

MATHEMATICS IN CONTEXT: AN ETHNOGRAPHIC STUDY WITH MIDDLE
SCHOOL STUDENTS WORKING AS STREET-MARKETERS, BARBERS, AND
BAKERS

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MATHEMATICS IN CONTEXT: AN ETHNOGRAPHIC STUDY WITH MIDDLE
SCHOOL STUDENTS WORKING AS STREET-MARKETERS, BARBERS, AND
BAKERS

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BARBERS, AND BAKERS**

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ABSTRACT

MATHEMATICS IN CONTEXT: AN ETHNOGRAPHIC STUDY WITH MIDDLE SCHOOL STUDENTS WORKING AS STREET-MARKETERS, BARBERS, AND BAKERS

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This ethnographic case study was conducted to analyze workplace mathematics of middle school students whom working as street-marketers, barbers and bakers after school time. Throughout this study, the phrase of “working students” is used as “the students who participate in a job activity to earn money without insurance”. The purpose of this study was to gain an understanding of middle school level street-marketers’, bakers’ and barbers' workplace mathematics and to compare school mathematics performance and contextualized workplace mathematics performance of middle school level street-marketers, bakers and barbers in Ankara, Turkey. To achieve these goals, the researcher has worked with eight middle school male students (four street-marketers, two bakers, and two barbers). All participants had been the students of the researcher for three years. Legitimate Peripheral Apprenticeship of Lave and Wenger and “Socio-cultural Learning Theory” of Vygotsky are accepted as theoretical framework. The structure of their overall work-

related practices and how those children engage in mathematical activities in their all work-related context are analyzed with observation. The views of the participants about interaction of the formal school-taught mathematics with their workplace mathematics and what extend the real life problems in the mathematics textbooks refer to the real lives of the participants, the responses of the participants to each other's workplace mathematics, the difference between achievements of the similar tests which include different workplaces problems, textbook problems and non-contextualized mathematical questions of the participants are analyzed with semi-structured interviews, observation check-lists, open-ended real life problem tests and field notes. All of the participants were voluntarily participated in the study and written permissions from their families were obtained prior to the study. The results revealed that the participants faced with lots of mathematical practices in in their workplaces. The students had better scores at the tests included the real life problems related with workplaces. According to participants, mathematics is used in street-markets mostly. The participants think that school-taught mathematics is generally used in the workplaces; on the other hand, workplace mathematics is rarely used in the schools. They also think that there are few real life problems that really refer to their real lives in the textbooks.

Key words: Ethnomathematics, workplace mathematics, apprenticeship, real life problems

ÖZ

MATEMATİKSEL BAĞLAM: PAZARCI, BERBER VE FIRINCI OLARAK ÇALIŞAN ORTAOKUL ÖĞRENCİLERLE ETNOGRAFİK BİR ÇALIŞMA

Geçen, Bilgehan

Yüksek Lisans, Orta Öğretim Fen ve Matematik Alanları Eğitimi Bölümü

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Bu etnografik durum çalışması, ortaokul düzeyindeki pazarcı, fırıncı ve berberlerin iş yeri matematiğinin analizi için yapılmıştır. Bu çalışma boyunca, “çalışan öğrenciler” kelime grubu, “sigortasız bir şekilde para kazanmak amacıyla bir meslek ortamına dâhil olan öğrenciler” anlamında kullanılmıştır. Bu çalışmanın genel amacı, Ankara, Türkiye’deki ortaokul düzeyindeki pazarcı, fırıncı ve berberlerin iş yeri matematiğine dair bir anlayış kazanmaktır. Bu amaca ulaşmak için araştırmacı, on üç yaşındaki sekiz erkek ortaokul öğrencisi (dört pazarcı, iki fırıncı ve iki berber) ile çalışmıştır. Tüm katılımcılar, araştırmacının üç yıldır öğrencisidir. Bu tez, Lave ve Wenger’in *Meşru Periferik Çıracılık* ve Vygotsky’ nin *Sosyokültürel Öğrenme Teorisi* çerçeveleri altında yapılmıştır. Ortaokul öğrencisi pazarcıların, fırıncıların ve berberlerin genel işle ilgili uygulamaların yapısı ve bu çocukların iş yeri kontekstindeki matematiksel aktivitelere nasıl dâhil oldukları gözlem yoluyla incelenmiştir. İşyeri matematiği ile okulda öğretilen matematik etkileşimi hakkındaki görüşleri, ders kitaplarındaki gerçek hayat problemlerinin katılımcıların hayatlarını

ne kadar işaret edebildiğine dair katılımcıların düşünceleri, katılımcıların birbirlerinin iş yeri matematiğine verdikleri cevaplar, iş yeri matematiği problemleri, ders kitabındaki problemler ve matematiksel cümle problemlerinden oluşan benzer testlerde katılımcıların başarılarının farkları, yarı yapılandırılmış röportajlar, gözlem kontrol listeleri, saha gözlemleri ve açık uçlu gerçek hayat problem testleri ile analiz edilmiştir. Tüm katılımcılar gönüllü olarak çalışmaya katılmışlardır ve çalışma başlamadan önce ailelerinin yazılı izinleri alınmıştır. Çalışma için, araştırmacının ve katılımcılarının okul idaresinin yazılı izni de alınmıştır. Çalışmanın sonunda, katılımcıların çalışma ortamlarında birçok matematiksel uygulama ile karşılaştıkları saptanmıştır. Öğrenciler, çalışma hayatı ile ilgili sorularda daha yüksek puanlar almışlardır. Katılımcıların görüşleri, en çok pazar yerinde matematik kullanıldığı yönündedir. Katılımcılar, okulda öğretilen matematiğin çalışma yerlerinde sıklıkla kullanıldığını, fakat iş yeri matematiğinin okulda nadiren kullanıldığını düşünmektedirler. Katılımcılar, ders kitabındaki gerçek hayat problemlerinin kendi gerçek hayatlarına çok az işaret ettiğini de belirtmişlerdir.

Anahtar kelimeler: Etnomatematik, iş yeri matematiği, çıraklık, gerçek hayat problemleri

To all children who have to work instead of playing

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CHAPTER 1

STATEMENT OF THE PROBLEM AND RESEARCH QUESTIONS

Everybody knows the famous quote of Plato that “Let no one ignorant of Mathematics enter here!”. Since those times, mathematics had been considered as a subject that can only be understood by elite group of people (Millroy, 1992, p. 50). According to Platonic version of mathematics conception, mathematical ideas are pure and evident, mathematicians discover them; in other words, mathematics is independent of the human's activities (Stech, 2006). Thousands years after Plato, today's people still think that mathematics cannot be understood by ordinary people. This is one of the biggest reasons of dropping out the school (Moses, 2011).

Although mathematics is an open door for everyone and people have equal chance to learn it, why are people afraid of mathematics this much? Why is mathematics untouchable and frightening? According François (2007), the problems are the gap between vocational and general education, and the absolutist view on mathematics. With current studies to deal with those problems, different areas of research have been raised such as ethnomathematics, everyday mathematics, and workplace mathematics. The common point of these research areas is focusing on the mathematics that lies snug in several aspects of life such as in play, at street, at home and at work. Why do people abstain doing mathematics while they are using mathematics in their daily lives? Cannot academic school-taught mathematics and everyday mathematics get married?

Since D'Ambrosio (1985) put forward the term “ethnomathematics”, researchers have deeply focused on explaining school-taught mathematics and everyday mathematics. Although ethnomathematics has been an issue for almost

thirty years, workplace mathematics as a domain under ethnomathematics still needs further research.

1.1 Research Questions

The general concern of this study is to understand the mathematics used in workplace by children. For this aim, the focus of this study was on middle school students working as street marketers', bakers' and barbers' workplace mathematics in Ankara, Turkey. Throughout this study, the phrase of "working students" is used as "the students who participate in a job activity to earn money without insurance". My purpose while conducting this study is to observe, to understand, to analyze, to compare and to explain mathematical practices and approaches to mathematics of middle school level street marketers, bakers and barbers in their workplace and to inspect what this knowledge can add to the study of everyday mathematics-more specifically-workplace mathematics.

The general aim of this study is to gain an understanding the middle school level street-marketers', bakers' and barbers' workplace mathematics in Ankara, Turkey. To achieve this goal, it is really important to understand the structure of middle school level street-marketers', bakers' and barbers' overall work-related practices and how those children engage in mathematical activities in their all work-related context. Therefore, first research question is;

1) What is the structure of overall work-related mathematical practices middle school students working as street-marketers, bakers and barbers?

The second aim of this study is to gain insight about the students' perception about the relation between school-taught mathematics and workplace mathematics. This question includes understanding the views of those students about school taught mathematics, the thoughts of them about how much mathematics they do in their workplaces or out of schools, the beliefs of them about whether knowing

mathematics helps them in their workplaces or not. Therefore, the second question is as follows;

2) What are the views of middle school students who are working as street-marketers, bakers and barbers about how the school-taught mathematics is related to workplace mathematics?

The third aim of this study is to understand, from the perspective of middle school students who are working as street-marketers, bakers and barbers, whether the real life mathematics problems in the middle school-taught mathematics textbooks are related with those students' real lives or not. Understanding the feelings of those students about real life problems in the mathematics textbooks that are distributed free of charge by the government is included in this question. The aim of this question is exploring the differences between what Ministry of National Education takes as real life and what the students think as real life.

3) According to those students' views, to what extend the real life problems in the mathematics textbooks are related to their real lives as street-marketers, bakers and barbers?

Forth aim of this study is gaining an understanding about responses of working middle school students in different workplaces mathematics problems. The exploring their feelings and their thoughts about different workplaces and needed mathematics for different workplaces is included in this question.

4) How do those students perform in solving mathematical problems and doing computations given in the context of street-market, bakery and barber shop?

Finally, fifth aim of this present study is determining whether the middle school students working as street-marketers, bakers and barbers are successful at solving the problems which are familiar with their own life and workplaces or not. What kind of problems can those students solve more easily? Could they solve the

textbook problems successfully as much as the problems which are related with their workplaces?

5) How do the scores of middle school students working as street-marketers, bakers and barbers for the similar tests that include workplaces problems, textbook problems and non-contextualized mathematical questions differ?

1.2 Background and Rationale

Mathematics is still frightening for majority of people, because it seems for those people as a mass of formulas and patterns that do not sense in daily life (François, 2007). Naresh (2008) classifies mathematicians into two groups: “infallibilists” and “fallibilists”. The first group mathematicians believe that mathematics is absolute and infallible, and this group makes the mathematics far away from people. She claims that: “This absolutist view of mathematics has been challenged since the beginning of the twentieth century and a new wave of “fallibilist” philosophies of mathematics has evolved” (Naresh, 2008, p. 3). To change the first view’s effects, large numbers of studies have been conducted in recent years by the second group of mathematicians. The general aim of those recent studies is proving that mathematics has social and cultural dimensions.

The social and cultural dimensions of mathematics make it alive, changeable and concrete. Those dimensions have enforced the researchers making local studies and determining everyday mathematics of people (Bishop, 1988; Carraher, Carraher, & Schliemann, 1985; D'Ambrosio, 1985; Gerdes, 1988; Naresh, 2008; Saxe & Esmonde, 2012). The focusing point and general concern of those studies is to determine how the social and cultural dimensions can be involved and affect teaching and learning process of mathematics.

1.2.1 Rationale for investigation of workplace mathematics. Sir Ken Robinson (2006) claims that teaching and learning mathematics take place at the top -besides languages- in all curriculums in the world. In other words, different nations and different countries give importance to teaching and learning mathematics at the same level. Studying cultural and social dimensions can enlighten the dark points of the teaching and learning process of mathematics for different cultures.

Although the idea that the mathematics was born in western cultures, recently it is revealed that the mathematics is common heritage of different cultures (Naresh, 2008, p. 3). The studies about multicultural and global aspects of mathematics can still broaden and enlighten the history of mathematics.

A western-born curriculum with little differences cannot fit in all schools from different cultures. There should be more characterized ways of teaching and learning process of mathematics in different cultures. A curriculum or teaching and learning process may be metaphorically compared with a dress. A dress that is produced in a fabric with the other hundreds of dress may fit in some people, but not all of them. If a tailor sews a dress just for a person with respect to exactly his or her body measures, it will fit more than any fabricated dress. In other words, if a curriculum is prepared for the needs of an exact culture or society, it will be more effective for people of that culture or society. Studying culture and society with respect to mathematics helps to develop more effective ways for teaching and learning process for different cultures, different societies and different people. Therefore, the people in that culture can adopt easily in mathematics teaching and learning process which is specifically produced for them. These studies can result with filling the gap between academic mathematics and street mathematics.

