Teachers’ views on the new measurement and assessment approaches with regard to Mathematics curriculum reform

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The aim of this study is to investigate teachers’ views on the new measurement and assessment approaches within the context of secondary school mathematics education reform. With this purpose, the factors which affected the implementation process were determined. The research data were obtained from two teachers via in-depth interviews, observations, and researcher’s notes and case study throughout an education year. As a result of the analysis of qualitative data with NVivo 7 program, the factors affecting the teachers’ views on the measurement and assessment aspect of mathematics curriculum were detected. The results of the study revealed that teachers’ culture about measurement and assessment, the usability of assessment tools, infrastructure conditions, new roles of teachers, lack of informing activities and the role of measurement and assessment on student learning had an effect on teachers’ views on the new measurement and assessment approaches within the context of mathematics education reform. The findings obtained pointed out that curriculum reform could not actualize the change considered for the measurement and assessment aspect. Suggestions were made for the measures to be taken and researchers in accordance with the results obtained from the research.

Key words: Curriculum reform, measurement and assessment, teachers’ views.

INTRODUCTION

The research carried out in the field of education in recent years indicates that measurement and assessment activities at schools must be reorganized to help promote students’ learning but not to select, eliminate or classify (Assessment Reform Group [ARG], 2002). The reason for this need is that the classical measurement and assessment practices used at schools are inadequate to evaluate students’ learning process and to determine students’ performance in a reliable and valid way (William, 2003).

National Council for Teachers of Mathematics [NCTM] (2000) emphasizes the need to make changes in students’ evaluation depending on the learning theories widely accepted in recent years. These standards...
suggest using various assessment techniques and tools which can assess what students can or cannot do what they know, promote students' learning mathematics and reveal their written, oral and operational performances. Similarly, mathematics curriculum which regards learning mathematics as an active process has been accepted to be implemented for classes with new students enrolled in high schools since 2005-2006 Education Year in Turkey and this curriculum emphasizes that an environment where students do research, explore, solve problems, share and discuss their solutions and approaches must be provided. It is pointed out that performance assessment must be used in order to lead students to think creatively, work tactfully, use knowledge and work with a group in such environments. Moreover, the importance of measurement and assessment was particularly emphasized to monitor students’ development and reveal the weaknesses and strengths of the curriculum in such environments. Therefore, various assessment tools to assess the skills which high school mathematics curriculum aim at developing (Mathematical Modelling Skills, Mathematical Thinking Skills, Problem Solving Skills, Communication Skills, Reasoning Skills and Connections Skills), Affective Behaviours, Self-Regulatory Competencies and Psychomotor Skills were presented for teachers’ use in the appendices of curriculum (Ministry of National Education, 2005).

In-service training provides a very important potential for teachers to perform their professional practice by having the qualifications required by the reforms carried out. Ministry of National Education (MEB) is responsible for providing in-service training for teachers in Turkey. Among these educational activities in question, the central ones are carried out by In-Service Training Head of Department and the local ones are performed by Provincial Directorate for National Education. Before new curricula were implemented, a centralized course for in-service training was organized for publicity, and then a short-term local in-service training was given to the other teachers by the teacher trainers and education inspectors who participated in this course. Güneş and Baki (2011) stated that it would be a big mistake to consider this short-term training as adequate for teachers to implement these new learning approaches. Similarly, it is pointed out in many studies that teacher training offered with the intent of new curricula was inadequate and short (Birgin et al., 2009; Bulut, 2007; Eraslan, 2013). On the other hand, the following results were obtained via examination of the studies carried out in Turkey after the curriculum was changed:

1. Teachers think that a great variety of assessment tools are suggested and these tools bring burdens (Acat and Demir, 2007; Güven and Eskiştürk, 2007; Sarır, 2007; Selvi, 2006).
2. Teachers’ old habits affect the implementations and decline the use of suggested assessment tools (Erdal, 2007; Gelbal and Kelecioğlu, 2007; Güven and Eskiştürk, 2007; Yılmaz, 2006).
3. Teachers find the current resources inadequate regarding examples (Erdal, 2007).
4. Teachers state that there is immense pressure on them due to the standardized tests (Çalık, 2007).
5. Teachers complain about lack of time while performing a work (Acat and Demir, 2007; Gelbal and Kelecioğlu, 2007; Güven and Eskiştürk, 2007).
6. Teachers lack knowledge about the new implementations (Çalık, 2007; Erdal, 2007).
7. Teachers think that in-service training offered is inadequate and they require to be informed in this field (Gelbal and Kelecioğlu, 2007; Yaprıcı and Leblebiciler, 2007).
8. Teachers think that the problems related to infrastructure such as class size and lack of equipment and tools affect their work negatively (Acat and Demir, 2007; Selvi, 2006; Üredi, 2013; Yılmaz, 2006).

It was understood that because the studies were conducted in a limited time by seeking the opinions of a specific population, longitudinal and adequate number of studies which concentrate on reflecting the changes in the process was not included. The reality which must be taken into consideration for the success of the reforms in education is that teachers should directly adopt, understand, and implement these reforms. And if so, at what levels should teachers adopt the suggestions offered by mathematics curriculum about measurement and assessment reform? And whether they are understood well and implemented correctly or not becomes important. It is known that teachers who are engaged in traditional measurement and assessment methods have shown a sign of resistance as it is revealed by the studies conducted in this field. This resistance is the most important obstacle to actualize the reform. The elimination of this obstacle depends on the examination of the resistance in detail. Consequently, this study aims at exploring teachers’ views on contemporary measurement and assessment approaches within the context of mathematics curriculum. In addition, the following research questions require an answer: “Which factors affect teachers’ views on the new measurement and assessment approaches within the context of mathematics curriculum and how do they affect them?”

METHOD

Case study as a research method was used in this research to illuminate the phenomenon investigated and explicate the relations between the phenomena. Case study research is preferred because it offers an opportunity for an in-depth analysis of a specific group and it also reveals the relations between the data gathered from the data collection tools; it is useful in providing answers to “How?” and “Why?” questions and creates an opportunity for the researcher to investigate an event or phenomena in-depth which he cannot manipulate (Büyüköztürk et al., 2008; Yıldırım and Şimşek, 2005). Bogdan and Biklen (1992)
stated that case studies have different types and added that case studies using an extremely in-depth investigation on a narrowly defined sampling can be described as micro ethnography method used by education anthropologists. When the in-depth interviews and observations carried out during the process for a year with two teachers working in two different towns in Trabzon city, in a high school (T1 with an experience of 7 years and T2 with 6 year experience) are taken into consideration, we can state that case study used in our study has the quality mentioned above. We wished to explore differences between the two teachers whose many variables are similar (experience, age, etc.). T1 and T2 are approximately the same age, both are males and both work in the same type of high schools.

