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Pinar Ozdemir
Hacettepe University

Sibel Guneyusu
Baskent University

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Perceptions of Primary School Teachers Regarding New Science and Technology Curriculum of Turkey in terms of Teaching and Assessment Methods

Pinar Özdemir
Hacettepe University

Sibel Güneysu
Başkent University

Abstract

The purpose of this study was to explore and investigate perceptions of the primary school teachers' in 4th and 5th grade public schools on new science and technology curriculum in science and technology classes in Turkey. Whether primary school teachers familiar with the improvements in science and technology curriculum and whether they feel themselves adequate in terms of theoretical knowledge and application of the new approaches in science and technology lessons were also investigated.

The research type of this study includes survey and qualitative research in nature which are non-experimental research methods. The quantitative part of this study includes questionnaire administration and qualitative part includes interviews. A perception questionnaire was administered on 155 primary school teachers. Then, the researcher carried out in depth interviews with 13 primary school teachers. Quantitative part of the study was analyzed by descriptive and inferential statistics by using SPSS (e.g., frequencies, percentage analysis). Qualitative part of the study was analyzed by using qualitative methods (Generating categories, themes, patterns and coding the data).

The findings from quantitative and qualitative data indicated that similar to the results of the studies carried out in other countries, primary school teachers have various perceptions to apply teaching and assessment methods related to knowledge, experience, students, parents, administrators, resources, opportunities, time, and science books. The interview results with the teachers yielded different categories like basic features of the New Science and Technology Curriculum, positive and negative perspectives on new curriculum, factors affecting the application of the new curriculum, and comparison of old and new curriculum. Although most of the teachers stated that the new curriculum is applicable and better than the old one, they have many problems especially regarding the application of the new curriculum.

Introduction

Recent calls for reform in science education have emphasized the need for science to be accessible to all students and for all students to have the opportunity to attain high levels of scientific literacy (American Association for the Advancement of Science, 1993; National Research Council, 1996; Council of Ministers of Education in USA, 1997). Although scientific literacy can have several dimensions, scientific literacy require that students acquire not only an understanding of the theoretical and conceptual principles of science, but also develop an understanding of the nature of science and relations between science, technology, society, and the environment and develop skills of scientific inquiry and problem-solving. Such reforms in science teaching require a fundamental change in the teacher's role, and many specialists have pointed to the need for teachers to change their conceptions and practices concerning the teaching of science (Hodson, 1998; Humphreys, et al, 1982; Longbottom & Butler, 1998; Miller, 1984).

There have also been increasing efforts to improve Turkish educational system especially since 1992. In the way of being a full member of the European Union and leading to the changes in education, the Turkish government now gives more importance to education in Turkey and the Ministry of National Education handles the problems in education and set the educational requirements of the 21st century as a priority (Aşkar & Akkoyunlu, 1994). One of the most important reforms in education for Turkey was to change the compulsory education by increasing from five years to eight years. This was done in August, 1997 by the MEB and the Turkish government. With this reform, education system has completely reorganized and so the primary science curriculum. Turkey still continues to improve its educational system, especially in the areas of learning theories, curriculum development, and educational technology by placing the students at the center of education. In light of all of the developments, science and technology curriculum has been currently changed and started to be used in 4th and 5th grade in 2005-2006 education year. With regard to the teaching methods in the New Science and Technology Curriculum (NSTC), constructivist teaching strategies are suggested for the teachers to be used in science and technology lessons, which are all student centered approaches. In the new curriculum, it is clarified that, based on the suggested teaching strategies, teachers have to select the appropriate strategies to acquire the determined objectives. They are expected to provide appropriate learning environment for their students. The role of the teacher is the facilitator by guiding the students. As for the evaluation and assessment of students, strategies are constructed by taking the constructivist view of teaching and learning process (MEB, 2005). In the curriculum, it is suggested that teachers should offer multiple assessment opportunities for their students to exhibit their knowledge, skills and attitudes. The curriculum give emphasis on alternative assessment and evaluation strategies rather than traditional strategies. With such changes in the teaching and assessment methods used by the teachers, this study aimed at identifying the readiness of the primary school teachers to adapt to NSTC.