According to Naresh (2008, p. 5) there are two types of studies conducted by researchers who have investigated the influence of cultural practices on the learning of mathematics:

- 1) Studying mathematical practices of people in distinct cultures

2) Studying mathematical practices of people within cultures

The studies of Ascher (2002), Gerdes (1988), and Saxe and Esmonde (2012) are the instances of the first group of studies. Those researchers focused on explaining mathematical practices of people in distinct cultures. On the other hand, the studies of Millroy (1992) and Naresh (2008) are the examples of the second group of studies. Their aim is to determine the mathematical practices in a social context.

The term “ethnomathematics” was first used by D’Ambrosio (1985, p. 45) whom defined it as “the mathematics which is practiced among identifiable cultural groups”. Here, the cultural groups were interpreted in different ways by different researchers. “Ethno” prefix can be thought as anthropological way; on the other hand, “cultural groups” in definition refer to social groups such as coworkers in a plaza, a play group of little children, people who live in the same city, the students in the same school etc.

Everyday mathematics has firstly stemmed from ethnomathematics, and workplace mathematics has stemmed from everyday mathematics (see *Figure 1.2.1*). Ethnomathematics is the broad topic and it includes all mathematical activities and thoughts in all culture groups. Everyday mathematics which contains the mathematics in our daily lives is subset of ethnomathematics. Workplaces are parts of our daily lives; therefore, workplace mathematics is subject under everyday mathematics subject. In other words, workplace mathematics is the subset of everyday mathematics and everyday mathematics is the subset of ethnomathematics.

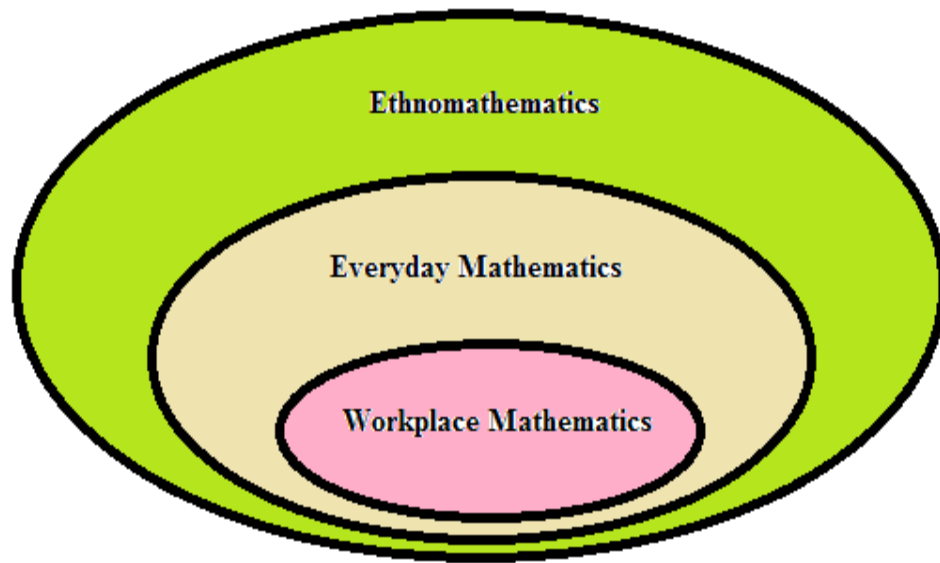


Figure 1.2.1: Relationship between ethnomathematics, everyday mathematics and workplace mathematics.

Studying workplace mathematics might give us deeper insight about;

- 1) When people need using mathematics in their workplace,
- 2) How people use mathematics in their workplace,
- 3) Whether using school-taught mathematics in workplace depends on age, gender, or any other parameter, or not,
- 4) The mental calculation methods are used in workplace,
- 5) The mathematical challenges which are faced with in the workplace,
- 6) The direction of effect between workplace mathematics and school-taught mathematics.

The number of questions can be increased with respect to focusing points of studies. The answers of these questions can make a huge shift in understanding of teaching and learning of mathematics, especially school-taught mathematics. These answers might help;

- developing an appropriate curriculum for needs of those groups,
- understanding deeply the demands of people in a workplace,
- enlightening the missing points in mathematics teaching process,
- filling the gap between school-taught mathematics and workplace mathematics,
- determining effects of workplace mathematics on school-taught mathematics,
- determining effects of school-taught mathematics on workplace mathematics,
- making concrete as much as possible the abstract parts of mathematics and etc.

In order to address all these benefits, further investigations should be conducted. Thus this study is conducted to contribute a perspective to workplace mathematics.

1.2.2 Rationale for investigating the workplace mathematics of middle school students working as street-marketers, barbers and bakers in Ankara/Turkey. I am a mathematics teacher in a religious vocational middle school. Our school was part of the state middle school, but after 4+4+4 education reform, it was separated from the nearby state middle school and it became a religious vocational middle school.

The school is in a slum neighborhood. Socio-economic level of the students are generally very low. Some of the students should work to have contribution to their family budget. The popular jobs between middle school level students are street-marketing, hairdressing, bakery, collecting and selling stuff collected from garbage, selling water, selling handkerchiefs at the traffic lambs by stopping car drivers, selling tea to bus drivers, selling plasters etc. Their grades from the main

courses (Literature, Mathematics, Science and Technology, Social Sciences) are low. Majority of them does not have her/his own room, computer and Internet. They are doing their homework on the floor or on the kitchen table. Although their families say that the school and education are important, they do not seem as they care education. The students are aware of this and they do not care about the school. They get lower grades and they go away from the school gradually because the school does not seem a part of their real life. I –as their teacher- think that is why they have lost their interest to school courses.

The main issue here is how teachers can handle with these problems. I, as mathematics teacher, do not have a magic wand to change our students' lives. To change of their socioeconomic level is mostly a governmental issue that needs too much afford and time. I do not have this much time and this much power. If I cannot change my students' lives, I can change the way of teaching mathematics. I can try to understand their lives and mathematics that they use in their daily lives, and I can rearrange my teaching methods and emphasized points in mathematics courses. I can attract their attention to course firstly, and then they can learn mathematics what they do not need now but they need in the future for higher education. The major idea behind this present study is to reach my working students. This idea made me motivate to search workplace mathematics and to conduct this study.

Since 1990s, there is a shift in workplace mathematics studies (e.g. see Hoyles et al., 2002; Mayo, 2012; Millroy; 1992; Naresh, 2008; Torpey, 2012). Although the increase of the number of workplace mathematics studies all over the world, there are few studies that are conducted about or related with workplace mathematics in Turkey.

I have searched “workplace mathematics (Turkish: çalışma alanında matematik, işte matematik), daily life mathematics, everyday mathematics (Turkish: günlük matematik), ethnomathematics (Turkish: etnomatematik), situated learning in mathematics (Turkish: matematikte durumsal öğrenme)” key words (with time restrictions 2000 -2015) in Thesis Center of Council of Higher Education of Turkey,

in ERIC (eric.ed.gov) and in Google Scholar to find researches published or conducted in Turkey. I have included the keywords “ethnomathematics, daily life mathematics, everyday mathematics” since workplace mathematics is the subset of those mentioned keywords (see *Figure 1.2.1*). I have also searched the key word situated learning in mathematics because workplace mathematics and situated learning cannot be separated with each other. I have explained the relationship between workplace mathematics and situated learning at theoretical framework of this study. The research studies that I could find related to my study with different perspectives are Aktuna (2013), Çorlu (2006), Erturan (2007), Kara (2009) and Küçük (2013).

There are also some research studies in other disciplines like technology or science teaching, but I thought that they are far away from my study so I did not include them. I try to organize place of those researches in Turkish workplace and situated learning literature in literature review part of this present study. As it is seen, there are few studies have been conducted between the years 2000 - 2015 in this research area in Turkey. Therefore, this study area is still as an infant in Turkey. There are too much dark points need to be enlightened. I hope that this present research may be a spark in this study area.

The ethnomathematics research in anthropological way is hard to conduct in Turkey, since lots of different nations live together such as Turkish, Kurdish, Armenian, Arabic, Zaza, Rumanian, Laz and Greek people for hundreds of years. It is hard to find a pure nation to study with them. Therefore, antromathematics study as defined the mathematics of an ethnic group by Millroy (1992, p. 52) is really difficult to conduct. On the other hand, everyday mathematics can easily be conducted in Turkey because people are generally willing to contribute such studies.

The everyday mathematics and also workplace mathematics studies are needed in Turkey, because there is a huge gap between school-taught mathematics and street mathematics. People do not use-even do not want to remember-mathematics after graduating any level of school. Mathematics is such a nightmare

for majority of people. Although everyday mathematics and workplace mathematics studies can help to handle this nightmare, just a few studies have been conducted in Turkey about them.

On the other hand, child labor is a general problem all over the world. United Nations International Children's Emergency Fund (UNICEF) analyzes the children issues all over the world by separating the world into eight regions, these are;

- Central and Eastern Europe and the Commonwealth of Independent States
- East Asia and the Pacific
- Eastern and Southern Africa
- Industrialized Countries
- Latin America and Caribbean
- Middle East and North Africa
- South Asia
- West and Central Africa

Turkey is in Central and Eastern Europe and the Commonwealth of Independent States Region. The child labor statistics from different regions prepared by UNICEF is shown in *Figure 1.2.2*.

Countries and areas	Total (%)	Sex (%)	
		Male	Female
Turkey	6 y	8	4
Regions:			
Sub-Saharan Africa	25	25	25
Eastern and Southern Africa	25	27	24
West and Central Africa	25	25	25
Middle East and North Africa	9	11	7
South Asia	12	13	12
East Asia and Pacific	8 **	10	7
Latin America and Caribbean	11	13	9
CEE/CIS	5	7	4
Least developed countries	22	23	21
World	13 **	13	12

Figure 1.2.2: Child Labor Statistics of Countries and Regions, UNICEF, November 2014

Note. In *Figure 1.2.2*, “y” means that “Data differ from the standard definition (for details see UNICEF, 2014) or refer to only part of a country. If they fall within the noted reference period, such data are included in the calculation of regional and global averages”, and “**” means “Excludes China”.

UNICEF describes child labor percentage in *Figure 1.2.2* as percentage of children 5–14 years old involved in child labor at the moment of the survey. A child is considered to be involved in child labor under the following conditions:

(a) children 5–11 years old who, during the reference week, did at least one hour of economic activity or at least 28 hours of household chores, or

(b) children 12–14 years old who, during the reference week, did at least 14 hours of economic activity or at least 28 hours of household chores.

As it is seen in *Figure 1.2.2*, child labor is an important problem all over the world. The 6% percent of children in Turkey is working. Although Turkey seems less child labor percentage than the world, when this number is compared with the

region of Central and Eastern Europe and the Commonwealth of Independent States which includes Turkey, Turkey has 1% more working children than its region. Besides that, the average of world in the *Figure 1.2.2* does not include the data of Industrialized Countries and China. We do not know how those data might change the average of world percentages; however, with these data what we can definitely say is child labor is a reality of the world.

Working children is a reality of Turkey as all over the world. Although the social policies of the Turkish Government and international agreements give increasing importance, what a pity the number of working children is still increasing and it is at significant level in Turkey. The *Figure 1.2.2* gives the numbers of working children in Turkey in 2006 and 2012. As seen in the *Figure 1.2.2*, total number of children (both males and females) has increased from 2006 to 2012. While the total number of male children who are engaged in economic activity has increased, the total number of female children who are engaged in economic activity has decreased. On the other hand, the total number of both male and female children who engaged in household chores has increased. Because of increasing of the total number of children who engaged in economic activity and engaged in household chores, there is a decrease in the total number of children who are not working.

