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An Observational Study in Elementary Mathematics Classrooms

İlköğretim Matematik Sınıflarında Gözlem Çalışması

Asuman DUATEPE-PAKSU*
Pamukkale Üniversitesi

Oylum AKKUŞ**
Hacettepe Üniversitesi

Öz

Çalışmanın amacı, ilköğretim ikinci kademedeki matematik derslerini matematiksel içerik, öğretim metodu ve ders saati süresi açısından incelemektir. Ankara'daki çeşitli ilköğretim okullarının ikinci kademesinde 15 matematik öğretmenine ait 241 matematik dersi gözlenmiştir. Elde edilen sonuçlar şunlardır: (a) Gözlemciler verilen matematik konularının öğretilmeye değer ve seviyeye uygun olduğunu, içeriğin doğru olarak verildiğini düşünmektedirler. Diğer taraftan işlenen derslerde dersin konusu ile matematiğin diğer konuları ya da günlük hayat arasında yeteri kadar bağlantı kurulmadığına inanmaktadırlar. (b) Yaygın olarak düz anlatım yöntemi ve soru-cevap tekniği kullanılmaktadır. Gözlenen derslerin hepsinde öğrenciler bireysel olarak çalışmaktadırlar öğrencilerin birbiriyle etkileşimini gerektiren hiçbir etkinlik gerçekleştirilmemiştir. Gözlenen derslerin yarısından çoğunda, ders kitabı dışında bir materyal kullanılmamıştır. (c) Ders süresi etkili bir şekilde kullanılamamaktadır. 40 dakikalık dersin ortalama 24,72 dakikasında derse yönelik bir çalışma yapılmaktadır.

Anahtar Sözcükler: Matematik öğretimi, sınıf gözlem formu, ilköğretim matematik dersleri.

Abstract

The purpose of this paper is to investigate elementary mathematics classrooms in terms of mathematics content, teaching method, and the duration of mathematics lesson. Data for this research study comprised of 241 elementary mathematics lessons taught by 15 teachers working in different schools in Ankara. The results suggested, (a) in these lessons the topic was worthwhile to teach, the level of teaching was appropriate to the grade level, the topic was presented correctly but the connection between the topic of the lesson and other topics of math or daily life was not built. (b) Commonly used teaching method was lecturing and technique was question-answer; and the students studied individually. More than half of the lessons teachers did not use any material other than textbooks; (c) teachers were not successful at using the time efficiently.

Keywords: Mathematics education, classroom observation protocol, elementary mathematics lesson.

Introduction

The classroom setting is an important factor to determine the motivation, attitude, and mathematics success of the students. Bong (2000) indicated that students' motivation and performance might be indirectly influenced by the classroom environment in which they were being taught. It was also proven that students can learn better and increase their academic efficacy in a positive classroom environment (Dorman, 2001). A relationship between mathematics classroom environment and the students' mathematics anxiety was another finding of the previous researches (Taylor & Fraser, 2003).

* Yrd. Doç. Dr. Asuman DUATEPE-PAKSU, Pamukkale Üniversitesi, Eğitim Fakültesi, aduatepe@pamukkale.edu.tr
** Dr. Oylum AKKUŞ, Hacettepe Üniversitesi, Eğitim Fakültesi, oyluma@hacettepe.edu.tr

In almost all countries, educational reforms have been made to enhance classroom settings in which the educational programs for all the disciplines were modified occasionally. The changes in the education programs require new teaching methods for learners in the classrooms. Even if the guidelines for implementing the fundamentals of the reform movement were specified, most of the time it is the teachers' responsibility to practice the theoretical reforms in their classrooms. Turkish educational system has experienced an educational reform recently. All curricula belonging to the all disciplines have been improved by considering contemporary educational issues. Particularly, mathematics education program has been altered by taking into consideration the classroom environment, the teachers' flexibility and growth and the students' expectations. From the 2004 – 2005 academic year, the new elementary mathematics education program (MEB, 2004) will be put into practice. While implementing this program, it is seemed essential to analyze the current mathematics classroom settings in terms of teacher efficiency, the structure of a lecture, and the students' interaction to present the general classroom setting in elementary mathematics courses.

