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Fourth Grade Teachers Evaluate the Mathematics Reform in Turkey

Dördüncü Sınıf Öğretmenleri Matematik Reformunu Değerlendiriyorlar

Renan SEZER*, Necdet GÜNER**, Oylum AKKUŞ ISPİR***

ABSTRACT: This study aims to evaluate the elementary mathematics curriculum, developed in 2005, textbooks, pedagogy and students' attitudes from elementary teachers' perspective. Teachers cite student-centered pedagogy and making connections between mathematics and real life as the strengths of the new programme and its spiralling nature, denseness and inadequateness of time as its weakness. Majority of the teachers found textbooks insufficient due to the lack of question variety. 57% of the teachers do 4 or more activities per week; yet, only 15.3% say they use a student-centered approach. There is no significant difference between the frequency with which activities are utilized and each of the following: geographical region, school location, teacher's experience, and class size. Teachers' claim that while students' desire to succeed and interest in mathematics is above moderate, their inclination to discover it and prior knowledge is slightly below average.

Keywords: Mathematics curriculum, mathematics reform, elementary school teachers, teacher perspective, mathematics textbooks, pedagogy, attitude.

ÖZET: Bu çalışma 2005 yılında yapılan ilköğretim birinci kademe matematik programının, ders kitaplarının, kullanılan pedagojinin ve öğrenci tutumunun sınıf öğretmenleri tarafından değerlendirilmesini amaçlamıştır. Öğretmenlere göre yeni programın kuvvetli yönleri öğrenci merkezli olması ve matematiğin hayatla ilişkilendirilmesi, zayıf yönleri ise yıl içindeki sarmal yapı, programın yüklü olması ve yeterli zamanın olmamasıdır. Çoğunluk ders kitaplarını yeterli bulmazken soru çeşitliliğinin azlığı en büyük neden olarak gösterilmiştir. Öğretmenlerin %57'si haftada 4 veya daha fazla etkinlik yaptığını ifade ederken, %15,3'ü öğrenci merkezli bir yaklaşım kullandıklarını söylemektedirler. Etkinlik yapma sıklığı ile coğrafi bölgeler, yerleşim bölgeleri, öğretmen deneyimi ve sınıf mevcudu arasında istatistiksel olarak anlamlı bir ilişki görülmemektedir. Öğretmenlere göre yeni program ile öğrencilerin matematikte başarılı olma isteği ve derse ilgileri ortanın üstünde iken, matematiği keşfetme istekleri ve önbilgi düzeyleri ortanın biraz altındadır.

Anahtar sözcükler: Matematik programı, matematik reformu, sınıf öğretmenleri, öğretmenin bakış açısı, matematik ders kitapları, pedagoji, öğrenci tutumu.

1. INTRODUCTION

With the developments in technology, there has been a mathematics reform movement around the world. The focus of current mathematics education is to enhance mathematical thinking, conceptual understanding, making connections between mathematics and real-life and problem solving skills (NCTM, 2000). Many countries, such as the United States and Singapore made revisions in their curricula (Sriraman, 2010). Menon (2000) claims that one of the most important criteria that effect students' success in mathematics is having a consistent and coherent mathematics curriculum.

In 2005, mathematics curriculum in Turkey was revised and reformed (MEB 2005a; 2005b). 1st to 5th grade curriculum was implemented in the academic year 2005-2006 (Erdoğan and Yenilmez, 2009). One of the goals of the new curriculum is to emphasize real-life applications, problem solving skills, making mathematical connections between concepts and mathematical reasoning (MEB, 2009). The new program has constructivist learning tendencies,

* Prof. phD., Ankara University, Faculty of Education, Ankara-Turkey, renan_sezer@yahoo.com
** Assoc. Prof. phD., Pamukkale University, Faculty of Education, Denizli-Turkey, nguner@pau.edu.tr
*** Assoc. Prof. phD., Faculty at Ohlone College, California-USA, oylumakkus@gmail.com

such as being student-centered, actively involving students in the learning process and using collaborative learning (MEB 2005a; 2005b). Thus, along with the curriculum, the pedagogy has also changed.

It was desirable to investigate the connection between teachers' views on the pedagogy the curriculum adheres to and their preferred methods of teaching mathematics. If teachers do not "buy into" the changes, these changes are doomed to fail (Sosniak, Ethington, and Varelas, 1991). Many teachers teach the way they were taught (Çınar, Teyfur and Teyfur, 2006) and show resistance to change (Gökçek, 2008). There are few studies investigating the usability of student-centered teaching in mathematics classes in Turkey (Anılan and Sarıer, 2008; Duru and Korkmaz, 2010; Erdoğan and Yenilmez, 2009; Güneş and Baki, 2011). These studies indicate that teachers in general demonstrate a positive attitude towards the constructivist pedagogy but face some challenges in the implementation process, such as infrastructure of the schools, class-size, and time constraints (Anılan and Sarıer, 2008; Duru and Korkmaz, 2010; Güneş and Baki, 2011). Yet all of these studies were conducted on a province of Turkey and cannot be generalized to the entire country.