Table 1.2.1: Children by Age Group, Sex and Type of Work, 2006 - 2012, (TÜİK)

Age group and sex	Number of children		Engaged in economic activity		Engaged in household chores		Not working	
	2006 (Oct.- Nov.- Dec.)	2012 (Oct.- Nov.- Dec.)	2006 (Oct.- Nov.- Dec.)	2012 (Oct.- Nov.- Dec.)	2006 (Oct.- Nov.- Dec.)	2012 (Oct.- Nov.- Dec.)	2006 (Oct.- Nov.- Dec.)	2012 (Oct.- Nov.- Dec.)
Turkey								
Total	15026	15247	890	893	6540	7503	7596	6850
6-14	11378	11386	285	292	4504	5290	6590	5804
15-17	3647	3861	605	601	2036	2213	1006	1047
Male	7677	7775	601	614	2589	3243	4486	3917
6-14	5809	5794	190	185	1864	2401	3755	3208
15-17	1868	1981	411	430	725	842	732	710
Female	7349	7472	289	279	3950	4261	3109	2933
6-14	5569	5592	95	108	2639	2889	2835	2596
15-17	1780	1880	194	171	1311	1372	274	337

An important question is arising here: “While the children are working, what about their well-being?” This question is crucial because children may work and also be happy and in safe. Working may not prevent their education or quality of their lives. So we need another data to analyze this. There is Table 1.2.2 below that gives ranks 1 to 30 for policy-focused child well-being in 30 OECD countries.

Table 1.2.2: Comparative Policy-Focused Child Well-Being in 30 OECD Countries
(2009)

	Material well-being	Housing and environment	Educational well-being	Health and safety	Risk behaviours	Quality of school life
Australia	15	2	6	15	17	n.a.
Austria	5	9	18	27	27	11
Belgium	11	11	20	26	13	19
Canada	14	n.a.	3	22	10	16
Czech Republic	18	24	19	5	23	17
Denmark	2	6	7	4	21	8
Finland	4	7	1	6	26	18
France	10	10	23	19	12	22
Germany	16	18	15	9	18	9
Greece	26	19	27	23	7	24
Hungary	20	21	12	11	25	7
Iceland	8	4	14	2	8	1
Ireland	17	5	5	25	19	10
Italy	19	23	28	17	11	20
Japan	22	16	11	13	2	n.a.
Korea	13	n.a.	2	10	2	n.a.
Luxembourg	3	8	17	7	14	23
Mexico	29	26	29	28	30	n.a.
Netherlands	9	17	4	8	9	3
New Zealand	21	14	13	29	24	n.a.
Norway	1	1	16	16	4	2
Poland	28	22	8	14	20	15
Portugal	25	20	26	18	6	21
Slovak Republic	27	25	24	1	22	25
Spain	24	13	21	12	16	6
Sweden	6	3	9	3	1	5
Switzerland	7	n.a.	10	21	5	13
Turkey	30	n.a.	30	30	29	12
United Kingdom	12	15	22	20	28	4
United States	23	12	25	24	15	14

Note. The rank “1” indicates the best performing country (www.oecd.org) (Note: To create the table, each indicator was converted into a standardized distribution. Then a within-dimension average was taken. This within-dimension standardized average was then used to rank countries in each dimension. Using standardized figures each country with half a standard deviation higher than the OECD average is colored blue on that dimension, whilst countries in dark grey are at least a half standard deviation lower. “n.a.”: no country data. Source: <http://dx.doi.org/10.1787/710786841304>)

In Table 1.2.2 material well-being is related with income, poverty and basic necessities of children. Housing and environment describe living conditions of

children and their families. The indicators of educational well-being are PISA 2006 scores, inequality in achievement around PISA 2006 scores and the proportions of 15-19 year-olds not in education and not in employment or training. Health and safety include child birth rate, infant mortality, child mortality, physical activities of children etc. Indicators of risk taking include 15-year-olds who smoke regularly, 13- and 15-year-olds who report having been drunk on more than two occasions, and rates of birth to females aged 15 to 19. Quality of school life is about bullying and overall satisfaction with school life.

According to the OECD report (2009) “Comparative Child Well-being across the OECD”, child well-being measures the quality of children’s lives. It is explained in the report that:

“Twenty-four OECD countries have at least one dimension where a blue value is recorded. Italy, Mexico, New Zealand, Poland, Turkey and the United States have no blues. Thirteen countries record blues on two or more dimensions. On the other hand, 20 countries have a dark grey in at least one dimension. Eleven countries have two or more dark grays. No one country does well across all dimensions. Iceland and Sweden are the strongest performers, with each having five blues and one white. Greece and Mexico, with five dark grays, have the least strong performance.”(p. 23)

Although in the report Greece and Mexico are seen as the worst performers, Turkey has the worst performance degree in material well-being, education well-being, health and safety. Turkey has the rank of 29th out of 30 countries in risk behaviors. Turkey’s best degree is in quality of school life with degree of 12 out of 30. Turkey has four dark grays; maybe Turkey can be seen better than Greece and Mexico; however, Turkey has one “n.a” in the table in housing and environment part. Although Mexico also has one “n.a”, Turkey may have the worst degree in children well-being between OECD countries.

The statistics tell that Turkey has child labor issue and children in Turkey are not happy, safe or good educated with respect to other OECD countries. So, what

can we do? How can we change this negative situation to positive or at least nonnegative one? Can the sick parts of us be a cure for other illness? Yes! We can bring close together workplace and school environment. If our students need to work, we can analyze their work mathematics and blend it with school-taught mathematics. Therefore, the workplaces of children can be more didactic and school teachings can be more real.

With increasing efforts of decreasing child labor all over the world, the reality of child labor may enlighten the dark points in the literature. These children are direct bridges between schools and workplaces. They can help us to understand how school-taught mathematics affects workplace mathematics and how workplace mathematics affects school-taught mathematics. The previous studies in workplace mathematics (e.g., Hoyles et al., 2002; Mayo, 2012; Millroy, 1992; Naresh, 2008; Torpey, 2012) include participants who are generally graduated from schools many years ago. Those people have got mathematics courses when they were students. Therefore, the limitations could have occurred while interpreting the results of the study about comparing school-taught mathematics and workplace mathematics, because of the fact that participants of the studies could have forgotten the school-taught mathematics. On the other hand, working children spend their time in their schools and in their workplaces. Therefore, the interpretations of their school-taught mathematics and workplace mathematics can give considerable results. Thus, this study intends to fill these gaps in the literature.

I thought that if I want to understand mathematics in working children's minds, I should focus on middle school level street-marketers, bakers and barbers who are faced with little more mathematics in their workplaces because their works are directly related with also measuring tools (street marketers and bakers use weight measuring tools and barbers use length measuring tools) besides money-change calculations. These students' one foot is on the school-taught mathematics and the other foot is on the workplace mathematics. Finally, I narrowed down my study to middle school level street marketers', bakers' and barbers' workplace mathematics.

1.2.3 The middle school level street-marketers in Ankara, Turkey. The street markets are crucial part of the daily shopping ritual for people in Turkey. People who want to buy daily vegetables and fruits go these street markets. Not only vegetables and fruits, but also cheap clothes, toys, kitchen staff, cheap make-up staff are also sold in there. You can see a photo of an ordinary street market example in *Figure 1.2.3*. As it is seen in the *Figure 1.2.3*, street markets are generally covered with a roof to protect customers and goods from sun, rain and snow. Street markets are popular in all socio-economical levels because of the broad scales of rates.



Figure 1.2.3: A street market photo from Turkey

They are built in days and places which are determined by the law (www.mevzuat.gov.tr). According to street market regulations, only people who have all these qualifications can get a selling location in determined street market.

a) To be the seller or producer of vegetables, fruit, other food or necessities that are allowed by the municipality to sale,

b) To be registered in Craftsmen and Artisans Community,

c) To be a tax-payer,

d) Not to be any cancellation / termination of the lease decision allocated by the municipality within one year preceding the date of application.

The people who have these qualifications work in street-markets, generally with their family and relatives. You can see street-marketers who are from age of 8 to age of 70, but the majority of the street-marketers are 14-25 years old. Before the 12 years compulsory education reform, the teenage street-marketers could drop out the school after elementary level. But after this reform in 2012, the government does not let anyone to drop out the school from any level before graduating from high school. When you walk around in a street-market and buy something from a young street-marketer, he has most probably already come from his school and he is still getting mathematics class.

1.2.4 The middle school level barbers in Ankara, Turkey. You can see lots of hairdressers all over Ankara; almost there is one hairdresser in every three streets (see *Figure 1.2.4*).

Ten years ago, these hairdressers were small businesses. But now, they have institutionalized all over Turkey, there are popular brands. They were two different hairdressers' types: For men and for women. The name of hairdressers of women was coiffeur and the name of hairdressers of men was barber. These days, almost all of the hairdressers serve both men and women especially in big cities. The big

hairdressers have different workers for different jobs such as manicurists, pedicurists, hair cutters, masseuses, accountants. However, there are still little barbers and coiffeurs in slums and in small cities. These little businesses only have two or three workers for all of the jobs. Masters and apprentices are observable in these shops. Those apprentices are generally middle school students who work part-time to learn job. These students are just like coeval street-marketers. They are still getting mathematics classroom whatever kind of middle school they go. In other words, they are also part of workplace mathematics and school-taught mathematics at the same time.

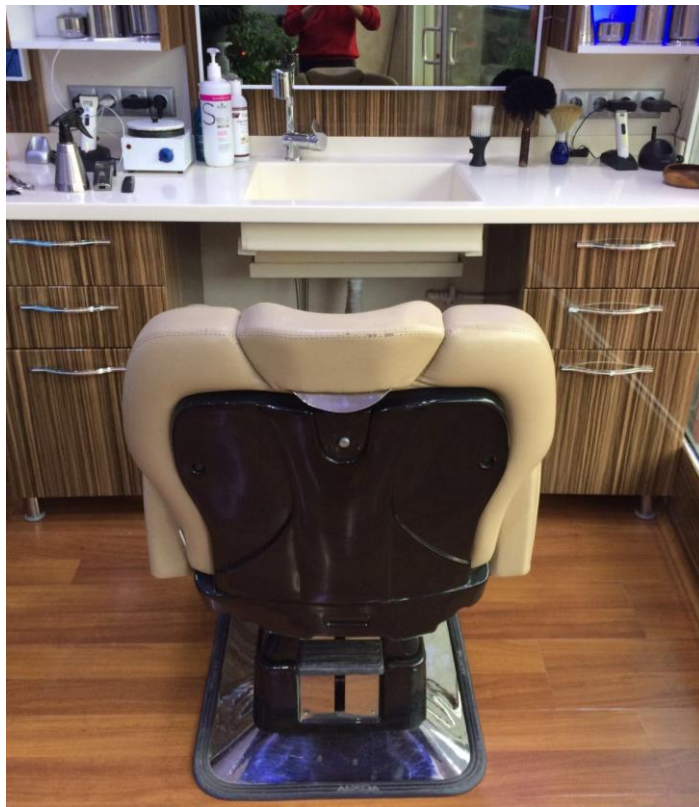


Figure 1.2.4: A hairdresser photo from Turkey

1.2.5 The middle school level bakers in Ankara, Turkey. In Turkey, being baker and opening a baker shop are regulated with the law. There is a federation of bakers (Türkiye Fırıncılar Federasyonu), and all bakers are dependent to this federation.

Although they have lost their old popularity with increasing of supermarkets and their bakery rayon, the bakeries are still alive and important for the neighborhoods, especially small ones. (see *Figure 1.2.5*)

There are the masters and apprentices in the bakery shop. The number of them depends on the capacious the bakery shop. Masters generally give shape to breads or other cooks and bake them. Apprentices are assigned with different works. Some of them are assigned with the cash, some apprentices clean the shop, and some of them measure the paste while some of them arrange the heat of oven and carry some staff. The age of apprentices can be change, but if there is an apprentice between the ages of 11 and 15, s/he is most probably middle school student.



Figure 1.2.5: A bakery from Ankara

CHAPTER 2

LITERATURE REVIEW AND THEORETICAL FRAMEWORK

2.1 Literature Review

Throughout history, mathematics is usually considered as a subject that can only be understood by elite group of people (Millroy, 1992, p. 50). This elite group is those people who can understand the mathematics that exists in nature themselves according to ancient epistemological conception of mathematics. According to that ancient epistemological conception that as known as Platonic version of mathematics conception (i.e., celestial mathematics), mathematical ideas are pure and evident, mathematicians discover them; in other words, mathematics is independent of the human's activities. Although there are other two influential conceptions of mathematics which are *terrestrial mathematics* (Mathematics knowledge is a reflection of natural and social world. Doing mathematics means to rediscover which is already given) and *instrumental mathematics* (Mathematics does not pre-exist either in the skies or hidden in the world around people. Doing mathematics is creating, not discovering.) (Stech, 2006), the celestial mathematics conception seems affect more than the other conceptions.