Data collection tools

The interviews carried out in the research for a year are unstructured interviews, one-legged interviews and also ethnographic interviews. The aim of an unstructured interview is to allow for spontaneity with open ended questions in place of forcing them to choose and collect rich and adequate data and it will be convenient for comparison and analysis (Büyüköztürk et al., 2008). Moreover, ethnographic interviews were used when the researcher did not let her researcher's identity be known. These interviews were carried out both with the two participant teachers of the research, and in the meetings which the researcher participated as a teacher, but not as a researcher. Ethnographic interviews aim at discovering the interviewee’s particular culture in order to understand the behaviours and experiences which constitute this particular culture. In these settings instead of manipulating the teachers, the researcher carried on a conversation which helped the teachers to answer the questions freely (Büyüköztürk et al., 2008). In addition, non-participant observation was used when the researcher observed a lesson within the process and participant observation was used when the researcher joined the meetings as a teacher and collaborated with her colleagues within the process. During the non-participant observations, the researcher sat at the back of the class and conducted observations without intervening in the setting. In participant observations, the viewpoints of the subjects who are observed were shared so their behaviours and reactions were tried to be discovered. During these observations, short notes were taken and just after the observations the notes were elaborated by the researcher. Moreover, the observations conducted were used to write teachers’ portraits.

Data collection events were priori fixed in the first and last interviews which were conducted and situation driven in interim interviews and observations which were conducted throughout the year. While the first interviews were conducted at the beginning of the term and the last interviews were carried out at the end of the term, the interim interviews were carried out during the term and there were 10-15 days between each interview.

Data analysis

Triangulation is used to check the reliability of the case study. Triangulation was tried to be actualized in this research with interviews, observations and analysis of study products (assessment tools which were suggested in curriculum, worksheets which were used in classroom, students’ works in the portfolios, etc.) by means of correlating them. The data obtained in the research were analyzed with NVivo 7 program following the given stages below:

1. Coding the first interviews
2. Identifying the themes (factors)
3. Analysing the interim interviews carried out according to the themes (factors), identifying the new codes which emerged, and associating the research notes and observations which indicate the same points with the identified themes (factors).
4. Analysing the last interview according to the themes (factors) identified, identifying the new codes which emerged and associating the research notes and observations which indicate the same points with the identified themes (factors).

Double-coding procedure was used for the data analysis. The qualitative data obtained in the process were coded again by another researcher. Intercode reliability between the researchers was computed with the formula (coder reliability: number of agreements/ (total number of agreements and disagreements) recommended by Miles and Huberman (1994). The percentage agreement in this study was 83% for the first factor, 84% for the second factor, 87% for the third factor, 86% for the fourth factor, 84% for the fifth factor, 80% for the sixth factor. These percentages indicate the reliability of the coding.

FINDINGS

Factor 1

The codes which emerged during the interviews and made up the first factor are presented in Table 1. T1 and T2 reported in the first interviews that measurement and assessment must be objective and explained that assessment tools based on qualitative data would decrease objectivity. In addition, they stated that how measurement and assessment was carried out must be determined with the legislative regulations. Both teachers mostly expressed their views on the objectivity of assessment and it was understood that they were worried about the objectivity of the assessment with the new tools.

There are no students who will carry out self-assessment objectively. Even though it is defeated and they are used in assessment, it is still not very clear. After the criteria are given to the students, I don't think that their biased attitudes can be prevented. Moreover, if the criteria and benchmark are certain, I believe that this assessment will be carried out more reliably by the teacher (T1).

As it is understood from this expression, T1 does not consider doing self-assessment as necessary while carrying out measurement and assessment; measurement and assessment with such alternative methods is not beneficial; and finally T1 has beliefs belonging to traditional understanding, which indicates that a teacher must be responsible for the assessment. On the other hand, it drew attention that the teachers expressed their dissatisfaction about the use of assessment tools depending on the qualitative data in the first interviews with such statements: "...The students can fill in the self-assessment form by concealing their ideas in order to get the teacher like them (T2)". Another point which drew attention in the first interviews is the statement of T2.

"...Considering these, I am expecting a change with the
Table 1. Teachers’ culture.

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<tr>
<th>Codes</th>
<th>First</th>
<th>Interim</th>
<th>Last</th>
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<tbody>
<tr>
<td></td>
<td>T1</td>
<td>T2</td>
<td>T1</td>
</tr>
<tr>
<td>Objective</td>
<td>6</td>
<td>5</td>
<td>4</td>
</tr>
<tr>
<td>Qualitative data</td>
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<td>1</td>
<td>2</td>
</tr>
<tr>
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<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Legislative regulations</td>
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<td>2</td>
<td>6</td>
</tr>
<tr>
<td>Assess the product</td>
<td>0</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>Assess the process</td>
<td>0</td>
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</table>

regulations about how to give grades with these assessments (T2)" indicates that he was not informed officially about the changes made in measurement and assessment. Below is given the rest of T2’s quote from the interview which indicates that the participant believes that measurement and assessment must be quantitative at the same time:

...The average scores from the participation rates on these forms must be determined and an association must be obtained with it (T2).

About 15 days after the first interviews carried out with the teachers participating in the study, the first and interim interviews were carried out to determine what kind of changes they experienced in the field of measurement and assessment during the process. During these interviews, first, the teachers were reminded of new conditions which they were going to encounter due to curriculum change and then they were asked what kind of changes they experienced in measurement and assessment. The statements of the teachers in the first interviews are given below:

In fact, there is not a lot of change. We haven't carried out a different task yet. We are trying to get to know the students at the moment… (T1)

Students have no ideas about the changes. I have not come up with an explanation yet... I, myself, am trying to understand what has changed. First, I must understand and then I can ask them to do something. (T2)

As pointed out, both teachers stated that they did not experience any changes in the field of measurement and assessment in the first interim interview. T1 determined that he did not do anything about measurement and assessment by asserting that it was the beginning of the term and this statement indicates that the teacher had still beliefs about summative assessment unlike what was suggested in curriculum. It was understood from the statements of this teacher that the teacher had beliefs about assessment of the product.

T2 stated in progressive stages of the interviews that he occasionally tried to check the works of the students in their portfolios and wrote notes for the students to make necessary changes about missing points; however, students did not pay attention to these notes, most probably, due to lack of such implementations in other courses. In addition, T2 said that his colleagues did not carry such an implementation into action and also added that it was because The Ministry of National Education did not make such regulations. Teachers’ portraits written depending on the observations carried out in the process and the products generated are given below:

A general evaluation shows that although T2 seems to be more willing, both teachers were reluctant about the portfolio assessment which they were trying to implement in their practices. In addition to this, they showed resistance because they thought that they would not be objective and it was observed that their attempts were only to ask their students to keep portfolios and sometimes remind them that they would be assessing their tasks. It was also understood that the more the number of tasks increased, the more rarely the teachers checked the portfolios and the tasks given were more like homework questions and sometimes teachers copied these assignments and gave them to the students and sometimes the students got them through their own efforts. Teachers’ and students’ lack of knowledge about portfolios might have caused this condition.