Teachers often base their teaching on the textbook they use. According to Reys, Reys and Chávez (2004), textbooks determine how the teacher will organize the lesson, give information on the topic that should be covered and provide the teacher with activities and ideas that could be used in a learning environment to motivate the students. Changes in the curriculum only go as far as the textbooks, reflecting the ideas of the new program, are able to bring the said changes to the classroom. The textbooks are the best instrument in determining how the program is actually being implemented and what learning opportunities are provided to the students (Törnroos, 2005). In that sense, textbooks are the materials most often used (Chávez-López, 2003; Kaya, 2008). Thus, when the elementary mathematics curriculum reform was implemented, new textbooks reflecting the philosophy of the curriculum were written (Arslan and Özpınar, 2009).

Since the new curriculum aims to develop positive attitudes towards mathematics in students, in evaluating the new curriculum, another factor that should be considered is student's attitude towards mathematics, exploration and mathematical research. There are many studies related to student's attitude toward mathematics and self –perception (Altun, 2007; Aşkar, 1986); yet, these studies were not designed to evaluate whether the new program had any impact on students' attitudes.

Besides research on the curriculum, textbooks, and students' attitudes, there is a dire need to explore how teachers view these changes. Yet, very few research studies were found on teachers' perspectives on the reform. What do teachers consider as the strengths and weaknesses of the new program; how do they like the textbooks they are using? How frequently do teachers utilize the mathematical activities in these textbooks and how satisfied are they with these activities? What pedagogy do they use in class?

Though there are studies attempting to measure the outcomes of the new curriculum on a few cities (Anılan and Sarıer, 2008; Erbaş and Ulubay, 2008; Duru and Korkmaz, 2010; Güneş and Baki, 2011), no nation-wide study exists. Therefore there is a dire need to explore the mathematics reform in Turkey from teachers' point of view. Thus the purpose of this study is to investigate Turkish elementary school teachers' perceptions on the curriculum, the pedagogy, the textbooks, and students' attitudes toward mathematics. To this end, the following research questions were asked:

1) a) What do teachers perceive as the strengths of the new elementary mathematics curriculum?
   b) What do teachers perceive as the weaknesses of the new elementary mathematics curriculum?
   c) How do teachers rate students' prior knowledge with respect to grade level with the implementation of the new curriculum?

2) From teachers' perception what are the characteristics of the elementary mathematics textbooks they are using that is satisfactory/unsatisfactory?
3) a) How frequently do teachers use the mathematical activities from the textbook in class?
   b) How satisfied are the teachers with the mathematical activities that are in the textbooks?
4) What pedagogy do they most often use to teach mathematics?
5) How do they perceive their students' attitude towards mathematics under the new curriculum?

2. METHODOLOGY

A survey research design was considered to be suitable for this study. Survey research asks questions about a topic to a large group of participants (Fraenkel & Wallen, 1996). For this study, data was collected from a sample of 4th-grade teachers whose students would represent Turkey in TIMSS 2011. This sample was particularly chosen because the students, who participate in TIMSS, are selected to represent the 4th-grade population of Turkey and their teachers form a "purposeful sample" (Fraenkel & Wallen, 1996). Moreover, elementary school teachers do not specialize according to grade levels and thus are in a position to evaluate 1st to 5th grade mathematics curricula. It is assumed that TIMSS officials have included students reflecting different characteristics of the population in this sample (Berg, 2007). The total number of 4th grade teachers, who would represent Turkey in TIMSS, was 250, and of this group, 202 teachers voluntarily participated in the survey. These 202 teachers formed the sample of this study.

The authors developed the survey instrument. The validity of the survey was established through the opinions of six educators, some of whom were faculty from education departments at universities and the rest elementary school teachers. The questionnaire was later piloted on graduate students, who are employed as elementary school teachers. In the pilot, the participants were asked to note any item or phrase that was unclear. The survey was finalized based on their suggestions. The survey consists of 15 questions. Of these questions, 10 are open-ended, 2 are multiple choice and 3 use a Likert Scale. The open-ended questions were designed so as not to limit the range of responses that could be given. Two researchers have jointly read all the answers to the questions in the survey and formed answer categories for each of the questions. This process was done for each open ended question. Later, two researchers individually assigned each of the answers to an already established category. Reliability was calculated, based on the consistency of these assignments, for each question. On each question whose reliability was less than 90, the researchers collaborated and the reliability calculated using the final reliability of each question was found to be %96.

3. RESULTS

3.1. Demographic Data

Survey questions 1 through 4 targeted demographic data, such as geographical region in which the teacher is employed, residential location of the school, the number of years of teaching experience teachers have, and the number of students each teacher has in his/her section. Question 1 asked about the geographical regions in which the teacher is employed.

