STSE learning outcomes, listed in Table 4.39. The explanations of 2 teachers regarding STSE are given below:

> Teacher 5: Science and technology is already related with all topics; the topics we teach are included in science and technology this way. By mentioning these topics interest [towards STSE] might be aroused in students.

> Teacher 6: Science, technology, society and environment are already the main ones; everything is included in these. It is science, the Earth and the Universe are a part of it. If science and technology do not develop, the society doesn't as well. When science and technology develop, the environment also develops.

Table 4.39 Teachers' opinions about STSE learning outcomes

Students:	Frequency
develop environmental awareness.	3
understand the effects of scientific and technological developments on the society and environment	2
understand the reason why they come into existence	1
apply in their daily lives what they have learnt in science and technology	1
contribute to their own society	1
adapt more easily to the environment they live in	1

4.8.3 Science Process Skills in the Curriculum (SPS)

In the curriculum, it is stated that the aim is not only to convey the accumulated knowledge to students, but also to educate individuals who conduct research, ask question, are able to make associations between their daily lives and science topics, employ scientific methods to solve the problems they face in their lives, and see the world through the perspective of a scientist (MNE, 2006, p.64). It is fundamental in the curriculum to make students acquire the skills called scientific process skills in order to teach them the ways and methods to conduct a scientific study. In addition to this, in the curriculum, there is a table listing science process skills (Table 4.40).

Table 4.40 Science process skills of 6th, 7th and 8th grade level presented in the curriculum

Planning and Starting	Observation
	Comparison-Classification
	Inference
	Prediction
	Estimation
	Determining the variables
Application	Formulating hypothesis
	Designing Experiment
	Knowing and using experiment materials and equipment
	Setting up an experiment apparatus
	Describing relationship between variables
	Functional description
	Testing
	Information and data gathering
	Recording the data
Analysis and Result	Data processing and modeling
	Interpretation and Result
	Presentation

Although at first it is observed that the teachers were not familiar with SPS, after they thought on it for a while they relatively went into the details of SPS learning outcomes in their examples (Table 4.41). In addition to this, some of the teachers stated that they viewed SPS not as a learning area but as a method of study. The explanations of two teachers who had received in-service training on the curriculum regarding why SPS are given in the curriculum are provided below:

> Teacher 7: Scientific Process Skills are given in order to show that we are in an era of continuous change and thus [these changes] are achieved through scientific research, accessing new scientific data and improving them. Therefore, to show that science is a source for the nature of science and to make students learn how to improve it.

> Teacher 8: It is a method of study. You should teach them how to conduct a scientific study.

Table 4.41 Teachers' opinions about SPS learning outcomes

Students:	Frequency
learn how to conduct a scientific study	5
learn how to think scientifically	3
learn how to find solutions to the problems they face	2
learn the importance of scientific research and scientific data	1
keep up with technology	1

4.8.4 Attitudes and Values in the Curriculum (AV)

In the curriculum it is mentioned that it is not enough for students to achieve only learning outputs such as knowledge, understanding and skills in order to be educated as a scientifically and technologically literate person. In order to achieve scientific and technological literacy, students should also develop some specific scientific attitudes and values (MNE, 2006, p.65). In addition to this, it is mentioned that teachers through functioning themselves as role models should encourage their students to develop behavior models called attitudes. In other words, attitudes are not achieved in the same way as skills and knowledge. The attitudes and values mentioned in the curriculum consist of five stages which are, from the easiest one to the most difficult, students' willing perception of the events happening around them, reacting in a positive way depending on the situation, developing positive values, organizing these values in their selves, and finally, adopting a life style which includes positive attitudes and values (MNE, 2006, p.65).

AV is the learning area is the most difficult one for the teachers to explain. It is observed that most of the teachers during the interview tended to explain other cards instead of the AV card, putting this one on the table back and trying to get another one. Almost all the teachers associated AV only and directly with social values and thus thought that it does not contain learning outputs of great importance regarding science and technology lessons (Table 4.42). For example, the explanation of one of the teachers is given below:

> Teacher 5: These will develop in time; they don't seem to be as important in my opinion as the others [pointing at other learning areas]. These seem to be simple things to which additions can be made… This one [AV] is formed as a result of these [other learning areas]. If the student is curious about it, has an interest and does some research on those topics, then this transforms into values. Something is developed there, I mean knowledge is developed.

On the other hand, only 1 teacher was able to explain the relationship of AV with other learning areas stated in the curriculum, and while doing this, he tried to emphasize the importance of scientific attitudes and values besides social values.

> Teacher 8: Changes in the matter, both physical and chemical, are the phenomena that affect our lives positively and negatively, and what would be our attitudes, behavior, values in this situation? When we look from this perspective, it is related to science and technology I think.

Table 4.42 Teachers' opinions about AV learning outcomes

Students	Frequency
learn social rules/values	4
develop appropriate attitudes and values	4
develop scientific attitudes and values	1

4.8.5 Aims of Learning Areas and the Relationship among Them

In the curriculum, 7 learning areas all of which are for establishing scientific and technological literacy are listed. In order to accomplish this general aim, in the curriculum, learning areas are separated into 2 main groups according to whether they are presented with units or not (MNE, 2006, p.60). 4 learning areas are presented as the units which are Living Organisms and Life, Matter and Change, Physical Phenomenon and Earth and Universe are came together in the topic "knowledge". In addition to this, remaining three which are Science-Technology-Society-Environment Relationships (STSE), Science Process Skills (SPS) and Attitudes and Values (AV) are not presented as units because it is stated that predicted skills from these three learning areas are acquired by very long processes. All the learning outcomes of these 3 learning areas are blended with the objectives and activities in units which come from the remaining 4 learning areas

related with knowledge (MNE, 2006, p.59). In the curriculum there is a figure which describes how the objectivities of STSE, SPS and AV are weaving with objectives of the units of knowledge (Figure 4.5).

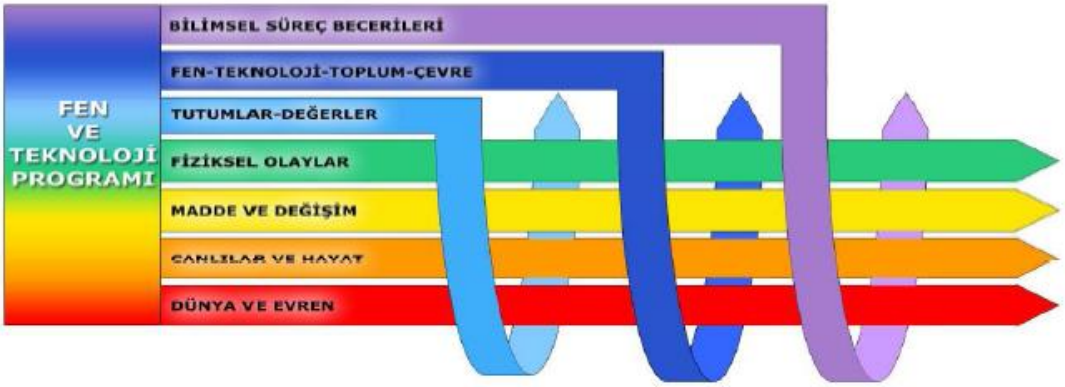

Figure 4.5 Relationships among seven learning Areas

In "Unit Organization" section of the curriculum (MNE, 2006, p.82-379), learning outcomes regarding learning areas of Living Organisms and Life, Matter and Change, Physical Phenomena, The Earth and the Universe are organized according to topic and concept order and given as lists. Learning outputs regarding learning areas of STSE, SPS and AV are referred with their numbers in the units' learning outputs when needed. By this way, the learning outputs of the units and learning outputs of STSE, SPS and AV become closely intertwined (MNE, 2006, p.59).

When the teachers were asked the reason of why these 7 learning areas, but not some other learning areas, are brought together for science and technology lesson, the teachers firstly and frequently emphasized the knowledge aspect of learning areas by saying that learning areas cover the topics of the lessons and necessary information regarding our daily lives. The teachers generally pointed out that people who are competent in these learning areas would become beneficial both for themselves and the society. Table 4.43 shows the teachers' views about why these 7 learning areas are brought together in the curriculum:

Table 4.43 Teachers' explanations about why seven learning areas brought together in the curriculum

Because:	Frequency
to bring together the topics that cover science and technology topics	3
to bring together the topics from our daily lives that are necessary to know	3
to educate individuals who know what they want and will do	3
to educate individuals that are beneficial to the society	3
to educate individuals that think scientifically	2
to educate individuals who are sensitive to the environment	2
to educate individuals who can access to true knowledge and who can transform what they have learnt into skills	2
to educate happy individuals	2

When we take a look at the interrelationship between learning areas, although the teachers could not remember the names of the learning areas presented in the curriculum, they were able to separate learning areas such as STSE, SPS and AV from 4 other learning areas which are about knowledge and they categorized these areas among themselves. Most of the teachers, in the later parts of the activity, realized that the Earth and the Universe, Living Organisms and Life and Matter and Change are presented as units, whereas SPS is one of the learning areas that is not presented as a unit, and as a result, they made better connections between these learning areas and the others. On the other hand, majority of the teachers thought that the scope of Physical Phenomena is broader than most of the other learning areas and did not put it in the same category with the learning areas which are presented as units. Interestingly, the fact that the teachers thought that STSE has a broader scope resulted in the fact that this learning area was more frequently put in the same category with the learning areas that are not presented as units. That the teachers associated AV only with society's value judgments again resulted in the fact that AV was placed in the same category with knowledge learning areas by half of the teachers. The teachers' opinions about the structure of the curriculum which provides the relationship of learning areas with each other were given in Table 4.44 with their explanations in Table 4.45.