The teachers were asked how they were going to use the data obtained from the tools which they were trying to benefit in the interviews carried out through the end of the first term. T2 stated the following about this issue:

I even did not look at many of them. I don't know but some of them are unnecessary. When I understood that they were unnecessary, I didn’t use them... Some of them are not suitable for mathematics.

The forms qualified as unsuitable for mathematics by T2 were the forms which aimed at evaluating the attitudes stated by the teacher in the previous interviews. Then, it can be deduced that the teacher felt uncomfortable due to the use of qualitative data during assessment in mathematics. T1 explained his view about the criteria which must be taken into consideration in measurement and assessment as given below:

Nothing has changed either with the mark books given to us or the computer program used for posting grades. It is what it used to be... Everything seems to be OK with 3 written test scores and at least one oral test score, but no change has still been made. It is not like that in primary education... I think their scoring system has changed...

1 When the research was conducted, curriculum change was carried out with some courses involving Mathematics.
There is nothing to do...We will add them to the oral scores. (T1)

Both teachers complained about their discomfort in the first interview at the beginning of the second term and they stated that because necessary adjustments were not made, they could not directly reflect the tasks onto the grading system in the first term. Below is given the expressions of T2 about the issue:

We did not experience any changes while scoring the term averages. It is what it used to be...Give three written tests and one oral test, it's OK...Although I said that I would grade the oral tests according to these tasks, it was not very convincing. I just graded their oral tests taking my impressions into account but not by using the suggested forms...However, we are not asked to hand in these works. (T2)

The following researcher's note was kept about the implementations in the second term:

Beginning to implement the changes in the second term lasted longer for the teachers than the first term. It was revealed that the teachers did not include any tasks intended to assess the process because they suggested that it was the beginning of the term. This condition caused them not to include portfolio which the students also tried to do in the first term. Therefore, it was considered that the teachers did not ask students to submit their tasks officially. The teachers stated that they did not include any tasks because it was the beginning of the term and this indicated that they still had beliefs to assess the product like in traditional understanding.

Although both teachers determined that they did their best to include the implementations in line with the suggested changes, the discomfort they felt, due to not being able to use them as desired (or reflect them in the results), drew attention. For example, T1 stated the problems encountered about how to use the performances carried out:

We were not informed about any regulatory changes. Because there was not an explanation about how to use the implementations we carried out, the implementations were ineffective despite being few in number. Moreover, in my opinion, some forms which aim at reaching the personal information of the students are not very necessary. Using them in assessment would be wrong for some of my students. Moreover, my other colleagues working in my school and in other high schools do not use these tools. However, I can say that these changes are implemented well in primary schools because primary education is inspected and to me, it is effective (T1).

To sum up, when the first interim and the last interviews were considered for the first factor, the teachers mostly stated that legislative regulations must be made and measurement and assessment must be objective. However, it was discovered that there was a considerable decrease because the teachers did not include the suggestions in their implementations due to their beliefs towards the use of suggested assessment tools which would decrease objectivity within the process.

Factor 2

In Table 2, the codes which emerged during the interviews and also comprised the second factor are given.

The statements of both teachers in the first interviews indicated a variety of the suggested forms. In relation to that, T1 stated that the variety of suggested assessment tools would cause time problems for teachers and T2 expressed his views about the Mathematics Attitude Scales2 used to identify the attitudes of the students towards mathematics:

There is no need for such a form to learn the attitudes of students towards mathematics. I know which students are interested in mathematics, like it and hate it. In order to flatter their teachers, students can fill in this form total opposite of what they think (T2).

Moreover, it was discovered in their first interviews that the teachers considered using suggested assessment tools waste of time as they would hinder teaching activities.

I don't believe that students will benefit from developing projects because they won't be asked questions about this in the most important examination of their life. They lack a lot of knowledge and there is no more time to waste. (T2)

Another point which drew attention in the first interviews is that both teachers stated that alternative assessments such as project would have a negative effect on the students who get prepared for the university exam. The statement of T1 can be given as an example: “Instead of spending our time and energy with them, we could solve more questions and be more successful in the exam”

When the teachers were asked what kind of changes they had in curriculum and measurement and assessment in the interim interviews, T1 reported that his previous experiences and the changes made contra-dicted with each other and more variety of tools were suggested:

We used to give written and oral tests in order to determine the level of the students in the past. But now with the new curriculum, we are asked to make many changes and also use many different tools. (T1)

It was found in the interim interviews that both teachers

2 This scale is one of the assessment tools suggested for teachers’ use in the appendices.
did not believe in the benefits of forms which especially included affective, psychomotor, psychological, or social skills and student's self-evaluation forms. In addition, it was determined that they had already obtained the knowledge which they would gain through these forms before through the observations, so using such forms was waste of time. The teachers were asked to evaluate their experiences during the implementations within the process with the last interviews at the end of the term. T1 stated that especially the final year students insisted on continuing their studies as usual due to the university entrance examinations which he acknowledged that it was their right:

_I can’t even think its implementation in the senior year of high schools…On the one hand, I am going to prepare them for the examination which is going to change their life; on the other hand, I will implement these activities. Students would rather solve more questions than participate in these activities and they are right…_ (T1)

In the last interview T1 stated that he did not believe that every teacher would use these forms; teachers would pretend to be filling in the form if obligations were imposed on them in terms of implementations, and although the suggested forms were used to assess students, teachers would digress from the criteria and behave as emotionally as they used to do while grading the oral tests. It was understood in this interview that the teachers included expressions which were mostly associated with “benefit” code. When the teachers’ statements associated with this code were examined, it was revealed that T1 usually did not use the suggested forms, but mentioned the benefits which can be gained from these forms after the required adjustments were made and T2 addressed the suggested tools in addition to this and also benefits which he observed when these tools were practised in the process.

To sum up, when the first, interim and the last interviews were taken into consideration, it was understood that the teachers’ opinions about the suggested assessment tools being beneficial or not in practice differed within the process. T1 in the interim interviews stated that using the suggested tools would not be beneficial and it was a waste of time; however, in the last interview he implied that in case some conditions were provided (for example, legislative regulations, inspection, and informing), using these tools would bring benefits. T2 referred to the benefits of the tools used within the process and in the last interview he stated that he agreed with what T1 addressed. Moreover, another attention grabbing point is that both teachers agreed that university entrance examination would affect the suggested assessment tools negatively within the process.

**Factor 3**

The codes which emerged during the interviews and also comprised the third factor are given in Table 3. When the statements of the teachers in the first
Table 3. Infrastructure conditions.

<table>
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<tr>
<td></td>
<td>T1</td>
<td>T2</td>
<td>T1</td>
</tr>
<tr>
<td>Crowded classes</td>
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<td>5</td>
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<tr>
<td>Economic reasons</td>
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<td>1</td>
</tr>
<tr>
<td>Intense subjects</td>
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</tr>
<tr>
<td>Social structure</td>
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<td>1</td>
</tr>
<tr>
<td>Type of school</td>
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<td>Extra hour</td>
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Interviews were taken into consideration, both teachers agreed that crowded classrooms would create problems while performing the suggested implementations.