Statement of the Problem

The problem statement of this study is that “What are teachers’ perceptions related to new science and technology curriculum in Turkey in terms of teaching and assessment methods?” Table 1 summarizes the problem and the research design of the study.

Table 1. Problem and the Research Design of the Study

Problem	Research Type	Data Collection Methods
What are teachers’ perceptions related to new science and technology curriculum in Turkey in terms of teaching and assessment methods?	Quantitative/ Descriptive Research Qualitative/ Ethnographic study	Questionnaire Interview

Subproblems of the study are:

1. Are primary school teachers familiar with the improvements in science and technology curriculum?
2. What do primary school teachers think which approaches improvements in new science and technology program are based on?
3. Primary school teachers feel themselves adequate in terms of theoretical knowledge and application of the new approaches in science and technology lessons?.

Population and Sample

Target population of this study was identified as all primary school teachers in the public schools in Ankara. Since it is not possible to reach this target population, accessible population was determined as all primary school teachers who teach science in the public schools in Yenimahalle and Çankaya district in Ankara. This is the population to which the results of the study was generalized. The number of primary school teachers in Yenimahalle and Cankaya districts are approximately 430 and 560, respectively. There are about 187 primary schools distributed in Yenimahalle and Cankaya districts. Of the 990 primary school teachers, 155 participated in the survey part of this study, which approximately 16% of whole population. Number of schools included was 31 and 38 for Yenimahalle and Çankaya, respectively. Two groups of teachers were involved in this study; for the questionnaire and for the interviews. Furthermore, there are two parts in this study; quantitative and qualitative part. The quantitative part of this study includes questionnaire administration and qualitative part includes interviews.

For the questionnaire administration which constitutes the quantitative part of the study, instead of randomly selecting a sample of teachers from every school, because of the time and budget, all teachers in selected schools formed a sample. First, the district was identified and the names of the schools in this district were obtained. The teachers, in each school, then constituted a cluster. The study sample chosen from the accessible population is a sample of convenience.

The sample was selected from a group of people available. For the interview part of the study, the researcher selected five schools randomly from the ones that questionnaire was administered and then interview with 4th and 5th grade teachers who are voluntarily participated to the interview. The teachers were different from the questionnaire part of the study.

Data Collection Instruments

Questionnaire

The Questionnaire for Primary School Teachers to Teach Science based on the New Science and Technology was developed by the researcher. In an effort to ensure the validity and reliability of the questionnaire used in this study, different questionnaires were searched. Most of the questions in the questionnaire of this study were added from General Qualified Teaching Profession Questionnaire (MEB, 2004) prepared based on aims of the new science and technology curriculum of Turkey. Some of the questions were added from three instruments in the literature; Teacher's perceptions and practices of Gardner's theory of multiple intelligences developed by MacLeod (2002), Science Teacher Inventory of Need (STIN) developed by Zurub and Rubba (1983) and Moore assessment profile developed by Moore (1978). None of these questionnaires were used exactly the same in this study but a few of the items of these questionnaires were used after being assessed by four science educators.

Interview Schedule

To support the findings obtained from the questionnaire part of the study, in-depth interviews were also carried by 13 teachers. The type of the in-depth interviews was standardized open ended because the exact wording and sequence of questions were predetermined and questions were open ended so that more questions could be asked on specific subproblems of the study giving emphasis on exploration rather than hypothesis testing. While preparing the questions of the interview schedule some of the points considered as suggested by Patton (1990), Bogdan and Biklen (1998) and Marshall and Rossman (1999) and were; relevance to the research questions of the study, specifying the context, asking open-ended questions rather than short answer, writing alternative questions, writing probes to get detail answers, using a non technical and clear language, considering subject's cognitive level and background, avoiding concepts, phrases or sentences that might be unfamiliar or misunderstood. Having prepared 13 questions for the interview, the interview schedule was piloted with three primary school teachers from Yenimahalle and Çankaya districts to ensure that there are no overlaps and they focus on the sub research questions. The data obtained from the interviews were summarized and coded descriptively to identify the perceptions of teachers with respect to NSTC in science and technology classrooms. The coding procedure was carried out based on the literature and experts opinions. The researcher went through the data looking for things pertinent to answering the research question. Then coded data was sorted into piles according to topics. Example of coding data is shown in Table 2.

