A Qualitative Study on 6th Grade Science and Technology Curriculum

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Abstract – The rapid development in technology, the effect of globalization and economical competition between countries make educational innovations necessary. In order to harmonize new generation with scientific and technological challenges, the science and technology curriculum plays crucial role. The aim of the study is to analyze new 6th grade science and technology curriculum so as to determine its main characteristics and the main differences between formal curriculum and experienced curriculum is based on analysis of formal curriculum, interviews with science and technology teachers and one observation. In this study, the researcher addresses Posner's (1995) curriculum analysis questions through using the documents provided, and interviews with four science and technology teachers who teach in four different cities. Additionally, one observation is conducted in a class to observe the implementation of the new curriculum in real learning environment and observe the infrastructure of school. Findings show that participant teachers are satisfied with characteristics of constructivist approach in new science and technology curriculum, whereas it is stated that they have difficulty in the implementation phase. The participants mention not only inadequate lab equipment, but also difficulty in schedule of laboratories. It is also believed that participants elicit sufficient theoretical information during their pre-service education; however, they criticize the inadequate practice sessions. It is also believed that crowded classrooms are obstacles to implement a new curriculum..
Key words: Teachers' views, science and technology curriculum, curriculum implementation

Özet – Altıncı Sınıf Fen ve Teknoloji Öğretim Programları Hakkında Nitel Çalışma – Küreselleşmenin etkisi ve teknolojideki hızlı gelişmeler, ülkeler arasındaki ekonomik yarış eğitimde yeni uygulamaları gerekli kılmıştır. Yeni neslin bilimsel ve teknolojik gelişmelere uyumlu yetişebilmesi için fen ve teknoloji öğretim programları önemli bir rol oynamaktadır. Bu çalışmanın amacı 6. Sınıf Fen ve Teknoloji Öğretim Programının temel özelliklerini belirlemek ve kağıt üzerindeki öğretim programıyla bu programın öğrenme ortamlarındaki uygulamalarının temel farklılıklarını ortaya koymaktır. Bu çalışmada, doküman analizi yoluyla Posner'in (1995) öğretim programları analiz sorularına yanıt, bulunmaya çalışılmış ve dört fen ve teknoloji öğretmeniyle görüşme yapılarak, hem analiz sorularına yanıt aranmış hem de uygulamalara yönelik görüşler alınmıştır. Ek olarak, gerçek bir sınıf ortamında programın uygulanışını ve okulun yeni programı uygulamak için altyapısını görme amacıyla bir gözlem yapılmıştır. Bulgular, öğretmenlerin, yeni eğitim programlarının yapılandırmacı yaklaşım temelinde olmasından memnun olduklarını, ancak uygulamakta bazı zorluklarla karşılaştıklarını ortaya koymaktadır. Katılımcılar, yetersiz laboratuar

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araç-gerecinin yanı sıra laboratuar kullanımı planında da sorun yaşadıklarını belirtmişlerdir. Ayrıca katılımcıların hizmet öncesi eğitimleri sırasında, yeterli teorik bilgiyi aldıkları fakat bu teorik bilgileri derslerinde uygulamadıkları için sıkıntı duydukları da belirtilmiştir. Kalabalık sınıfların yeni programı uygulamada bir engel oluşturduğuna da inanılmaktadır.
Anahtar kelimeler: Öğretmen görüşleri, fen ve teknoloji öğretim programı, program uygulamaları.

Introduction

The rapid development in technology and globalization, and the effect of economical competition between countries made innovations necessary (MONE-Ministry of National Education, [*MEB - Milli Eğitim Bakanlığı*], 2003). Additionally, Turkey had low scores on international exams such as PISA or TIMMS and these situations lead to think about educational implementations (Şahin & Özata, 2007). For these reasons, primary schools' new science and technology curriculum was declared by the Ministry of National Education (MONE) in 2004 and put into implementation in 2005 - 2006 academic year in Turkey (TSA-Turkish Science Academy, [*TUBA - Türkiye Bilimler Akademisi*], 2004). Implementing a new curriculum requires a paradigm shift, the willing abandonment of familiar perspectives and practices, and the adoption of new ones (Brooks & Brooks, 1999, p. 25). However, making changes in curriculum does not directly lead to change in teaching practices (Wilson & Berne, 1999). In that aspect, the formal curricula, which gain official approval, and operational curricula, which refer to implementation of formal curriculum by the teachers, might be different (Goodlad, 1979). As curriculum implementers, teachers play crucial role in educational reforms (Duffee & Aikenhead, 1992) and their beliefs and knowledge can affect the success of the reforms (Van Driel, Beijaard, & Verloop, 2001).