Table 1: The geographical regions in which the teacher is employed

Marmara	E. Anatolia	S. Anatolia	Aegean and C. Anatolia	Black Sea	Mediterranean
24.9%	15.9%	12.9%	12.4%	11.4%	10.0%

As indicated in Table 1, 24.9% of the teachers work in the Marmara, 15.9% in Eastern Anatolia, 12.9% in South-eastern Anatolia, 12.4% each in the Aegean and Central Anatolia, 11.4% in the Black Sea and 10.0% in the Mediterranean regions. Question 2 asked which residential location the school is situated in. The responses reveal that 37% of the teachers work in inner-city schools, 41% in borough schools, 6% in town schools and 16% in schools in rural areas. Question 3 asked about the number of years of teaching experience teachers have. Results for this question indicate that the mean teaching experience of responding teachers is 12.7 years with a standard deviation of 9 years. Question 4 asked about the number of students each teacher has in his/her section and found that the average class size is 30.23 with a standard deviation of 10.88.

3.2. Strengths and Weaknesses of the 2005 Elementary Mathematics Curriculum which Forms the Basis of the Revised Program of 2013

Question 5a asked about the strengths and part *b* asked about the weaknesses of the new mathematics curriculum. As the strengths of the program 17.82% of the teachers cited that the new curriculum is student centered; 16.83% indicated that it is activity based; 12.38% pointed out that it makes connection with real life. 6.93% of the teachers said the revised curriculum increases students' higher level thinking, 4.95% indicated that it helps make abstract mathematical concepts concrete and 4.46% claimed it develops positive attitudes in students toward mathematics. Those who gave other reasons formed 15.35% of the sample whereas 21.29% did not respond to the question. As for the weaknesses of the curriculum, program's disregard for the inadequate infrastructure of the schools (11.39%) and discrepancies between geographical regions (8.42%). 5.45% of the teachers said the new program does not emphasize the development of higher thinking/problem solving ability in the students, while 9.40% cited other reasons. 8.91% of the teachers left the question unanswered.

Question 5c asked if students' prior knowledge was up to par with their grade level. This question was coded on a Likert Scale. The mean response was 2.78, with a standard deviation of 0.65. No statistically significant difference was observed between teachers' perception of students' prior knowledge and geographical regions (F=1.445, p=0.199); however, a statistically significant difference was observed between teachers' perception of students' prior knowledge and the school location (F=5.946, p=0.001). To determine in which school locations such a difference occurred, Multiple Comparisons LSD analysis was done, revealing that students in rural areas are at a disadvantage compared to those in other locations (inner cities p=0.000, boroughs p=0.002, and towns p=0.024). Similarly, a significant difference was observed between teachers' perception of students' prior knowledge and teachers' experience (F=5.013, p=0.001). Based on LSD analysis, this difference occurs within two groups: students who have teachers with 10 or more years of experience and those with teachers having 1-4 years of experience, and students who have teachers with 20 or more years of experience and those with teachers having 5-9 years of experience. In both cases, the difference was in favor of students with more experienced teachers. Class size did not have a statistically significant impact on teachers' perception of students' prior knowledge (F=0.921, p=0.468).

3.3. Characteristics of the Elementary Mathematics Textbooks that are Satisfactory/Unsatisfactory

Questions 6 and 7 concerned mathematics textbooks. Question 6 asked which textbook is used in class and why. In response to question 6, 78% of the teachers indicated using the textbook published by the Ministry of Education (MEB), while 22% used textbooks published by private publishing houses but sanctioned by the same ministry. The most important reasons given for choosing the MEB book were as follows: the book was sent by the ministry (53.5 %), the book was free (9.3 %) and unspecified (37.2%). Those who used textbooks published by private companies gave similar responses: the book was sent by the ministry (17.6 %), the book has more examples/activities (14.7%), the book explains mathematics topics well (11.8%), the book was free (5.9%) and unspecified (50%). Question 7 asked teachers which aspects of the

MEB textbook they favored/disfavored and to what extent. 40% of the faculty was satisfied with the MEB textbooks. Of those satisfied with the textbook, 32% found the activities in the book sufficient, 16% found the level appropriate, 9% believed that the worked-out examples were sufficient, 7% liked the treatment of the topics, 5% considered the textbook in-line with the mathematics program, 5% thought it was sufficient at the knowledge and application level, 5% considered the problems sufficient, 5% thought the textbook developed reasoning and research skills, 3% thought the activities were well chosen and 3% appreciated the planning and organization of the text. Of the 60% of the teachers who were dissatisfied with the MEB textbook, 19% found the problems/exercises requiring reasoning skills insufficient, 16% thought question variety was limited, 14% considered the number of activities inadequate, 13% found the problems/exercises requiring application skills insufficient, 12% believed the worked out examples were too few, 10% considered the explanations not enough, 7% felt the organization of the topics, and 4% regarded the content knowledge as poor, whereas 3% believed that the visual aspects of the book was lacking and 2% cited other reasons. Independent of their satisfaction with the MEB textbook, 10% of the teachers in each category did not specify any reasons for their point of view.

3.4. Frequency with which Mathematical Activities from the Textbooks are Used in Class and Satisfaction with These Activities

To answer the first part of the research question 3, related to the frequency with which mathematics activities from the textbook is used in class, question 8 of the survey was used. Question 8 asked about the number of activities done in class per week. 57.4% of the teachers indicated doing four or more activities, 17.3% doing three activities, 11.9% doing two activities, 3.0% doing one activity, and 5.4% doing less than one activity per week. Those who did not respond formed 5.0% of the sample. The data revealed that 57% of the teachers did 4 or more activities per week and at the .05 significance level, the number of activities did not show a statistically significant difference with respect to geographic regions ($\chi^2 = 10.461$, p=0.439), school locations ($\chi^2 = 9.469$, p=0.662), teaching experience ($\chi^2 = 16.608$, p=0.411), class size ($\chi^2 = 12.977$, p=0.878) or students' prior knowledge with respect to grade-level ($\chi^2 = 11.044$, p=0.807).

