

# Curriculum Reform in Turkey: A Case of Primary School Mathematics Curriculum

Mehmet Bulut

*Gazi Üniversitesi, Ankara, TURKEY*

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The purpose of this study was to analyze the newly developed elementary school (grades 1 through 8) mathematics curriculum by considering 5<sup>th</sup> grade students' and classroom teachers' views. The analysis of the curriculum was realized in three dimensions; (1) Classroom management – classroom physical and emotional environments, teacher and student roles, and interactions, (2) Instruction – objectives, planning, implementation, method and techniques, instructional media, and measurement and evaluation, and (3) Strengths (and/or benefits) and weaknesses (and/or limitation). Qualitative case study method was utilized with the participation of three elementary school teachers and their forty-three fifth grade students were invited. The responses gathered from the participants were content analyzed and then the codes were categorized. The findings indicated that several changes have been done and reflected into the classroom implementation and student-centered approaches have been incorporated into the instruction. On the other hand, some difficulties emerge during the implementation due to lack of infrastructure.

*Keywords:* Elementary Mathematics Curriculum, Reform, Teacher Change, Qualitative Research

## INTRODUCTION

### **A Brief Overview of Turkish Educational System and Ongoing Reform Efforts**

Turkey has a population of 72 million. According to estimations, it will be about 82 million by year 2015. According to the statistics by the Ministry of National Education (MONE) there are about 13 million students at the primary and secondary education levels with more than 500,000 teachers (MONE, 2001).

Pre-primary education in Turkey involves the education of children in the age group of 3 to 5 who have not reached the age of compulsory primary education, on an optional basis. Primary education involves the education and training of children in the

age group of 6 to 14. Primary education is compulsory for all male and female citizens and is free at public schools. Primary education institutions consist of eight-year schools where continuous education is provided and primary education diplomas are awarded to the graduating students. Secondary school is not yet compulsory (MONE, 2006).

In the last ten years, some development and improvement efforts have been attempted in the education system. In 1997, compulsory education was increased from 5 to 8 years. There are 10,673,935 students receiving compulsory primary education with 389,859 teachers (MONE, 2006). In 2005, Secondary school years were extended from 3 to 4 years. In 2002, preschool curriculum for 36-72 months-old children was developed. On the other hand, even though these continuous efforts to improve the education system of Turkey, international are benchmarking studies such as Third International Mathematics and Science Study - Repeat. TIMSS-R (1999), The Progress in International Reading Literacy Study PIRLS (2001) and Programme for International Student Assessment PISA (2003) have shown that Turkish students' performed below the

*Correspondence to: Mehmet Bulut, Research Assistant,  
Gazi Üniversitesi, Gazi Eğitim Fakültesi,  
İlköğretim Bölümü, Matematik Öğretmenliği AD,  
Teknikokullar 06500, Ankara, TURKEY  
E-mail: mbulut@gazi.edu.tr*

international average (Berberoglu, G., Celebi, O., Ozdemir, E., Uysal, E., & Yayan, B. 2003; Is, 2003; TIMSS, 1999).

New curricula have been developed and are being implemented for primary and secondary schools with ongoing changes since 2004 in Turkey. The idea behind these curricular reforms is to change the curriculum from a subject centered to a learner centered one and change the pedagogies from a behaviorism to more constructivism. The purpose of the curriculum reform is to change considerably the focus and content of the whole national curriculum. The basic objectives of the curriculum reform in Turkey are;

- to reduce the amount of content and number of concepts
- to arrange the units thematically
- to develop nine core competencies across the curriculum
- to move from a teacher-centered didactic model to a student-centered constructivist model
- to incorporate information communications technologies (ICT) into instruction
- to monitor student progress through formative assessment
- to move away from traditional assessment of recall, and introduce authentic assessment
- to enhance citizenship education (Board of Education(BoE), 2005)

One of the curricula started to be developed since 2004 is Primary School mathematics curriculum. The curriculum has been developed under the guidance of a committee consisted of academicians, teachers, and educational specialist. Further, feedbacks and opinions were gathered from other teachers, parents, students, and non-governmental organizations (NGOs). The Curricula developed for 1<sup>st</sup> to 5<sup>th</sup> grade students were firstly pilot tested in 120 pilot schools in 2004. One year after piloting, it was revised based on feedback obtained through the pilot administration, and implemented nation-wide. During this process, textbooks and instructional materials for grades 1<sup>st</sup> – 5<sup>th</sup> have been designed for use. Similarly, the math curriculum for grades 6<sup>th</sup> to 8<sup>th</sup> have been still developed and implemented in pilot schools gradually. Furthermore, basic education course schedule is being redesigned (Karip, 2005). As a following to the attempts in primary level, on-going reform attempts has been also reflected in secondary schools (changes in the courses and time of the secondary education) and universities (new courses were added and changes are done in the content of existing courses) as well.