Thousands of years after Plato, today's people still think that mathematics cannot be understood by ordinary people. It is generally thought that only some gifted people can understand the mathematics which pre-exist before the human being. The remained people feel them more and more hopeless at doing or understanding mathematics day by day and year by year. Hopeless follows failures and failures follow hopeless. Those students feel that they cannot learn any complex issues because they have no capacity for this. The feelings towards to mathematics affect other courses. Finally, this situation causes negative feelings for entire school

and education life. And thus, it seems that mathematics is one of the biggest reasons of dropping out the schools (Moses, 2011).

In spite of being mathematics is created by human beings, why is majority of people afraid of this creature? Obviously there are some differences of school types and education procedures. However, the students in a country generally have the same chance to have mathematics education except some cases. What makes a few of those students mathematicians and the majority of them frightened of mathematics? Although mathematics is an open door for everyone and people have equal chance to learn it, why are people generally afraid of mathematics this much? Why is mathematics untouchable and frightening?

To understand the source of this problem, it might be better to understand history of mathematics education. D'Ambrosio (1985) given an historical overview of Western mathematics education by making periodizations with respect to major turns in the socio-cultural composition of Western history. He pointed that up to the time of Plato, mathematics had been classified two branches: scholarly mathematics and practical mathematics. While the scholarly mathematics is a part of ideal education of Greek, the practical mathematics is the mathematics which is used by the workers. This division had lasted until time of Plato who claimed that all mathematics is not for mass but for a selected few. In the Middle Age, there was a one-way interaction between the scholar mathematics and the practical mathematics. The geometry which is a field of scholarly mathematics started to use in the practical mathematics.

The next period according to D'Ambrosio (1985) is the Renaissance. In this period, sometimes inventors and scientists (such as Galileo and Newton) wrote their studies non-technical language and in a style accessible to non-scholars. After the Renaissance, the Industrial Era came. The practical mathematics got much more close to the scholar mathematics in this era. That was because of dealing with complex machineries, instruction manuals and social reasons (raising children of aristocracy to keep their social and economical predominance). These ages are the

beginning of entrance of the scholar mathematics and the practical mathematics to the school system.

D'Ambrosio (1985) defines the last period as 20th Century. In this period, the question of what should be taught in mass educational system is posed.

“The answer has been that it should be a mathematics that maintains the economic and social structure, reminiscent of that given to the aristocracy when a good training in mathematics was essential for preparing the elite (as advocated by Plato), and at the same time allows this elite to assume effective management of the productive sector. Mathematics is adapted and given a place as “scholarly practical” mathematics which we will call, from now on, “academic mathematics”, i.e., the mathematics which is taught and learned in the schools.”(p. 45)

Today, it is possible to talk about another periodization in the 21st century. In this period, we can talk about the huge effect of technology on scholarly practical mathematics in school education. The technology might decrease the effect of the scholar mathematics in scholarly practical mathematics since approachability of the scholar knowledge easily.

The relationship between the scholar mathematics and the practical mathematics seem to the answer of the question how mathematics can be for everyone, not only selected ones? According to François (2007), the problems are the gap between vocational and general education, and the absolutist view on mathematics. With current studies to deal with those problems, different areas of research have been raised such as ethnomathematics, everyday mathematics, and workplace mathematics. The common point of these research areas is focusing on the mathematics that is hidden in the several aspects of life such as in plays, at streets, at home and at work. Why do people abstain doing mathematics while they are using mathematics in their daily lives?

The problematic conception of that mathematics is only for the selected ones and it is not for mass may collapse by revealing of the mathematics in people's

routine lives. All people do mathematics less or much in their routine life. They can deal with the mathematical problematic situations, but they may not be aware of them. They may learn how to deal with these mathematical problems in their daily lives with experiences even without knowing they are related with mathematics. This is the “situatedness” characteristics of learning.

While Lave and Wenger (1991, p. 54) put forward the concept of *Legitimate Peripheral Participation*, they accept that the participation in social practice is the fundamental form of learning as basis. Furthermore, they describe “legitimate peripheral participation” (1991) as:

“Learning viewed as situated activity has as its central defining characteristic a process that we call legitimate peripheral participation. By this we mean to draw attention to the point that learners inevitably participate in communities of practitioners and that the mastery of knowledge and skill requires newcomers to move toward full participation in the sociocultural practices of a community. Legitimate Peripheral Participation provides a way to speak about the relations between newcomers and old-timers, and about activities, identities, artifacts and communities of knowledge and practice.”(p. 29)

Lave and Wenger (1991, pp. 65-84) presented five accounts of apprenticeship in their book *Situated Learning Legitimate Peripheral Participation*. These are:

1) Yucatec Mayan midwives in Mexico: According to Jordan’s study (as cited in Lave & Wenger, 1991), the Yucatec apprentice midwives earned the knowledge about birthing, herbal remedies, massage and ritual procedures by observing their masters and participating in the real life experiences. Generally apprentice midwives had a mother or a grandmother who were experienced midwives and they learnt how to be midwife from them. Those apprentice midwives moved from peripheral to full participation in midwifery with time.

2) Vai and Gola tailors in Liberia: According to Lave's study (as cited in Lave & Wenger, 1991), with respect to Yucatec midwives, Vai and Gola tailor apprenticeship is more formal. There are three stages of this apprenticeship. Firstly, the apprentice children learn subsistence skills from their same-sex parent, and then they learn part-time specialism in the same way. Finally, they learn a specialized occupation from a specialist master. Yucatec midwives and Vai and Gola tailors have strong similarities in the process of moving from peripheral to full participation in their occupations.

3) The United States navy quartermasters: Hutchins's study (as cited in Lave & Wenger, 1991) is an ethnographic research on an amphibious helicopter-transport ship of the U. S. Navy. New quartermasters are firstly trained about technical details for one year. Then, they participate in joint activity with more experienced colleagues in the contexts of Standard Steaming Watch and Sea and Anchor Detail. Finally, they can be in different positions independently.

4) Butchers in the United States supermarkets: The study of Marshall (as cited in Lave & Wenger, 1991) is an example of that apprenticeship may not facilitate learning sometimes. These butchers have two stage training. First one is school training that has so many perspectives. Some of them do not relate with the real job and seems useless, that is why the apprentices do not want to learn them. The second stage of training is on-the-job training. In supermarkets, the managers assign the apprentices in the most effective ways and those effective ways generally do not include the jobs of an experienced butcher. The apprentices feel insecure about being butcher at the end of the training.

5) Nondrinking Alcoholics in Alcoholics Anonymous: According to Cain's study (as cited in Lave & Wenger, 1991), the apprentice alcoholic people participate in several meetings in a week, and spend time with each other. An experienced non-alcoholic person tells his/her alcoholic past and how s/he starts to his/her non-alcoholic life. They have also some discussion groups that are focused one beautiful aspect of non-alcoholic life that they will achieve at the end.

When it is thought about those examples above, it can be seen that there are lots of examples in their lives about situated learning. Boiling an egg, brushing our teeth, tiding our bed, preparing a romantic dinner, having bath, washing our car, ironing our shirt, even speaking are all situated learning that is started from the house by the supervision of our parents. Besides these general examples, there are some specific examples that change from culture to culture. For example, in Turkey, in an eastern village, a little girl may learn from his mother how to make regional cheese; a little girl may learn from his mother how to dry tobacco leaves in a western village.

Considering those ethnical situated learning examples and mathematics in real life, the concept of “ethnomathematics” has been released.

This term was used first time by D’Ambrosio (1985) where he defined ethnomathematics as “the mathematics which is practiced among identifiable cultural groups”(p. 45).

The term of “cultural groups” which is the crucial part of D’Ambrosio’s definition of ethnomathematics was interpreted different ways by different researchers. The mean of “ethno” prefix which is added to mathematics can be thought as anthropological study of mathematics such as the mathematics in Africa or the mathematics in Australia. However, D’Ambrosio (1985) described clearly with examples ethnomathematics as:

“...(W)e will call ethnomathematics the mathematics which is practiced among identifiable cultural groups, such as national-tribal societies, labor groups, children of a certain age bracket, professional classes, and so on. Its identity depends largely on focuses of interest, on motivation, and on certain codes and jargons which do not belong to the realm of academic mathematics. We may go even further in this concept of ethnomathematics to include much of the mathematics which is currently practiced by engineers, mainly calculus, which does not respond to the concept of rigor and formalism developed in academic courses of calculus. As an example, the Sylvanus Thompson approach to calculus may fit better into this category of

ethnomathematics. And builders and well diggers and shack-raisers in the slums also use examples of ethnomathematics.”(p. 45)

D’Ambrosio (1985) believed that with this concept, the mathematics will be interpreted broader than the mathematics in Platonic view because some mathematical capabilities such as classifying, ordering, inferring and modeling are very broad range of human activities that are established, formalized and codified throughout history.

Similarly to the idea of being contrast of Platonic view to mathematics and ethnomathematics, Naresh (2008) classifies mathematicians into two groups: “infallibilists” and “fallibilists”. The infallibilist mathematicians believe that mathematics is absolute and infallible, and this group makes the mathematics far away from people. She claims that: “This absolutist view of mathematics has been challenged since the beginning of the twentieth century and a new wave of “fallibilist” philosophies of mathematics has evolved” (Naresh, 2008, p. 3). To change the first view’s effects, lots of researches have been conducted in recent years by the second group of mathematicians. The general aim of those recent researches is proving that mathematics has social and cultural dimensions.

According to Naresh (2008, p.5) there are two types of studies conducted by researchers who have investigated the influence of cultural practices on the learning mathematics. These are the studies of mathematical practices of people in *distinct cultures* and the studies of mathematical practices of people *within cultures*.

The studies of Ascher (2002), Gerdes (1988), and Saxe and Esmonde (2012) are the instances of the first group of studies. Those researchers focused on explaining mathematical practices of people in distinct cultures.

Ascher (2002) conducted a study “Mathematics Elsewhere: An Exploration of Ideas across Cultures” that is about some mathematical ideas of people in traditional or small-scale cultures. In her book, there are several specific cases of mathematical ideas and their cultural embedding. This study focuses the topics which

are divination, calendars, models and maps, systems of relationships (less than, more than, equal to, unequal to, four times as much as... etc), figures on thresholds in different cultures. Since this study describes the different cultures' mathematics, this study is a distinct-culture study.

The study of Gerdes (1988) was conducted to refute the claim of that mathematics is culture-free. He demonstrated alternative constructions of Euclidean geometrical ideas developed in the traditional culture of Mozambique. He studied with the future mathematics teachers (in a third world country with his description). He analyzed cultural conscientization of those teachers by studying of alternate axiomatic constructions of Euclidean Geometry in teacher training and of regular polygons, theorem of Pythagoras with woven buttons, alternate circular functions with traditional fish traps and the generation of (semi)regular polyhedral with football.

The study of Saxe et al. (2012) is another distinct culture studies. They draw the emergence of new forms of numerical representations and ideas in the social history of the community by help of the studies which are conducted by Saxe in 1978, 1980 and 2001 about Oksapmin (a remote Papua New Guinea group). This study is aimed to contribute to understanding of relations between culture and thought. The Oksapmin people were using a 27-body-part counting system until their first contact with the Western people in 1938. Saxe and Esmonde focused on shifts that occurred over Saxe's three stints of fieldworks in 1978, 1980 and 2001 in Oksapmin. They took up an issue core to the cognitive sciences that where the numerical representations and ideas about numbers that we use in daily life come from. They concluded that collective systems of representations emerge over time as the unintended consequences of local goal-directed actions of individuals.

After exemplifying the first group studies which are the studies of mathematical practices of people in *distinct cultures*, the studies of Millroy (1992) and Naresh (2008) are the examples of the second group of studies the studies of

mathematical practices of people *within cultures*. Their aim is to determine the mathematical practices in a social context.

Millroy (1992) conducted an ethnographic study. She spent her six months as an apprentice carpenter in Cape Town, South Africa. She aimed to examine and to give firsthand account of the teaching and learning of mathematical ideas in the context of the apprenticeship, and to document the valid mathematical ideas that are embedded in the everyday woodworking activities of a group of carpenters. She observed that the carpenters use lots of mathematical concepts such as parallel lines, straight lines, proportion, congruence, symmetry, spatial visualization.

Naresh (2008) has conducted a study about mathematical practices of a group of people in their work settings. This group of people is five bus conductors who work in Chennai, India. She described in her study the educational characteristics of bus conductors, how those bus conductors are trained, and what kind of mathematics that they use in their workplaces and how they deal with the mathematics at work.

While the socio-cultural perspectives of mathematics were risen, there are some concerns have revealed about the culture that mathematics born or effects of different cultures to the today's mathematics.