To answer the second part of the research question 3, that asked teachers to evaluate how well students make connections between the activities done and the mathematical concepts these activities aim to teach, question 9 of the survey was used. Responses to question 9 were coded on a Likert Scale, with 5 being excellent and 1 being poor. The mean for this question was 3.50 with a standard deviation of 0.69. At the .05 level no statistically significant difference was found between question 9 and geographical regions (F=0.908, p=0.590); however, at the 0.05 level a statistically significant difference was observed with respect to school locations (F=8.029, p=0.000). In order to determine which school locations exhibited such a meaningful difference, LSD analysis was conducted, indicating that inner-city and borough teachers' evaluation of their students' abilities to make connections between activities and mathematical concepts is higher than those located in towns and rural areas (Inner-city vs. town p=0.002; inner-city vs. rural areas p=0.000; borough vs. town p=0.016; borough vs. rural areas p= 0.001). Also, at the .05 level, a statistically significant difference was observed between question 9 and teaching experience (F=5.422, p=0.000). LSD analysis was done, revealing that teachers with 20 or more years of experience show a significant difference with respect to others (20 or more years vs. 1-4 years p=0.000; 20 or more years vs. 5-9 years p=0.000; 20 or more years vs. 10-14 years p=0.004), this difference being in favor of the students with more experienced teachers. Moreover, a similar difference is observed between teachers with 15-19 years of experience and those with 1-9 years of experience (15-19 years vs. 1-4 years p=0.043; 15-19 years vs. 5-9 years p=0.012), this difference also being in favor of the students with more experienced teachers. At the .05 level, χ^2 did not indicate a significant difference between students' abilities to make connections between activities and mathematical concepts (question 9) and the frequency with which mathematical activities are done in class (question 8) ($\chi^2 = 17.567$, p=0.126). The correlation factor between Question 9 and Question 5c (students' prior knowledge with respect to grade-level) was found to be 0.491 and p=0.00.

3.5. Pedagogy Used

To answer the fourth research question, survey questions 10-12 were utilized. These questions dealt with the pedagogy used. Question 10 asked what pedagogy teachers most commonly use to teach mathematics. Responses this question varied to a great extent. 34.2% of the teachers could not identify the teaching approach they were using in class. 19.3% categorized their teaching as classical/teacher- centered, whereas 15.3% of the teachers claimed they were using a student-centered/constructivist approach. 8.9% of the teachers said they were using question and answer, as well as brain storming, 7.4% said they use applications/reasoning, 4.5% cited multiple intelligence, 4.0% indicated working out exercises and problem solving, 3% said exploration, and 1.5% claimed they use technology/e-group collaboration.

Question 11 asked how often teachers expect their students to explore a mathematics topic not yet learned in class. The mean expectation level was found to be 2.64 on a Likert Scale with a standard deviation of 1.04. No statistically significant difference was observed between expectation and geographical area (F=1.537, p=0.168), residential location (F=0.553, p=0.647) and teacher's experience (F=0.968, p=0.426). No statistically significant difference was found between teachers' expectations of students to explore mathematical topics (question 11) and the number of activities done in class (question 8) ($\chi^2 = 21.697$, p=0.153). At the .001 level, a correlation (0.23) was observed between teachers' perception of students' ability to make connections between activities and mathematical concepts (question 9) and teachers' expectations of students to explore/research a new mathematical topic (question 11).

In question 12, the percentage of time allocated for various steps involved in learning a mathematical procedure was inquired about. The mean percentages for each step is as follows: 21.87% for finding the procedure to be applied, 20.31% steps of the procedure, 16.28% results, 16.15% why this procedure works, 15.92% discussing the existence of an alternate procedure and 9.47% other. Teachers spent the largest percentage of time (21.9%) on finding the procedure that needs to be applied and less time on discussing why this procedure works (16.2%) and whether there are alternate procedures (15.9%). No statistically significant difference was observed between question 12 and teachers' experiences.

3.6. Attitude Towards Mathematics

Questions 13-15 were related to the psychology of mathematics education. Question 13 asked teachers to evaluate their students' desire to be successful in mathematics. The mean and standard deviation for this question were found to be 3.74 and 0.86 respectively. A statistically significant difference was not observed between this question and geographical regions (F=0.359, p=0.904), yet such a difference was found in regards to school locations (F=6.785, p=0.000). Inner-city students' desire to be successful in mathematics was perceived to be significantly higher than those living in towns (p=0.008) and rural areas (p=0.000). This was also the case between students living in the boroughs and rural areas (p=0.003).