One limitation of the previous science education curriculum was described as lack of clarification on schools' and teachers' needs. This important limitation can be accepted as an obstacle to find the answer of why new curricula was developed, because teachers, as the implementers of the curriculum, can easily express the limitations and positive aspects of previous educational programs (Ünal, Coştu & Karataş, 2004). So as to make best in the field of educational implementation, firstly teachers are trained on implementations of educational reforms. Providing handbooks for teachers and practicing the requirements of curricula in teacher training programs are necessary for reaching the answer to when a new curriculum is needed in (Yiğit, Akdeniz & Kurt, 2002). People who participate in the curriculum development process may produce a perfect formal curriculum whereas if the changes are not clear and cannot be perceived appropriately, it cannot be named as successful curriculum (Şahin & Özata, 2007). Although teachers are in need of getting training about implementation of the new curriculum (Özpolat *et al*., 2007) they believe that the pre-service education is satisfactory to implement the new curriculum (Gültekin & Zubukçu, 2008). If constructivist learning environment is provided to teacher candidates during the

undergraduate years, gaining practical habits will be easy, more effective and permanent (Richardson, 1997).

Another important suggestion to increase effective implementation is to provide cooperation among schools, colleagues and parents (Ercan & Akbaba-Altun, 2004). The new curriculum held families responsible for sharing educational responsibilities with students; especially activities require parents' involvement in to learning process (Metin & Cansüngü-Koray, 2007). Indeed, Ornstein and Hunkins (1998) stress the importance of educational institutions like Ministry of National Education to find urgent solutions to problems of implementations. So as to identify possible problems, the responsive institutions can provide cooperation with teachers. Furthermore, supervisors' visits to schools would be beneficial for identification of possible problems (Erdoğan, 2007).

As for the frequently stressed aspect of new science and technology program, it can be said that the role of the students, the constructivist approach and the complementary evaluation techniques are main changes. Teachers try to get accounted with complementary evaluation techniques but teachers believe complementary evaluation techniques take long time and it is very difficult to apply it in crowded classrooms. Furthermore, the official procedure requires that the teachers should score two written exams and one oral exam; that is why teachers hesitate on using complementary evaluation techniques (Ercan & Akbaba-Altun, 2004). The teachers also put emphasis on the changes in the role of students' as a positive aspect of new Science and Technology Curriculum; they are not passive recipients anymore, and the role of the teachers changed to being as facilitators (Erdoğan, 2005). Constructivism plays a main role in the Science and Technology Curriculum. According to requirements of constructivism, knowledge cannot be transferred from teacher to learner, it has to be conceived (von Glaersfeld, as cited in Akar, 2003). So, the new curriculum requires active learners in the learning process; on the other hand teachers encounter some difficulties in the learning-teaching process (Gözütok, Akgün & Karacaoğlu, 2005).

The existing literature revealed that there are too few studies pertaining to the analysis of 6th grade Science and Technology Curriculum. Posner (1995) suggests some steps for researchers who want to analyses a curriculum. These steps were organized under 4 main headings. The first step is "The Curriculum Documentation and Origins". During this step, the researchers ask for some responses to questions such as what social, cultural, economical and political aspects influence the curriculum, why the curriculum was developed or how the curriculum was documented. The title of the second step is "The Curriculum Proper". In this step, the researchers deal with the assumptions underlining the curriculum, and content and purposes of it. The third step is "The curriculum in use". The focus of the step can be summarized as a phrase: "how to implement the curriculum" and "what kind of data can be collected for evaluation of the curriculum". The final step is named as "The Curriculum Critique". This step

includes determination of limitations and positive aspects of the curriculum and offering suggestions for improvement of the limitations (Posner, 1995).