When the crowded classrooms are considered, it is very difficult and time consuming for the teachers to observe the groups during group work and take observation notes... (T1)

There are 30-35 students in my classes. How can I track their portfolios? (T2)

Moreover, both teachers stated that different levels of students and their different economic and social environment would have an effect on the problems encountered during implementations.

...However, we are complaining about the lack of student interest. These techniques might be used in some exceptional high schools, but in my opinion they are not possible in high schools and vocational high schools. (T1)

Another point which was emphasized by the teachers is that the equipment required for the use of suggested tools are not the same in all schools. A researcher’s note about the points stated by the teachers and reflecting the observations made during the seminar where the curriculum was introduced at the beginning of the term was given below:

During the seminar I made observations which revealed that most of the teachers in the hall, especially middle-aged and older teachers, defended that the qualities of the new curriculum would not be implemented in our education system. They also stated that the use of assessment tools particularly suggested by the curriculum would lead to waste of time and expenditures on stationery.

When Table 3 was examined, it was realized that the teachers mostly referred to the crowded classrooms and the issues related to the textbook in the interim interviews. T1 stated that crowded classrooms and the different student levels were the obstacles to scatter group work broadly:

No matter how groups are composed, the good student manages it. What are its advantages? Some students support each other. The working students think that they carry the loads of the other students on their shoulders, so they restrain themselves. If the class size were small and student levels were the same, it would be implemented. Therefore, these conditions can exist in the schools where students are accepted after an examination. (T1)

T2 drew the attention on the fact that each student did not have the same conditions to reach knowledge and each of them came from different social environments and explained the obstacles for the use of new tools:

I regard the following as the obstacles: Students’ involvement in such an implementation for the first time, students’ inadequacy to reach knowledge, the socio-economic conditions of their environment, and teachers’ lack of experience (T2).

In another interview, T1 stated that the use of the suggested tools and the processes they required would prevent the subjects from being covered and explained it as follows:

In conjunction with four year secondary education, we have difficulty in teaching the subjects although the course load seems to be reduced. Under such circumstances if we spend more time on these assessments, completing the subjects might become more difficult. (T1)

Teachers mentioned the negative criticisms attributed to the textbook and stated that the questions in the textbook ignored the basic principles which are teaching from simple to complicated and easy to difficult and what
students try to accomplish through questions are given in pursuit of the questions. Below is given teachers’ portraits by the researcher depending on the points observed during the in-class observations and mentioned in the interviews:

... It was revealed during the observations that both teachers mostly did not include the activities in the textbook while instructing. It was observed that teachers used the book to assign homework or to save time because some of the shapes were drawn in the book. This condition was also uttered during the one-legged interviews after the classes.

In the last interview T2 stated that standardized test (central examination) factor was the reason for not using the textbook at a desired level in such a way:

...I don’t want to be misunderstood but I don’t have positive opinions about this textbook. On the other hand, I don’t hold negative views about it, either. At least it is not useless. But, there are other external factors which reduce its usability... Such as Student Selection and Placement Examination, external reactions (students’ parents), what the students learn or whether they develop or not is important for the parents, the result is important, in other words examination... (T2)

In the last interviews, teachers stated that the implementations which began with curriculum renewal were practiced better in primary education. T1 stated that due to inspection in primary schools, such implementations seemed to be practiced better and added that because they were monitored by the Ministry of National Education, the implementations were ostensibly carried out. Moreover, such teacher opinions emerged. They stated that class size and school infrastructure facilities were not at a desired level, which was important and it was meaningless to mention such implementations before these deficits were eliminated.

To sum up, it was revealed throughout the study that crowded classrooms and inadequate school infrastructure facilities were considered as the obstacles to implement the changes brought with curriculum. In the first interviews teachers did not share their opinions about the textbook; however, what drew attention is that they shared different opinions within the process while using the textbook.

**Factor 4**

The codes which emerged during the interviews and also comprised the forth factor are given in Table 4.

When Table 4 was examined, it was discovered that lack of time which would hinder teachers’ roles was mentioned in the first interviews. In addition, opinions such as tracking the activities and the observations required for the follow-up would hinder teachers’ roles were mostly included. T2 asserted that with the curriculum change mathematics course was reduced from 5 to 4 credit hours, so intensive subject load would not let teachers carry out such techniques as group work:

*Time is not enough; however, mathematics course was reduced from 5 to 4 credit hours with the new curriculum.... I believe that this system is going to be replaced by another system later on. Although teachers want to perform these works completely, I don’t think that enough time won’t be allotted to them.* (T2)

T1 stated that teachers would be criticized because students, students’ parents and even teachers, themselves, were not used to using assessment tools based on qualitative data:

*Since the frequent use of assessments based on observation requires the results to be evaluated personally - low score or high score, they will probably cause criticism ...* (T1)

In the first interview T2 stated his opinion about the difficulty of tracking the tasks as follows:

*My classes consist of 30-35 students. How can I track and check the portfolios of so many students? If I check them in the class, I will spend my time ticking the checklists. If I check them after the lesson, how can I remember what each student has done?* (T2)

A researcher’s notes about the observations made within
Depending on the in-class observations I made, it was discovered that the changes brought along with the new curriculum were not transferred to the learning environments. Firstly, I can state that lessons were teacher-centred, and trial-run group works were far from the logic of group work based on collaboration. It was revealed in the lessons during the observations that the activities in the textbook were usually not used and the questions similar to exam questions were mostly included in the lessons. I can say that the teachers encouraged their students to search different question types and although rarely done, they also reminded them to include them in their portfolios.

To sum up, it can be stated that the teachers mostly complained about the difficulties of tracking the tasks and lack of time allotted to follow them up in the interviews carried out throughout the study.

Factor 5

The codes which emerged during the interviews and also comprised the fifth factor are given in Table 5.

When Table 5 was examined, it was revealed that the teachers included statements in their first interviews indicating that they needed sample works and the explanations about the subjects were inadequate. In the interim interviews it was found that there were still statements by the teachers which indicated that the explanations were inadequate. For example, T1 stated that he did not have much information about portfolio and he decided where to keep the portfolios based on his experiences:

I had no idea about whether I was going to keep the portfolios or the students. At first I was keeping the portfolios. Then, I realized that it did not have any benefits. Now, students keep them and I sometimes ask them to bring them to me to check them. (T1)

T2 stated in the interviews that he tried to use project method, one of the alternative assessments suggested by the curriculum, but he had to quit due to lack of student interest:

… Because I did not have satisfying resources suggesting project work examples and tasks, I could not help my students; therefore, I quit this implementation at the beginning of the term. I could not find clear and comprehensible information about the subject in the curriculum guide. (T2)

Similarly, it was discovered in the final interview that the teachers stated that in-service training was inadequate and they needed examples which introduces the relationship between mathematics and daily life and history of mathematics to guide them in their studies. Furthermore, the teachers added that such reasons as students’ low levels, their disinterested attitudes and behaviours, implementation tracking being difficult and time consuming and regulatory obligations affected their implementations negatively.