Question 14 asked teachers to rate students' interest in mathematics on a Likert Scale. The mean and standard deviation was found to be 3.58 and 0.80 respectively A statistically significant difference was not observed between this question and geographical regions (F=0.634, p=0.703), yet such a difference was found in regards to school locations (F=4.799, p=0.003). Inner-city students' interest in mathematics was perceived to be significantly higher than those living in towns (p=0.025) and rural areas (p=0.001). This was also the case between students living in the boroughs and rural areas (p=0.003). At the .000 significance level, a high correlation (.72) was found between teachers' perception of students' interest levels in mathematics (question 14) and students' desire to be successful in mathematics (question 13).

Question 15 required teachers to rate students' desire to investigate mathematics topics not yet learned in class on a Likert Scale. The mean and standard deviation were found to be 2.99 and 0.88 respectively. A statistically significant difference was not observed between this question and geographical region (F=0.352, p=0.908) or school location (F=1.712, p=0.166). A correlation (0.38) was, however, observed between teachers' expectations of students to investigate a mathematics topic not yet learned (question 11) and students' perceived desire to investigate a mathematics topic not yet taught in class (question 15), (p=0.000). Based on χ^2 analysis there was no statistically significant difference between the number of activities done in class (question 8) and students' perceived desire to explore mathematical concepts (question 15) ($\chi^2 = 13.753$, p=0.617). A correlation (0.41) was found between students' perceived desire to investigate mathematical topics (question 15) and to succeed in mathematics (question 13), (p=0.01). Similarly, a correlation (0.52) was found between question 15 and question 14 (students' perceived interest level in mathematics), (p=0.01).

4. DISCUSSION and CONCLUSION

4.1. Discussion of Findings

Teachers appreciate the 2005 mathematics curriculum because it is student-centered; activity based, and makes connections between mathematics and real life. Arslan and Özpınar's (2009) study also had similar findings. Another finding of our study is that teachers also feel that the 2005 program, which in the pedagogy it had endorsed resembles the revised program of 2013, does not take into account the infrastructures of schools. This result is supported by Duru and Korkmaz's (2010) study as well. The fact that teachers rate students' prior knowledge slightly below grade level is a concern; yet a study that investigated this aspect of the program was not found in the literature.

60% of the teachers found the mathematics textbook published by the MEB insufficient in terms of the number of problems/examples requiring reasoning skill, limited question variety and the number of application questions. Of the 40% who found the textbook sufficient, only 4.6% were pleased with the problems. These findings indicate that Turkish students encounter a limited variety of questions, the majority of which correspond to knowledge-level questions. These results parallel those of Çakır's (2006), and Çakır's (2009) findings. In all these studies, elementary school teachers found the mathematics textbooks lacking in terms of exercise and problem variety.

Interestingly, no statistically significant (p<.05) difference was observed in the number of activities done and geographical regions, school locations, teacher's experience, or class size. One might think that these activities might be used less in disadvantaged geographical regions such as Eastern Anatolia, and less in rural areas. One might also think that new graduates of education departments, being more familiar with constructivist pedagogy, would use these activities more in their classes. Bulut's (2007) and Orbeyi's (2007) results parallel this finding, indicating that experience of the teacher does not have a significant effect on the ability and willingness to adhere to the new mathematics curriculum. One argument often raised by teachers against the constructivist approach has been the large class size in Turkey. Yet, according to this study, class size did not have any significant effect on how frequently these activities were done, contrary to Yapıcı and Leblebicier's findings (2007), where 56% of the primary school teachers indicated large class size as a disadvantage to activity-based learning. Similarly in Anılan and

Sarıer's study (2008), teachers agreed that the large class size was a hindrance to activity-based learning. Both studies were localized, each pertaining to one particular city.

Another interesting finding of this study was that no statistically significant difference was found between perceived students' abilities to make connections between activities and mathematical concepts (question 9) and the frequency with which mathematical activities are done in class (question 8). This result indicates that independent of the student profile, classroom teachers do the activities in the textbooks. This is in line with Ball and Cohen's (1999) argument that textbooks are the gist of what is done in class. The findings of our study support the viewpoint that textbooks determine what teachers teach, how and when they teach it (Elliott, 1990; Westbury, 1990).

Teachers were asked to identify the pedagogy they had used in class. This open-ended question was the most problematic to categorize because 34% of the teachers did not know what pedagogy they were using or what some of the established teaching techniques are. This finding is alarming and reflects the ineffectiveness of the education departments in the country. If teacher candidates graduate not even being able to name pedagogical approaches, their ability to implement them becomes even more suspect. EARGED (2008) study on 8th- grade teachers also indicated a similar finding, where Turkish mathematics teachers felt underprepared to teach the 8th-grade content. 19% of the teachers classified their teaching as classical, i.e. teacher-centered; while 15% claimed their teaching to be constructivist and an alarmingly small percentage (4%) indicated using a problem-based approach. 57% of the teachers indicated doing 4 or more activities per week. This percentage alone is in contradiction with the 15% who claimed they use constructivist learning. There are two possible explanations for this: either teachers do not know what constructivist learning is or they do not think having students do the mathematical activities in class constitutes constructivist learning. Another seemingly conflicting finding of this study was that no statistically significant difference was observed between teachers' expectations of students to explore mathematics topic not yet learned and the frequency with which mathematical activities were done in class. This indicates that teachers do not consider the activities in the textbooks as mathematical explorations. Moreover, not observing a statistically significant difference between the frequency with which mathematical activities are done in class and teachers' perception of students' abilities to make mathematical connections with the aid of the said activities indicates that these activities are done just because they are in the textbook and that teachers were told to do them by the Ministry of Education. The alarmingly small percentage (4%) of teachers using a problem-based approach is in line with the activities in the textbooks.