In Turkey, exploratory teaching and memorization are still dominant in mathematics classrooms. Previous mathematics curriculum was based on behaviorist theory. The recently developed elementary school

mathematics curriculums can be labeled as a reform based attempt to achieve the contemporary educational changes in the world. (Umay et.al, 2006)

### **Basic characteristics of new elementary school mathematics curriculum in Turkey**

According to rationale of program, scientific studies, national and international evaluation reports, the experiences of teachers, the reports related to the current mathematics program and the findings of the non-governmental organizations state that there are problems about mathematics teaching in Turkey (MONE, 2004). The main reason for this is that educational methods, which are applied, are not programs where the students are mentally and physically active. The Vision of the Newly Developed Mathematics curriculum are stated in the guide book as training individuals who can be able to use the mathematics in their lives, who can be able to solve problems, who share their solutions and ideas, and who enjoy learning mathematics (MONE, 2004).

The principle entitled “Every child may learn mathematics,” is the main focus of the curriculum. A conceptual approach, which aims to develop the mathematical concepts as well as developing mathematical expression problem solving skills, communication skills and other important abilities, has been incorporated in the curriculum (BoE, 2005)

These all attempts aim to enhance students’ active participation in learning mathematics and its principals. The program highlights the importance of a learning environment where the students may research, discover, solve problems, and where they can share and debate their solutions and approaches. Also it adopted the idea of associating mathematics within itself as well as other subjects and disciplines. Concepts in mathematics have abstract characteristics due to its nature. It’s hard for the children to gain these concepts directly when their development level is considered. Therefore the concepts discussed within this program have been selected from factual and finite existence mode. In case the students realize that mathematics is an indispensable tool for everyday life, then they shall develop a positive attitude towards it. The program has been prepared by considering the integrity of elementary schools and the topics have been prepared according to the development level of the students for each class. (MONE, 2004)

Newly developed Mathematics curriculum is different from the old one by some aspects (BoE, 2005). New Curriculum;

- follows a conceptual approach in order to enable the students to comprehend and consider mathematics abstractly by using their institutions and experiences,

- is based on the fact that the students shall actively participate in the learning process,
- enables the students to express their individual differences and abilities via projects and specific homework,
- aims to prepare environments where students may research, discover and where they may discuss their solutions,
- aims to develop the students psychomotor abilities via using materials at activities,
- aims to provide the students with an education appropriate for the environment they live in via activity samples adaptable to different periphery environments.

The primary mathematics curriculum has many characteristics: it has four learning areas supported by skills, understanding and attitudes; there is a spiral approach for each learning areas; mainly based on the constructivist approach; enriched with teaching activities and multiple assessment methods and techniques. The four learning areas are the following: Numbers, geometry, data and measurement. (MONE, 2004)

The *numbers* learning area aims; to develop the ability of using the numbers and digits, to develop the estimation and operation abilities via understanding the four arithmetical operations, to ensure that the students associate the fractions, percentages and the decimal fractions, to ensure that the students determine the relations within patterns and that they apply all these information to the problem situations.

The *geometry* learning area aims; to develop the spatial (situation – location, direction – angle) abilities, to ensure that the students determine the relations between the geometric shapes and objects, to teach decorating with planar shapes, to teach them to determine and use symmetry, to teach them to use geometry tools and materials.

The measurement learning area consists of the measurement units, which the students shall face and need during their lives. The development of the estimation abilities for the students has been emphasized as much as the development of the concepts of measurement.

While forming the *data* learning area the starting point was based on the fact that the students should be conscious citizens and they should be able to analyze the data they come upon during their everyday lives. The data gathering, organizing and interpreting abilities were emphasized. The probability topic has been taught at a intuitional base starting from the 4<sup>th</sup> grade (BoE, 2005).

The students shall develop more creative and constructive attitudes as they become successful at the problem solving process and as they feel that their own

ways for solving problems are appreciated, because their confidence about their mathematical abilities shall increase. When they learn to communicate by using mathematics they shall restructure what they learnt and by this way they shall develop their high level thinking abilities. The students shall realize that mathematics does not only consist of rules and memorizing but that it is an entertaining, meaningful and logical profession.