In order to provide valuable insight, analysis of formal curriculum becomes necessary. In addition, the teachers' perceptions about the requirements of newly developed curricula will provide valuable information. It is believed that the findings of the study would open to way to future studies.

The Purpose of the Study

The purpose of the study is to analyze 6th grade Science and Technology Curriculum based on Posner's (1995) analysis questions and teachers' views. In order to do so the following questions, based on Posner's (1995) curriculum analysis questions, were asked: a) how was the curriculum documented b) how was the curriculum developed c) what perspectives does the curriculum present d) what are the purposes and content of the curriculum e) how was the curriculum organized f) how is the curriculum implemented g) how is the assessment and evaluation done h) what are the strengths and weaknesses in terms of the curriculum and its implementation. In order to answer these questions, articles on curriculum implementation and innovation were reviewed and critiques of some educational institutes, proceedings of national conferences regarding new curricula were examined. The curriculum analysis served as the foundation of the study and facilitated the understanding of the formal curriculum. The other aim of the study is to determine the main differences between formal and experienced curriculum based on teachers' views and one in class observation. In conclusion, the descriptive nature of the study will provide valuable insight regarding the framework of the curriculum that has been implemented for the last two years. Observation and interviews with teachers provide information about main differences between formal and experienced curriculum.

Methodology

In this study, qualitative research techniques were used. Qualitative research is a procedure which produces realistic and specific data using collection techniques such as observation, document analysis and interview (Yıldırım & Şimşek, 2005). Additionally, qualitative methods provide insights and in depth information about the investigated issue (Patton, 1987). The study consists of three main steps: Document analysis based on Posner (1995) curriculum analysis questions; interview with four science and technology teachers and one in-class observation.

During the document analysis, the proceedings of three national conferences on education were reviewed. Only the conferences conducted between 2004 and 2008

were taken into consideration. Fourteen journals, published in Turkey, between 2000 and 2009 were searched to reach content-related articles. Since the previous science curriculum was developed in 2000, the year 2000 was included.

Semi-structured interview techniques were used to collect data about teachers' views on formal and experienced 6th grade Science and Technology Curriculum. Convenience sampling method used to have interviews with science and technology teachers. A convenience sample is a group of people who are easily accessible or available for a study (Fraenkel & Wallen, 2003). Four science and technology teachers, one of whom was doctoral student in educational sciences department, working in different cities participated in the study. They reflected different perspectives, comments, opinions about strengths and limitations of the curriculum.

One observation was made in a 6th grade science and technology class in Kalecik district of Ankara to observe classroom seating, type of instruction, teacher's role and organizational codes such as small group discussion, cooperative learning during the classes. The class was video recorded. After the observation, one interview was conducted with the teacher whose class was observed, about constructivism, teacher's role, students' role, activities, types of questions and teaching or learning methods.

Participants

In order to conduct interviews, the convenient sampling method was used and four science and technology teachers volunteered to participate in the study. Two of the participants (one male and one female) had 4 years of experience teaching respectively in Antalya and Şanlıurfa. One of the female teachers had 8 years of experience working in Ankara and the other had 12 years of experience working in İzmir. Interviews were conducted in an office in Ankara in the fall semester break.

In addition to these participants, one teacher gave permission to the researcher to observe her class and interview with her about observation results. She had 11 years of experience as a science and technology teacher.

Data Collection Tools

The content of the interview form was determined after document analysis was completed. Before being finalized, the objectivity and order of the questions were reviewed and edited with the help of a professor from the curriculum and instruction department, in addition, the form was improved using the feedback given by one of the participants. After improvements were made, the interviews were conducted with the four science and technology teachers, audio recordings were made during the interviews and transcribed.

The interview form contained 6 demographic questions and 18 questions about documentation of the curriculum, attainments, content, teacher training, teaching-learning process, teachers' role, and evaluation methods.

An observation form and an interview form for observed teacher were also developed by the researcher following guidelines given by one professor. Firstly, classroom seating and size were observed and a checklist was filled. Every five minutes, notes were taken about the type of instruction, the teacher's role and the organizational codes such as small group discussion or cooperative learning during the class.