To sum up, teachers mostly mentioned inadequate explanations and their needs for examples related to the fifth factor throughout the interviews in the study. Furthermore, what drew attention in the last interview is that teachers indicated that in-service training offered to them was inadequate.

Factor 6

The codes which emerged during the interviews and also comprised the sixth factor are given in Table 6.

When Table 6 was examined, both teachers stated that students were not ready for such techniques which would have an effect on students’ learning. Moreover, T1 mentioned lack of students’ interest and T2 stated the differences between student levels as follows:

… We almost complain about our students’ lack of
interest. These techniques might be used in some exceptional high schools, but in my opinion they are not possible in high schools and vocational high schools... (T1)

… This form can be used with the good students and it can be beneficial to them. (T2)

It was indicated in the interim interviews that T1 evaluated students’ personal qualities as one of the important factors affecting students’ learning. It was determined in the interim interviews that T2 mentioned two main components which could be associated with the sixth factor. When Table 6 and the interviews were examined, T2 mentioned lack of students’ interest and thought that the new approaches and measurement and assessment tools were more suitable to implement in the schools where students are accepted after an examination. However, it was determined that while teaching courses, T2 tried to do his best to include teaching and learning techniques such as group work, portfolios and self-evaluation and the new measurement and assessment approaches mentioned in the curriculum.

… Apart from these, I tried to use the project method included in the curriculum. I gave students some time to do research on this subject, but I did not encounter any good examples. I can say that students were really not interested in it. They complained, “How are they going to develop projects?” (T2)

On the other hand in the last interviews it attracted attention that both teachers mentioned the importance of collaboration in group. The statements of T1 about this subject were given below.

T1: An enthusiasm and excitement occurs in unsuccessful students during the group work because my aim is to help them think that they can learn something without disturbing the class. Students’ participation is very important; in other words, a student cannot solve every question, but I encourage him to do it if I notice that he is zealous. Such students try not to cause trouble and make an effort to be supportive. During the study, they considered themselves a member of the group as they tried to participate and bring documents.

Considering all the findings gathered from this research, it was revealed with the interviews and observations carried out for a year that six factors were effective in teachers’ views on the measurement and assessment aspect of the curriculum, but no permanent changes were experienced with the implementations when evaluating the process.

**DISCUSSION**

**Factor 1: Teachers’ Culture**

The interviews and observations indicated that teachers used written tests as the key determinant when assessing and evaluating students. This finding overlaps...
the results of the studies which stated that teachers preferred mostly traditional methods to assess students’ performance (Gelbal and Kelecioglu, 2007; Karakuş, 2010; Nalbantoğlu-Eyitmiş, 2007). Moreover, the observations carried out within the process indicated that T1 and T2 asked their students to create a portfolio and despite being few in number, they included group works in their lessons. T1 and T2 tried to include these works within the process until the end of the first term despite different problems they encountered; however, they preferred only traditional methods for a long time in the second term. It was understood from the interviews that the reason for this situation was that the data obtained from the works could not be used officially. Although it was stated that the results obtained from these methods were reflected on oral assessments, it was discovered that teachers shared a culture in which they added the assessment results on students’ scores as they used to do in the past.

When the documents involving legislative regulations related to measurement and assessment were examined, it was determined that the changes which were limited to only primary education institutions were included from the year when curriculum renewal started to the moment when the study was completed. Failure in legislative regulations for secondary education institutions was considered as a barrier to catch up with the desired changes. Thus, teachers emphasized this point from the beginning of the process to the end and stated that required changes had to be made as soon as possible in order to provide unity. Moreover, it can be stated that what teachers experienced in the field of measurement and assessment until the end of the term was more compatible with the curriculum anticipations. However, because the regulatory changes mentioned were not carried out in measurement and assessment, not being able to use the tasks accomplished at the end of the term tangibly prevented teachers from keeping up with the changes and also caused teachers to behave in ways similar to their previous teaching life for some time.

The studies conducted reveal that teachers focused on product rather than the process while assessing the tasks (Stiggins, 2002) and they were not qualified for process assessment (Yılmaz, 2006). The findings of this research revealed that measurement and assessment methods preferred by T1 and T2 were not very different from the ones used in the previous years and they actually used tests and oral assessments. This finding shows similarities with the results of the other studies (Erdal, 2007; Gelbal and Kelecioglu, 2007; Nalbantoğlu-Eyitmiş, 2007). Under these circumstances, it was considered that teachers’ lack of information due to lack of satisfactory explanations about how to use the suggested tools, lack of importance given to the new implementations included in the curriculum after some time due to not being able to use them officially, and lack of essential regulations for the subjects mentioned must have been effective.

To sum up, it can be stated that the first factor which affected the teachers’ views on contemporary measurement and assessment approaches within the context of mathematics curriculum reform is related to the teachers’ opinions about how to do measurement and assessment. During the interviews, teachers shared opinions such as objective measurement and assessment which are specified with legislative regulations.

Factor 2: Usability of the assessment tools

Opinions such as the use of suggested measurement and assessment tools in the study under the present circumstances may cause teachers to spend more time and energy and this situation may become a barrier for the students to get prepared for the university entrance exam emerged. It was discovered in the interim interviews that the suggested tools and the use of the processes required by them and student selection and placement examination (SSaPE) were emphasized, but it was found that this condition was mentioned less than in the first interviews. However, the observations made within the process demonstrated that teachers focused on the previous exam questions in the past and they warned their students about them. This condition indicated that courses were instructed based on the standardized tests. Because implementations carried out were preparing students for the standardized tests, the opinions which were stated in the interim interviews that the use of suggested tools would hinder preparation for SSaPE diminished. However, it was determined that both teachers addressed this subject many times during a general evaluation in the last interviews. This condition indicates that teachers viewed SSaPE as an obstacle to keep up with the required changes. The same issue was also specified in the previous studies conducted in Turkey (Çalık, 2007; Mercan, 2013). Some studies conducted abroad revealed that such tests would damage the reform (Briars, 1999; Carless, 2005), they could have negative effects on classroom practices (Boardman and Woodruff, 2004; Mabry et al., 2003) and they would be responsible for the emergence of students who got good scores in the standardized tests but were not well-trained.

To sum up, it can be stated that the second factor which affected the teachers’ views on the contemporary measurement and assessment approaches within the context of mathematics curriculum reform is related to the usability of the suggested assessment tools. It was identified during the interviews that teachers used expressions such as there was a variety of suggested assessment tools, using these assessment tools would not bring the essential benefits under these circumstances and also cause time loss, and student selection

3SSaPE (Student Selection and Placement Examination) is a standardized test administered every year to select and admit students in higher education. Students get into a university as a result of this exam.
and placement test reduced the usability of assessment tools.