The program is open for technology usage. The students are encouraged to use calculators for problem solving but not for doing basic operations. It is believed that by this way an opportunity for working on more realistic problems shall become possible and they shall conclude the operations quicker and save from time. With the developing computer technology of our day the education software creates new opportunities for students to learn mathematics more meaningfully. There are also sources on the Internet for the teachers.

The program aims to provide that the mathematics teachers determine the running time and order of the learning areas and sub-areas. According to this while preparing the sections the main point to be considered is to consider the learning areas and their earnings together. While preparing the sections' activities these associated earnings should be brought together.

The mathematics program emphasizes on learning with cooperation, problem solving, discovering, and the importance of diversity. The main principle for determining the educational methods is to be sure that to the activities planed should ensure that the students are mentally and physically active (MONE, 2004).

The program has positive effects on teachers, students and parents, because students are active in lessons, has positive attitude towards mathematics. However, teachers have some problems about assessment methods in practice (Temiz, 2005). Students' higher order thinking level can improve by new program but there are problems about learning activities and assessment (Baykul, 2005).

According to Ozdas, A. Tanisli D., Kose, N.Y. & Kilic C (2005), teachers believe that changes about the content of old program is necessary and new program's subjects such as patterns, tessellation and probability are useful and interesting for students. Also, teachers believe that mathematical content connected with real life by means of newly developed mathematics curriculum.

The existing literature revealed that there are a few study pertaining to the implementation of new mathematics curriculum. In this regard this study was significant because it is believed that the findings of the study would shed on light the future studies and provide several feedbacks to decision makers on curriculum development.

## Purpose of the study

This study aimed at analyzing the primary school mathematics curriculum, started to be developed in 2004, based upon the views of teachers and students. The analysis of the curriculum was realized by considering the issues of (1) Classroom management – classroom physical and emotional environments, teacher and student roles, and interactions, (2) Instruction – objectives, planning, implementation, method and techniques, instructional media, and measurement and evaluation, and (3) Strengths (and/or benefits) and weaknesses (and/or limitation). Furthermore, based upon the teachers' views, whether the change in the primary school math curriculum is required (necessary) or not was also tried to be revealed.

## METHODOLOGY

This is a qualitative case study facilitating to obtain in depth information not only from the teacher but also from the students who experienced the new primary school mathematics curriculum. For this study, qualitative methodologies were selected because, as stated by Patton (1987), using qualitative methods provide insights, understandings and deep information about the issue under investigation.

The teachers were firstly asked to mention about in-service training in which they participated to get informed on newly developed primary school mathematics curriculum. They were required to respond where and when it was done and which aspects of the new curriculum were introduced. The in-service training was performed in one of the universities' (METU-Middle East Technical University) Cultural and Conservation Centre on the dates of 1<sup>st</sup>-14<sup>th</sup> September, 2004 in Ankara. The training lasted fourteen days. Throughout the in-service training, new mathematics curriculum was overall introduced to the participants. Further, they were informed on the main philosophy underlying the curriculum, the topics (units and subjects) to be covered, guide book to be used, activities and implementation of those activities, and measurement and evaluation methods. In addition to general aspects of the newly developed mathematics curriculum, an understanding of relating course topics with real life and of learning by doing and living were mentioned as well.

## Participants

The participants of the study included three primary classroom teachers and forty-three fifth grade students. The participants were selected based upon purposeful

sampling procedures from one primary school in Ankara in Turkey. Because of the confidentiality, the name of the school was not stated here. The school was one of pilot schools that the new developed mathematics curriculum was implemented. One teacher was male and the others were female. Their experiences were different from each other. One of the female teachers was working as a teacher for 17 years. The other one had 18-year-experiences in teaching profession. On the other hand, the male teacher who was the most experienced one had 27-years-experiences. Of the students, 23 were girls whereas 20 were boys. Their ages ranged from 10 to 11.