Data Analysis

During the analysis of the interviews, in order to minimize threat to theoretical validity, two experts read all of the interviews several times and analyzed data together as prescribed in Maxwell (1996) and discussed them until reaching an agreement (Maxwell, 1996). Finally, codes showing similar results emerged. So as to provide internal validity, the coherent concepts were clustered together (Miles & Huberman, 1994) then grouped under relevant themes reflecting the general picture.

Observation was video recorded and watched by the researcher, one professor and two teachers, one of whom was classroom teacher and PhD candidate in Division of Curriculum and Instruction, and the other teacher was a science and technology teacher and PhD student in the same division. Observation results were discussed by the expert, the researcher and two teachers and then reported written to the teacher whose class was observed.

Results

The results of the study were presented by dividing into seven headings; namely, documentation of the curriculum, teaching-learning process, teachers' role, purpose of the curriculum, curriculum organization, evaluation, and teacher training.

Documentation of the Curriculum

The introduction part of the 6th grade Science and Technology Curriculum consisted of two main parts; namely, foundations of the program, and teaching fields and units. At the first part, the basic philosophy related to the vision of the program, the importance of being science literate, learning-teaching process, evaluation, the importance of learner's individual differences and their needs, the organization of the program, and

some suggestions to implementers were provided with examples. Additionally, constructivist learning process, using process evaluation techniques, taking into account individual differences and developmental stages, spiral curriculum characteristics, and integrity and sequence of the new curriculum were explicated. It was emphasized that the aim was not to get much knowledge; the real purpose was to gain effective and permanent knowledge. There were not many scientific terms, so language was clear. Other positive aspect is that educators could reach new educational program easily because documents were available on the internet. The formal curriculum includes clear explanations related to homework, necessary equipments and sources for science and technology education.

Development Process and the Main Characteristics of the Curriculum

The 6th Grade Science and Technology Curriculum was developed by 36 people, 16 of whom were teachers. Besides teachers, 10 professors, 7 research assistants, 1 expert working in the field of curriculum development, 1 expert working in the field of measurement and evaluation, and 1 chairman of the committee were also participated in the curriculum development process. Only the names of the members were published, there was not information about selection of the committee members.

One limitation of the documentation and curriculum development process can be accepted as the lack of the needs assessment results. Since this newly developed curriculum focuses on learner during the teaching learning process and tries to meet students' needs, it would be better if educators had a chance of seeing the needs assessment result.

Perspectives That the Curriculum Represent

Constructivist approach played central role; multiple intelligence theory, reflective thinking, and cooperative learning were also emphasized (Ayas et al., 2006). It was emphasized that the main role of the students during the learning process was to explore and elicit the needed information. The roles of the teachers were stressed as guidance and facilitators. Constructivist learning approach was explained in detail in the formal curriculum. The importance of learning by doing and by experiencing was explained. To create an effective learning environment, laboratory activities were suggested besides group activities and cooperative learning. In other words, learning environments did not describe as classrooms or laboratories, moreover, out of school activities and research activities were suggested.

The Purposes and Content of the Curriculum

No matter what the individual differences students have, making everyone science literate person was declared the one of the main purposes of the curriculum. Another one is to improve students' skills like independent thinking, critical thinking, problem solving and decision making. "In order to understand the world, students should be equipped with basic knowledge and skills" was stressed. For every grade level, to create scientific and technological curiosity; to provide fundamental knowledge to understand the strong relationships between science, technology, society and environment is also emphasized. As part of constructivism; making effort to develop students' skills about constructing knowledge by reading, discussing, and conducting research and developing the skill of how to learn are among the purposes of the curriculum. Developing a habit of following scientific steps while making an individual decision in daily life, and importance of eliciting awareness about science and technology ethics, social and economical problems based on science and technology are stressed. The curriculum is also dealing with providing a base related to science based jobs.

> "The students with high academic achievement benefit from the new curriculum. They develop their creative thinking skills, problem solving skills and they can guess what kind of questions could be asked to solve the problems and they are able to construct their own knowledge." (Female science and technology teacher with 4 years experience).