Table 4.44 Teachers' matching of learning area-ingredient

Bread: Can be given alone[12]	Frequency	Ingredient: Cannot be given alone / should be inside of 4 learning areas	Frequency
Earth and Universe	8	Scientific Process Skills	7
Living Organisms and Life	7	Attitudes and Values	5
Matter and Change	6	Physical Phenomena	5
STSE	5	STSE	4
Physical Phenomena	4	Matter and Change	3
Attitudes and Values	4	Living Organisms and Life	2
Scientific Process Skills	2	Earth and the Universe	1

Table 4.45 Teachers' reasons for matching of learning area-ingredient

These four learning areas can be given alone because	Frequency	These three learning areas cannot be given alone in the lesson / should be inside of 4 learning areas because	Frequency
it provides a platform for other three learning areas	4	it can be placed within other four learning areas	4
has a limited scope	3	it has a broad scope	3
its topics change in time	1	its topics do not change in time	1
it includes biology topic	1	it includes the topics of physics and chemistry	1

When we take a general look, it is observed that the teachers gave priority to the learning areas that are connected with knowledge rather than STSE, SPS and AV because the teachers claimed that the main aim of learning areas is primarily to cover the content of science and technology. In addition to this, it is observed that they recognized unit names rather than learning areas. The teachers firstly gave examples from unit titles in order to explain learning areas, but they had difficulty with matching the units with learning areas. Still it is clear that the perceptions of the teachers regarding learning areas were in alignment with the curriculum to a certain extent because most of the teachers explained the interrelationship of learning areas in consistency with the organizational structure stated in the curriculum. On the other hand, it is observed that most of the teachers did not

[12] In the curriculum, it is stated that 4 learning areas, which are Earth and Universe, Living Organisms and Life, Matter and Change, Physical Phenomena, can be given alone in the lesson through units. However, in the curriculum it is stated that 3 learning areas, which are Scientific Process Skills, Attitudes and Values and STSE, cannot be given alone and should be within other four learning areas.

make sense of the learning areas of STSE, AV and Physical Phenomena satisfactorily and in accordance with the curriculum.

4.9 Implementers of the Curriculum

In the curriculum it is stated that teachers, inspectors, course book writers, course book evaluation experts, officials responsible for the choice of course books and parents of the students are together thought to be the implementers of the curriculum (MNE, 2006, p.66). Since the interviews were conducted with the teachers and teachers have more chance to get into contact with both inspectors and parents, in this section the teachers' opinions about teachers, inspectors and parents will be focused on. [13]

4.9.1 Teachers

When the curriculum is scanned thoroughly from the beginning to the end, it is seen that there are some certain definitions, which are listed in Table 4.46, regarding the duty of teachers although the tendency is towards making suggestions rather than making certain statements related to the role of the teacher. Furthermore, in the curriculum there are associations such as counselor, coach and role model regarding the teacher.

Table 4.46 The duty of teachers presented in the curriculum

Teacher:
determines his/her own learning strategy by himself/herself
uses appropriate resource, equipment and technology
facilitates learning by guiding students
provides opportunities for students to express themselves
motivates students in learning activities
becomes a role model for students with his/her behaviours

[13] In order to collect information about the issue, basically 3 game activities were employed. In the *School Alive* activity, generally the teachers' perceptions of the roles of teachers, inspectors and parents in education system were focused. In the *Education Balloon* game, the teachers' self-perceptions of teachers' degree of importance in learning and teaching process were focused on. Moreover, in the *Free Throw* game, the teachers' opinions about professional competence areas were focused on.

In addition to this, the suggestions concerning the role of the teacher in teaching-learning process (MNE, 2006, p.14) is given in Table 4.47.

Table 4.47 Suggestions for teachers given by the curriculum

A teacher should:
form a supportive and appropriate environment to learn science,
take students' individual differences such as motivation, interest, ability and learning styles into consideration,
be searching continuously in order to reveal students' previous knowledge and understanding regarding the topic of the lesson and make them aware of their own thoughts,
provide in-class and out-of-class learning environment, methods and activities and be the leader in implementation by diagnosing students' weaknesses and strengths (education trainer),
encourage students to think on, discuss and evaluate suggested alternative ideas,
lead discussions and activities in a way that students themselves can construct knowledge and understandings which are accepted as scientific as much as possible,
provide students with the opportunity to use new concepts that they have constructed in different situations,
encourage students to improve their ability to form hypotheses and make alternative comments in order to explain a phenomenon,
make students feel the desire he/she feels towards studying science and technology topics and learning and become "an admired role model" for them.

Moreover, in the curriculum it is emphasized that the teacher should be in cooperation with parents when needed.

When the interviews done with the teachers were analyzed, it is seen that they did not avoid making certain statements regarding teacher's role in teaching and learning process (Table 4.48). In fact, the teachers preferred to talk about the opinion that teachers are in a way an indispensable component of teaching and education rather than emphasizing the characteristics of a good teacher.

Table 4.48 Teachers' perceptions of teaching profession

Perception of Teachers	Frequency
Nobody can replace his/her shoes	5
With his/her content knowledge, he/she is already as equipped as the course book	4
He/she prepares his/her curriculum if needed	3
He/she cannot do his job if there is no school	3
He/she gives education as well as teaching	3
Students cannot do anything without a teacher	2
He/she controls students	2
A teacher is a teacher everywhere	2
He/she is a guide	2
The most important competency of him/her is his/her content knowledge	1
A teacher can understand best what a student lacks	1
If there is not a curriculum, the teacher cannot do his/her job.	1
A teacher him/herself is a school	1
He/she is the window of the society	1
He/she is a captain	1
A teacher is the most effective person in the class	1
The success of a teacher can be measured by students' level of learning	1
There cannot be any education without teachers	1

5 of 9 teachers, when they were asked to take the figure symbolizing the teacher out of the picture and to fill the space left with other components (principal, parents, inspector, society) in the *School Alive* game, emphasized that nobody can replace the teacher's shoes and that all the other components cannot do a teacher's job properly even when they all come together since some of their qualities are aligned with the role of the teacher to a limited extent. In addition to this, 6 of 9 teachers left throwing the weight symbolizing the teacher in order to save the balloon to the very end. These teachers generally prioritized the teacher rather than the course book, curriculum or school saying that a teacher can write his/her own course book, he/she can prepare his/her curriculum and he/she is a teacher in any place. Moreover, the teachers claimed that teachers should be in cooperation with parents by placing the figures symbolizing the teacher, parents and students

very close to each other especially in the *School Alive* activity. The teachers' all perceptions of the qualities of a good teacher are listed in Table 4.49.

Table 4.49 Teachers' perceptions of the qualities of a good teacher

A good teacher should:	Frequency
be in cooperation with parents	4
know the environment, society and family the student lives in	2
know how to approach students	2
motivate students and reveal their abilities	2
have a broad perspective	1
master practical knowledge in daily life	1
be a good role model for students	1
be smart and intelligent	1
lead the society	1
have a body of knowledge superior to that of students	1
convey his/her own experiences to students	1
be in cooperation with the society	1

Furthermore, it is understood that the teachers most frequently use knowledge of students and content knowledge and least frequently use context knowledge, curriculum mastery and knowledge of assessment and evaluation techniques in teaching-learning process[14] (Table 4.50 and Table 4.51).

Table 4.50 First three areas of competence of teachers in terms of their frequency of use

Preferred areas of competence	Frequency
Knowledge of students	9
Content knowledge	8
Knowledge of teaching strategies	3
Pedagogical content knowledge	3
Assessment and evaluation	2
Mastery of the curriculum	2

[14] In the *Free Throw* game, the teachers had to make a priority order among the areas of competence in order to diagnose and overcome misconceptions and while doing this, they expressed their opinions about the areas of competence and told how often they generally use these areas in learning-teaching process.