Another surprising finding of this study was that the correlation between teachers' perception of students' prior knowledge and that of students' abilities to conceptualize mathematical ideas through activities not being very high (.49). Three possible reasons come to mind: 1) activities can be performed even though the students are below grade level; 2) activities do not require students to make mathematical generalizations; 3) teachers do not require their students to make mathematical generalizations. One or more of the said reasons might be valid, none of which is desirable. This result, together with the finding that teachers do not associate these activities with mathematical exploration then raises the question of the purpose of such activities. Though the authors do not question the validity of doing activities in which students are exposed to mathematical thinking and the exploration of mathematical ideas, not every activity qualifies for the intentions indicated. Many researchers such as Taşdemir (2011), Ildırı (2009), Kaya (2008) focused on the textbooks of 1st to 5th grades and all three of these studies explored teachers' perspectives on textbooks. All three studies, independently found the textbooks lacking in terms of developing scientific thinking, reflection, creativity, questioning, decision-making, higher order thinking and problem solving skills. Another finding was that the textbooks did not contribute to promoting research attitude in students.

Results of question 12 and 13 indicate a statistically significant ($p<.05$) difference between students' perceived desire to succeed in mathematics, students' perceived interest in mathematics and students' residential locations, in all cases the differences favoring students living in bigger settlement areas. Considering that students living in smaller settlements usually come from families with lower socio-economic levels, the differences can be explained by the socio-economic status of their families (Chiu & Xihua, 2008; Yang, 2003). Not surprisingly, a high correlation (.72) was observed between students' perceived desire to succeed in mathematics and students' perceived interest in mathematics. This finding confirms the result of previous studies, correlating interest in mathematics with the desire to succeed in mathematics (Ashby, 2009; Aşkar, 1986).

Teachers rated their perception of students' desire to explore mathematical concepts as average. This was correlated with students' perceived interest in mathematics (.52), students' perceived desire to succeed in mathematics (.41), teachers' expectations of students to explore mathematics (.38). No significant difference was found between students' perceived interest in exploring mathematics and the number of activities done in class. These results indicate that the perceived desire to explore mathematical ideas is more closely related with the perceived interest level in mathematics and has low correlation with external expectations and practices.

4.2. Conclusion and Recommendations

Teachers' opinions of what needs to be improved in terms of students' attitudes, textbooks, curriculum and pedagogy is extremely valuable. Curricular reforms and higher-quality textbooks go as far as teachers' abilities and willingness in implementing them. This study aims to understand the concerns of mathematics education in Turkey.

The new mathematics curriculum should be revised taking into account that the spiralling nature of the program from one unit to the next, in the same academic year, is not working well. Since teachers find the program too dense and time lacking, in the revision process topics that are not crucial for elementary education should be omitted and/or mathematics class time should be increased. While recommending activities in the program, the infrastructure of schools should also be taken into account.

It is a well-established fact that parents' low socio-economic level has a negative impact on students' mathematics performance (Yang 2003; Chiu and Xihua, 2008). Having inexperienced teachers in rural schools, where the conditions are already less than desirable, exasperates the difference. Installation of computers, with supplementary on-line materials can be used to bridge the gap in the prior knowledge of students in these regions.

Furthermore, the textbooks published or approved by the Ministry of Education should be improved. The textbooks should have a larger variety of questions and the number of questions that require application and reasoning skills should be increased. The activities in the books should also be geared more to exploration of mathematical concepts and utilize reasoning and problem-based approaches.

Education departments should imbue their students with various teaching methods and give a solid pedagogical foundation. Furthermore, teacher candidates should develop the ability to write questions to assess a wide range of cognitive skills. Teachers, on the other hand, need to make more conscious decisions in their pedagogical practices, being fully aware of their students' complete profiles. Evaluating prior knowledge of the students, deciding on the teaching technique and activities best suited for that group, and being able to vary the teaching style are crucial for effective teaching. When necessary, teachers should be able to write supplementary questions and activities that support those in the textbook.