In order to realize the vision of being a science literate person, the learning areas were determined as: "living organism and life", "matter and change", "physical events", "world and universe". Realizing the aim of the new curriculum, perceiving and discussing "science, technology, society, and environment relationship", "scientific process abilities", and adopting positive "attitude and worth" headings were stressed as long term purposes. To bring up science literate children, seven dimensions were considered: "the nature of the science and technology", "key science concepts", "scientific process abilities", "science, technology, society, and environment relationship", "scientific and technique psycho-motor skills", "the values that constitutes core of the science", and attitude and worth related to science". These titles were used for developing students' self-respect and motivation. Because of the curriculum approach, 'attainments' were used instead of 'objectives'. For each strand and sub-strand, attainments were written in the curriculum. In addition, for each sub-strand, activities and necessary explanations about the implementation of these activities were considered. It was clearly stated in the curriculum that materials which were used for instruction should match with the attainments and reflect the purpose of the curriculum.

> "The attainments are appropriate for students' cognitive level and also they are very useful. For example, students discussed the possible precaution for reducing noise pollution. I think this example is a very good example to show effectiveness and

> appropriateness of attainments." (Female science and technology teacher with 4 years experience).

Assumptions Underlie the Curriculum Organization

The characteristics of three different assumptions; subject centered, society centered and learner centered assumptions were reflected in the program. Broad field curriculum design characteristics can be easily recognized. Social needs were included in the curriculum. For example, in the 'foundation of curriculum' part some social needs such as the needs stemming from being in the information age, the effects of globalization, speed access to information sources and their results were explained. Regional differences are not taken into consideration.

Especially first 34 pages show learner-centered approach characteristics. Students are responsible for learning and constructing their own knowledge. Individual differences and needs are taken into consideration. Relationship between daily life and content of the lesson is constituted. The students are active participants. Complementary evaluation techniques, such as portfolio assessment and peer evaluation are offered, the skills are highly emphasized. The curriculum is highly flexible to meet the needs and interests of the learners.

The participants were asked for their views on documentation and organization of the curriculum. The findings showed that they were satisfied with the documentation of the curriculum, teacher handbook and textbooks used in the classes. They (n=2) not only talked about the easily accessible characteristic of the new curriculum via internet, but also expressed liking new textbooks

> "I think the textbooks help me hold students' attention because they are colorful and pictures are very interesting. I like the clear explanations in teachers' guidebook as well." (Male science and technology teacher with 4 year experience).

Teaching–Learning Process

In the formal curriculum, constructivist approach was stressed frequently. It was emphasized that the major role of the students during the learning process was to reach the needed information and conduct knowledge. The roles of the teachers were underlined as guidance and facilitators. Constructivist learning approach was explained in detail in the formal curriculum. The importance of learning by doing and experiencing was explained.

The researcher asked for participants' opinions through a question of "from your stand point, what are the some of the most important and effective characteristics of the new curriculum" constructivism and teachers role were told. One participant mentioned positive aspects of constructivist curriculum and she thought she created constructivist

learning process by asking questions. During the observation, the teacher asked yes/no questions and she named them as guided questions. As for learners' differences and addressing their different learning styles, the teacher expressed that the same students were willing to participate in the activities.

The participant teachers were asked to discuss how a science and technology class is covered. Two participants stressed questions, which were related to course content, written on the textbooks and suggested activities. Participants (n=2) assumed that all of the activities should be administered in classes instead of applying some suggested activities.

> "I think there are a lot of activities in the curriculum. I have difficulty in conducting all of the experiments and activities because of the limited time." (Male science and technology teacher with 4 years experience).
>
> "My students enjoy the activities. They perceive them as plays." (Female science and technology teacher with 4 years experience).
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> "The suggested questions are very effective; the textbooks might offer more questions." (Female science and technology teacher with 12 years of experience).
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> "The positive aspects of the curriculum are just in theory since few students are active and the rest of them keep their passive status." (Female science and technology teacher with 4 years experience).

Structures of the schools were clarified as an important factor which limits teachers' applications (n=3). Lack of science laboratory in some schools, insufficient materials and crowded classrooms were stated as limitations for implementation of the curriculum. There were 51 students in the observed classroom. U shaped classroom seating is suggested by experts but the crowded classroom did not allow such a seating. Similarly, findings of another study illustrate that teachers had troubles in arranging the classroom environment because of high number of students (Bulut, 2007).