Table 4.51 Last three areas of competence of teachers in terms of their frequency of use

Ignored areas of competence	Frequency
Context knowledge	9
Assessment and evaluation	7
Mastery of the curriculum	7
Pedagogical content knowledge	3
Knowledge of teaching strategies	1

Moreover, it is important to mention that the teachers could not remember 'context knowledge' and after they were provided with an explanation regarding context knowledge, most of the teachers accepted that this one is also an important area of competence, but almost none of the teachers made a direct explanation on this competence during the activity. The teachers' explanations regarding all areas of competence are listed in Table 4.52.

Table 4.52 Teachers' explanations regarding all areas of competence

Area of Competence	With the help of this area of competence	Frequency
Content Knowledge	I can have a body of knowledge and I can convey true knowledge	7
	I can make assessment and evaluation more properly	2
	I can use other areas of competence as well	1
Context Knowledge	I can make associations between society, environment and parents regarding students	1
Knowledge of Teaching Strategies	I can determine a more appropriate strategy for both the topic and students	6
	I can determine in which way learning will take place regarding the topic	1
Knowledge of Students	I can understand which student has difficulties in which topic	3
	I can determine the appropriate teaching strategy for the student	3
	I can correct student mistakes using their interest areas	1
	I can more easily see student mistakes	1
	I can understand the source of student mistakes	1
	I can determine the assessment and evaluation method suitable for the student	1
Assessment and Evaluation	I can diagnose students' mistakes regarding the topic	7
	I can understand at what level students comprehend the topic	2
	I can provide students with an environment where they can correct their own mistakes	2
Pedagogical Content Knowledge	I can determine how to approach the student	4
	I can determine the source of the problems during the student's learning process	2
	I can understand psychological approaches of the student	1
	I can know the student	1
Mastery of the Curriculum	I can correct my mistakes by revising the advice given in the curriculum regarding the topic and apply new teaching strategies.	3
	I can decide whether the level of the topic is appropriate for the student	1

It is interesting that the teachers emphasized the importance of the role of the teacher in learning-teaching process rather than emphasizing the importance of teachers' areas of competence. Therefore, it is seen that there is a partial parallelism between the teachers' perceptions of the profession of teaching and the duties attributed to teachers and suggestions in the curriculum. In addition to this, it is clear that the teachers trust content knowledge and knowledge of students more and that they occasionally refer to the curriculum when they face with problems arising during learning-teaching process.

4.9.2 Parents

In the curriculum it is stated that students perform better at school when parents take place in their children's education process and thus it is necessary for parents to cooperate with teachers as follows (MNE, 2006, p.67):

"… in supporting children's learning parents have an important role. Parents can understand what their children will learn in each grade level and why they will learn it by reading the curriculum. As a result, they can discuss their children's work with them, communicate with teachers and ask questions regarding the development of their children. Parents should also attend parent-teacher meetings and meetings of Parent Teacher Association regularly and encourage their children to complete their homework in time and properly."

Although none of the teachers said that parents are the implementers of the curriculum, they talked about the importance of parents in the student's education[15]. For example, one of the teachers said that parents are not the implementers of the curriculum, but the same teacher explained that parents take an important role in education:

> Teacher 8: Parents are not the implementers [of the curriculum] but they can contribute to the implementation of the curriculum. The implementers is teachers, the guide is teachers. Parents can only help their children. They can help to manage the parent-teacher association.

[15] Especially when they were placing the figure symbolizing parents in the picture.

When all the interviews were scanned, it is seen that 6 of 9 teachers claimed that parents must be in cooperation with teachers. For example, one of the teachers who previously stated that because of the implementation of the curriculum, students became dependant on their parents made the explanation below for the role of parents in education:

> Teacher 1: If the parents cannot overcome the deficiencies or if they are late to deal with those problems, or they are not in cooperation with you, then you cannot increase those student's achievement.

On the other hand, some of the teachers stated that parents do not take care of their children at a satisfactory level. One of the teachers who defined the socio-economical level of the school he was working as low stated his opinion regarding the parents' indifference as below:

> Teacher 5: The closer the parents to school and the more they get in one to one relationship with the teacher, student, school, the more successful their children become. We got into contact with the parents in order to increase the success of 6th grade levels. But they say it doesn't matter whether the child goes to school or not, because they say this is not their aim. They don't support education. They think when the child finishes his/her school, he becomes a hairdresser or starts working with his father. I mean when the parents think this way, then the children don't care about education. I've experienced this here.

Moreover, some of the teachers stated that it is necessary for the parents to provide economical support for the school when school facilities are not sufficient, but they said that the parents are not so willing to do this. One teacher who worked at different schools around Turkey complained that parents are unwilling:

> Teacher 6: These three [parents, teacher, student] should be involved in education. For example, when I came here first, I couldn't manage to make the parents buy a projection machine. I said give 10 or 20 liras and we'll adapt these kids to our era. No, they don't pay any money.

The teachers' all perceptions regarding the role of parents in education are listed in Table 4.53.

Table 4.53 Teachers' perceptions of the role of parents in education

A parent should:	Frequency
be in cooperation with the teacher	6
be inside education	4
provide economical support for the school	3
monitor the student	3
be in cooperation with school administration	2
monitor the teacher	2
teach the student some basic codes of behavior	2
form balanced relationships within their family	1
check their child's homework	1
know their child's deficiencies	1
encourage their children to create solutions	1
overcome their children's deficiencies	1
be in cooperation with other parents	1
be cultured	1
have a close relationship with the school	1

When the teachers' perceptions of the role of the parent in education system were analyzed, it is clear that these perceptions are aligned with the roles stated in the curriculum to a great extent. Still, different from the statements in the curriculum, they did not define parents as the implementers of the curriculum. Moreover, some of the teachers complained about the fact that many parents do not properly meet their responsibilities regarding the student's education.

4.9.3 Inspector

Although in the curriculum, inspectors are considered as the implementers of the curriculum (MNE, 2006, p.66), there are not any suggestions regarding the inspector.

When the teachers' views considered, 7 of 9 teachers criticized inspectors for not fulfilling their duties properly[16]. The teachers' explanations about this issue are given in Table 4.54. In addition to this, those 7 teachers provided some

[16] They placed the figure symbolizing the inspector in the school garden or even outside the school in the *School Alive* game.

explanations for what an inspector should do (Table 4.55). For example, a teacher with 30 years of experience in science teaching stated his opinions regarding the inspector as follows:

> Teacher 3: The inspectors coming to our school always give us some information about the new curriculum. They investigate us once in 2 years but this is not really effective. 40 minutes of observation is not enough for me because there might be other factors affecting the performance of that day. That does not reflect my success or failure. Therefore, I think that the inspectors should come to school without letting us know that they are the inspectors and they should observe us. This is better I guess. In the past, they were coming without informing. Maybe new teachers might not prefer this kind of observation, but in the current situation inspectors are just like hosts coming to our house after we invite them. You are always prepared for a host coming to your house, everything is OK. But what is important is that you should behave in the same way towards your host who has come without informing.

Moreover, another teacher thought that the school principle could better fulfill the duties of the inspector and says that:

> Teacher 7: The inspectors should make their observations, present their reports but they shouldn't make certain decisions. They might be making a mistake while giving a certain decision because they cannot be as good observers as the school principles. I think the principle is the best inspector of a given school. In terms of both students and teachers.

On the other hand, 2 of 9 teachers, mentioned the importance of the duties of an inspector by emphasizing the necessity for teachers to be monitored. One of these 2 teachers, completely in opposition with the teacher in the previous quotation, claimed that the inspector should monitor the school principle as well and said that:

> Teacher 8: The decisions that the school principle makes may not always be good decisions. Inspecting is a control mechanism. In order to establish criteria for the problems and to solve them, [inspectors] are needed I think.

Table 4.54 Teachers' critical statements about inspectors

The inspector cannot monitor teachers properly because	Frequency
They do not know teachers well enough	3
They do not visit the school frequently enough	2
They make unnecessary interventions in the class	2
They are distant from the profession of teaching	2
They do not inform the teacher satisfactorily	1

Table 4.55 Teachers' explanations about the role of the inspectors

An inspector should:	Frequency
only make observations	2
monitor the teacher	2
visit the school more frequently	2
master not only science curriculum but also the others	1
avoid making certain judgments about teachers	1
inform teachers only about necessary issues	1
guide teachers	1
monitor the school principle	1
teach well	1
visit the school without informing beforehand	1

When a general look is taken, it is observed that the majority of the teachers criticized inspectors for the reasons such as being distant from the profession of teaching, not knowing the teachers and not visiting the school frequently enough and stated that they do not fulfill their duties at a satisfactory level.