**Factor 3: Infrastructure conditions**

It was revealed in the interviews that teachers viewed crowded classrooms as a major obstacle to meet the requirements of the curriculum. This finding shows similarities with the results of many studies conducted on new curriculum designs in Turkey (Acat and Demir, 2007; Duru and Korkmaz, 2010; Gelbal and Kelecioğlu, 2007; Selvi, 2006; Yapıcı and Leblebiciler, 2007).

While T1 and T2 expressed their opinions especially about the tasks included in portfolio in curriculum guides, teachers stated that the economic conditions of students would cause problems in the implementation. This result shows similarity with the results of the study conducted by Yılmaz (2006) which stated that teachers received complaints from students’ parents about expenditures while students were preparing performance tasks and projects and this condition prevented assignments from being done. These findings are also similar to the results of the study by Garet and Mills (1995) who stated that it is difficult to turn change into action and sustain it and it is also associated with the demographic features of the schools. Similar results are obtained with many research studies conducted on the newly developed curriculum designs in Turkey (Erdal, 2007; Yapıcı and Leblebiciler, 2007).

T1 and T2 usually preferred not to use textbooks in their implementations. Thus, in-class observations indicated that teachers used books which prepared students for university exam as resources and they used textbooks mostly to assign homework or save time by using the drawings in the textbook (for example; function graphs) and explain them. This condition was regarded as an indicator of their not being able to give up their own past experiences.

It can be stated that the third factor which affected the teachers’ views on the contemporary measurement and assessment approaches within the context of mathematics curriculum reform is related to infrastructure conditions. Teachers indicated during the interviews that the conditions related to infrastructure such as crowded classrooms, lack of equipment and tools in schools, intensive subjects, and students’ social and economic conditions caused problems between measurement and assessment aspect of curriculum and the essential change.

**Factor 4: Teachers’ new roles**

Teachers’ new roles are very important while implementing the changes carried out in education (Hayward et al., 2004; Patterson and Norwood, 2004). While teachers’ views on the measurement and assessment aspect of curriculum were being explored in this study, the fourth factor generally represented the codes which were composed from the statements mentioned in the interviews and also indicated teachers’ new roles. It was found that opinions were formed on the criticisms teachers received while doing assessment with the new assessment tools in the first interviews only, but this subject was not mentioned not only in the interim interviews but also in the last interviews. It was understood in the first interviews that teachers predicted that they would receive criticism due to qualitative data based on observation and evaluating their attitudes. Such statements did not occur during the implementations and assessments in the last interviews, which indicated that teachers might have used this condition as an excuse to escape at the beginning of the implementation. Moreover, lack of preference to use the mentioned assessment tools was considered to be effective in this condition. Borko et al. (1997) reported that if the beliefs of teachers are incompatible with the ones identified officially, teachers either avoid using these new ideas or they try to adapt them to their existing experiences. When considered from this aspect, it can be stated that the findings obtained from the research are similar to the points indicated by this study.

Acat and Demir (2007) indicated in their study that teachers stated that making copies for criteria to assess performance for each lesson and activity especially hindered the implementation of assessment tasks beneficially due to lack of time and the crowded classrooms. The opinions expressed in this study during the first, interim and last interviews were that time allotted to carry out these changes introduced by the curriculum would not be enough. T1 and T2 restated in the study that it became more different to check and examine the portfolios due to crowded classrooms, so they could not give feedback at a desired level. Therefore, it is implied that teachers’ opinions about this subject did not undergo any changes within the process. Many studies indicating similarities with the results of this study are encountered in Turkey and they reveal that teachers could not experience the essential changes to adopt formative assessment due to lack of time (Çalık, 2007; Erdal, 2007; Gelbal and Kelecioğlu, 2007; Keleş, 2009). In addition to these, many studies carried out abroad indicate the same points (Alsup and Springler, 2003; Borko et al., 1997; Borko et al., 2000; Butler et al., 2005; Carless, 2005; Dawn-Camacho and Vickie, 2007; Hayward et al., 2004; Mabry et al., 2003; Osborne, 1993).

Teachers give meaning to reform in line with their own experiences (Drake and Sherin, 2006). There are really big differences between the teachers in terms of accepting the requirements of the curriculum or showing resistance (Remillard and Bryans, 2000) and using the materials and activities for the suggested subjects, so teachers resort to other different ways related to their beliefs in place of the methods aimed by the curriculum developers and experts in education. When considered from this aspect, it can be stated that similar findings
were obtained in this study. In other words, although both teachers tried to integrate these changes along with their knowledge and experiences, they quitted them, which they made an effort to include, due to their beliefs in time. Two teachers were different from each other in that T2 was more willing than T1 to include the mentioned changes and also he tried to reflect them on his implementations. However, the statements of T2 during the interviews revealed that the teacher perceived the changes made in the field of measurement and assessment as only using the suggested forms. This finding is reinforced with the expectation of the teacher. The teacher has expectations in every opportunity about what the percentages of the scores obtained via these forms will be on average score and how they will be calculated. He also expects them to be determined by legal procedures. On the other hand, the difficulties of following the tasks mentioned by T1 and T2 in the first, interim and last interviews drew attention. It was understood that they mentioned the challenges of following the groups during the group works in the classroom practices and portfolios. It was indicated that such opinions as implementing many tasks and difficulties of implementing the changes under present conditions (Hayward et al., 2004) resulted in achieving success with the goals of formative assessment; therefore, it hindered the progress of the desired changes. When considered from this aspect, the reasons for failing to experience permanent changes with the implementations in connection with the teachers’ opinions have been realized better.

It can be stated that the fourth factor which affected the teachers’ views on the contemporary measurement and assessment approaches within the context of mathematics curriculum reform is related to the teachers’ new roles. It was revealed by the teachers during the interviews that conditions related to teachers’ new roles such as lack of time, difficulty of following the tasks and doing observations and taking notes at the same time lead to problems in curriculum to experience the target changes in the field of measurement and assessment.

**Factor 5: Being informed about the changes in the curriculum**

The fifth factor, which generally represented the codes which were composed from the statements of the teachers in the interviews, indicated information about curriculum change. Although the observations and interviews carried out during the research indicate that some attempts have been made to capture the desired changes, they were either short-term or they were up to teachers’ choices due to inadequate explanations and resources, teachers’ not being informed about this subject at a required level and the arrangements’ not being made according to the regulations. Similarly, it is determined in the literature that since teachers are not provided with adequate information and resources about which assessment techniques they are going to use and how they are going to use them while doing in-class assessment, the way these assessments are handled will remain limited to teachers’ experiences (Baki and Birgin, 2002), teachers who are supposed to use performance assessment have experienced very few changes with their teaching practices (Firestone et al., 1998), teachers prefer to use the method which they think they are competent at (Gelbal and Kelecioğlu, 2007; Erdal, 2007).