Additionally, the new curriculum stressed "group activities" such as cooperative studies, group discussions, group studies; however, when we looked at the implementation part of the curriculum, "silent" classroom was being accepted as "ideal" classroom by teachers. During the interview with the observed classroom's teacher, she expressed silent classroom was necessary for covering subjects although constructivism requires discussions, cooperative learning activities.

> "The classes are very crowded. It is very difficult to create a silent classroom to be covered the classes in an ideal learning environment." (Observed class' female science and technology teacher with 11 years of experience).

Without moving, without walking from one side to another (for example, in the class students would do research on the computer and then they would walk to other side of the room to read book) students might have difficulty in construction of their own knowledge. During the observation, the teacher used direct instruction and questioning and she could not hold students' attention. The teacher who created noisy classroom spent more time to turn their attention to subject. The teacher made effort to

provide silent classroom. Additionally, it is observed that lack of materials like computer and books restricted the implementation of constructivist curriculum. The need for materials was mentioned by interviewee as well (n=3).

> "One problem is lack of materials like overhead, visual materials, computer to cover the classes effectively. Materials can be supplied to schools." (Female science and technology teacher with 12 years of experience).

A study showed that some insufficient number of materials limit teachers' endeavor to conduct experiments (Bayrak & Erden, 2007), and the studies clarified the needs of in-service training about usage of laboratory materials and conducting experiments as well (Karatepe et al., 2004). Parallel to these results, one of the participants said that she was talking about the experiments rather than conducting it. Besides laboratory experiments, group activities, research projects and cooperative learning were suggested. In other words, learning environments were not described as classrooms; moreover, out of school activities were offered.

> "The school did not have a laboratory but it had some space and we designed the space as laboratory. I know some schools where they do not have a laboratory." (Female science and technology teacher with 4 years experience).

Laboratory activities require not only materials but also extra time to prepare materials, tools, and chemical ingredients; and two interviewee teachers expressed their reluctance to allocate time to conduct experiments. With this aspect, the teachers might be motivated to conduct experiments by providing enough materials.

> "The school doesn't have a science laboratory that's why I can conduct simple experiments in the classroom. I have to cover the classes by transforming knowledge; my classes are teacher focused classes; I must do it because the cognitive levels and skills of students are low and this situation requires teacher centered classes. The students don't have inquiry skills, they don't ask any questions." (Male science and technology teacher with 4 years experience).

Teachers' Role

Participants asked for their opinions about their role and what changed in the classes with the implementation of new curriculum. They (n=2) explained that the responsibility of teachers was to create curiosity by asking questions about the new curriculum. Teachers (n=2) stressed learner - centered classes and stated that the students have fun during the learner centered activities.

> "The new curriculum encourages teachers to create curiosity about nature. Because of the questions written on the textbooks, I can easily attract students' attention. I ask questions like 'why does vapor emerge on the glass when the weather is cold?' they impatient to hear the answer." (Male science and technology teacher with 4 years experience).

This statement highlighted that the teacher gave the answers and the students were still passive recipients. Although the teacher defined their role as curiosity–makers at

the beginning of the interview, he reflected he used direct instruction methods and they did not encourage students to construct their own knowledge.

> "The role of the teachers is to be guidance and also to prevent students' misconceptions; the role of the students is being researcher, instructor and knowledge constructor." (Female science and technology teacher with 12 years experience).

So as to enhance the effectiveness of the program, one participant put emphasis on parent-school cooperation. Information about activities and projects can help teachers' implementations.

> "I would like to say that informing parents about new curricula would increase the effectiveness." (Female science and technology teacher with 12 years experience).

Curriculum Organization

In the documents related with the development process of the new curriculum, there were some evidences how the content and subject matter of the curriculum were organized. While organizing the content and the subject matter of the curriculum; the developmental level of the students, the principles of learning such as from simple to complex, from concrete to abstract, were taken into consideration. Moreover, the learning units were organized in such a way that it would meet the needs and the interests of the students. So as to deal with the integration issue, while developing the curriculum, a system tried to be established between the commissions of different subject areas. As a result, the science curriculum was integrated with the other courses in order to prevent isolation of science course from the other courses. The spiral construct of the program could be easily examined, because same subjects were offered to students in detail during the different grades. Additionally, time flexibility was provided. Time of the units could be determined by the teachers at the frame of the 10% time flexibility.