## Data Collection

The qualitative data collection procedures were used for obtaining data from the participants. One semi-structured interview consisting of six open-ended and three demographics questions was developed for classroom teachers serving fifth grade courses (mathematics, science, social sciences...etc). The teachers were asked to give information about in-service training done, the reasons why changes in mathematics curriculum was needed, differences between existing and new curriculum, affirmative aspects of newly developed curriculum, the problems that they faced with during the implementation of newly develop curriculum. At the end, they were required to provide their suggestions for other classroom teachers that would implement new curriculum for next years. In order to collect data from the students, an instrument in which one open-ended question was asked to the students so as to describe the differences between last year mathematics course and current course was developed. Student allowed responding the question either by writing or by drawing picture or by using both methods. These two types of instruments were reviewed by three curriculum developers to ensure content coverage; that is, content validity. Based upon their suggestions, the last forms of the instruments were developed. Having obtained the necessary permissions from the schools, the instruments were sent to the one of pilot school in Ankara in the academic year of 2004-2005. Before administering the instruments, pre-interviews were carried out with teachers in order to make them inform about purpose of the study. Also, the clear directions were given to in the instruments. Once they completed the forms, they sent those back to the researchers. Even though the instruments were developed for conducting interview, since teachers did not want to carry out face-to-face interview, they were requested to write their responses for each question.

**Table 1. The comparison of existing and new mathematics curriculum by teachers**

Themes	Existing Mathematics Curriculum	Newly Developed Mathematics Curriculum
<i>Teachers' roles in classroom</i>	(1) Dominant in class and (2) information-giver	(1) Facilitator, (2) Guide, and (3) not active as before
<i>Students' roles in Classroom</i>	Passive	(1) Active, (2) Skillful, (3) Learner by doing and living, (4) logical thinker and (5) interpreter
<i>Interaction (Between Students-Students / Teacher-Students)</i>	Lack of interaction	(1) Cooperation, (2) Helping each other, (3) Knowing themselves and their skills
<i>Course Content</i>	(1) Abstract, (2) Hard to understand and (3) Excessive topics to be covered	(1) Diminishing course content, (2) Enhancing some topics (symmetry, pattern construction...etc)
<i>Methods and Techniques</i>	(1) Lecturing and (2) Questioning-answering	(1) Induction methods and (2) Group working
<i>Knowledge acquisition process</i>	Transmitted	Constructed by students
<i>Students' attainments</i>	Product-oriented	(1) Easy to reach, (2) Reasonable and (3) Process oriented
<i>Evaluation Procedures</i>	Product-oriented	(1) Integration of Evaluation into Instruction, and (2) Process-oriented as well as product

### Data Analysis

The data were analyzed by using one of qualitative research analysis methodologies; content analysis. Once the responses were collected, they were compiled and then, they were coded under each question. In order to ensure reliability of results, the methods of inter-rater reliability was used. That is, the compiled data were coded by two experts; one is expert on mathematics education and the other one is expert on curriculum development. Codes emerged by two experts indicated similar results. The inter-rater reliability was high.

### RESULTS

The results were broken down into two main categories; *teachers* and *students*. Then themes were constructed by considering the codes emerged from the data. The themes of teachers' role, students' roles, interaction between students-students and teacher-students, course content, methods and techniques, knowledge acquisition, students' attainment and evaluation procedures were mentioned under these categories.

#### Teachers' views

As clear from the background information of the teachers, they had long experiences in classroom teaching profession. Their experiences ranged 17 years to 28 years.

Teachers participated in this study believed the importance of the change in the previous math curriculum. They thought that the basic reasons underlying the curriculum reform and/or change in mathematics curriculum were abstractness and hardness of the topics (subjects in previous curriculum) to students' development level. They also reported that students did not understand why to learn what were covered, because these topics had been covered without their real life implications. There reasons why the reform in curriculum was required were abstractness and hardness of the topics, and the lack of real life implementations. They believed that the changes in the curriculum provided students with opportunities to learn the topics by doing and living. They indicate that new curriculum provides the students with plenty of practice in their studies. In addition, new curriculum contributes the students to understand the importance of subjects taught in classroom and to relate them with real life.

For the sake of comparison, the teachers were asked to mention about the distinct differences between previous and new curricula based on the aspects of teacher and student roles, interaction, course content, method and techniques, knowledge acquisition process, objectives, and evaluation process. Teachers' responses are summarized in table 1. They reported that teachers in the existing curriculum were active and information-giver, and had more work load while they have started to act as facilitator and guide in implementing new

curriculum. Their work loads seem to be lessened in implementing new curriculum.

The active role taken from the teachers has been given to the students. Students have been placed at the centre of the education. In other words, students have been activated. They have undertaken active roles in the classroom. In this way, they have realized their skills and capacities, as claimed by teachers. This helps the student develop self-awareness. Students have been started to execute their duties by living, doing, interpreting and logically thinking.