On the other hand, teachers’ lack of necessary details which are required to implement the innovations prevents them from achieving the goals in the field of measurement and assessment (Hayward et al., 2004). It was determined in the study that due to the reasons mentioned above, teachers’ efforts towards the goals of the curriculum decreased and they continued to carry out the teaching and learning activities in line with their past experiences. Therefore, it is revealed that in order to actualize the target changes the teachers need a very good content knowledge (Firestone et al., 1998), satisfying and on-going in-service training (Borko et al., 1997; Briars, 1999) and support and incentive (Carless, 2005).

Moreover, it is reported in the literature regarding the research studies conducted in Turkey that teachers encounter problems such as lack of inadequate explanations about measurement and assessment techniques (Çakır, 2007, Keleş, 2009), lack of examples about how to use the new tools and evaluate the results (Gelbal and Kelecioğlu, 2007), teachers’ lack of knowledge about alternative assessments and lack of explicit explanations about how to convert the alternative assessment results into school report grades in course and examination regulations (Bulut, 2006). In addition to these problems encountered by the teachers, it is identified that teachers found the assessment results related to curriculum implementations as meaningless (Selvi, 2006) and they could not use these tools in meaningful ways in their lessons; therefore, teachers could not exactly comprehend and implement what they are asked to do in the curriculum (Selvi, 2006) and they are in need of knowledge.

The interviews revealed that teachers wanted to see task examples (project, portfolio and so on) and they also needed guide books for examples. The interim interviews revealed that teachers needed examples of in-class activities and projects, they also mentioned the importance of access to sample portfolios for the introduction of portfolios on the website of Ministry of National Education and they had difficulties in finding the required samples; therefore, all these affected their implementations negatively. Examples of research studies which have been conducted on new curriculum and obtained similar results are encountered in Turkey (Yılmaz, 2006). In parallel with this, Firestone et al. (1998) found that very few changes were observed with
the implementations of teachers who were supposed to use performance assessment and also indicated that lack of rich activities and sample problems in curriculum materials which promote such approach is the obstacle which hinder the desired change (Morrison et al., 2003). Moreover, Hayward et al. (2004) stated that implicit tools are one of the reasons for achieving less success than the desired one in the field of measurement and assessment.

It is not easy for teachers to learn their new roles. In addition, it is not easy for students to put aside their passive roles and acquire their new role, responsibility. Change requires adequate resources, ownership, knowledge and skills and implementing them at the right time and right place (Morrison et al., 2003).

Therefore, it is obvious that teachers need satisfying information in order to keep up with the changes intended with curriculum. Thus, it is known that in-service training activities designed for the changes are very important for teacher’s training and awareness as well as providing the desired development during education. It drew attention that teachers considered in-service training activities related to the introduction of the curriculum as inadequate throughout the research and they also reacted because their needs were not met despite the period of time especially in the last interview.

It can be stated that the fifth factor which affected the teachers’ views on the contemporary measurement and assessment approaches within the context of mathematics curriculum reform is related to giving information about the curriculum changes. It was determined in the interviews that such reasons stated by the teachers as inadequate in-service training and task examples, lack of explicit and detailed information given in the field of measurement and assessment in the curriculum caused problems to achieve changes with the measurement and assessment aspect of curriculum.

**Factor 6: Students’ learning**

While the changes with teachers’ views on the measurement and assessment aspect of curriculum were being explored, the sixth factor which generally represented the codes which were composed from the statements of the teachers in the interviews indicated student learning. Mathematics education authorities hold positive views about using these assessment techniques to help students to learn mathematics better (Doğan, 2011). As a result of the examination of the interviews carried out in the process, three factors, student qualities, interaction and environment were influential on students’ learning. According to the statements of T1 and T2 in the interviews, it was found that student qualities which had an effect on learning were different levels between students, confidence, preparation and imitation.

In the first interviews, it was stated that due to low mathematics levels of the students, it would not be possible for the students to carry out projects; therefore, the suggested Project Evaluation Form would be used with the good students only. This finding revealed that the differences between the levels of the students are considered as an obstacle to carry out the changes in the field of measurement and assessment. In the interim interviews it was stated with the similar logic that Science or Turkish-Mathematics classes would be suitable to implement group work and it seems to support this view. It was also pointed out in the interviews that the differences between the levels of the students caused problems while using worksheets given in the textbook and this condition affected student learning negatively. In-class observations carried out within the process indicated the same point. Another interesting finding which drew attention is that even the best students could not understand what was tried to be taught with the worksheets and the goals were achieved only with the help of the students. This condition can be explained with the fact that students were not used to carrying out such implementations before and they were used to utilizing the information given by the teacher. Thus, this condition was addressed by the teachers in the later interviews. Pupils’ not being ready for the system and their not being used to the problems given in the textbook or guide book became the barriers to keep up with the desired changes. Although the existing problem was expected to be solved in time, the observations and interviews at later stages indicated that there were still problems about this issue and that is why teachers quitted using textbooks and they reverted to the old methods and test books in their practices. However, it is emphasized in many studies that student-teacher interaction has been important in formative assessment practices (Barootchi and Keshavarz, 2003; Wiliam et al., 2004).

Portfolios ( Birgin, 2011; Simon and Forgette-Giroux, 2000), self and peer assessment (McDonald and Boud, 2003) can promote students’ participation in assessment process. It is determined that self-assessment has a very important role in learning and assessment activities (Brookhart, 2001); therefore, students take the responsibility for their own learning (McDonald and Boud, 2003; Hayward et al., 2004). Teachers stated in the study that the tasks mentioned above would be beneficial, but the benefits can be obtained if the necessary regulations are made. As mentioned in the previous sections, due to incomplete infrastructure conditions and official regulations, teachers preferred to quit the implementations which they tried to carry out in the first stages of the study.

It can be stated that the sixth factor which affected the teachers’ views on the contemporary measurement and assessment approaches within the context of mathematics curriculum reform is related to the new role of measurement and assessment on student learning. It was revealed by the teachers during the interviews that
student qualities, student-student interaction and student-teacher interaction and environment had an effect on students’ learning.

As a result of the examination of the data gathered from the research, six factors (cultural aspect, usability of measurement and assessment tools, infrastructure conditions, teacher’s role, informing, student learning) which affected the teachers’ views on the contemporary measurement and assessment approaches within the context of mathematics curriculum reform were identified. The findings obtained from the research based on the factors identified in the research were given below.

1. Teachers’ culture about measurement and assessment tools affected their views on the new measurement and assessment approaches within the context of mathematics curriculum reform.
   i. Teachers share a culture in which assessment should be objective. Teachers are anxious about the suggested tools because they believe that these tools will decrease the objectivity of assessment. Therefore, they did not prefer to integrate them into their implementations which gradually decreased within the process.
   ii. Teachers continued to assess their students with written and oral examination as well as homework which were stated in the official regulations, but not with the suggested tools in the curriculum and they evaluated their observations about the new implementations which they tried to make use of by reflecting them on oral grades.
   iii. Teachers stated that both changes in the field of measurement and assessment and necessary official regulations must be made in order to develop unity in implementation.
   iv. Teachers asserted that the use of forms based on the assessment of affective, social, and psychomotor skills in measurement and assessment implementations would not bring any benefits under the present circumstances.