> "Some subject matters covered in short span, that's why we have a chance of passing the next subject when the content is covered." (Female science and technology teacher with 8 years experience).

As for assumptions underlie the curriculum organization in relation to bases, the characteristics of three different assumptions; subject centered, society centered and learner centered assumptions, were reflected in the program. Broad field curriculum design characteristics, learner centered approach characteristics can be easily recognized. Additionally, social needs taken into consideration because curriculum development model comprised social needs. In the 'foundation of curriculum' part some social needs such as the needs stem from being in the information age, the effects of globalization, the speed access to information sources and results of these situations were explained.

Evaluation

Newly developed science and technology curriculum offers different assessment and evaluation techniques such as demonstration, anecdotes, discussions, presentations, observations, projects, self evaluation, peer-evaluation, portfolio assessments, rubric and performance assessment. In order to clarify the necessity of process oriented assessment, each technique was discussed one by one in detail in the document. Moreover, these techniques were suggested not only for the summative purposes, but also for the formative purposes. Why teachers avoid implementing only process evaluation and why complementary evaluation techniques were necessary, were explained. When participants asked for what evaluation methods they preferred to use, they mentioned process evaluation but they implement product evaluation.

> "I use multiple choice test and projects to evaluate students' success." (Female science and technology teacher with 4 years experience).
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> "I prefer to administer multiple choice exams and open - ended questions like why do level of mercury raise when the temperature increase." (Male science and technology teacher with 4 years experience).
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> "I think students must be familiar with multiple choice exams because they will take national exams such as level test or university entrance exam." (Female science and technology teacher with 8 years experience).

The expression indicated that the suggested evaluation techniques were yet to be applied. It could not be accepted as a documentation problem but teacher training problem. One of the most difficult parts of the new curriculum was students' success evaluation, because it might be very hard for teachers to give up their habits. Although complementary evaluation techniques were explained in the formal curriculum in depth and clear way, experienced curriculum showed differences. Instead of explaining complementary evaluation and assessment techniques, some examples could be offered to teachers, and some activities could be conducted during in-service teacher training. In conclusion, internalizing and implementing constructivist approach and implementing traditional evaluation cause confusion.

One of the participants mentioned in-service education and evaluation techniques.

> "We did not cover evaluation courses effectively. I did not learn anything about evaluation that are suggesting now."

Consistency between what is expected from teachers through new curriculum and what the content of the courses were criticized by the participants.

Teacher Training

In addition to evaluation, teacher training programs can put emphasis on other fundamental requirements of the constructivist curriculum. Participants commented on in-service and pre-service teacher training to implement new curricula. They claimed

supervisors informed teachers by reading passages written on transparency during in-service training. They did not experience cooperative learning activities or constructivist learning process. According to them, supervisors used overhead in a routine and boring way. They thought reading; whatever was written on transparency, was more boring than lecturing and this teacher training method influence teachers' motivation and curiosity negatively.

The participant teachers believed they received sufficient theoretical knowledge during in service education; whereas, they highlighted that they did not have any experience on how some teaching and learning methodologies and theories put into implementation.

One teacher expressed that they had sufficient theoretical knowledge elicited during pre service education but they did not know how to implement constructivism in the learning environment. The interviewee talked about her pre service education and emphasized that they covered the subjects by using direct instruction in their pre-service education. The teacher training programs could provide teachers with all information and experiences that science and technology teachers need for.

> "We mentioned inquiry learning, cooperative learning by presenting knowledge to our class-mates during the undergraduate years; especially the last two years. Regarding this aspect, demanding student centered approach, even though we received pre-service training in the limits of direct instruction method, is unfair." (Female science and technology teacher with 4 years experience).
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> "I am doctoral student and the school administration wants me to give a seminar to my colleagues. I think this situation can be accepted as one indicator of ineffective in-service education." (Female science and technology teacher with 8 years experience).
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> "The training on the new curriculum lasted 5 days and the time spent was ineffective. We watched CD's and then some examples were given. I and my friends struggle to understand. The implementation of the new curriculum depends on our endeavor. The training was really boring." (Female science and technology teacher with 12 years experience).