Table 2. An Example of Coding the Data

Part of the Data	Sample Coding
<p>Yeni Fen ve Teknoloji programında aslında <u>bilgiyi öğretmekten ziyade kişilik üzerinde çok duruluyor, yani nedir, sorumluluğunu bilecek, iyi bir vatandaş olacak, kişilikli olacak, dürüst olacak, araştırarak, sorgulayacak, bir şeyi hemen kabul etmeyecek, ben bunu çocuklara veriyorum ama herkes böyle değil. Fakat bunların dışında öğretmen değil, nitelikli öğretmen, iyi öğretmen, mesleğini seven öğretmen yetiştirmek önemli. Ondan sonra eğer öğretmen mesleğini seviyorsa, ona bir ideal olarak yaklaşıyorsa, ve eline verilen öğrencilerin ileride Türkiye'yi yöneteceklerini biliyorsa ve bunun bilincinde ise özveriyle çalışıyor, yoksa olmuyor.Bir de genelde bayan öğretmenlerin maddi sıkıntıları yok, eşlerinden dolayı, o yüzden hobi olarak yapıyoruz, çok severek yapıyoruz, belki erkek öğretmen olsaydım, maddi sıkıntım çok fazla olsaydı veya ailevi sorunlarım olsaydı kendimi mesleğime bu kadar veremezdim. Yani sınıfa giren bir öğretmen mutlu olmalı, on anda öğrencilerden başka bir şey düşünmemeli....</u></p> <p><u>Fen ve Teknoloji kitabını çok beğendim, çok güzel yazılmıştı, yalnız bu kitabın uygulanması için çok güzel laboratuvarlar gerekiyor, laboratuvar eksikliğimiz var bizim bu okulda. Eğer bir laboratuvarımız olsaydı ve başında özellikle söylüyorum bir laboratuvar öğretmeni olsaydı çok iyi olurdu. Eskiden bu da vardı, küçümsedikleri eski fen programında bu da vardı, laboratuvarımız vardı ve laboratuvar öğretmenimiz vardı</u></p>	<p>Emphasis on personality rather than information</p> <ul style="list-style-type: none"> • Knowing responsibility • Good citizen • Good personality • Honest • Researcher • Examiner <p>Features about teachers</p> <p>Gender of teachers</p> <p>Liking the teaching profession</p> <ul style="list-style-type: none"> • Income • Concentration • Happiness <p>Well written science book</p> <p>Lack of laboratories</p> <p>Lack of lab teacher</p> <ul style="list-style-type: none"> In OSC • Having lab • Having a lab teacher

Results

Results of the Questionnaire

The descriptive statistics of the questionnaire for the demographic informations of all primary school teachers (gender, grade level, program graduated, years of teaching experience, whether they participated in pre-service education and in-service education on new methods in science and technology education) in this study are given in Table 3.

Table 3 Demographic Distribution of All Primary School Teachers in the Study

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

For the subproblem 1 of the study, to show their familiarity with the improvements in science and technology lessons, teachers gave their responses on a 5 point scale from 1 meaning less familiarity to 5 meaning most familiarity. Teacher's responses to this question were summarized in Table 4. The mean of the responses was 4.37 as shown in Table. Therefore, it can be stated that teachers are familiar with the improvements in science and technology lessons.

Table 4. Familiarity of the Primary School Teachers with Improvements in Science and Technology Lessons

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

For the next subproblem "What do you think which approaches these improvements are based on?", teachers' responses were tabulated as frequency counts, by counting the same statements made by the teachers, in Table 5. About 25 % of the teachers stated that new science and technology program is based on learning by doing and student centered approach. 16 teachers stated that they have no idea about the approaches on which new curriculum is based on.