Studies on the observation of the classroom settings in terms of many aspects were carried out by many researchers (Burnett, 2003, Page, 2002; Proulx, 2002; van Zoest, 1994; Waxman & Huang, 1996). Proulx (2002) investigated an observational study in primary mathematics classroom with a detailed classroom observation protocol. She claimed that in mathematics lessons, the teacher talk took place more than student talk and the teachers were weak in making connections between mathematics and real life examples of it. Van Zoest (1994) explored a classroom observation study on 12 secondary mathematics classrooms monitored by preservice mathematics teachers. It was indicated that, the participants found the methods for teaching mathematics very "teacher-oriented". Burnett (2003) also examined teacher-student interactions in mathematics and reading classrooms. He found that if teachers interact with the students and students interact with each other, their inner talks will be improved and they could give positive feedbacks about mathematics to their teacher. It was argued in Page (2002), use of technology in mathematics classroom has a potential to make students better mathematics achievers, and to make classroom interaction more student-oriented with group works, as well. Moreover, after a classroom observation study Waxman and Huang (1996) clarified that, one way to enhance mathematics classrooms in terms of teacher-student interactions and gaining conceptual knowledge is to use technology effectively in instruction.

After reviewing related research studies and considering the need to address the shortcomings of the mathematics classrooms before the application of the new program, it was decided to conduct an observational study focusing on elementary mathematics classrooms. In order to accomplish the purpose of the study, data were decided to be collected with the help of senior preservice mathematics teachers since along with the teacher education program, the preservice mathematics teachers need a variety of field based experiences to become familiar to the mathematics classroom setting. In a similar vein, to reach professionalism, a preservice teacher needs to gain an ability to observe and analyze a lesson and to critize the inservice teacher of that lesson (Panasuk & Sullivan, 1998). Therefore, it was decided to carry out a second-hand observation in mathematics classrooms including the preservice mathematics teachers who gathered information from the mathematics classrooms that could be beneficial for them in the direction of their future teaching in mathematics classrooms.

Purpose of the Study

The purpose of this present study is to investigate the elementary school mathematics classroom settings by conducting systematic observations in them.

Research Questions

1. How are the elementary school mathematics classroom settings in terms of mathematics content?

2. How are the elementary school mathematics classroom settings in terms of teaching method?
3. Is the duration of the mathematics lesson used effectively for mathematics learning?

Method

Data Source

Data of the study involved 241 mathematics lessons observed by 56 preservice elementary mathematic teachers in the fall term of 2004- 2005 academic year. These preservice mathematics teachers (48 female, 8 male) observed mathematics lessons given by 15 different mathematics teachers (11 female, 4 male). Each lesson was observed between 1 - 4 preservice mathematics teachers. Of the observed mathematics lessons, 6th grades were observed 77 hours, 7th grade were observed 81 hours and 8th grade were observed 83 hours. The distribution of the observed mathematics lesson hours in terms of the grades can be seen in Figure 1.

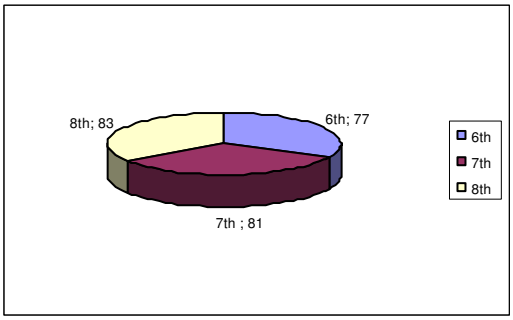

Figure 1: The distribution of the observed mathematics lesson hours in terms of the grades.