Participants' opinions about structure of schools were mentioned under the heading of teaching- learning process. Additionally, one participant touched upon teacher training and insufficient equipment and laboratory activities during the undergraduate years. Structure of the university buildings was stated as limitation for implementation of the new curriculum. One participant stated she felt inefficient to conduct experiments in laboratories because of the insufficient experiment activities during undergraduate years.

Discussion

This study aims to analyze new 6th grade science and technology curriculum offered by Ministry of National Education. The findings of the study is addressing to the

documentation of the curriculum, teaching learning process, teachers' role, evaluation and teacher training.

The participants were satisfied with the documentation of the curriculum. The curriculum was easily accessible and the explanations were very effective. Textbooks were still perceived as main resources by the teachers. Like results of another study (Gömleksiz & Dilci, 2007), lack of needs assessment results in the new curriculum can be accepted as a limitation.

One of the positive aspects of the curriculum is its perspective. The students are not at schools for just sitting and listening; they are at schools to construct their own knowledge and to learn the ways of reaching, using and sharing knowledge, whenever and wherever they need it. Reflection of teachers' views by including teachers in the curriculum development process can be acceptable as one of the strongest aspect. The characteristics of the formal curriculum were applied in classes with some differences. Although the participants mention the requirements of and basic characteristics of constructivism, it is very obvious that they did not change their practical habits.

Lack of laboratory equipments restricted teachers' endeavors to conduct experiment. Besides equipments, insufficient time spent in laboratories during undergraduate years was defined as factors that affect the new curriculum implementation.

Constructivism plays an important role in the new science and technology curriculum. In constructivism, it is expected that the learner would be active and construct their knowledge. Putting emphasis on learning, instead of teaching; and changing role of students were evaluated as useful innovations (Kaptan, 2005). The results of the study showed that teachers were satisfied with the innovations, they explained the requirement of the new curriculum but in practice they have some misapplications. One of the participant named yes/no questions as guided questions and observation results and interviews showed that the students were waiting for teachers' answers instead of researching, in other words they are still passive recipients, and teachers are perceived as the source of knowledge. The participants expressed that the in-service teacher training was ineffective. They are in need of getting information by implementing the requirements of the new science and technology curriculum. Similarly, Bukova-Güzel and Alkan (2005) and Erdoğan (2007) reported that in-service teacher trainings did not completely meet the teachers' needs.

Only in-service teacher training cannot be hold accountable for some misapplications. Gözütok, Akgün and Kocaoğlu (2005) suggested that it was better to implement requirements of the curriculum during pre-service education. If the teacher candidates train in the mimetic tradition and they are expected to implement the transformative tradition, the effective changes would be perceived as limitation and challenges by the teachers. Pre-service training needs to be in line with the requirements of the curriculum implementation.

Complementary evaluation techniques are among the requirements. Implementation of constructivist approach during the learning process in the elementary school classrooms and implementing traditional evaluation techniques leads to confusion. One of the findings of this study was that some national wide exams such as Level Determination Exam (LDT [*SBS-Seviye Belirleme Sınavı*]) or University Entrance Exam (UEE [*ÖSS- Öğrenci Seçme Sınavı*]) leads to confusion in teachers' mind. In order to enable student to solve multiple choice questions, some teachers tend to evaluate students' success through multiple choice exam to make them familiar with these kinds of exam questions. Teachers encounter some difficulties when using suggested evaluation techniques (Metin & Cansüngü-Koray, 2007). Bayrak and Erden (2007) suggest preparation of a booklet including various types of questions and exercises because sufficient explanations about complementary evaluation techniques do not exist in the curriculum (Bayrak & Erden, 2007).

The findings showed that the suggested activities were perceived as compulsory and all of the activities should be done. In in-service teacher training some misconceptions and misapplications can be explained.

Finally, the new 6th grade science and technology curriculum is an opportunity for teachers, faculty in educational institutions and supervisors who are speakers in in-service teacher training procedure to increase the effectiveness of science and technology classes.

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