For the last subproblem of the study teachers were asked whether they feel adequate in terms of theoretical knowledge and application of the new approaches in science and technology lessons. Teachers answered the question by marking the "yes" or "no". They were also asked to write the reason if their answers were "yes" or "no". Among teachers, 153 of them answered this question and most of the teachers explained the reason of their answer for this question. The results of the answers of the primary school teachers for this question was shown in Table 6.

Table 5. Frequency Counts of Perceptions of Teachers on Improvements in Science and Technology Lessons

Improvements in science and technology lessons are based on		
Statements by teachers	<i>f</i>	%
Learning by Doing	36	14.1
Student centered approach	29	11.4
Investigation	26	10.2
Constructivist Approach	24	9.4
Experiments and observation	23	9
Multiple Intelligence	19	7.5
Relation with daily life	12	4.7
Avoiding from Rote learning	12	4.7
Developing creative and critical thinking	9	3.5
Approaches on developing skills to reach knowledge	9	3.5
Discovery learning	7	2.7
Projects	7	2.7
Activities	6	2.4
Emphasis on visual learning	6	2.4
Permanent learning	5	2
Drama based instruction	4	1.6
Spiral Approach	3	1.2
Individualized Instruction	3	1.2
Discussions	3	1.2
Process based	2	0.8
Developing scientific process skills	2	0.8
Developing problem solving skills	2	0.8
Integrated curriculum (relation with other lessons)	2	0.8
Using developments in technology	2	0.8
Questioning	2	0.8
Total	255	-
Having no idea (stating “I do not know” or “I can not give any example of approaches”)	16	-
Stating that NSTC is “Not applicable”	4	-

Table 6. Perceptions of Teachers to Feel Adequate in terms of Theoretical Knowledge or Application of New Approaches in Science and Technology Lessons

		ANSWER	
		YES	NO
f		71	82
%		46.4	53.6
Explanations (The reason of stating “yes” or “no”)			
Yes	f	No (or yes but)	f
Because of		Because of	
-Getting in-service education on new science and technology curriculum	6	-Inexperience in teaching profession -Need of more years in teaching science and technology	3
-Having enough theoretical knowledge for 5th grade science	1	-Not reading or searching to renew herself	2
-Having skills and ability for interacting with the students	1	-Inadequacy of the materials -Need of abundance of materials -Difficulties in obtaining materials	3 6
-Richness of the activities in new program	2	-Immediate change of the curriculum -Not proper with the physical conditions in schools	2
-Easiness of application	1	-Need of in-service education about new curriculum -Inadequacy of the teacher education -Irrelevancy of content of the seminars with the curriculum -Inadequacy of educators giving the seminars -Shortness of in-service educations -Theoretical content of in-service educations	3 8
-Detailed explanations in science and technology teacher book	4	-Difficulties while carrying out the experiments -Most of the time, failing during experiments -Not knowing how to carry out -Inadequacy of the laboratories in the school -Not using the laboratory for each experiment -Having no equipped laboratory -Need of science teacher in the laboratory lessons	2 5
-Presence of enough materials in the school such as data projector and computer	3	-Need of time to be used to the curriculum -Hardness in adapting to the new curriculum	9
-Feeling adequate in knowledge but not in application	8	-Not giving importance for developing herself because of family life	1
-Following up every development related to science education	1	-Need of technology such as computers and internet connection in the school or in the class	4
-Reading many books and articles on science education	2	-High number of students in the class	1 4
-Learning the application of new approaches during pre-service education	8	-Not knowing how to reach application examples about new approaches	6
-Personal effort to adapt to the curriculum	2	-Need of more time to carrying out all activities in the book	4

Table 6 (cont'd)