CHAPTER 5

DISCUSSION AND RECOMMENDATIONS

In this chapter, a discussion on the consistency between the teachers' perceptions of the curriculum and curriculum itself obtained through the findings of the explorative content analysis of in-depth interviews conducted with 9 science and technology teachers and some relevant recommendations will be given.

5.1 Discussion

In this section, discussions are conducted under nine headings, which correspond to sections of Result chapter.

General Opinions about the Curriculum

In this study, it is observed that almost half of the teachers had generally positive opinions about the curriculum, whereas the other teachers had generally negative opinions. This polarity is different from the picture described in the literature as in the studies conducted it was stated that teachers generally had positive opinions regarding the curriculum (e.g. Çengelci, 2008; Değirmenci, 2007; Şeker, 2007) Moreover, in the present study, the number of the features that the teachers found positive (5 different issues) was far less than the number of features that the teachers found negative (12 different issues). The most frequently stated positive opinions were that the activities were suitable for daily life and these activities were prepared in a way that they would cover the essence of the topic and the curriculum lessened the burden on the teacher in class. On the other hand, that students do not understand without formula, there are unnecessary details in some topics, and time is limited for the implementation were stated as the weakness of the curriculum. These results cover some of the findings of Boyacı (2010), who studied the problems of the teachers regarding 6^{th}, 7^{th} and 8^{th} grade levels Science

and Technology curriculum. Boyacı found that teachers declared that integration of the curriculum into life was a strong (positive) feature, but time shortages to implement curriculum and reduction in the mathematical formulas related with the lessons were the weak (negative) features of the curriculum.

Furthermore, in this study it is found that whether the teachers liked the curriculum or not, they spent an effort to implement it. However, the teachers' perceptions of the content of the curriculum were different from what is stated in the curriculum. Therefore, although the teachers tried to implement the curriculum, their efforts did not correspond to what is required in the curriculum and thus they might fail to implement the curriculum properly. Similarly, in the qualitative study conducted with 5th grade level teachers by Akdeniz and Tekbıyık (2008), it is stated that the teachers adopted the new Elementary Science and Technology Curriculum, they believed in its success, they paid an effort to implement it, but because they did not know the curriculum enough, they faced with some problems. Moreover, the fact that teachers' attitudes and values play an important role in the successful implementation of the curriculum in educational settings has been set forth in several studies (Crawley & Salyer, 1995; Olson, 1981; Tobin, 1987). In line with this finding, in this study it might be said that the teachers' attitudes and values affected the implementation of science curriculum. It is understood that the teachers perceived the teacher as indispensible and the curriculum only as a helper to the teacher in order for education to continue. Moreover, the teachers needed the school more than they needed the curriculum for education and they gave more importance to the school. Thus, as a result of this study, it can be concluded that the problems in the proper implementation of the curriculum may also be rooted in the teachers' belief that they do not really need the curriculum.

Scientific and Technological Literacy & Scientific Knowledge

Educating all students as scientifically and technologically literate people is the aim of the curriculum. On the other hand, in this study it is realized that some of the teachers even did not find this general aim as meaningful for all students

because they believed that scientific and technological literacy is related with students' individual interests and/or capacities. Furthermore, these teachers generally did not have the necessary terminological knowledge regarding scientific and technological literacy. In the curriculum, scientific and technological literacy is defined as a composition of skill, attitude, value, mentality and knowledge which is necessary for the individuals in order to develop skills of inquiry, critical thinking, problem solving, decision making, in order to become life-long learners and in order to maintain the sense of curiosity about their environment and the world (MNE, 2006, p.5). On the other hand, the teachers in this study tried to define the term through associations instead of giving a proper definition. Among these associations were an ability, reading scientific articles, following scientific and technological improvements. In addition to this, none of the teachers stated a link between student achievement and scientific and technological literacy, whereas they frequently referred to student achievement in the exams while talking about students' success in science and technology lesson. In this situation, it is clear that the teachers' perceptions of student achievement were completely different from the targeted student profile, who is a scientifically and technologically literate person, in the curriculum. This difference may be the result of the fact that students' success in "Seviye Belirleme Sınavı (SBS)" examinations determines their future academic life and teachers focused on this reality in educational process. In addition to this, Lederman (2007) states that although the comprehension of the nature of science has long been considered as one the most important components of scientific literacy, the studies showed that students did not have a satisfactory understanding regarding this issue. It is thought that the most important reason for the deficiency in this issue might be teachers, who are the key person responsible for education. Moreover, in this study it is found that teachers also perceived nature of science differently (and even wrongly) from what is stated in the curriculum. Aslan, Taşar, and Yalçın (2009) claimed that science and technology teachers had some wrong and unsatisfactory opinions concerning the definition of science, the nature of observations, the changeability of scientific knowledge, the structure of propositions, theories and laws, and scientific method. In addition to this,

Çakıroğlu and Köksal (2010) stated that "science teachers had many naive understandings about the aspects of NOS" and they specifically emphasized that "[teachers] had the most extreme naive understandings regarding relationship between theory and law (p.206)." Similarly, in other studies, it was found that many teachers had insufficient opinions regarding the structure of theories and laws (e.g. Doğan Bora, 2005; Yakmacı, 1998). For example, many teachers thought that there was a hierarchy between a theory and a law, whereby theories become laws with the accumulation of supporting evidence (Abd-El-Khalick, & BouJaoude, 1997; Lederman, 2007). Parallel with the studies above, in this study it is seen that teachers did not adopt the nature of science aspects in the curriculum. In this study, one of the most striking problems in the perceptions of the teachers was related to characteristics of scientific laws and theories. The teachers considered the scientific knowledge derived from laws as certain and stable and the scientific knowledge derived from theories as uncertain and unstable. In addition to this, some of them even stated that some certain and stable knowledge was given in the curriculum as well, which means that they misinterpreted the nature of science approach in the curriculum.

General Aims of the Curriculum

In this study, it is seen that according to the teachers, the general aims in the curriculum were very similar to each other. In fact, it was observed that the teachers had some difficulties with understanding those aims. Dindar and Yangın (2007) conducted a research study on the opinions of the elementary 4^{th} and 5^{th} grade level teachers regarding the aims of the curriculum and their perspectives towards the lesson during the transition period. As a result of their study, they found that the teachers had a tendency towards the aims that include behaviorist approach. In addition, teachers claimed that they had not been informed about the curriculum at a satisfactory level. For that reason, teachers could not understand the curriculum which is based on a perspective of science-technology-society and they could not differentiate the aims presented in the curriculum. In line with Dindar and Yangın's study, in the present study it is understood that the problems experienced in 4^{th} and 5^{th} grade levels regarding the aims have been transmitted to

6th, 7th and 8th grade levels since the curriculum was put into force. This study shows that although the teachers knew that there were 11 general aims of science and technology lesson mentioned in the curriculum, they complained about not being able to allocate enough time to reach these aims in their lessons. Since the teachers thought that they should spend a separate period of time on these aims, it is understood that they perceived the general aims of science and technology lesson different from those 11 aims and thought that the aim of the lesson was to make students acquire the necessary knowledge that they are going to use in the exams, which also fits in with the teachers' general perception of student success mentioned above. In addition to this, the teachers found the curriculum insufficient in representing these 11 general aims of science and technology education. Moreover, it is seen that the teachers have not internalized some of those aims, which are especially related with "students' career development," because they believed that those aims were not suitable for elementary level students. Therefore, it is understood that the teachers had some difficulty in figuring out the importance of elementary education, which is emphasized in the curriculum, in students' future professional life and that the teachers missed out the emphasis on students as life-long learners.

"Little but essential knowledge"

Another point to mention in the present study is that it seems that the teachers generally adopted the principle of "little but essential knowledge;" however, they stated that this principle was not successfully highlighted in the curriculum. This opinion results from the fact that they perceived the aims of science and technology lesson different from the curriculum itself. Therefore, they missed out the emphasis made on this principle in the curriculum and thus they could not conduct their lessons in line with this principle. In the literature, it is seen that teachers faced some problems related with this principle during the implementation of the curriculum. Boyacı (2010) stated that most of the teachers fully agreed with the idea that although in the curriculum the principle of "little but essential knowledge" is mentioned, the number of existing units and learning outcomes are quite high. Moreover, Öztürk (2009) in her study studied the

problems with 4th and 5th grade levels Science and Technology curriculum that the teachers faced and she stated that the teachers' implementation of the principle of "little but essential knowledge" was insufficient.