Collection of the Data

For data collection, the classroom observation protocol developed by the researchers was given to the preservice mathematics teachers so that they can fill the form for each observed mathematics lesson. This protocol involved the following parts: content, method and time-log part in which observer must jot down flow of the lesson minute to minute. In the content part, a scale with five statements was given and preservice mathematics teachers were responsible to give mark to each statement from 0 to 4 as to reflect their thinking. The five statements were the followings:

- The topic was worth to teach.
- The level was appropriate to the student.
- Students were engaged in the mathematics topic.
- Teacher presented the topic correctly.
- The connection between the other topics of math or daily life was built.

In this part, preservice mathematics teachers were also asked to whether the observed lesson included procedural or conceptual knowledge. They asked to give a score for each lesson from 1 to 11 as completely a procedural lesson gets 1 and completely conceptual lesson gets 11. In the method part of the classroom observation protocol, preservice mathematics teachers were asked to write down the teaching method(s) and technique(s) used in the lesson and to write how was the students' interaction (individual, pair work, group work etc.) during each lesson. Preservice mathematics teachers were also requested to take time-log which includes writing the flow of the lesson minute to minute. In this part of the classroom observation protocol, adequate space was provided to write what was happened every two minute-period of the lesson. The time log was used to determine whether the duration of the mathematics lesson

used effectively or not. The preservice mathematics teachers were articulated that each of them should fill the forms separately so that the researchers can compare data for validation.

Results of The Data Analyses

In data analyses, first of all, observation protocols filled by different preservice mathematics teachers for the same lesson were compared for consensus. The mean score for each lesson calculated and analyses were carried out on this mean score of each lesson. In this part, findings of the data analyses are presented.

Mathematics Content

Related to the mathematics content of the observed lessons, the mean score of the preservice mathematics teachers' ratings out of 4 appear in the Table 1. As the mean scores indicated preservice mathematics teachers believed that the topic was worthwhile to teach (M= 3.45) and the level of teaching was appropriate to the students level (M= 3.325). Moreover, the preservice mathematics teachers were also positive about the correctness of teachers' teaching (M= 3.06). The mean score for the statement of "Students were engaged in the mathematics topic" is fair (M= 2.56). On the other hand, preservice mathematics teachers did not seem to think that the teacher made enough connection between the topic of the lesson and other topics of math or daily life (M= 1.07).

Table 1.
The Mean Score of the Preservice Mathematics Teachers' Ratings of Scale of Mathematics Content

Statement	Mean
The topic was worth to teach	3.45
The level was appropriate to the student	3.32
Students were engaged in the mathematics topic	2.56
Teacher presented the topic correctly	3.06
The connection between the other topics of math or daily life was built	1.07

In addition to these, preservice mathematics teachers scored the each observed lessons to indicate the included knowledge was procedural or conceptual. The frequency of each score from 1 to 11 is given in Table 2. The mean score of the data in Table 2 is 3.68. As 1 reflects the lesson is completely procedural and 11 reflects the lesson is completely conceptual, 6 stands for the lesson is fairly conceptual and procedural. Therefore the mean of 3.68 implies that the lessons were mostly procedural.

Table 2.
The Frequency of Each Score Reflecting Whether the Lesson is Conceptual or Procedural

Procedural to Conceptual	1	2	3	4	5	6	7	8	9	10	11
Frequency	58	23	28	48	11	24	18	8	15	6	2

Teaching Method

As preservice mathematics teachers implied, the lecturing was the only method and question-answer was the only technique used in the observed mathematics lessons. The data showed that in 64 lessons lecturing was used and in 68 lessons question-answer was the main teaching technique. The remaining 109 mathematics lessons both lecturing and question-answer were used. In this part, preservice mathematics teachers were also asked to describe the students' interactions during the lessons. Data showed that, in all 241 lessons students worked

neither cooperatively nor even in pairs. Related with the student interaction, it can be stated that, the students studied individually in all the observed lessons.