Although the idea that the mathematics was born in western cultures, recently it is revealed that the mathematics is common heritage of different cultures (Naresh, 2008, p. 3). History of mathematics may still be broaden and enlighten by studying different cultures and different aspects of cultures.

As it is mentioned in the dress example in Chapter I, manufactured dresses may not be fit to everyone. If a dress is sewn for only one person with his/her measures, it will be perfectly fit to his/her body. A western-born curriculum is similar to the manufactured dress. That curriculum cannot fit in all schools from different cultures although it is tried to be applied with little differences.

Studying culture and society with respect to mathematics helps to develop more effective ways for teaching and learning processes and curriculums for different cultures, different societies and different people, and thus those people can adopt easily in mathematics teaching and learning process which is specifically produced for them.

With these concerns, the researchers deepen their studies through socio-cultural contexts, especially through the within culture contexts. Some new study areas are arisen in time such as everyday mathematics and workplace mathematics.

Figure 2.1.1 shows the places of workplace mathematics and ethnomathematics as study areas arisen in socio-cultural contexts of mathematics.

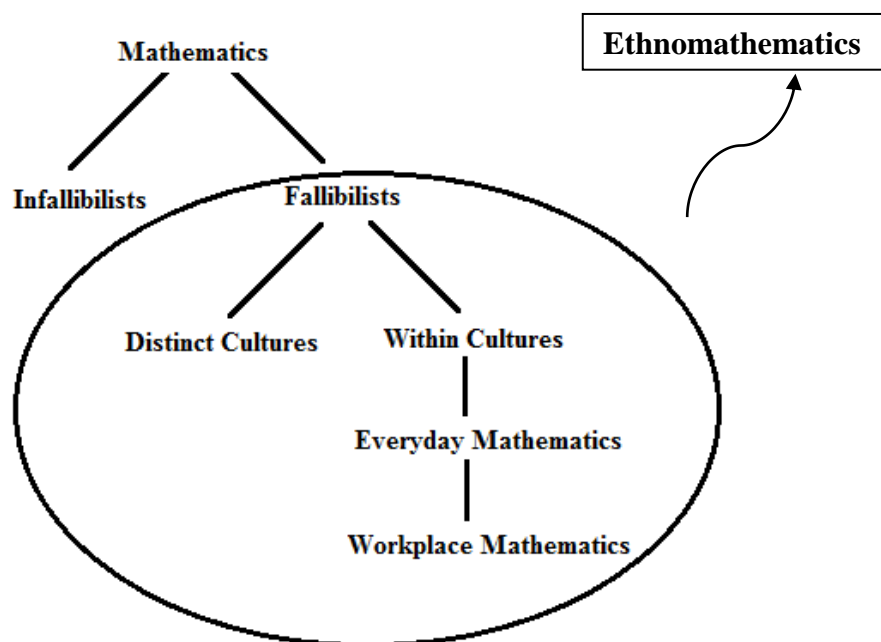


Figure 2.1.1: A diagram of the relations of different study areas in mathematics

In *Figure 2.1.1*, it is drawn that the relationships of these study areas to make visualization easier. It is started from the infallibilists that are the supporters of Platonic view and the fallibilists that are supporters of the effects of socio-cultural context in mathematics. It has been classified the fallibilists into two groups. The

first group is the researchers of distinct cultures mathematics and the second group is the researchers of within cultures mathematics. These have not totally strict borders. This classification conducted to help to understand and visualize better.

Under within cultures, there is every day mathematics and under it, there is workplace mathematics. These two may be also under distinct cultures group, but I tried to draw a path to my study. That is why this chart is drawn this way. Anyone can draw this chart in many different ways.

Here, I should explain the relationship between ethnomathematics, everyday mathematics and workplace mathematics. As you see in *Figure 2.1.1*, ethnomathematics includes fallibilists, within and distinct cultures, everyday mathematics and workplace mathematics. That is because ethnomathematics includes entire socio-cultural contexts in mathematics.

As I described the relationship between ethnomathematics, everyday mathematics and workplace mathematics in Chapter I with the three sets in *Figure 1.2.1*, workplace mathematics is the subset of everyday mathematics and everyday mathematics is the subset of ethnomathematics. The reason of is this is that the ethnomathematics is the broad topic and it includes all mathematical activities and thoughts in all culture groups. On the other hand, everyday mathematics which contains the mathematics in our daily lives is narrower topic than the ethnomathematics. Since workplaces are parts of our daily lives and workplace mathematics is the mathematics that is all mathematics related with work settings, workplace mathematics is narrower topic than everyday mathematics.

The social and cultural dimensions of mathematics make it alive, changeable and concrete. Those dimensions have enforced the researchers making local studies and determining everyday mathematics of people. The focusing point and general concern of those studies is determining how the social and cultural dimensions can be involved and affect teaching and learning process of mathematics. The aim of workplace mathematics studies is also determining how the social and

cultural dimensions can be involved and affect teaching and learning process of mathematics. The discrimination of workplace mathematics studies and everyday mathematics studies is difficult. Since all of the workplace mathematics studies are also examples of everyday mathematics studies, the examples below should be considered both everyday mathematics studies and workplace mathematics studies.

The ethnographic study of Millroy (1992) is also a workplace-mathematics study which is about carpenters in Cape Town, South Africa. As I mentioned before, according to her, carpenters use lots of mathematical concepts such as parallel lines, straight lines, proportion, congruence, symmetry, spatial visualization.

While Naresh (2008) has conducted a study about the workplace mathematics of five bus conductors who work in Chennai, India; Torpey (2012) focused on the mathematics needed in the workplaces. She exemplified three occasions and how mathematics is in their jobs. These are cryptologists, health data analyst and math teacher. She gave details about their math-related job tasks follow, along with the occupations' outlook, wages, and required preparation. She also mentioned about some workers specialize in mathematics—or a particular branch of it. These workers include actuaries, mathematicians, operations research analysts, and statisticians. The difference of this study from the others is focusing on the pure mathematics more than hidden mathematics in workplace settings.

Mayo (2012) has conducted a research “What mathematics do people use in the workplace?” to understand details of workplace mathematics and how school-taught mathematics and workplace mathematics differ from each other. She used different contents of problems that include sixth grade mathematics. All problems were word and on-the-job problems that had no explicit mathematics. She concluded that workplace mathematics need critical thinking ability and she also claimed that “We need to teach students to see the world in terms of math, or they will be unemployable” (p. 29).

Hoyles et al. (2002) conducted a report to determine current requirements for mathematical skills in workplace. They chose 22 cases from seven sectors (Electronic Engineering and Optoelectronics, Financial Services, Food Processing, Health Care, Packaging, Pharmaceuticals, Tourism) and conducted telephone interviews. They concluded their report that mathematical skills in the workplace are changing, with increasing numbers of people involved in mathematics-related work, and with such work involving increasingly sophisticated mathematical activities. And thus, they claimed that the country (England) needs to rethink and look to upgrade mathematics provision for young people and to ensure that people have access to additional provision over their lifetimes.

Carraher et al. (1985) conducted a research which has lots of common points with this present study from lots of perspectives as it is mentioned in Chapter V. They studied with five children (four boys and one girl) aged 9-15 years old and ranging in level of schooling from first to eighth grade. All of them were from very poor backgrounds. They were like other children that help to their street-vendor parents in their business which is common in Recife, Brazil. This study is an analysis of everyday use of mathematics by working youngsters in commercial transactions. Subjects answered the questions in formal and informal tests and these answers are analyzed. It has been found that performance on mathematical problems embedded in real-life contexts was superior to that on school-type word problems and context-free computational problems involving the same numbers and operations. There is a paragraph of the interpretations and inferences of their study below (1985):

“Are we to conclude that schools ought to allow children simply to develop their own computational routines without trying to impose the conventional systems developed in the culture? We do not believe that our results lead to this conclusion. Mental computation has limitations which can be overcome through written computation.”
(p. 249)

Their last but not the least conclusion is (1985):

“...(We) do not dispute whether ‘school maths’ routines can offer richer and more powerful alternatives to maths routines which emerge in non-school settings. The major question appears to centre on the proper pedagogical point of departure, i.e. where to start. We suggest that educators should question the practice of treating mathematical systems as formal subjects from the outset and should instead seek ways of introducing these systems in contexts which allow them to be sustained by human daily sense.” (p. 249)

It seems that the marriage of “*the mathematics hidden in the sky*” and “*the mathematics in front of our eyes in daily routine*” is crucial for mathematics teaching.

It can be concluded that all of them have priceless contributions to their education system because each study is a little light to enlighten the dark points of literature. While the number and the quality of these lights increase, the dark points will be smaller and smaller. These studies are wealth of their cultures and each culture needs these studies to analyze with different aspects of its education system.

There are a few studies about ethnomathematics and everyday mathematics as below. Among these, Kara (2009) conducted a research to develop an instruction integrated with ethnomathematics related to symmetry and patterns subject with examples from Topkapı Palace and to clarify the effects of this instruction in an experimental design. a quasi-experimental design was implemented in three schools that has totally 137 seventh grade students in İstanbul to analyze the effectiveness of the instruction on mathematics achievement level and attitudes towards mathematics. She found that there was a significant interaction both effect of type of instruction and mathematics achievement levels, and effect of type of instruction and attitude towards mathematics between the experimental and control group of only one school.

The other example of ethnomathematics study in Turkey is the paper of Küçük (2013). He examines in his paper some reflections of geometry perception in

carpet and rug motifs (*Figure 2.1.2*) in terms of Ethnomathematics in Anatolian culture. This study revealed that Anatolian people has made use of mathematics in their lifestyles. Küçük also claimed that it can be assumed that the motifs in the rugs and carpets are the reflections of mathematical thoughts in the minds of Anatolian people. He added in his paper that it is possible to get the students to realize how societies do mathematics in their own cultures and their mathematical thoughts.



Figure 2.1.2: The examples of carpet and rug motifs in Turkey. (Küçük, 2013, p. 1362)

Another ethnographic research which is conducted in Turkey is the study conducted by Çorlu (2006). This study aims to describe the formal mathematical enculturation of the middle- school students in an international school. He examined the entire academic year during the on-going creation of a specific mathematical culture within the classroom and portrayed how each of its members defined, maintained, and shared the unique mathematical culture of the classroom. He has proved with this study the dynamic nature of the creation of the culture in an international school-taught mathematics classroom. This study is not counted as the ethnomathematics study group, however, I wanted to include this study as example because it is an ethnographic research that is conducted in a mathematics classroom.

Another ethnomathematics study example from Turkey is the study of Aktuna (2013). While conducting this study, her aim is to explore how students perceive and engage with the area measurement instruction enriched with ethnomathematics. She collected data from twelve 6th grade students in a public school located in rural region of İzmir, Turkey. At the end of her study, she found that an instruction enriched with ethnomathematics result in an increase in students' motivation, interest, and self-confidence; comfort and enjoyment in mathematics classes; a peaceful and sharing classroom environment; progress in problem solving skills through culturally relevant activities about their daily practices in a familiar context and promotion of their own culture and other cultures in mathematics classroom.

There are a few studies about ethnomathematics and everyday mathematics in Turkey, and there is no workplace mathematics study which is conducted in Turkey in literature. To provide more local and more suitable interpretations for comparison school-taught mathematics and workplace mathematics in Turkey and to gain an understanding about needs of mathematical education system in Turkey, this gap at workplace mathematics literature in Turkey, more researches on workplace mathematics and ethnomathematics are needed to conduct. This study aims to be one of those studies that should be conducted.

2.2 Theoretical Framework

The present study is an ethnographic case study on workplace mathematics of the middle school level street-marketers, barbers and bakers. The aim of this study is to observe, to understand, to analyze, to compare and to explain mathematical practices and approaches to mathematics of middle school level street marketers, barbers and bakers in their workplace and to inspect what this knowledge can add to the study of everyday mathematics-more specifically-workplace mathematics. Regarding this aim as an initial point of present study, the study is focused the key

words which are workplace mathematics, school-taught mathematics, situated learning, ethnomathematics, and daily life mathematics (everyday mathematics).

When I have decided to conduct this study, my aim was to build a bridge between the real lives of students and the school-taught mathematics. I was inspired from a philosopher who was invited to Turkey by Atatürk to help conduct new education system in 1924. This philosopher was John Dewey. In his pedagogic creed (1897), he shared these inspirational thoughts:

"I believe that the school must represent present life-life as real and vital to the child as that which he carries on in the home, in the neighborhood, or on the playground.