The teachers seem to have difficulty in arranging the physical classroom environment since they are so many students in the classroom. In spite of crowded classrooms, newly developed curriculum provides the students with more interaction and cooperation by offering group work and discussion activities. It seems that the interaction between student and student, and teacher and students has been encouraged with new mathematics curriculum. As mentioned by the teachers, the interaction enables the students to communicate, cooperate (with) and help each other and teacher. Looking at the content of the course in the new curriculum, some topics were taken from course content and some (e.g. symmetry, pattern construction, and prediction ...etc) were enhanced. Further, some topics that were abstract to the students were taken out as well. In the implementation process, since there were no mathematics books written in line with new approaches on which the new math curriculum based, the teachers were generally prone to use internet web site constructed for new mathematics curriculum by the Board of Education.

The teachers believe that the topics in new primary school mathematics curriculum are more in line with the students' development level. Since the students have not received the knowledge from the teachers passively and they have reached knowledge by doing, living, and searching, the students have constructed their own knowledge by themselves. As also indicated by the teachers, the knowledge constructed and thus gained are more permanent because the students have opportunities to solve problems and to do activities, and also to relate theoretical knowledge with their real life. In this respect, the attainments, called objectives in previous curriculum, related to units and topics are comprehended in a process. Teachers believe in that students would be more successful with the new curriculum. Students' outcomes were assessed by diversity of evaluation procedures. Since instruction and evaluation is tied in new curriculum, students' performance was evaluated in each step of the instruction. The evaluation goes hand in hand with instruction. The evaluation procedures used focus upon process-oriented methods as well as product-oriented methods. However, the crucial problem in

implementing new curriculum that the teachers faced in relation to grading students' performance is the inadequate use of rubric. In addition, since, as teacher indicated, the time allocated for the evaluation was not substantial, they have difficulty in evaluating students' performance.

The teachers were also asked to review whole mathematics curriculum and to explain the strengths and weaknesses of the curriculum based upon their experiences during the pilot administration of the curriculum. Their responses are summarized in following Table 2.

Table 2 presents that the newly developed mathematics curriculum has many strengths as well as some weaknesses. In relation to strengths mentioned by teachers, the new curriculum serves many visualized and student-centered activities. The topics to be covered are not much more detailed as it was before. In addition, the other positive aspect of the curriculum is that it enables the students to construct their own knowledge by living, doing, searching, sharing, and experiencing. These processes provide the opportunities for the students to self-express, to be self-confident and self-awareness. Also, with new curriculum the teachers adopt the roles of guide and facilitator. Being guide and facilitator promote the teacher to develop and equip themselves with necessary skills. The new curriculum encourages cooperation among groups (for example between teachers in math group and teachers in science group) in schools in order to overcome the problems and difficulties faced. All the processes emphasize the importance of participation of each student in class activities. In other words, the new curriculum emphasizes the understanding of "*no students left behind*".

Despite the fact that the newly developed mathematics curriculum has several strengths, it has some weaknesses, as claimed by teachers, as well. According to them, the in-service training given before pilot testing was not adequate to make understand the vision and mission of whole curriculum, and philosophy underlying. They believe that the activities suggested are not applicable in crowded classrooms. The infrastructure facilities of schools were not sufficient for the realization of the activities suggested. They complained that no books prepared in line with new mathematics curriculum provided for the teachers. In addition, they believed that they left alone with new curriculum without any supports.

At the end, the teachers were required to provide suggestions based upon their experiences with new curriculum for the other teachers who would implement the new curriculum next years. They suggested for their colleagues to consider some issues in relation to time, evaluation procedures, visual materials, group working and activities. They suggested that the teachers be careful about the time devoted both for instruction and

Table 2. The strengths and weaknesses of the newly developed mathematics curriculum

<i>Strengths of the newly developed mathematics curriculum</i>	<i>Weaknesses of the newly developed mathematics curriculum</i>
(1) Learning by doing and living	(1) Inadequacy of in-service training
(2) Encouraging the students to construct their own knowledge by living and doing	(2) Unsuitability of activities for crowded classroom
(3) Encouraging the students to share their knowledge with others	(3) Lack of mathematics books
(4) Student-centered rather than teacher- or subject-centered	(4) Lack information given about the evaluation procedures during in-service training
(5) Visualized	(5) Lack of Infrastructure of schools
(6) Not detailed	(6) Insufficient use of technological devices
(7) Suitable to students' development level	(7) Leaving the teachers alone with new curriculum
(8) Enabling the students to self-express, to be self-confident, and self-awareness	
(9) Encourage the teacher to develop themselves	
(10) Emphasizing the understanding of "no students left behind"	
(11) Encouraging the cooperation among the teachers	

evaluation processes. They added that the lessons should be enhanced with visual and technological equipments to get attention and curiosity. The group work activities should be encouraged so that interaction among the students can be ensured. In addition, they suggested that the teachers seek for new materials that can be easily found, and for play (game) activities relevant to students' development level.