Data also showed that of the 241 mathematics lessons, in 131 lessons, teachers did not use any material other than textbooks. In 66 lessons, ready-made or teacher made worksheets were utilized. In the remaining 44 lessons, test-books involving only multiple choice mathematics questions were used.

Duration of the Mathematics Lesson

Each lesson hour began and ended with the ringing bell and was supposed to last 40 minutes in the mathematics lesson for this sample. But the data showed that, the mean of the lesson lasted less than that duration. Generally, the mean score of the duration was approximately 30 minutes because of teacher or students' tardiness or some ceremony related with the national festivals, etc. Furthermore, only about 24 minutes were dedicated to each lesson. This means, after teacher and students were ready for the lesson another 6 minutes were lost for greetings, taking attendance, quieting students, checking homeworks, etc. The investigation of the time log also asserted that mean score of duration of teacher talk was about 19 minutes and duration of student talk mean was about 10 minutes. This implies that the teacher talk occurred more than student talk.

Conclusions and Recommendations

As the results indicated, the general view in mathematics classrooms was not satisfactory and there is much to discuss about it. Firstly, although the preservice mathematics teachers found the topic was worth to teach, the teacher presented it correctly and students were engaged in it, the necessary connections between the mathematical topics and daily life or other mathematical contents were not established. It is a well-known fact that, real life based contexts and making a bridge among mathematical topics can make students interested in the mathematics course and better achievers (Civil, 1998; Smith, 2004). Especially, for introducing the new mathematics topic, these linkages should be built to make the topic meaningful to the students. Also, in observed mathematics lessons, it should be noted that mostly procedural knowledge instead of conceptual was used in line with previous findings (Moseley & Brenner, 1997; Pape & Tchoshanov, 2001). According to the Moseley and Brenner (1997) mathematics instruction was generally built on the procedural knowledge. Furthermore, Pape and Tchoshanov (2001) agreed this idea by adding even for the fundamental topics at the introductory level in mathematics.

Students worked only individually during all lessons. Any cooperation with other students, collaborative work in mathematics classroom environment or social negotiation for conceptualizing a mathematical topic were not observed in any of the lessons, yet learning cooperatively has many positive effects on achievement and attitude (Sharan, 1980). Concurrent with the findings of Proulx (2002) the teacher talk took more place than student talk in this study. There was no occurrence of reflecting students' inner talk or communication among students. In addition to this, it can be said that some of the lesson hours was wasted for redundant tasks instead of teaching mathematics.

For teaching method and techniques in observed mathematics lessons, it was obtained that lecturing and question-answer which are old-fashioned yet generally used teaching methods and techniques in mathematics (Larkin, 1991; Leitzel, 1991) were dominant. Many teaching methods and techniques for mathematics were recommended in research studies. The inservice mathematics teachers could implement many teaching methods and techniques for mathematics instead of using only lecturing or question-answer.

Another important point in this study was related with the materials. The usage of educational material other than textbook was barely seen in this study. Furthermore, in none of

the lessons any instructional technology was used, yet it can enhance mathematics understanding and support conceptual learning (Page, 2002; Waxman & Huang 1996).

When the results of the study were examined, it can be concluded that all drawbacks were related to the teacher in elementary mathematics classrooms. Thus, this study put forth some necessary recommendations for consideration relevant to the teacher role which should be shifted in a contemporary manner. Hill (2004) defined typical classroom teacher as; "…who work under the guidance, incentives, and sanctions provided by systemic reform yet who lack access to professional development of the kind offered by university researchers" (p. 7). She also added that if the teachers were supported with adequate opportunities to learn, they can develop their teaching method and be adaptable to the new educational reforms. The mathematics teachers need this guidance and support. This can be ensured by continuous teacher education programs. Besides, it was taught that monitoring current mathematics classrooms was useful for preservice mathematics teachers since they perceived the existed view through the process of observation, and are supposed to be en route to becoming better practitioners.

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