-Experience in teaching profession for many years -Being at least 20 years of teaching experience -Having ability to solve the problems for many years	6	-Hardness to understand the science and technology teacher book -Full of unknown words -A few examples on application of the new approaches -Objectives are not clearly stated	2
-Necessity of adapting to the knowledge age -Being compulsory to apply new approaches to catch the developed countries	1	-Inconvenience of using the approaches in new curriculum -Not appropriate approaches for Turkish students	2
-Doing preparation before science and technology lesson	3	-Thinking that the new curriculum is not properly prepared -Not appropriate for students' thinking level -Many changes at a time	5
-Having positive attitude toward science and technology	2	-Being not appropriate for physical structure of the class -Not proper arrangement of the desks -Small class size -Not having enough visual materials in the classroom	3
		-Being not familiar with the equipments written in NSTC -Need of in-service education on using equipments in Science	3
		-Presence of examinations in Turkey affect the quality of the education that the teacher give	5
		-Science book is unproper -The main topics are not clearly stated	4
		-General structure and perspectives of Turkish people affect the application of NSTC	1
		-Graduating from irrelevant department in university	8

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

Result of Interviews

Thematic analysis of interview questions yielded 5 categories for main problem of the study relating to the perceptions of teachers on NSTC as shown in Figure 1. Categories emerged from the responses of the teachers were explained separately each having additional sub-categories and codes.

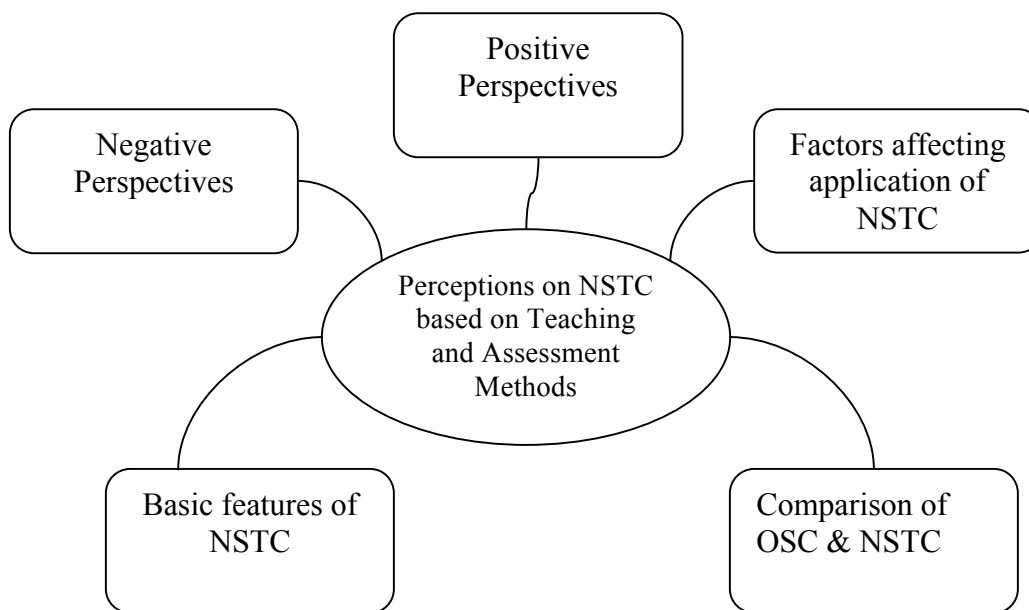


Figure 1. Categories Emerged from the Perceptions of Primary School Teachers on NSTC

Basic Features of the NSTC

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

Comparison of the Old and New Science Curriculum

In this study, most of the primary school teachers also compared Old science Curriculum (OSC) and NSTC in many respects. This might be because most of the teachers were experienced teachers in their years of teaching. Differences between the two curriculum based on teachers' statements were summarized in Figure 2. Based on the teaching and assessment methods, teachers stated that NSTC was better than OSC in many respects such as having more group projects, less theoretical knowledge, better adaptation of the students,

having better books and so on. However, few of the teachers stated that OSC was better in terms of laboratory activities by having laboratory teachers, laboratory notebooks for each child and application of more laboratory.