Teacher-centered vs. Student-centered

This study shows that although the teachers were aware of the dominance of the constructivist approach in the curriculum, when the fact that they talked about knowledge within a structure where knowledge is transferred from the teacher to the student is considered, it is seen that their understanding was quite far from constructivism. When we take a look at the literature, it is seen that teachers had positive opinions regarding constructivist approach, student-centered structure, learning by doing and experiencing concerning the teaching-learning dimension of the curriculum. In their studies Altun and Ercan (2005) found that 95% of the teachers thought that the new 4th and 5th grade levels Science and Technology curriculum was student-centered and that the students were more active when compared to previous years with the curriculum. According to the study of Erdoğan (2005), 5th grade level Science and Technology teachers thought that the positive characteristic of the curriculum was that it provides the students with an opportunity to learn by doing and experiencing. Moreover, regarding the teaching dimension of the Science and Technology curriculum, Şeker (2007) showed in his study that the teachers did not have much difficulty in implementing the curriculum. In addition to this, in Şeker's study the teachers stated that they turned to their old teaching methods such as classical instruction from time to time; the students participated in in-class activities more than before; the students had the opportunity to do more science activities than they were in the past. Furthermore, Çengelci (2008) stated that most of the teachers had positive opinions regarding the teaching-learning process in the curriculum. In addition, the findings of Kırıkkaya (2009) were consistent with the findings of other studies. She claimed that an important number of the teachers had positive opinions about student-centered approach, the emphasis of learning by doing and experiencing, focus on activities which helps students enjoy science lessons, the motivation provided for students to do scientific study and units being spiral in structure of the curriculum.

In the present study, it is understood that the teachers believed that student-centered learning, which is one of the requirements of constructivist approach, could take place through the presentation of the lesson by the students. In addition to this, even though the teachers stated that they allocated space to student-centered teaching strategies in their lessons, they implemented these strategies by putting the teacher at the center. When all these are considered, it is clear that the teachers have not perceived constructivist approach correctly and as a result of this, they could not implement it properly. Similarly, Şeker (2007) mentioned that teachers turned to old teaching strategies from time to time, were not fully aware of the real philosophy and dimensions for implementation of the underlying constructivist and multiple intelligence learning theories of the curriculum. In addition to this, Penick (1995) stated that although curricula changes took place, the teaching habits of the teachers did not change and they continued to teach through traditional methods. In brief, in this current study, it is clear that although the teachers stated that they admired the constructivist approach and student-centered structure in the curriculum very much, they had some serious misconceptions regarding the content of the curriculum. What is worse is that these teachers believed that they adopted a student-centered approach, but in fact they did not leave teacher-centered approach.

Traditional Assessment vs. Alternative Assessment

The present study shows that whichever teaching strategies that the teachers used in their lessons, in assessment their commitment to traditional assessment strategies continued. Since they thought that the alternative assessment techniques mentioned in the curriculum unnecessarily require too much time, they did not like and thus implement these techniques. However, time limitation is not the only reason for the teachers for not using alternative assessment techniques. The teachers felt so competent in assessment that they thought they could evaluate the student just through question and answer. Nonetheless, it seems that the teachers could not understand the link between the alternative assessment and student-centered structure, showing that their competency in assessment is quite limited. Findings of the teachers' perceptions of the assessment techniques are quite

parallel with the literature. When the related literature was considered, it can be seen that teachers perceptions of and attitudes towards the applications of alternative assessment are quite negative (e.g. Çengelci, 2008; Gökçe, 2006; Özdemir, 2006; Şeker, 2007). Kırıkkaya (2009) mentioned that the teachers used very few of the alternative assessment techniques and they had never practiced some of the alternative assessment types suggested in the curriculum such as structured grid, descriptive branched tree, self and peer assessment. Similar to present study, findings in Kırıkkaya's study indicated that the most important problem which the teachers faced while they were implementing assessment activities was spending too much time. Moreover, the teachers in her study stated that it was difficult to leave old methods, or habits, and they could not implement alternative assessment techniques mainly because of the high number of students in the class and thus they could not effectively deal with the students. For that reason it was easy for them to use traditional assessment techniques.

In this present study, it is seen that most of the teachers were product oriented, which is a feature of traditional assessment, during assessment and evaluation process. Their basic expectation from students is to give logical answers to the teacher's questions. It is concluded that this situation results not only from their lack of knowledge regarding alternative assessment but also from the fact that they find alternative assessment and evaluation techniques unnecessary and demanding.

Taking All Students Needs into Consideration

In the current study, it is understood that the teachers were not much hopeful about their students since they drew a negative picture regarding students. However, the general profile in the minds of the teachers was based on solely the teachers' observations and did not include professional techniques. Therefore, the teachers could not identify students with special abilities in science and they were not able to pay necessary attention to and care for students with special needs in learning. In addition to this, the teachers had a limited description of gifted students since they frequently referred to student achievement, intelligence and

high performance while talking about gifted students. Therefore, the reason why these teachers could not identify gifted students may be related to this narrow description of the term giftedness. Ball, Cashion and Sullenger (1997) emphasized that characteristics such as leadership and creativity are now included in the definition of giftedness and if the teachers cannot internalize this new definition, they have difficulty in identifying gifted students and thus, continue to conceptualize giftedness as having a very high IQ.

However, when it comes to gender issue, the overall picture is relatively more hopeful. In the current study it is seen that, although there were some generalizations in the minds of the teachers regarding male and female students, they tried not to make gender discrimination in their lessons. However, the interesting thing is that some teachers associated pertness and naughty behaviors of boys with their biology and nature instead of social values and judgments. In addition to this, the teachers thought that girls are more successful in science lessons than boys. The reason they provided for this success was not because girls are intelligent but because they are hard working. This situation shows that although the teachers tried to be egalitarian in learning environments, they had subtle gender stereotypes. Emmanuel and Tatar (2001) stated that elementary school and female teachers gave more gender egalitarian responses to the questions. However, they also stated that these teachers had lack of awareness about their own gender stereotypes and influence of these stereotypes on students. Moreover, Erden (2004) in her study with early childhood teachers revealed that although teachers had a tendency to hold egalitarian discipline and gender role attitudes, many teachers had stereotyped beliefs in terms of gender roles and discipline of boys and girls. In addition to this, as mentioned in Uysal's (2008) study, the teachers in this study seemed to be traditional teachers trying to be modern in terms of gender discrimination. Uysal (2008), who studied on gender-related beliefs of Turkish female science teachers, stated that traditional teachers believed that males and females should have certain defined roles, male students were brighter than their female students, female students excelled only because they worked harder. Moreover, traditional teachers provided more speaking time

to male students. On the other hand, modern teachers did not assign specific roles to either males or females and they believed that females needed to work harder than males to prove themselves, success was dependent on each student's background and his or her interest in science. These teachers also paid equal attention to all their students. Uysal concluded that both groups' belief systems (traditional and modern) were apparent and impacted their interactions with their students. Moreover, Klein, Sadker and Sadker (1991) identified two types of sex bias in their studies: boys received more attention from teachers and were given more time to talk in classrooms than girls, and boys received more praise, critical feedback, and remediation than girls.

Learning Areas

In this study, it is seen that the teachers had no difficulty in transferring the learning outcomes of SPS learning area to class; however, they had difficulty in understanding and giving meaning to STSE and AV learning areas. On the other hand, although the teachers have not internalized the content of 7 learning areas and the interrelationship among these learning areas at a satisfactory level, they paid intensive attention to the learning outcomes in the curriculum regarding these learning areas, especially to the ones concerning science content area. When the related literature was considered, it can be said that teachers achieve the learning outcomes regarding 7 learning areas in the curriculum, but they do not have sufficient knowledge regarding SPS and AV learning areas. Bulut and Gömleksiz (2007) studied the effectiveness of the elementary science and technology curriculum in implementation with 383 primary teachers. As a result of their study, they found that teachers achieved the learning outcomes as suggested in the curriculum at a high level. In another study by Yılmaz (2007), which focused on teachers' opinions regarding the effectiveness of science lesson in making students gain scientific attitudes and behavior in primary level, all the teachers mentioned the importance of making students gain scientific attitudes and behavior in science lesson; however, it was emphasized that the teachers' existing knowledge in scientific attitudes and behavior was not satisfactory.

The curriculum consists of two main parts. The first part is Foundations of the Science and Technology Curriculum such as philosophy, vision and general aims of the curriculum and the second part is Science and Technology Lesson Learning Areas and Units, which includes the learning outcomes. In the curriculum it is stated that the curriculum should be taken as a whole in order to interpret its content in the right way and to implement it effectively (MNE, 2006, p.4). It is suggested that before implementing it, teachers should internalize the philosophy, the attitudes towards learning, teaching, assessment and evaluation and the organizational structure of the units of the curriculum, which are given in the "Foundations of the Science and Technology Curriculum" part, in order to provide students with a learning environment where they can learn the concepts in the learning outcomes best during the implementation of the curriculum (MNE, 2006, p.66). In this study, it is understood that the teachers were in an effort only to put into practice the learning outcomes in the learning outcomes tables which also include following components: objectives, suggested learning activities, assessment and evaluations and some explanations to the teachers rather than dealing with the curriculum as a whole. In addition, it is understood that the teachers looked at the curriculum almost only to review the learning outcomes of that day and to understand the flow of the lesson. In other words, it seems that they perceived the curriculum rather as 'a TV guide' showing the stream of the lesson and did not feel the need to examine it closely.