### Students' views

The students were required to compare the previous mathematics course and new mathematics course (newly developed mathematics curriculum) by considering all aspects of the course; teachers, classroom, evaluation...etc. Their responses varied. Students' responses were consistently parallel to teachers' responses. Most of them are satisfied with the changes in the curriculum, but a few was not. The students' responses are summarized in table 3.

Students found the last year mathematics course boring and unpleasant due to some reasons. One of those reasons was the extensive topics covered. They claimed that it took plenty times to cover some of the topics. This made the student bored. Since the teacher preferred to use the methods of lecturing and expression, the students just listened to the teachers and wrote some notes. The information was transmitted from teacher to students. As claimed by the students, teachers just tried to complete the topics to be covered without considering whether the students understood the subject studied. Further, they asserted that it was difficult for them to understand and learn some of the subjects; especially the subjects of geometry (e.g.

*triangles*). During instructions, it seemed that the teachers were active in classroom rather than students. In this regard, parallel to teachers' claims, the students reported that they had lack of self-confidence in classroom since the teachers were dominant in class and the interaction between students-students and students-teacher were not adequately encouraged. They got bored because they had difficulty in solving questions and doing homework, they were not encouraged to participate in classroom activities, and they generally used traditional materials like paper, pencil, blackboard rather than visualized and technological materials.

They asserted that problem solving activities were done in classroom. As understood from the picture drawn by students coded 34, the questions studied seem to be more related to developing lower level of cognitive skills of students in last years (*see Figure 1*).

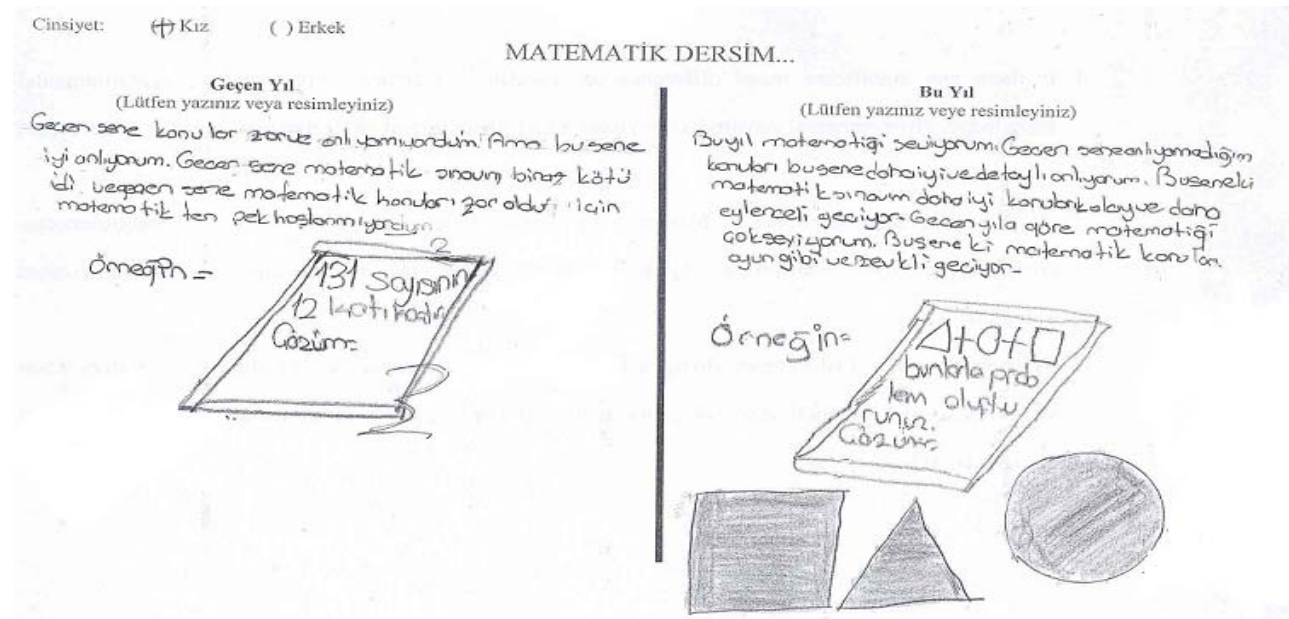
The activities done in classroom were not student-centered. Further, the students sometimes did not understand why they were doing such activities. It seems that the objectives of the course were not shared with the students and it was not clear what was expected of the students at the end of the instruction as claimed by *students-33*. The course book was always used as a reference source. There seemed to be book dependency in classrooms. The students claimed that the assignment given were somewhat difficult for themselves. For this reason, they sometimes did not do their assignment by themselves and they tended to cheat from their peers. They had an exam-anxiety since they felt that they were going to be unsuccessful in the exam. In order to assess students' performance, the teacher always preferred to use traditional evaluation procedures (such as written and oral exams) as mentioned by students.