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Genişletilmiş Özet

Dünyadaki matematik eğitimi reformları sonucunda, mevcut matematik eğitiminin odağı matematiksel düşünceyi geliştirme, kavramsal anlama, matematik ve günlük yaşam arasında bağ kurma ve problem çözme gibi konulara doğru kaymıştır (NCTM, 2000). Diğer ülkelerdeki gelişmelere paralel olarak ülkemizde 2005 yılında matematik dersi öğretim programları değişmiştir. Bu yeni program yapılandırmacı eğitim eğiliminde olup, öğrenci merkezli matematik öğrenimini önemsemektedir. Değişen matematik ders programı beraberinde değişen ders kitaplarını, öğrenci merkezli öğretim yöntemlerini ve öğrenci tutumlarını da beraberinde getirmiştir. Sınıf öğretmenlerinin bu değişimi nasıl algıladıklarının araştırılması büyük bir ihtiyaç haline gelmiştir. Bu konuda çeşitli araştırmalar yapılmıştır (Anılan and Sarıer, 2008; Erbaş ve Ulubay, 2008) lakin bu çalışmalar, bölgesel olup bütün Türkiye'yi temsil etmemektedir. Bu çalışmanın amacı, dördüncü sınıf öğretmenlerinin matematik ders programını, öğretim yöntemlerini, ders kitaplarını ve öğrencilerin matematik dersine yönelik tutumlarını nasıl algıladıklarını ortaya koymaktır. Araştırmanın amacına yönelik olarak aşağıdaki sorulara yanıt aranmıştır. 1) a) Dördüncü sınıf öğretmenlerine göre ilköğretim birinci kademe matematik ders programının güçlü yönleri nelerdir? b) Öğretmenlere göre programının zayıf yönleri nelerdir? c) Öğretmenler uygulanan matematik programına göre öğrencilerinin ön bilgilerini nasıl derecelendirmektedirler? 2) Öğretmenler yeni programa göre yazılmış olan ilköğretim matematik ders kitaplarından ne oranda memnunlardır ve kitapların hangi yönlerini tatmin edici, hangilerini de yetersiz bulmaktadırlar? 3) Öğretmenler matematik kitabındaki etkinlikleri sınıfta ne sıklıkla kullanmaktadırlar? 4) Matematik öğretmede öğretmenlerin en sık kullandıkları pedagojik yöntem hangisidir? 5) Öğretmenler yeni matematik programı çerçevesinde öğrencilerinin derse yönelik tutumlarını nasıl algılamaktadırlar?

Bu araştırmada verileri toplamak için 15 soruluk bir anket araştırmacılar tarafından geliştirilmiştir. Anketin geçerlik çalışması için matematik eğitimi alan uzmanı olan altı araştırmacıdan görüş alınmış, bu görüşler doğrultusunda anket anlam açısından yeniden düzenlenmiştir. Ankette toplam 15 soru bulunmaktadır. Bu soruların 10 tanesi açık uçlu, iki tanesi çoktan seçmeli ve üç tanesi ise Likert tipi dereceleme maddesi içermektedir. Araştırmanın verileri TIMSS 2011 sınavında Türkiye'yi temsil edecek dördüncü sınıf öğrencilerinin öğretmenlerinden toplanmıştır. TIMSS'de Türkiye'yi temsil eden ilköğretim birinci kademe öğrencilerinin öğretmenleri de Türkiye'deki dördüncü sınıf öğretmenlerini temsil etmektedirler. Türkiye'de sınıf öğretmenleri sadece tek bir sınıfa yoğunlaşmadıkları için, 1.-5. sınıf ders programı hakkında bilgi ve deneyime sahiptirler. Öğrencileri Türkiye'yi temsil eden 250 öğretmenden 202'si anketi gönüllü olarak yanıtlamışlardır. Bu öğretmenlerin %24,9'u Marmara Bölgesinde, %15,9'u Doğu Anadolu Bölgesinde, %12,9'u Güneydoğu Anadolu Bölgesinde, %12,4'ü Ege ve İç Anadolu Bölgesinde, %11,4'ü Karadeniz Bölgesinde, %10'u Akdeniz Bölgesinde çalışmaktadırlar. Öğretmenlerin %37'si şehir okullarında, %41'i kasaba okullarında, %6'sı ilçe okullarında ve %16'sı da kırsal kesimde öğretmenlik yapmaktadırlar.

Birinci araştırma sorusuna yönelik olarak araştırmaya katılan dördüncü sınıf öğretmenlerinin %17,82'si 2005 yılında hazırlanmış olan matematik dersi öğretim programını öğrenci merkezli, %16,83'ü etkinlik temelli olduğunu belirtmişler, %12,38'i de programın gerçek yaşam ile ilintili olduğuna dikkat çekmişlerdir. Öğretmenlerin %6,93'ü programın öğrencilerin ileri düşünme becerilerini artırdığını belirtmişlerdir. Ayrıca öğretmenlerin %4,95'i programın soyut matematiksel kavramları geliştirmeye yardımcı olduğunu, %4,46'sı da öğrencilerde matematiğe karşı olumlu tutumlar geliştirdiğini söylemişlerdir. Programın zayıf yönleri ise okulların alt yapısının yetersizliği (%11,39) ve programın bu alt yapıyı dikkate almaması olarak görülmüştür. Yeni programla, öğretmenler öğrencilerin hazır bulunuşluk seviyesinin ortanın biraz altında (2,78) olduğu kanısındadırlar.