I believe that education which does not occur through forms of life, or that are worth living for their own sake, is always a poor substitute for the genuine reality and tends to cramp and to deaden." (p. 78)

Therefore, it can be said that the contributions of pragmatist view of John Dewey are crucial for this study from beginning to end.

This study focuses on the effects of the work places and the social relationships in workplaces on mathematics of middle school level students. Therefore, the emphasized point is social perspectives of learning. When social perspectives of learning are considered, Vygotsky comes to mind first who suggests that "The social dimension of consciousness is primary in time and in fact. The individual dimension of consciousness is derivative and secondary." (as cited in Wertsch & Bivens, 1992, p. 206). It can be said that learning from the social environment is crucial part of the entire learning.

Postformalism provides a background view to this study. This is not only the background view of this study; postformalism is also my philosophy in teaching. Kincheloe (2007) explained the postformalism as the combination of the views of Dewey and Vygotsky as:

"... (I)n the spirit of John Dewey and Lev Vygotsky, postformalism is about learning to think and act in ways that hold pragmatic consequence—the promise of new insights and new modes of engaging the world. In this context students in postformal schools encounter bodies of knowledge, not for the simple purpose of committing them to memory but to engage, grapple with, and interpret them in light of other data. At the same time such students are confronting such knowledges they are researching and interacting with diverse contexts. They are focused on the process of making meaning and then acting on that meaning in practical and ethically just ways" (p. 28)

The last but not the least theory that provided a theoretical framework for this study is Lave and Wenger's Legitimate Peripheral Apprenticeship Theory (1991). They claim that:

"Learning, thinking and knowing are relations among people engaged in activity in, with, and arising from the socially and culturally structured world." (p. 51)

According to this theory, newcomers learn from the old-timers. After a while, newcomers may move from peripheral to the center of the community and may become old-timers. For example, an apprentice street-marketer learns from his father as observing and practicing in the street-market. After a while apprentice street-marketer will be an old-timer and he will raise other new-comers.

Legitimate Peripheral Apprenticeship Theory is chosen for this present study because of two reasons. First, the apprentice street-marketers, barbers and bakers work with the old-timers until they learn the job. They observe the old-timers, and they do lots of practices. Second, since the participants are in the middle of the process of training, I could have chance to observe them as both apprentices and experts. The participants shared their experiences as apprentices and experts in the interviews. Therefore, I could have chance to explore their training process, too. Thus, Lave and Wenger's (1991) Legitimate Peripheral Apprenticeship Theory was appropriate for this study.

CHAPTER 3

METHODOLOGY

3.1 Design of the Study

This study has one core subject (workplace mathematics of students working as street-marketers, barbers and bakers) and questions around that subject. The research questions are aimed to gain insight about that core subject. To provide these answers, this study has designed as ethnographic case study.

Creswell explained the ethnographic studies (as cited in Creswell, 2003, p. 14) as the studies about an intact cultural group in a natural setting over a prolonged period of time by collecting, primarily, observational data. According to Fraenkel and Wallen (2005, p. 12), ethnographic study can be conducted to gain some insight into such concerns. This study is conducted to gain insight about the workplace mathematics of the students working as street-marketers, barbers and bakers. That is why this study is an ethnographic study.

According to Creswell (2003, p. 15), in case studies, the researcher explores in depth an event, a program, a process, an activity or one or more individuals. Furthermore, Fraenkel et al. (2005, p. 438) defined case studies as the study of cases has been around some time. One of the case studies types is instrumental case study. They explained instrumental case study as the studies that the researcher is interested in studying the particular case only as a means to some larger goal. The other type of the case studies is multiple (or collective) case study which is explained by Fraenkel et al. (2005, p. 439) as the study which a researcher studies multiple cases at the same time as part of one overall study. Although this research includes three workplaces (street-markets, bakeries and barber shops) and three groups of students, this study focused on the cases that are similar for those three groups. Besides that,

the participants are eight classmates. Their behaviors in the classroom are also used to gather answers. In other words, in spite of the fact that it seems that there are three cases in this study, there are one case which is fed by three sources. And this one case is to gain understanding for a larger goal which is to understand workplace mathematics of students working as street-marketers, barbers and bakers. At the end of this study, there are interpretations for mathematical education system in Turkey. That is why this study is instrumental case study.

This research is a qualitatively driven project with a qualitative core and quantitative sequential component. The way of combining qualitative and quantitative research types are explained with triangulation design. Denzin (as cited in Mathison, 1988) has classified the triangulation which is a strategy for improving the validity of research or evaluation findings into four groups;

- a) Data triangulation including time, space, and person
- b) Investigator triangulation
- c) Theory triangulation
- d) Methodological Triangulation

In this study, data triangulation, investigator triangulation and methodological triangulation were used to improve validity and to evaluate findings. The quantitative part of this study is designed to conduct data triangulation and methodological triangulation.

According to Mathison (1988, p. 14), “Data triangulation refers simply to using several data sources, the obvious example being the inclusion of more than one individual as a source of data.” In this present study, data triangulation is used to evaluate findings by gathering data from four street-marketers, two barbers and two bakers.

Mathison (1988, p. 14) describes the investigator triangulation as the triangulation that involves more than one investigator in the research process. This is used to improve validity in this present study.

The last triangulation used in this study is methodological triangulation which is defined by Mathison (1988, p. 14) the use of multiple methods in the examination of social phenomenon. It is used both to improve validity and to evaluate findings especially to analyze fourth and fifth research questions. The quantitative sequential component of this study has an important role to provide methodological triangulation.

To provide internal validity, several threats were tried to be dealt. The major problem which threatened the interval validity was the characteristics of subjects. Some of the participants were really talkative such as the Student Kiwi and the Student Scissors. They were enthusiastic to tell all their lifes. On the other hand, some of the participants were not talkative such as the Student Comb and the Student Salt. Since I knew the participants' general characteristics, I tried to deal with this threat by using different question types during interviews. For example, I asked to the Kiwi to tell me his daily routine, he told his whole weekend. On the other hand, I asked to the Comb: "When do you get up on Saturdays?", "Do you have your breakfast in your home or in the barber shop?" etc.

The second internal validity threat that I faced with was the location. The workplaces were not suitable to conduct interview, so I used the school counselor's room (thanks to her).

The third internal validity threat that I faced with was about instrumentation. I tried to ask short questions to the participants because I did not want them to be tired during tests. Data collector characteristics are important for a qualitative research. I and the other data collector tried to be kind to the participants. We botu believed to thos study would make a difference at least in our teaching lifes. This study was important for us, and still it is. We tried to be open minded to lifes of

students, decisions of their families and views of them. I cannot claim that we listened them without any bias, but we tried to make our prejudices at minimum level. We tried to understand the lifes of participants without judging.

To deal with forth internal validity-testing, I applied the tests to the participants with two -week periods. So, the students could not remember the problems and how they solved them. Before applying the tests, I did not know whether two-week periods were enough intervals or not. However, after applying the tests, I was sure that the intervals were appropriate. They could not remember the problems and their solutions. At the end of this study, they said that they did not notice the tests were similar.

The fifth and another important threat for internal validity were attitudes of the subjects. If the participants did not have positive attitudes towards me and this study, this study would be waste of time. Thanks to their positive energy and attitudes, this present study could be conducted.

Since this is a qualitative research study, trustworthiness cannot be provided or measured easily. However, the mutual trust between me and mu students can be observed throughout the study. This mutual trust and the details raised by this mutual trust made this study valuable and trustworthy.

After explanation of the design of the study, all the steps that were taken to get answers for five questions are mentioned in details in this chapter.

3.2 Participants and Their Characteristics

In this study, I need the middle school street-marketers, barbers and bakers. As I mentioned in Chapter I, the reason of the study is my desire to be more efficient teacher for my students. Observation is a key point to get answers for all of the research problems of this study.

Since the reason of this study is my students and observation is this much important, I have chosen the sample of this study from within my students so that I could know their background, their interests, and the subjects that they are successful and they are not, even their private issues.

To get a general idea about the study environment, I should mention about our school firstly.

3.2.1 Characteristics of my school. My school is a religious-vocational middle school as I mentioned in Chapter I. I have told characteristics and history of the religious vocational middle schools (Imam-Hatip middle schools) to help visualizing profiles of parents, students and teachers.

Aşlamacı (2014, p. 266) explains about religious-vocational middle school as follows:

“These schools are education institutions which renewed themselves according to actual conditions due to modernization efforts starting from the final period of Ottoman Empire and which are continuation of the madrasa tradition that initiated in Seljuk empire period with the support and monitoring of the state in Islamic education history. The intellectual basic of these schools is the effort for finding a harmony between “traditional” and “modern” references. These schools which won its status into the educational system and legal basis in the Republic period, with their way of appearance, structure, syllabus, students and graduates, have always been an issue for debate between secular and Islamic sections in agenda of Turkey throughout the history of Republic.”

Our school is a two-storey building with an entrance floor. There is a small paved garden with no trees or grass. Our school was sharing the same garden with the state middle school (now it is a state primary school), but after some regulations the gardens are separated. The gardens and also the campus have divided into two with a wall to prevent chaos that occurs at break times, entrance and exit times. Now we have different gates and gardens.

The other important thing that I want to explain is the teacher selection process for the religious vocational (imam-hatip) middle schools to help psychological environment of our school to be visualized better. The teachers of the religious vocational (imam-hatip) middle schools are assigned with the exact same procedures with the other state schools. Those teachers do not have extra missions, extra responsibilities or extra courses. They are assigned to teach their professions. They are totally the same as other state school teachers from graduation from a university to retirement.

All teachers have options when they choose their places of duty. They have grades according to their previous schools, experiments, rewards, exam scores etc. With these grades, they have chance to choose lots of school all over the country. The teachers generally choose the metropolises, the places that their husbands or wives work, the places that their families live or the cities that they continue to graduate schools there. After 4 + 4 + 4 law, the teachers could choose also the religious vocational (imam-hatip) middle schools.

Since our school is in a slum neighborhood, every teacher who is assigned to this school plans to go as soon as possible to another neighborhood. However, none of them wants to leave after a few months working. There are the teachers who have opposite views. There are discussions in the teachers' common room. But everybody is happy with these respectful discussions. The teachers come together even in vacations. All teachers are close friends; no one is out. Although some of the teachers have enough qualifications to go another school with better opportunities (easier transportation and better student-parent profile, not in salary) or to the schools with the teachers who have same political views with them, they stay in this school for this positive attitudes of teachers.

Although there is no difference between selection system of teachers and staff, there are some differences between the state middle schools and the religious vocational (imam-hatip) middle schools (Presidency of Board of Education and Discipline). While the other state middle schools have 35 lessons in a week, the

religious vocational (imam-hatip) middle schools have 36 lessons in a week. There are some differences between the courses and the number of hours of these courses. To illustrate, while the state middle schools have 2 hours Physical Education courses and 2 hours Religious Culture courses, the religious vocational schools have one hour Physical Education course and one hour Religious Culture courses. For another example; the courses of Qur'anul Karim, Arabic, the life of Prophet Mohammad and Basic Religious Information are elective courses in the state middle schools; on the other hand, these courses are compulsory in the religious vocational (imam-hatip) middle schools. The numbers of hours in a week of the main courses such as Mathematics, Literature, Science and Technology, Social Sciences, English as Foreign Language are the same in these two types of middle schools.

Making a comparison was not possible between the state middle schools and the religious vocational (imam-hatip) middle schools with respect to their academic achievements in the exams of Transition from Primary to Secondary Education (TEOG) that are conducted throughout Turkey. The reason of this is the religious vocational (imam-hatip) middle schools had started to education in 2012-2013 education seasons. Since the exams of Transition from Primary to Secondary Education (TEOG) are conducted only for 8th level students and there were no students at 8th level of the religious vocational (imam-hatip) middle schools, it could not be possible until this year to compare objectively these two kinds of schools with respect to academic achievement throughout the country. By the time at the end of 2015-2016 education seasons, this comparison will be doable.

After giving general information about religious vocational (imam-hatip) middle schools in Turkey and our school, I want to describe our school in more details. As I said in the previous paragraphs, our school is in a slum neighborhood. This neighborhood is known as "bully". Almost every family has a member in the prison and going to jail is normal for them. Carrying gun is "cool" for those people. Voice of gun shots is considered normal and regular thing in this neighborhood.

I want to share a conversation here between me and one of my students. One morning, one of my students came late to my course. In the break, I asked her the reason. She said me that: "I am sorry. I have to babysit my sister." I was upset about this situation, because I thought that the mothers of some of the students did not care about their children enough. Elder sister has a kind of baby sitter in the house. While those mothers are walking around, going for shopping, or visiting neighbors; these little girls have a heavy responsibility like taking care of their baby siblings. Sometimes they even cannot do their homework or study for the exam, and I am upset about this.