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

Figure 2. Comparison of the OSC and the NSTC Based on Teaching and Assessment Methods

Factors Affecting Application of the NSTC

Most of the teachers during interviews stated the factors that affects the application of the NSTC. According to the teachers, there are many factors that affect the implementation of NSTC. There were many sub-themes generated based on teachers’ perceptions. Teachers stated that teachers properties were the most significant factor that affects the implementation of NSTC. For instance, they believed that personality, beliefs, perspectives, family life and gender of the teachers might affect the teachers’ teaching skills by affecting the application of NSTC. One of the teachers, expressed her perspectives related to this factor as in the following sentences:

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

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

One of my students’ parent asked me about the teacher that teach instead of me as I changed my school at that time. I said that she is a good teacher, she asked the age and family of the teacher. I replied, she had two children. They were in high school. She said that ‘oh my good’ now is the most problematic time of that teacher, she can not concentrate on the class. Yes, this parents’ conclusion was true. Curriculum

changes continuously but if teachers' income and family problems continue nothing will change.

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

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

Positive Perspectives on the NSTC

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

I am very happy to apply this program. It was so useful for me and for my class. My students' achievements increased so much. Mathematics curriculum was also changed but I especially like the NSTC. The book were very good, activities were excellent. As our general examinations revealed, students' achievement in science was better than other lessons.

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

stated that knowledge acquired through the methods in NSTC would be more permanent for the students.

Negative Perspectives on the NSTC

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

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

It can be said that teachers have mostly positive perspectives on the NSTC. Most of the teachers said that teachers' properties were the most significant factor that affects the implementation of the NSTC. For instance, they believed that personality, beliefs, perspectives, family life and gender of the teachers might affect the teachers' teaching skills by affecting the application of the NSTC. This result is consistent with the other studies. Teachers' personality characters might affect their science teaching in many respects (Gyamfi, 2008; Hodson, 1998).

Majority of the primary school teachers stated that their training was not adequate to apply the NSTC. One of the essential points to emphasize is that teachers think that they took seminars from unqualified persons. Also they experienced many technical difficulties especially in laboratory applications. Their problems related to the laboratory included the absence of laboratory lesson and a laboratory teacher in school, having no lab notebooks, lack of equipments, lack of time, inappropriateness of the experiments with levels of students, difficulties in searching and reaching materials and difficulties in preparation for the experiments. A research carried out by Çepni, Küçük and Ayvacı (2003) support the findings of this study. Results of their study included that most of the classroom teachers do not give science courses with pleasure, teachers had difficulties in implementing laboratory activities and especially believe that it is more convenient that these courses should be taught by science teachers. The importance of laboratories in science and technology lessons and the significance of the qualification of the teachers in terms of knowledge and experience is an accepted idea for better science teaching (Asoko, 2002). Teachers came to the reform with varying degrees of knowledge about and experience with the instructional approaches of the curriculum and not all teachers held a belief system that coincided with the reform. Some of

the teachers came into the field test with a better understanding of these key concepts, strategies, and skills than did others. Previous to the reform, as noted earlier, some of these teachers had begun to make changes in their approaches to teaching by incorporating new approaches based on individualized instruction in their science and technology classroom and by working with university personnel to develop and adapt effective strategies for hands-on science activities. Therefore primary school teachers need training to teach science effectively.

Related to the science book teachers clarified that the books were inappropriate with levels of the students and sources available. Also two of them stated that explanations were so long in the book and it gives no emphasis on Turkish Scientists. Most of the teachers also said that there were many units and subjects in the book and the number must be decreased. The study carried out by Yıldırım and Öztürk (2002) had similar findings related to the inappropriateness of the curriculum and students' level and so support the findings of this study. The abundance of the contexts in the curriculum is a common problem in Turkey. In Turkey, primary education programs include Turkish language, Turkish literature, mathematics, social studies, science and technology, civics and human rights, the history of the Turkish Republic and Atatürk's reforms, a foreign language (English, French, or German), individual and group activities, religious culture and ethics, art/handicraft, music, physical education, traffic safety and first aid, career guidance, and elective courses. In such a rich context, primary teachers are not able to achieve the purposes of the science and technology program effectively. There is a predetermined hours of each subject per week at Turkish schools by MEB and primary teachers try to manage their program to cover all of the subjects that must be taught. The MEB also prepares students' textbooks, teachers' textbooks, worksheets, and teaching aids. Any materials to be used in schools must be approved by the Ministry.