Implementers of the Curriculum

In the curriculum it is stated that teachers, inspectors, course book writers, course book evaluation experts, officials responsible for the choice of course books and parents of the students are together thought to be the implementers of the curriculum (MNE, 2006, p.66). Moreover, it is stated that students perform better at school when parents take place in their children's education process and thus it is necessary for parents to cooperate with teachers as follows (MNE, 2006, p.67).

This study shows that even though the teachers did not consider the parents as one of the implementers of the curriculum, they thought that in order for the

curriculum to be implemented in a proper way, parents have some certain responsibilities. Altun and Erman (2005) stated that parents' attitudes concerning education and their openness to change in education had an important role in the effective implementation of the new curriculum. On the other hand, in the present study, some of the teachers by making references to this increasing burden on the parents satirized the curriculum for being "parent-centered" instead of student-centered.

Conclusion

In conclusion, although the teachers spent an effort to implement the curriculum, since they did not examine the curriculum closely, their efforts go in vain. The only real novelty that the new curriculum is able to incorporate into the classroom environment is that learning activities are given more time in the class than they were in the past. Still, it is seen that the aim of educating students as scientifically and technologically literate people was not taken into consideration and student were not put at the center during these activities.

5.2 Recommendations

In line with the nature of constructivist approach, the teachers should learn the novelties regarding the curriculum by doing and experiencing. It is understood that in-service education was not preferred and paid attention to by some of the teachers for various reasons. To increase the teachers' participation in in-service education, the content of it should be revised so that it will meet the practical needs of the teachers while they are implementing the curriculum in the classroom. It is seen that in-service education concerning constructivist approaches is not satisfactory alone. In order to make teacher interpret student-centered structure in the right way, they should be provided with in-service seminars on learning strategies. In addition to this, in order to make teachers adapt themselves to this student-centered structure, there should be some elements that would increase teachers' pedagogical knowledge in their in-service training on

learning strategies. In this way, teachers' attitudes towards students will improve and they will be able to provide their students with better learning environments. Moreover, the teachers should be provided with a constant support as an extension of this in-service education. Furthermore, taking the advantage of technology, internet-based interactive activities should be prepared to revise and refresh teachers' knowledge regarding the curriculum and should be served to all teachers. This approach to in-service education should be compulsory to all teachers. By this way, thousands of teachers will probably be adapted to the novelties more quickly. Moreover, teachers should be encouraged to share their feedback regarding the curriculum and its implementation on an official Internet-based platform.

Together with the in-service training which aims at improving teachers' perceptions of the nature of science, some VCD presentations and booklets should be prepared and distributed all schools in Turkey. In this way, teachers' misconceptions regarding the nature of science will be eliminated all over the Turkey in a quick way.

Parents should be informed about the curriculum. For example, a guidance book just like teacher guidance books containing necessary explanations and guidance regarding both the entire curriculum and lesson units should be prepared and parents, who are accepted as implementers of the curriculum as teachers, should be provided with these books at the beginning of the term. Moreover, workshops which would develop the interaction among parents, teachers and students should be focused on by the Ministry and both parents and teachers should attend these workshops together.

It is important that the examination system which affects students' education after elementary school should be in full alignment with the curriculum, which would increase both the understandability and feasibility of the curriculum, in order to increase the quality of education at school.

In the process of educating pre-service teachers, more attention should be drawn to the unity of the curriculum and more time should be given to introduction of

the foundations of the curriculum such as its philosophy, vision and general aims in teacher education programs.

As for schools, it is necessary that their general physical facilities should be improved and classroom population should be reduced. Curriculum developers should much more take into consideration the insufficiencies that the teachers frequently mentioned regarding time and material and they should give more space in the curriculum to learning activities applicable to crowded classes. By this way, until physical facilities of all the schools have been improved, effectiveness of the curriculum will increase in a short period of time.

In order to put forth the problems concerning the implementation of the curriculum in a more intensive way, more qualitative studies should be carried out and these qualitative studies should be varied in terms of their methodology and scope. For example, classroom observations to examine the correspondence level of teachers' discourse and their classroom implications should be made. Another example is studies that would cover the perceptions of students, parents and inspectors and these should be brought together with the perceptions of teachers to be compared.

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APPENDIX A

EĞİTİM FAKÜLTESİ DEKANLIĞI
Ev. Arş. Md. Saat:

T.C.
ANKARA VALİLİĞİ
Milli Eğitim Müdürlüğü

BÖLÜM : İstatistik Bölümü
SAYI : B.B.08.4.MEM.4.06.00.06-312/ 77979 16/09/2010
KONU : Araştırma İzni
Elif Ece ADAL

ORTA DOĞU TEKNİK ÜNİVERSİTESİNE
(Eğitim Fakültesi)

İlgi : a) MEB Bağlı Okul ve Kurumlarda Yapılacak Araştırma ve Araştırma Desteğine Yönelik İzin ve Uygulama Yönergesi.
b) Üniversiteniz Eğitim Fakültesinin 10/08/2010 tarih ve 10955 sayılı yazısı.

Üniversiteniz Eğitim Fakültesi Yüksek Lisans öğrencisi Elif Ece ADAL' ın **"Fen ve Teknoloji dersi öğretmenlerinin yürürlükte olan 6., 7. ve 8. sınıflar Fen ve Teknoloji dersi öğretim programı üzerine görüşleri"** konulu tez ile ilgili çalışma yapma isteği Müdürlüğümüzce uygun görülmüş ve araştırmanın yapılacağı İlçe Milli Eğitim Müdürlüğüne bilgi verilmiştir.

Mühürlü anketler (9 sayfadan oluşan) ekte gönderilmiş olup, uygulama yapılacak sayıda çoğaltılması ve çalışmanın bitiminde iki örneğinin (CD/disket) Müdürlüğümüz İstatistik Bölümüne gönderilmesini rica ederim.

Gülçin UYSAL
Müdür a.
Müdür Yardımcısı

EKLER :
Anket (9 sayfa)

22.09.10 016425

23/09 İÖB'ne Netelim G.S.
23/09 CSA

İl Milli Eğitim Müdürlüğü-Beşevler
İstatistik Bölümü
Bilgi İçin:Nermin ÇELENK
Tel : 223 75 22
Fax: 223 75 22
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APPENDIX B

Yaşayan Okul / The School Alive

Etkinliğe Başlarken

Rastgele Yapılmış Örnek Yerleştirme

Etkinlik Soruları:

Bulutların içinde verilmiş olanları resimde gördüğünüz öğelere yerleştiriniz. (Hepsini yerleştirmesi beklenir.)

1) Bu yerleştirmeyi neyi veya neleri baz alarak yaptınız?

2) (Yerleştirme sırasına göre, her kavramı neden oraya yerleştirdiği sorulacak)

Ör: Müdürü neden oraya yerleştirdiniz?

Öğretmeni yerleştirdiğiniz yerden çıkarıyorum!

3) Bu boşluğa diğerleri arasından hangisini koyalım?

4) Bu kişi bu boşluğu hangi özelliği ya da özellikleri ile kapatır?

5) Tam olarak öğretmenin boşluğunu kapatabilir mi?

6) Seçtiğiniz kişin yetersiz kaldığı noktalar için kimleri hangi özellikleri sebebiyle bu boşluğa yerleştirmek istersiniz?

7) Program'ı rehber olarak kullanırsak bu yerleştirmeyi nasıl yapmalıyız?

8) Sizin yerleştirmenizle Program'ın öngördüğünü düşündüğünüz yerleştirme arasında fark oluştu mu? Neden?

Eğitim-Öğretim Balonu / The Education Balloon

Eğitim-Öğretim Balon'u öğrencilerini ve dengeli bir şekilde uçması için gereken ağırlıkları alarak havalanıyor. Eğer bu ağırlıklar olmasaydı kontrolsüz bir şekilde yükselip gözden kaybolabilirdi. Gökyüzünce güzelce süzülürken birden düşmeye başlıyor.

1) Sizce neden?

Ve siz bu düşüşü engellemek için bir tanesini (göstererek) atmak zorundasınız!

2) Hangisini atardınız?

3) Neden bunu seçtiniz?

4) Balonun üzerinden nasıl bir yük kalktı?

5) Bunun atılması diğerlerini nasıl etkiledi?

6) Bunun atılması balonun dengesini nasıl etkiledi? Düşüşü durdurabildik mi sizce?

Evet… Balonumuz biran için dengelenir gibi oldu ama maalesef düşmeye devam ediyor!