2. Teachers’ opinions about the usability of assessment tools affected their perceptions towards the new measurement and assessment approaches within the context of mathematics curriculum reform.
   i. Teachers think that the use of suggested measurement and assessment tools and the essential processes are obstacles to SSaPE preparation.
   ii. Teachers think that the content of the suggested measurement and assessment tools have an effect on their usability. Thus, it was understood that criticism related to the criteria (scoring weight of the test items, too broad, not related to mathematics and etc.) to score the tools did not change and that’s why teachers did not feel the need to integrate these tools into their teaching.
   iii. It was determined that teachers’ previous experiences contradicted with the desired implementations in curriculum change and this was one of the factors which became a barrier to keep with the desired change.
   iv. Similarities between the previous experiences and the implementations required due to curriculum change were among the reasons why teachers did not use these suggested tools.
   v. Both teachers and the researcher adopted the view introduced in the last interview. According to the view, the inspection would be effective to keep up with the desired changes in the field of measurement and assessment and to disseminate it widely.
   vi. The interviews and the observations revealed that there was no change with the teachers’ views about the use of suggested tools as they considered them waste of time.

3. Infrastructure conditions affected teachers’ views on the new measurement and assessment approaches within the context of mathematics curriculum reform.
   i. There was no change with the teachers’ views on the crowded classrooms within the process. They stated that crowded classrooms were the obstacles to keep up with the desired changes regarding the measurement and assessment aspect of the new curriculum.
   ii. There was no change with the teachers’ views which stated that students’ economic conditions and social environment would be effective to keep up with the desired changes regarding the measurement and assessment aspect of the new curriculum.
   iii. There was no change with the teachers’ views which stated that schools must be equipped to keep up with the desired changes regarding the measurement and assessment aspect of the new curriculum.
   iv. It was concluded that the activities included in the textbook and the measurement and assessment implementations were criticised by the teachers and the textbook was rarely used during the education.

4. Teachers’ new roles affected their views on the new measurement and assessment approaches within the context of mathematics curriculum reform.
   i. There was no change with the teachers’ views within the process which stated that time would not be enough to implement the innovations introduced with curriculum in the field of measurement and assessment.
   ii. There was no change with the teachers’ views within the process which stated that it was difficult to follow the required tasks under the present circumstances in order to keep up with the required changes regarding the measurement and assessment aspect of the curriculum.

5. Lack of information activities affected teachers’ views on the new measurement and assessment approaches within the context of mathematics curriculum reform.
   i. Teachers’ needs for the sample works related to the philosophy of the curriculum continued within the process.
Teachers stated that in-service training activities for the introduction of the curriculum were inadequate.

It was revealed that the explanations given in the introduction of curriculum and guide book were not considered clear and detailed by the teachers.

6. The role of measurement and assessment in student learning affected teachers' views on the new measurement and assessment approaches within the context of mathematics curriculum reform.

i. There was no change with the teachers' views within the process which stated that students' qualities had an effect on student learning and the desired changes regarding the measurement and assessment aspect of the curriculum.

ii. It was concluded that interaction was another factor which had an effect on student learning.

SUGGESTIONS

Teachers were informed about the mathematics curriculum reform by the people who were not experts in the field and it was limited to theoretical knowledge and offered only once; therefore, teachers were involved in the process without understanding the goals related to the changes. Thus, a need for in-service training activities emerged. During these activities while introducing the curriculum, time must also be spared for measurement and assessment because as stated in the first section the results of many studies carried out reveal that teachers had encountered more problems with this aspect.

Teachers stated in the research that they were not satisfied with the in-service training activities offered to them by the teachers like themselves and who were not well informed about the changes made. In order to eliminate this problem, information activities must be given by the experts in the field, they must involve rich examples about the new methods, and the program of the activities must be flexible so that they can be shaped according to teachers' feedback. Therefore, project works must be carried out with the participation of experts and teachers at certain intervals and the results obtained must be shared with teachers. Within the context of these studies, first of all teachers can learn the basic knowledge, they can develop new tasks after examining the sample tasks, and they can share the experiences they have with each other within the process via interaction and communication with their colleagues.

Another contribution is that pre-service teachers must be trained in the courses related to measurement and assessment in the universities and they must be involved in the system as well equipped and qualified teachers.

The observations and interviews revealed that the explanations in the curriculum and guide book were inadequate in order to keep up with the required changes. Therefore, it was introduced that teachers needed a teacher's book equipped with rich examples and explanations to use in their implementations. In addition, the present textbooks must be reviewed, equipped with activities which can utilize educational technologies, and eliminate the points which are not consistent with constructivist approach. Measurement and assessment tasks in the textbooks must enable a student to generate his own knowledge. Teacher's books and textbooks enriched with such tasks will help teachers understand the desired goals and also help them to develop task examples suitable to their own conditions. Moreover, the website of Ministry of National Education should include arrangements where teachers find activity examples and project works and share their knowledge with each other. For example, teacher portals can be designed to give opportunities to share practises carried out. Moreover, teachers must be informed about how to integrate the relationship between mathematics and daily life and history of mathematics into the courses.

It was found in the study that one of the obstacles which hindered teachers was student selection and placement test (SSaPE). If measures for such standardized tests are not taken, it will become difficult for the teachers to include implementations about constructivist approach. Thus, examination system must be reorganized in line with constructivist approach like the curriculum.

The results of the study revealed that infrastructure conditions are an important factor for the required changes. Thus, infrastructure conditions must be tried to be improved as soon as possible and if the conditions are not improved, teachers must be provided with satisfying explanations and examples about how to behave under such circumstances. In addition, by taking into consideration the results of the research conducted, suggested measurement and assessment tools must be rearranged, or even they can be reduced. Moreover, teachers must be given extra hours to examine the implementations and carry out research studies out of the class hours. Therefore, it will make contributions both to the teachers and the students to reach the required changes through the new curriculum.

The effective factors important for teachers' views regarding the measurement and assessment aspect of curriculum were defined in the study. The separate and elaborate examination of these factors is important for the identification of the problems and the measures taken. This study reflects the experiences of two teachers by focusing on the process about the measurement and assessment aspect of curriculum. On the other hand, literature review indicates that change must be interpreted regarding the culture where it occurs. Thus, similar studies should be conducted to examine the change process and also explore the reasons for resistance. Nearly the same years of experience and working conditions of the participant teachers in the study caused
the likely conditions to emerge to be limited. In the future studies, teachers with different years of experiences and working conditions can be chosen and the conditions which have emerged can be examined comparatively.

NOTE: This study was generated from the PhD Dissertation of the first author under the supervision of the second author.

Conflict of Interests

The author(s) have not declared any conflict of interests.

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