Discussion

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

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

Educational leaders must recognize the many factors that are critical to the success of reform, including the ways and practices that support teacher learning as well as the obstacles that can inhibit its progress. With such understanding, we can foster action that will support valued change and, importantly, address limiting factors. Keeping these points in mind and acknowledging that the process of learning to teach can take place across a variety of

contexts (i.e., content courses, teacher preparation programs, professional development courses and workshops, and classroom settings), several actions can support teacher learning and the teacher change process. First of all, teachers should address preexisting knowledge and beliefs about teaching, learning, learners, and subject matter. It is valuable to assist teachers as they make their beliefs explicit and provide them with contexts to examine, critique, and weave new ideas into their existing constructs. Second, teachers must be given continued opportunities to deepen and expand their subject matter knowledge. Without necessary subject matter knowledge, it is hard for teachers to learn strategies and techniques needed to respond to students' thinking about the subject in ways that facilitate their learning.

Validity and Reliability of the Study

There are many threats in both quantitative and qualitative studies that must be controlled. For example, potentially confounding variables that will not be controlled in this study can be educational policy of school, economical conditions of schools, learning styles of teachers, teaching experiences of teachers and their socioeconomic status. The science teachers may have negative attitudes toward using the new teaching approaches. Teachers' educational backgrounds may be also important. There might be some main threats to internal validity in the research. They can be subject characteristics, mortality, location, instrumentation and instrument decay for the survey part of this study. The teachers' perception of the study can create a subject attitude threat to internal validity. Instrument decay might also affect interview surveys as the participants in this study might also get tired or get bored affecting the validity of information obtained. A location might be a threat in this study if the collection of data is carried out in places that may affect responses. Location was held constant that is tried to keep the same for each teacher including the room, silence and lightening. Teachers were recommended to fill the questionnaires in a silent and calm environment in their free hours in order to control this threat. Fatigue of the scorers can be instrument decay if she becomes tired and scores tests differently. This threat will try to overcome by schedule data collection and scoring so as to minimize the any changes in any of instruments and scoring procedures by different scorers. The design and implementation of the survey was also subject to threats. For example, teachers may not have self-reported with a high degree of accuracy. To overcome this effect for data validity, a uniform method of data collection was implemented. Furthermore, the survey was developed in a manner that did not cause teachers' beliefs to be captured. To reduce the effect of this issue, piloting of the survey helped the researcher to design questions that were not complex and based on experiences of primary school teachers increasing the likelihood of the teachers' information represented what they believed.

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

There is also the possibility of an unconscious bias on the part of the data collector, as when she or he asks leading questions of some individuals but not others. All of these issues were considered throughout the data collection procedures. In this study, the descriptions of informants were compared with the others' descriptions and as a result no discrepancies were found. The interview questions had been written down to reduce distortions attributed to selective forgetting. Interview guide was designed and its framework was established based on the literature review. This enabled the researcher to keep focus on the research questions

of the study. Interview questions were piloted with primary school teachers and revised interview questions were also sent to experts to get opinion. An expert from the department of Educational Sciences reviewed and evaluated the interview process of this study.

The researcher designed the interview process and made necessary changes on the schedule. This process enabled content and construct validity of the questions. To increase validity, audiotapes for the interviews were used. The results of the interviews were discussed and shared with the primary school teachers to ensure the accuracy of research results. Also the data of interviews were read and coded by two educators different from the researcher. By checking coding definitions become sharper when two or more researchers code the same data set and discuss difficulties and issue arising. More coders mean a good reliability check for the qualitative studies. Inter-coder reliability was also calculated by dividing the number of agreements to the total number of agreements and disagreements. The results of the coding and generating categories of this study were compared between three coders and inter-coder reliability was calculated as approximately 82%. It is acceptable for checking the reliability in qualitative studies since it is larger than 70% (Yıldırım & Şimşek, 2001). This procedure also increases the reliability of the results of this study.

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