Bir tanesini daha atmak zorundasınız!

Hangisini atardınız?.....

Tek ağırlık kalana kadar oyuna aynı düzende devam edilecek, son ağılığa gelince aşağıdaki gibi devam edilecektir:

3 şeyi feda ettik ama düşüşü durdurmayı da başardık. Şimdi balonumuz mutlu öğrencileri ve geriye kalan son dengeleyicisiyle gökyüzünde süzülüyor. Fakat balon birden sarsılıyor ve kontrolsüzce yükselmeye başlıyor.

7) Bu son kalan ağırlık tek başına eğitim-öğretimi kurtarabilir mi sizce? Neden?

Savaşçılar / The Warriors

(Her 3 durum ayrı kâğıtlarda bulunacaktır)

Savaşçılar 1

Detay bilgi şarttır!

Az bilgi özdür!

Savaşçılar 2

Fen sabit ve kesin bilgiler bütünüdür!

Fen sabit ve kesin bilgiler bütünü değildir!

Savaşçılar 3

Öğrenci bilgiyi olduğu gibi alır!

Öğrenci bilgiyi olduğu gibi alamaz!

Burada karşı karşıya gelmiş iki savaşçı görüyoruz. İkisi de farklı söylemleri savunmakta.

Savaşçılar 1 (Program'ın ana ilkesi: Az bilgi özdür!)

1) Sizce bu söylemler sizin dünya görüşünüze göre gerçekten çatışır mı?
2) Size göre hangisi kazanmalı? Neden?
3) Kaybedeceğini düşündüğünüz savaşçının övülecek özellikleri var mıdır?
4) Pekiyi, Fen ve Teknoloji Dersi Öğretim Programı'nda bu söylemler gerçekten çatışır mı?
5) Program hangi savaşçının zaferinden bahseder?
6) Programla ilgili hangi bileşenleri düşünerek bu kararı verdiniz?
7) Bundan sonra yazılacak programlarda kazanan ve kaybeden değişebilir mi?
8) Sizce detay nedir? Detayın zıttı nedir?
9) Fen ve Teknoloji Dersi için detay bilgiye bir örnek verir misiniz?

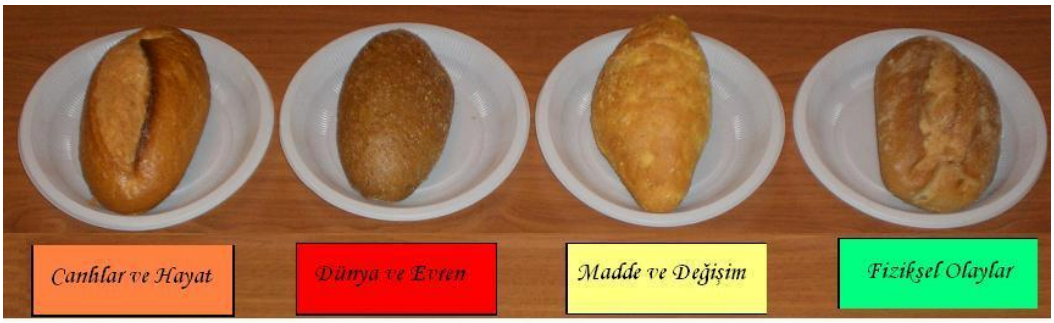
Savaşçılar 2 (Program'ın gerekçesi)

İlk 7 soru bu etkinliğin bu kısmında tekrar sorulacaktır.

Savaşçılar 3 (Program'ın ana ilkesi: Yapılandırmacı Yaklaşım)

İlk 7 soru bu etkinliğin bu kısmında tekrar sorulacaktır.

Dört Öğün Bir Sene / The Meal for a Year



Etkinlik Soruları:

Burada 4 farklı tip ekmek ve salam, kaşar ve domates olmak üzere 7 çeşit malzeme görüyoruz. Bu malzemeler öğrenme alanlarını temsil etmektedir. Öğrenme alanlarını öğrencinin bir eğitim-öğretim yılındaki beslenmesi olarak düşününüz.

1) Sizce bu öğrenme alanları malzemeleri öğrencilerinizin dengeli beslenmesi için yeterli midir?

Şimdi biz bir senelik beslenmeyi dört öğüne indirgeyeceğiz. Lütfen her öğrenme alanını malzemelerle eşleştiriniz.

2) Bu eşleştirmeyi yaparken neyi baz aldınız?

Aşağıdaki sorular her eşleştirme için ayrıca sorulacaktır.

3) Bu malzemenin neden "Canlılar ve Hayat" öğrenme alanı için uygun olduğunu düşündünüz?

4) Canlılar ve Hayat öğrenme alanı öğrencinin gelişimini nasıl etkiler? Gerekli midir?

5) Canlılar ve Hayat öğrenme alanı tek başına doyurucu olabilir mi?

6) Canlılar ve Hayat öğrenme alanı bakımından yetersiz beslenmiş bir öğrenciyi nasıl tanırız?

Tüm eşleştirmeler için yukarıdaki sorular sorulduktan sonra:

7) Sizce bu öğrenme alanları ile beslenmek için masaya oturtulmuş ve masadan beslenerek kalkmış iki öğrenci arasında fark oluşur mu? Lütfen açıklayınız.

8) Sizce ne amaçlanarak bu 7 öğrenme alanı programda bir araya getirilmiştir?

9) Fen ve teknoloji okuryazarlığı hakkında ne düşünüyorsunuz?

10) Fen ve teknoloji okuryazarlığına sahip birini hangi özelliklerinden tanırız?

11) Fen ve teknoloji okuryazarlığı her öğrenci için gerekli midir?

12) Bu öğrenme alanlarının hangisi ya da hangileri fen ve teknoloji okuryazarlığı için gereklidir?

13) Öğrencileriniz için 1 seneye bedel sağlıklı 4 öğün hazırladınız fakat öğrencileriniz beslenme işini abur cuburla geçiştirmek istediler. Ne yapardınız?

14) Öğrencileriniz öğünleri afiyetle yedi fakat bazılarının mideleri bozuldu. Sizce neden?

Kart Oyunu / The Card Game

Oyun:

Oyuncunun elinde başlangıçta hiç kart yoktur.

Oyun mülakatı yapan kişinin amaç kartlarından birini masaya koyması ile başlar.

Oyuncudan kartta yazılan amaca ilişkin 2 farklı strateji belirlemesi istenir.

Mülakatı yapan, oyuncunun belirlediği stratejileri hazırda varsa masaya koyar, yoksa boş strateji kartlarını doldurarak masaya bu yeni kartları koyar.

Oyuncuya neden bu stratejileri seçtiği sorulur.

Oyuncudan bu stratejilerin işe yarayıp yaramadığını anlaması için 2 farklı ölçme değerlendirme tekniği belirlemesi istenir.

Mülakatı yapan, oyuncunun belirlediği ölçme değerlendirme teknikleri hazırda varsa masaya koyar, yoksa boş ölçme değerlendirme kartlarını doldurarak masaya bu yeni kartları koyar.

Oyuncuya neden bu teknikleri seçtiği sorulur.

Masadaki strateji ve teknik kartları oyuncuya verilir. Amaç kartı açık kalacak şekilde kenara çekilir.

Masaya yeni bir amaç kartı koyulur.

Oyuncu dilerse elindeki kartları kullanabilir, dilerse yeni tercihleri ile oyuna devam eder.

Açıklama:

<u>Kırmızı Kartlar:</u> Program'ın genel amaçları

Öğrencilerin;

- Doğal dünyayı öğrenmeleri ve anlamaları, bunun düşünsel zenginliği ile heyecanını yasamalarını sağlamak,
- Her sınıf düzeyinde bilimsel ve teknolojik gelişme ile olaylara merak duygusu geliştirmelerini teşvik etmek,
- Fen ve teknolojinin doğasını; fen, teknoloji, toplum ve çevre arasındaki karşılıklı etkileşimleri anlamalarını sağlamak,
- Araştırma, okuma ve tartışma aracılığıyla yeni bilgileri yapılandırma becerileri kazanmalarını sağlamak,
- Eğitim ile meslek seçimi gibi konularda, fen ve teknolojiye dayalı meslekler hakkında bilgi, deneyim, ilgi geliştirmelerini sağlayabilecek alt yapıyı oluşturmak,
- Öğrenmeyi öğrenmelerini ve bu sayede mesleklerin değişen mahiyetine ayak uydurabilecek kapasiteyi geliştirmelerini sağlamak,
- Karsılaşabileceği alışılmadık durumlarda, yeni bilgi elde etme ile problem çözmede fen ve teknolojiyi kullanmalarını sağlamak,
- Kişisel kararlar verirken uygun bilimsel süreç ve ilkeleri kullanmalarını sağlamak,
- Fen ve teknolojiyle ilgili sosyal, ekonomik ve etik değerleri, kişisel sağlık ve çevre sorunlarını fark etmelerini, bunlarla ilgili sorumluluk taşımalarını ve bilinçli kararlar vermelerini sağlamak,
- Bilmeye ve anlamaya istekli olma, sorgulama, mantığa değer verme, eylemlerin sonuçlarını düşünme gibi bilimsel değerlere sahip olmalarını, toplum ve çevre iliksilerinde bu değerlere uygun şekilde hareket etmelerini sağlamak,
- Meslek yaşamlarında bilgi, anlayış ve becerilerini kullanarak ekonomik verimliliklerini artırmalarını sağlamak