I: "Why did not your mother take care of them, where was she?"

She: "My mother went with my father to the jail."

I: "I could not understand, did they both go to jail?"

She: "No, my father killed the husband of my aunt. So he is in the prison, and my mother accompanied with my father."

I have shocked and I could not say anything. She continued her speech: "But he was beating my aunt with iron pipes, he had deserved this!"

I have learnt after this conversation that this event was really happened. Her mother went to the pink-room that designed for the married prisoners. She had to take care of her sister. But the shocking point is how she knows this much details about a homicide and how she stays this much calm while she was telling this event.

Another scene that I saw is that one man had shot with a gun from his leg on the school road. All students had seen this. We (the teachers) had shocked but the students said us "We will protect you, dear teachers. Do not be afraid! We always see these kinds of things!"

After that event, I have learnt from a taxi-driver that those people who shot and who had been shot were friends. The taxi-driver said me that he saw them after that event and they were playing cards together.

Although there is much more, these events were the scariest ones that I have observed while working in this school. These would be enough to give some clues about those students' daily lives, their psychologies, and the neighborhood.

In this neighborhood, the school is the only religious vocational middle school. Some of our students' parents said that "I have chosen this school and sent my son/daughter because I know s/he will not learn anything from a school. S/he cannot understand mathematics, science or languages because s/he is stupid. At least s/he learns how to read Qur'anul Karim and how to pray." The parents do not believe their sons/daughters, so -not surprisingly- the students' self-esteem levels especially with respect to those mentioned courses are low.

I observe that religious vocational middle schools are accepted as rehabilitation center by the parents and other state middle school teachers. Some of the students who have discipline problems are canalized to religious vocational middle schools by the other state middle schools' teachers and principals. Especially in neighborhoods as our schools' neighborhood, this view makes religious vocational middle schools groups of "problematic" children. Therefore, I think the teachers of those schools have more responsibilities than other schools.

Of course not only problematic children, but also the children whose parents are religionists attend to religious vocational middle schools. In our school, half of the parents are officers and police who have come to this neighborhood for conscription; on the other hand, half of the parents are natives of this neighborhood. The parents that come from this neighborhood from different neighborhoods for conscription are more educated with respect to the parents that are natives of this neighborhood. Those more educated parents send their children to this school

because of the positive attitudes and qualifications of teachers besides the political and religious concerns.

In this mixed types of cultures and expectations, I as a mathematics teacher have a heavy responsibility that is to achieve the determined mathematical course objectives and goals with all students. I thought that it is possible only if I could know students' needs about mathematics, current levels at the course, expectations from mathematics and prerequisite knowledge at mathematics. Some evaluation tests could give clues about them, but they are not enough.

I have started to spend more time with the students, especially with the students who have low level at mathematics course. Socio-economic levels of those students are generally low. Besides mathematics grades, their grades from the other main courses (Literature, Science and Technology, Social Sciences, Foreign Languages (Arabic and English)) are low. Majority of them does not have her/his own room, computer and Internet. They are doing their homework on the floor or on the kitchen table. A small group of those students even cannot get enough food in their houses. Some of them should work to have contribution to their family budget. I have learnt that most of those students are working after school at street markets, barbers, and bake houses. Some of them are going to collect papers for recycling; the others are going to traffic lambs to sell handkerchief or water. I have understood that those children have to have contribution to family budget. Although their families say to the teachers that the school and education are important, they do not behave like that. It seems that the most significant thing for the families is money that the children earn in their workplace. The students are aware of this and they do not care about the school. They get lower grades and they go away from the school gradually because the school is not a part of their real life. Therefore, they have lost their interest to school courses. Training and education at school are not important things for them. This is not surprising result when Maslow's hierarchy of needs (1943) is thought (see *Figure 3.2.1*).

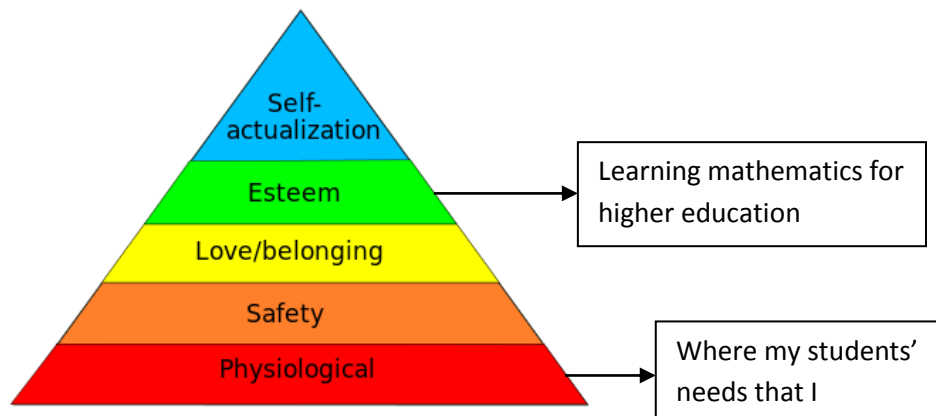


Figure 3.2.1: The place of my students' needs that I observed in Maslow's hierarchy of needs (1943)

Their aims are consistent to their needs. They are not expected to go to the university. They bow to the inevitable. The school education is only a compulsory for them. Because according to the new education model 4 + 4 + 4, if the students do not attend, they know that they have to pay cash penalties.

When all needs, daily lives and working lives of students are considered, their points of views to school are acceptable. As I have written in the Chapter I, the important question that is raised here how can be dealt with these sophisticated problems? It is really hard (even impossible) to change lives of my students on my own. Even if all teachers try, it is still impossible to handle this multifaceted issue. To change of their socioeconomic level and life standards is a complex issue that only government can handle it with too much affords and time. One cannot have this much time and this much power.

I thought that if I cannot change my students' lives, I can change my way of teaching mathematics. I can try to rearrange my teaching methods and emphasized points in mathematics courses by exploring their lives and mathematics that they face with in their real lives. I believe that I should attract their attention to mathematics course firstly, and then they may have enthusiasm to learn mathematics which they do not need now but they need in the future for higher education. As I explained

before, the major idea behind this present study is to contact with my working students and to make them stay in contact with school education. This idea made me motivate to search workplace mathematics of middle school children and to conduct this study.

3.2.2 Characteristics of my students in this study. Before describing the students in sample of this present study, I should explain why I have chosen these students and why they want to join this study.

I have assigned this school as an intern teacher, and I completed my internship in this school. I have worked in this school for two years with same classes. Since this school is a religious vocational (imam-hatip) middle school, in spite of some of the teachers' objections, in accordance with requests of majority of parents, the students have been separated into two classes according to their gender, even different floors. The first floor is for the classes of boys and the second floor is for the classes of girls.

The lessons in the classes of boys are more difficult with respect to girls' classes for teachers. Even it is really hard to make the boys sit down to their desks. The girls, on the other hand, are more enthusiastic for courses and better-behaved with respect to boys.

When I assigned this school, there is another intern teacher who assigned with me to same school. She was younger than me and she came from different city. That was the first time she had left from her family and she had no experience on teaching. Since I had worked in private school before, I have volunteered to take boys' mathematics classes.

After a while, since there was no English teacher, I had to take English courses of some classes of boys too. This means that I am with some of them for 10 hours each week. They have totally 36 hours in a week and 10 hours are with me. I

have time to know them well. They are coming to me if they have any private or common problem.

When I started this study, they inspired me and I shared with them the subject of my study. I told them I want to study about working children. They seemed really excited about participating in this study. I had to make elimination while choosing the students for this study because some of them were not working at anywhere but still they wanted to participate in this study. Some of them were working but in one workplace, they did several jobs. Some of them were not working regularly. I had selected those students who;

- work generally at one workplace
- work more regular than the others

At the end of this selection, I have got eight volunteer male students who were working generally and regularly at one workplace (four of them are in street markets, two of them are in bakeries, two of them are in barber shops). They are all seventh graders. They are all 13 years old. I got permissions of the parents of the students and I had started my study.

This sample is a purposive sample because the participants were selected with purpose. There is no randomization in participation selection process. Fraenkel et al. (2005, p. 439) explained eight types of purposive participation selection. One of them is typical sample which is considered or judged to be typical or representative of that which is being studied. The participants of this present study composed a typical sample with respect to this definition because the group which is aimed to study is working students.

It is time to describe them one by one. I had mini semi-structured socio-economic level interviews with each of them. I have combined these interviews information with my and other teachers' natural observations throughout the two years. I have given them the nicknames. These nicknames are not related with the

name of the students. Their nicknames are only related with their workplaces. The order of description of the students is random.

3.2.2.1 The Student Pineapple.

“But, ma’am?!?”

This is the classic expression of the Pineapple. He loves objections and denials. The daily talks of any teacher of him with the Pineapple are as below:

Teacher: “The Pineapple, please! Why are you disturbing your friend?”

P: “But, ma’am?!? He is the one who started the all thing.”

(After a while)

Teacher: “As I said before...”

P: (He heckles without permission) “But, ma’am?!? You didn’t say such a thing!”

(After a while)

Teacher: “So, as you can see, the answer is 5.”

P: “But, ma’am?!? It is four... Ooo, wait! Wait! Yes, it is 5.”

(After a while)

Teacher: “You have punched your friend, he is crying now. Why the Pineapple? Why?”

P: “But, ma’am?!? I didn’t do such a thing. (Silence) Actually I did, but he deserved.”

According to his other teachers, the Pineapple is a stubborn, intelligent, enthusiastic and aggressive student. Those examples of speeches in the classroom support the ideas of his teachers.

He has at least two trouble cases in a week. His mother comes to school every time after those fights. She apologizes from the parents of other students who have a beat-up and the teachers. She cries and begs for forgiveness. Actually she is afraid of what happens when her husband hears. Her husband (the father of the Pineapple) is a peevish old man. He beats his children. Therefore, she is afraid of the father. She endeavors to keep secret fights of the Pineapple.

Although the Pineapple is afraid of beats of his father too much, the warning of him like “If you do this again, I will call your father.” never works on him because the Pineapple loves to seem fearless. One day, I saw that his arm had broken. I ask him, and he said he had fought with a strange man. I learnt the details from the witnesses. The man said him to be silent, and the Pineapple said something rude. The man got angry and pushed the Pineapple. The Pineapple stood up and punched the man. And the man had beaten him and broken arm of the Pineapple. The Pineapple seemed proud of what he had done because he could have “proved” his fearless to the others.

A teacher does not want to obstinate with the Pineapple, because this is useless. If you want to make him to do something, you should show him that you believe him, you respect him and you care about him. If he feels this, he can do whatever is expected from him.

He is popular in his friends. He has kind of leadership role in the class. This role makes him a key to achieve other students. If one can gain respect of the Pineapple, whole class respects to him/her.

He and his family live in the same neighborhood with the school. They have their own flat with four rooms. This flat is old. There is not central heat system in the

apartment. The house gets heat with heating stove. Although they do not have many technological devices in their house, they have a computer and the Internet.

The Pineapple does not have his own room. Actually no one in the house has own private room. Siblings share the rooms. The Pineapple lives with his twin and also one of participants of this study, the Student Grape. The parents have their own room. The grandfather also lives with them and he has a room.

Family is not a wealthy family. His family and his close relatives have come to Ankara from the East of Anatolia. He did not know the reason. However, according to his mother said, as the other families, his family also has come to Ankara to get higher social-economic standards.

His mother is a house-keeper. Her job is not a regular job. She works sometimes twice in a week and sometimes she does not work. In other words, her contribution to family budget is very few. The father is a street marketer. The father and two brothers of the father (two uncles of the Pineapple) have places in different street-markets. They are working together. Having place in a street-market and working there is a rare situation because generally the owners and workers are not the same people. The owners are usually rich people. They hire some workers to work in street-markets. However, the family of the Pineapple and his uncles are not as wealthy as other owners so they have to work in their places.

The Pineapple works in the street-markets generally five days in a week with his father and uncles. Working in street markets is own decision of him. He wants work in street markets to have a job. Actually he wants to be a policeman in future; he knows what should be done to be a policeman. However, he thinks that if something goes wrong in future, at least he will be able to a street-marketer. He does not earn money by working in the street market. He earns money at the end of the day if his father and uncles give him. It depends on their moods. Sometimes they only give 5 TL and sometimes they give 50 TL. They always pay him, but the amount of money that he earns changes.