**Table 3. The comparison of existing and new mathematics curriculum by students**

Aspects	Existing Mathematics Curriculum	Newly Developed Mathematics Curriculum
Teachers' roles in classroom	Active	(1) Not completely active, (2) Facilitator
Students' roles in Classroom and their characteristics	(1) Passive, (2) Listener, (3) Not attentive, (4) Lack of self-confidence	(1) Active, (2) Self-expressive, (3) Self-confident, (4) Self-aware, (5) Researcher, (6) Sharing with peers, (7) Participative, (8) active thinker
Interaction	Inadequate	Encouraged
Course Content	(1) Difficult to understand, plenty of topics to be covered, (2) Dependency of books, (3) long topics	(1) Easy to understand, (2) Enhanced topics, (3) Extracting some topics, (4) Use of activity sheets
Methods and Techniques	(1) Lecturing, (2) Memorization of subjects, (3) Questioning-answering, (4) reading and writing	(1) Problem solving, (2) Play, (3) estimation making, (4) Researching
Classroom Activities	Subject- and teacher-centered	Visualized and student-centered activities
Knowledge acquisition process	(1) Transmitted from teacher to students, (2) Passively received	Actively constructed by students under the guidance of teacher
Students' attainments	(1) Not clear, (2) Not shared with students, (3) Lower level thinking	(1) Clearly stated and shared with students, (2) Higher level think
Evaluation Procedures	Traditional methods (written and oral exams)	Portfolio

On the other hand, looking at the new mathematics curriculum depending on students' responses, most of the students seem to be satisfied with new one compared to the existing one. The reform in the mathematics curriculum has brought rise to many chances in classroom environment as understood from the students' responses. These changes are realized by students and they reflect their views through the pictures, and writings. *Student-3* and *student-42* explicitly

mentioned about the entrance to new system. Similarly, *students-23* said that "this year, mathematics course is funny. Our teacher has changed his teaching style". In the new system, as perceived by students, the teacher is not active, as he was before, any more. The teacher acts as facilitator, and motivates the students toward mathematics. The active role of teacher in existing curriculum is given to the students. The students are undertaken to the role of researcher, active thinker and