İkinci araştırma sorusunun bulguları öğretmenlerin %40'ının MEB tarafından dağıtılan matematik dersi kitaplarından memnun oldukları yönündedir. Bu öğretmenlerin %32'si kitaptaki matematik etkinliklerini yeterli bulmuş, %16'sı kitabın öğrenci seviyesine uygun olduğunu düşünmüş, %9'u örnekleri, %7'si de konu işlenişini beğenmiş, %5'i kitapların program ile örtüştüğünü belirtmişlerdir. Kitapları yetersiz bulan öğretmenler en başta gelen eksiklikler olarak akıl yürütme becerisi gerektiren problem ve alıştırmaların yetersizliğini (%19), soru çeşitliliğinin sınırlılığını (%16), etkinlik sayısının (%14) ve uygulama sorularının (%13) azlığını dile getirmişlerdir.

Üçüncü araştırma sorusu öğretmenlerin %57,4'ünün ders kitaplarından haftada en az dört etkinlik yaptıklarını ortaya koymuştur. Öğretmenlerin %17,3'ü haftada üç, %11,9'u ise iki etkinlik yaparken, %3'ü bir etkinlik yapmaktadır. Öğretmenlerin %5,4'ü ise haftada birden az etkinlik yapmaktadırlar. Öğretmenler, öğrencilerin etkinlikler ile matematik kavramları arasında bağlantı kurabilmelerini Likert ölçeği üzerinden 3,50 olarak değerlendirmişlerdir. χ^2 öğretmenlerin görüşüne göre öğrencilerin etkinlikler ile matematik kavramlarını anlama düzeyleri ile etkinliklerin yapılma sıklığı arasında (0,05 düzeyinde) anlamlı bir farklılık bulunmadığını ortaya koymuştur ($\chi^2 = 17.567$, p=0.126). Öğretmen görüşüne göre öğrencilerin etkinlikler ile matematik kavramlarını anlama düzeyleri ile öğretmen perspektifinden öğrencilerin ön bilgileri arasındaki korelasyon 0.491 olarak bulunmuştur (p=0.00).

Dördüncü araştırma sorusunun bulgularına göre öğretmenlerinin %34,2'si sınıfta kullandıkları öğretim yöntemlerini tanımlayamamışlardır. %19,3'ü öğretim yöntemlerini klasik öğretmen merkezli yöntem olarak tanımlarken, %15,3'ü yapılandırmacı, öğrenci merkezli olarak tanımlamışlardır. Öğretmenlerin ne sıklıkta öğrencilerinden sınıfta henüz öğrenmedikleri bir matematik konusunu araştırmalarını beklediklerine verilen cevapların ortalaması Likert ölçeğinde 2,64 olarak saptanmıştır.

Beşinci araştırma sorusunun bulguları öğretmen görüşüne göre öğrencilerin matematikte başarılı olma isteklerinin Likert ölçeğine göre ortalama 3,74, öğretmen görüşüne göre matematiğe olan ilgilerinin de 3,58 olduğu yönündedir. Öğretmenler öğrencilerinin matematiği araştırma isteklerini ise 2,99 olarak belirtmişlerdir. Öğretmenlerin öğrencilerin araştırma yapmasına yönelik beklentileri ile öğretmen görüşüne göre öğrencinin araştırmaya yönelik isteği arasında az bir korelasyon (0,38) görülmüştür. χ^2 analizine göre haftada sınıfta yapılan etkinlik sayısı ile öğretmenlere göre öğrencilerin matematiği araştırma istekleri arasında istatistiksel olarak anlamlı bir farklılık görülmemiştir ($\chi^2 = 13.753$, p=0.617).

Araştırmanın ilginç bulgularından biri öğrencilerin etkinlikler ve matematik kavramları arasında bağlantı kurabilmeleri ile etkinliklerin yapılma sıklığı arasında istatistiksel olarak anlamlı bir ilişkinin bulunmamasıdır. Bu bulgu, öğretmenlerin öğrenci profilinden bağımsız olarak kitaptaki etkinlikleri yaptığını göstermektedir. Bir diğer bulgu da öğretmenlerin %34,2'sinin kullandıkları öğretim yöntemini adlandıramamasıdır. Bu öğretmen eğitimimizdeki büyük bir eksikliktir. Ayrıca dördüncü sınıf öğretmenlerinin %54,4'ü haftada dört veya daha fazla etkinlik yaptırırken ancak %15,3'ünün kullandıkları pedagojiyi öğrenci merkezli olarak tanımlamasının iki sebebi olabilir: ya öğretmenlerimiz öğrenci merkezli yaklaşımı bilmiyorlar, ya da kitaptaki etkinlikleri yapılandırmacı yaklaşıma uygun bulmuyorlar. Her iki sebep de eğitim sistemimizde ciddi sorunlar olduğunu ortaya koymaktadır.

Araştırmaya katılan dördüncü sınıf öğretmenleri 2013 programının da dayanak aldığı 2005 programın öğrenci merkezli olmasını, matematiğin etkinliklerle işlenmesini, matematikle gerçek hayat arasında bağlantı kurulmasını beğenirken programın okulların alt yapısını göz önüne almadığını da düşünmektedirler. Öğretmenlere göre, programın yanı sıra ders kitaplarının da düzenlenmesi gerekmektedir. Öğretmenler matematik ders kitaplarının daha fazla sayıda soru içermesini, bu soruların uygulama ve akıl yürütme becerilerine hitap etmesini beklemektedirler.

Citation Information

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