<u>Yeşil Kartlar:</u> Öğretim Stratejileri

← Öğretmen merkezli stratejiler			→ Öğrenci merkezli stratejiler		
Klasik sunum	Gösterim	Tüm sınıf tartışması	Rol yapma	Proje	Bağımsız çalışma
	Hikâye anlatımı	Video gösterimi	Küçük grup tartışması (akran öğretimi)	Kütüphane taraması	Öğrenme merkezleri
	Programlandırılmış birebir öğretme	Simülasyon	Okul gezisi	Sorgulama	Programlandırılmış öğrenme
		Alıştırma yapma	İşbirliğine bağlı öğrenme	Keşfetme	Kişileştirilmiş öğrenme sistemleri
			Drama	Problem temelli öğrenme	
			Oyun oynama		

<u>Mavi Kartlar:</u> Ölçme ve Değerlendirme Teknikleri

Geleneksel Teknikler	*Alternatif Teknikler*
Çoktan seçmeli testler	Performans değerlendirme
Doğru-yanlış soruları	Öğrenci ürün dosyası(portfolyo)
Eşleştirme soruları	Kavram haritaları
Tamamlama (boşluk doldurma) soruları	Yapılandırılmış grid
Kısa cevaplı yazılı yoklamalar	Tanılayıcı dallanmış ağaç
Uzun cevaplı yazılı yoklamalar	Kelime ilişkilendirme
Soru -cevap	Proje
	Drama
	Görüşme
	Yazılı raporlar
	Gösteri
	Poster
	Grup ve/veya akran değerlendirmesi
	Kendi kendini değerlendirme

<u>Her turda sorulacak sorular</u>

1) Bu sizce fen ve teknoloji dersi için gözetilmesi gereken anlamlı bir amaç mıdır?

2) Bu fen ve teknoloji dersi için eğitim-öğretim esnasında sizin gözettiğiniz bir amaç mıdır?

3) Sizce Program genel itibariyle bu amacı gözetiyor mu?

4) Bu amacı gerçekleştirmek için uygun olduğunu düşündüğünüz 2 adet öğretim stratejisi belirler misiniz lütfen?

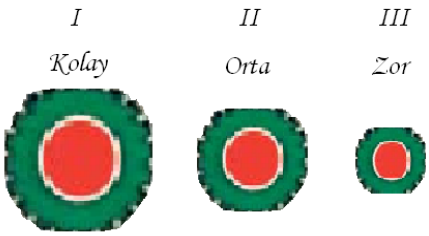
5) Bu belirlediğiniz stratejilerini bu amacı gerçekleştirmek için nasıl kullanabiliriz? Örnek verir misiniz?

6) Bu stratejilerin işe yarayıp yaramadığını ve amacımıza ulaşıp ulaşmadığımızı anlayabilmek için uygun olduğunu düşündüğünüz 2 adet ölçme ve değerlendirme tekniği belirler misiniz lütfen?

7) Bu belirlediğiniz ölçme ve değerlendirme tekniklerini ile öğrenciyi nasıl ölçeceğiz ve nasıl değerlendireceğiz? Örnek verir misiniz?

Atış Serbest / The Free Throw

Hedef Seçme



Hedef Tahtası

Ölçme ve değerlendirme bilgisi

Programa hâkimiyet

Öğrencileri tanıması

Pedagoji bilgisi

Alan bilgisi

Bağlam bilgisi

Eğitim stratejileri bilgisi

Eklemek istediğiniz Diğer

Burada üç farklı büyüklükte daire görüyoruz.

1) Bir kavram yanılgısını tespit edip, yok etmek ne kadar zordur? Düşüncenize uyan üç farklı büyüklükteki daireden birini seçiniz.

2) Tespit etmek neden zor, neden kolaydır?

3) Yok, etmek neden zor, neden kolaydır?

4) Seçtiğiniz hedefi isimlendirelim. Hangi kavram yanılgısı olsun?

5) Seçtiğiniz kavram yanılgısına göre uğraşılması daha kolay olan bir taneye örnek verir misiniz?

6) Neden bu ikinci örnekle mücadele etmenin daha kolay olduğunu düşünüyorsunuz?

7) Seçtiğiniz kavram yanılgısına göre uğraşılması daha zor olan bir taneye örnek verir misiniz?

8) Neden bu üçüncü örnekle mücadele etmenin daha zor olduğunu düşünüyorsunuz?

Artık hedefimizi hedef tahtamıza yerleştirebiliriz! Tahtada gördüğünüz üzere, kavram yanılgısını tespit ve yok etmek üzere, öğretmen olarak sahip olduğunuz güçler/silahlar oklarla temsil edilmiştir.

9) Sizce bunlar bir öğretmenin yetkin olması gereken alanlar mıdır?

10) Eklemek istediğiniz başka bir güç/silah var mı?

11) Kavram yanılgısını vurmak için en güvendiğiniz gücünüz/silahınız hangisi?

12) Neden bu gücünüz/silahınız diğerlerine göre daha güvenilir?

Artık atış serbest!

Güzel bir atış oldu ama rûzgar estiği için hedefimizi vuramadık, şimdi hangi gücünüzü/silahınızı kullanacaksınız? Lütfen geriye kalanlar arasından en çok güvendiğinizi seçiniz.

Bu oyuna tüm oklar bitene kadar devam edilecektir.

"Öğrencileri Tanıması" okunu seçince

13) Öğrenciyi iyi tanımak size kavram yanılgısını yok etmekte nasıl bir yardım sağlayacak? Lütfen örnek veriniz.

14) Sizce öğrencileri tanımak kolay bir iş midir?

15) Yeni öğretmenlere öğrencileri tanıma konusunda ne gibi tavsiyeler verirdiniz?

16) Hiç özel becerili öğrenciniz oldu mu?

17) Özel becerili öğrencilerinize ders esnasında ve ders dışında diğer öğrencilerden farklı yaklaşımlarda bulundunuz mu?(Bulunur muydunuz?)

18) Farklı davranmayı uygun buluyor musunuz?

19) Özel becerili öğrenciler için eğitim stratejilerinizde değişikliğe gittiniz mi? (Gider miydiniz?)

20) Özel becerili öğrenciler yönelik farklı eğitim stratejilerine yönelmeyi uygun buluyor musunuz?

21) Hiç özel öğrenme ihtiyacı olan öğrenciniz oldu mu?

22) Özel öğrenme ihtiyacı olan öğrencilerinize ders esnasında ve ders dışında diğer öğrencilerden farklı yaklaşımlarda bulundunuz mu?(Bulunur muydunuz?)

23) Farklı davranmayı uygun buluyor musunuz?

24) Özel öğrenme ihtiyacı olan öğrenciler için eğitim stratejilerinizde değişikliğe gittiniz mi? (Gider miydiniz?)

25) Özel öğrenme ihtiyacı olan öğrenciler yönelik farklı eğitim stratejilerine yönelmeyi uygun buluyor musunuz?

26) Pekiyi kız öğrenciler ve erkek öğrenciler arasında derse karşı tutum, derse katılım ya da başarı açısından farklılık gözlediniz mi?

27) Bu dengesizliği giderme ihtiyacı hissettiniz mi? Neden?

28) Dengesizliği gidermek için ne gibi tedbirler alırdınız? Neden?

"Programa Hâkimiyet" okunu seçince

Size göre, Fen ve Teknoloji Dersi Öğretim Programı öğrencide kavram yanılgısı oluşmasını önlemek için öğretmeni doğru şekilde ve yeterince yönlendirmekte midir? Lütfen açıklayınız.

29) Size göre, Program'ın kendisi öğrencide kavram yanılgısı oluşmasına meydan vermekte midir? Neden?

Oyun bitince

30) Sizce öğrencide oluşmuş bir kavram yanılgısını tamamen yok etmek mümkün müdür? Neden?

31) Öğrencide oluşan kavram yanılgısını tespit ve yok etmek için ayıracağınız zamanı öğrenci için daha faydalı olduğunu düşündüğünüz başka bir şeye ayırmak ister miydiniz?