**Figure 1. A Picture drawn by a student on comparison between last years and now (student # 34).**



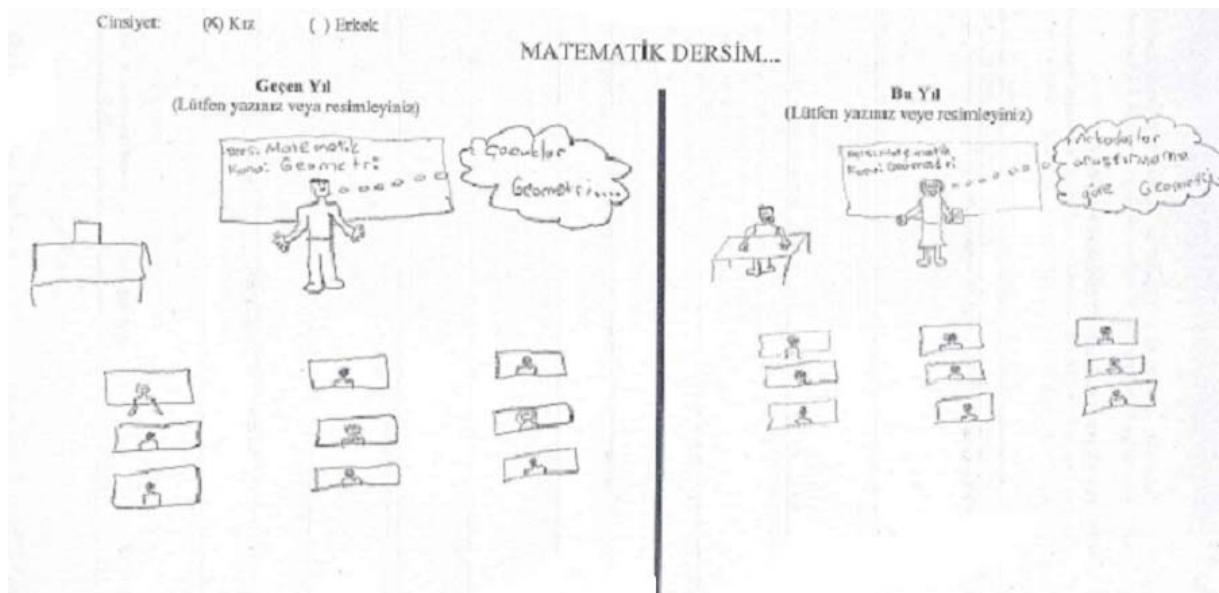


Figure 2. A Picture drawn by a student on comparison between last years and now.

interpreter as well. The students are aware of this situation and they seem to be as active as possible. To them, being encouraged by teachers and being active in classroom makes them interact with teachers and their peers, share their knowledge with others and participate voluntarily in the classroom activities. In this way, they seem to become aware of their skills and capacities. Further, starts to share their knowledge, experiences and their research findings in front of classroom (see Figure 2).

By doing so, as claimed by students, they have started to express themselves (*self-expresses*). Also, they seem to deal with the problem of self-confidence as they had lack before (last years).

As indicated by most of the students, they enjoy funny times during lessons since the visualized and students-centered activities are used in classroom and technological devices are integrated into the course implementation. The students are given opportunities to involve in practice activities by encouraging class participation. In the process of making instruction easier for students, and of making the topics concrete and relate with the real life, they generally play games in the classroom. They prepare play cards for their activities. Playing games enable the students to easily understand the subject studied and to grasp main points. In addition to playing activities, they have actively constructed their knowledge in writing, reading, applying and researching as well.

The students believe that the topics covered in this year are easy to understand since they are related and similar to the topics in last year mathematics course. Some topics are enhanced and improved, but some topics were extracted from the curriculum. The topics are studied with the support of visualized materials and technological devices; especially OHP.

In contrast to previous curriculum, the students seem to believe that they have improved their mathematics and these improvements has reflected on their exam results. In the classroom, they solve many problems by playing games and sharing with others. The teacher provides many materials to the students and wants them to create their own questions so as to develop students' creative thinking. Further, the teacher encourages the students to estimate the problems given by logically thinking. As understood from the students' drawings, the questions asked in the classroom seem to be related to developing higher order thinking skills (see Figure 1). During the learning process, the teacher requires the students to use separate sheets for activities instead of notebooks. Then, the activity sheets written by students are collected and they are filed in the students' portfolio. The portfolio here is used as a learning tool as well as assessment tool.

## DISCUSSION & CONCLUSIONS

This was qualitative case study seeking for in dept information about the implementation of math curriculum. The study was realized with fifth grade students and classroom teachers who experienced pilot administration of new mathematic curriculum. The results of the study revealed so many significant findings addressing to the classroom design, teachers' and students' new roles, classroom implementation, and instructional delivery. Further the study indicated that the teachers had several difficulties.

The findings of the present study were so much parallel to the findings found by Toptas (2006) who conducted a study with classroom teachers to determine their difficulties with implementing the new curricula. He found that the main problems confronted by teacher

were regarded as insufficient sources, lack of instructional medium, insufficient time for instruction and evaluation, and insufficient number of activities.

According to Güzel & Alkan (2005), students had positive opinions about the application of the constructivist learning approach utilized in the new program. For instance, the students reluctantly behaved in sharing responsibility. These are parallel to the findings of the present study. On the other hand different from teachers' views in this study, they found that , the students could not establish relation with the science, the real world and the school.

In relation to strengths mentioned by teachers in this study, the new curriculum emphasizes the understanding of “no students left behind”. Similarly Çakmak & Bulut (2005) stated that teachers can enable children to learn and understand what is taught effectively if teachers have effective strategies. Consequently, newly developed mathematics curriculum gives opportunities for students and teachers about effective teaching and learning.

### Author's Note

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