He is an apprentice in the workplace. Although he does not earn money with exact amount, his contributions to the work of his father and uncles are important for them. If he did not work with them, they should hire someone to do his job. They should pay him at least 30 TL for a day. His contributions to family budget are crucial with this point of view.

3.2.2.2 The Student Grape.

“Ma’am! Homework?!?”

I will always remember The Grape with his love of homework. The following are some ordinary lesson speeches between me and the Grape:

Me: (I have just entered the classroom, and said nothing yet)

G: “Ma’am! Ma’am! Ma’am! You will check the homework!”

Me: “Please, let me say firstly “Good morning!” The Grape...”

G: “Ha, yes, good morning ma’am! Now, homework?”

(After a while)

Me: “As we learnt in previous week...”

G: “Yes, ma’am, there was a question about that in the homework.”

(After a while)

Me: “Now, you are assigned to do exercises at page 37 for next week.”

G: “Yes, I already did it last night ma’am, please check my notebook, please!”

These conversations may be seen as usual conversations between the teachers and hardworking students, but there are more details here.

The Grape is not a hardworking student, actually he never minds about lessons. He has report from Counseling and Research Center. According to this report, he has mild mental disability. He does not answer the same questions with his friends in exams. The teachers give him different questions in the exam. His teachers follow different program for him. Generally, his grades are low, because to get passing degree (45 points) is enough for him.

Besides his low grades at lessons, he loves fighting. Every week, the Grape involves in a trouble situation just like his twin the Pineapple. Yes, the Pineapple and the Grape are twin brothers. Their poor mother comes every week to the school, sometimes for the Grape and sometimes for the Pineapple.

The Pineapple and the Grape have lots of similarities besides their physical appearances. The Grape is also afraid of his father as much as the Pineapple. The Grape loves fighting as much as the Pineapple loves. They are in the same classroom. They both work with their father and uncles in the street-market. Both the Pineapple and the Grape are rude to their teachers unless they like him or her.

Above and beyond their similarities, they have differences. While the Pineapple seems really intelligent with respect to his classmates, the Grape has mild mental disability report from Counseling and Research Center. The Grape and the Pineapple both do not love studying, but they get different results. The Pineapple has high grades with little self-studying; on the other hand, the Grape has low grades although he takes easier questions in the exams. The Pineapple is popular one in the class and has a leader role between his friends; on the other hand, the Grape has no best friends and his classmates do not like him much.

There can be risen a question here: “Why does the Grape love this much homework?”. The Grape does not love any of the courses, but he likes to be flattered. One day, I noticed that his hand writing is very neat. I showed his notebook to whole class and made him applaud. After that day, he never missed homework of my

courses. Always he reminds the homework. When I forgot to check in the first lesson, his unhappiness and disappointment can be seen clearly from his face.

One can ask: “How can the Grape solve the problems and answer the exercises in the homework?”. The answer is “No, he cannot.” The clues of answers and solutions of our textbooks are ready on the Internet. The solutions and answers are not always correct. Even, sometimes there is an answer as: “It depends on the student”. The Grape writes exactly this sentence to his notebook as cited from the Internet. He does not think what he is doing. He thinks that: “This is the homework, and this is the answer, so I should write it down.” Although I know he does not learn from his homework, I continue to say him “Well done!”, because I do not want to discourage him.

His enthusiasm to homework affects his behaviors in the lesson. Before he started to do homework, he had loved to paint his desk and table. He had spoken to his classmates who had been trying to listen and involve to the course. He had looked at the blackboard with no interest. He had seemed that he did not care about what was happening in the classroom. After he started to do his homework, he tries to involve courses and says “I wish all courses were mathematics”. He is not a successful student but he makes an effort to be successful.

He has same family and socio-economic characteristics with the student the Pineapple. They share the same room. However, what a pity, they hate each other. They have not spoken with each other for a year. They say that they are enemies in the same family. Despite of our efforts to make them peace, they refused to speak every time. Since they always fight in their home, their father has forbidden them to speak with each other. They have accepted this as a rule and they apply this rule in everywhere.

The Grape has different future dreams with respect to his classmates. Actually, I have never heard this kind of dream in this neighborhood. He wants to be an actor, moreover specifically he dreams to be a theatre player in future. He does

not know how to become a theater player. He has inspired during a school trip to the theater.

The family of The Pineapple and the Grape is not a well-educated family. Their mother has left the school after the first grade. She has only one year education at school. She does not know how to read and write. Their father has graduated from the high school. He was the fuzziest before he started to work in street markets. He had left that job because of the financial issues.

Although their family is not well educated, one of the elder sisters of them has exceeded the limits. She has graduated from one of the most popular universities in Turkey. She is a dentist now. Educated woman is not usual in this neighborhood. Girls are raised to get married here. Majority of girls dreams to be a bride, not a business woman or educated woman. That is why the elder sister of the Grape and the Pineapple is a pioneer here. All of the books in their house are hers.

The Grape respects his dentist sister and loves her. When he talks about her, you can feel that he is proud of his sister. However, the Pineapple does not seem like the Grape about his sister. I think, the Pineapple thinks that he will be in better condition from his sister. Therefore, he underestimates success of his elder sister.

The Grape also works in the street markets five days in a week. He gets money with the same procedure as the Pineapple. He earns money if his father and uncles give him. Although he could not earn money, his contribution to family budget is important as I have explained while describing his twin the Pineapple. The Grape gives the money that he earns to his mother. If he wants something expensive such as original sports shoes, his mother gives him money back. Therefore, he can buy what he wants with his money. On the contrary, the Pineapple does not give his money to anyone. He does not collect his money. He spends it in the same week.

He likes to work there. His own decision is to work in street markets. The Pineapple thinks more logically about working in street markets. He wants to learn a job in case of misfortune in the future. However, the Grape really loves to be there.

He seems very happy while he is talking with the customers. He loves to do mathematics in the street markets although he was not aware of it.

The contribution of the Grape in this study is really important for me, because the first idea of this study has come to my mind with his solution method of a problem. I have noticed that he could solve the problems if there is something about money calculations in it. If there is not money in the problem, he converts the question a money problem in his mind and solves it.

3.2.2.3 The Student Scissors.

“OK, I am leaving then...”

The Scissors usually says this. Before explaining why he says so, let me describe his social situation in the classroom and in the school.

He is very popular in the classroom. He is a good soccer player, and playing soccer is important for male students in the school. He generally becomes the captain of the team of classroom during the soccer matches between classrooms or schools. He is loved by his friends. He generally swears. He sometimes fights with his friends because of his bad words. Whenever he feels a bit upset, he says “OK, I am leaving then...” and he leaves in the middle of match. His friends bag him to come to play back. If those friends send the one who made the Scissors angry off, he comes back to match.

Sometimes he gets angry with his teachers during the lesson, he takes his bag and says “OK, I am leaving then...” and goes out of the classroom. The teacher goes out with him and tries to persuade him to come back to the lesson. The teacher should do this because the students cannot leave the classroom. The teachers are responsible of unity of classroom during the lesson. This is one of the assignments of teachers. The teachers should keep the students together in the classroom. This is crucial part of classroom management.

The Scissors is a difficult student for me. It took one year to get a connection with him. He is too far to his teachers. Although I have 10 courses of 36 courses with them in a week, I could not reach to the Scissors easily.

In first times, he never listened to me during the lesson He refused to do class work and homework. I tried to talk with him lots of times. One time, I said him that: "I believe you the Scissors. You will be a great professor in future. You are really smart to be whatever you want. Please, try to understand mathematics, participate in the lesson. I believe in you. You can." He seemed like accepted what I said. However, he acted in the courses like we had never spoken.

I tried to communicate with his parents. I have never met his father even on the phone, but whenever I call; his mother comes to the school immediately. She is a concerned mother; however, she also suffered from the same problem: She could not reach her son. His mother and I connected with the teacher in counseling service of the school. She also could not communicate well with the Scissors.

After a while, I supported the class in soccer matches of class. I tried to arrange class trips to the places they want to go. After those, I felt that the classroom started to love me and respect me gradually. I can say that the last student in the classroom that respects me was the Scissors. I have given him a responsibility. He would be class president in my courses. Before I come to class, he should prepare the class for the lesson. He loved this responsibility. Being class president made him more interested with my course. He started to follow hours of my course. He started to come before my courses to ask me to take my books and materials to the classroom. We became much better with respect to first times.

The last event that made him trust to me was an argument. One of the male students and cleaner man had argued because of some reasons. The Scissors was also near them. Although the Scissors was innocent, he seemed like the guilty one because the Scissors generally argues with the people. Our vice-principal started to yell at him without questioning. I entered to the room while vice-principal was

yelling at him and ask what happened. The Scissors told the event. Clearly, he had no mistake in that situation. Vice-president said that he was lying because this was not the first time. I found the other student that had argued with the cleaner man. Cleaner man also accepted that the Scissors was not guilty. Although I only helped to reveal the truth, the Scissors thanked me lots of times because vice-president would almost have called his father. The Scissors is really afraid of his father. The Scissors felt that I rescued him. After that day, I feel his trust and respect to me. Eventually, I have a connection with him. He was one of the first volunteers of this study. Now, I hear less “OK, I am leaving then...” from him than the first times.

He lives with his family in the same neighborhood with the school. He and his mother were born in Ankara. His father and his grandfathers come from the eastern cities of Anatolia. The reason of coming from the East Anatolia to Ankara is the same reason with the parents of the Grape and the Pineapple.

The Scissors has one little sister who is five years old. His father and his mother graduated from the primary school. The Scissors has no relatives who graduated from a university or college. In other words, his family is not a well-educated family. They have no library in their house; furthermore, they do not have a book shelf.

His father works with minimum wage. His mother does not work. She is a housewife. They live in a rented home in the same neighborhood with our school. Their house has four rooms. Only father, mother, the Scissors and his little sister live together. Although that is usual in this neighborhood, they do not live with grandparents or close relatives.

The Scissors has his own room; however, he does not have a studying table. There is no computer or the Internet in their house. They have car, television, dish washer (this machine is rare in the slum neighborhood) but they do not have materials for studying. When he has to study or to do homework, he uses the floor.

The Scissors wants to be a sergeant as a member of military in future. He does not know how to be a sergeant, but he knows there should be an exam for it.

The Scissors works in a barbershop since he was ten years old (He is thirteen years old now) every summer. He works in his uncle's barbershop. Although he says working in the barbershop for three months in summer vacation, he also admits that he wants to go somewhere for vacation but his family cannot afford a vacation. That is why he should work and learn a job. He thinks that if he cannot be a sergeant, at least he will be a barber in future.

He works as apprentice there. He is not paid for working by his uncle. He can get only tips if the customers give him. Some days, he could not earn any money and some days he could earn 50 TL. The amount of money that he earns depends on the customers. Sometimes he gives his money to his mother for kitchen spending, and sometimes he uses it for himself.

3.2.2.4 The Student Orange.

“Am I a good student, ma'am?”

The favorite question of the Orange is this. Below, there is ordinary school day conversation between the Orange and me:

Me: “Who wants to reply?”

O: “Me! Me! Me!”

Me: “Yes, the Orange?”

O: “The answer is 2, ma'am!”

Me: “I am sorry the Orange, it is not! Any other answer?”

(In the break)

O: “Do you think I am a good student, ma’am?”

Me: “Of course you are!”

O: “But I have replied wrong”

Me: “It does not matter, you are a good student.”

O: “Could you please say this to my mother, too?”

This conversation did not happen once or twice. Every week, we make this conversation with the Orange. There are the hidden aspects of this conversation.

He barely answers the question correctly although he is the one who raises his hand to reply. In other words, he is willing to reply questions, but he cannot find the correct answer. Actually, he seems that he does not care whether his answer is correct or false. He only wants to participate in the lesson.

I have asked his other teachers about him. They say “He is willing to reply, but his answers are false.” Then, I understood that this does not happen only in my courses, his general behavior in the lessons is that.

After I met his mother, I could understand why he is doing that. His mother makes him motivate to participate in the lessons. However, since she is not educated and she does not exactly visualize what happens in the classroom, she insists to raise his hands in lessons. She thinks that raising hand makes a student hardworking and intelligent. The result is not important. According to her, the Orange should win his teachers’ favor by raising hand. That is why the Orange keeps “participating in” the lesson whether his answers right or wrong. That is also why the Orange insists his wants that make me tell to his mother how he is good.

I try not to devitalize him. The motivation of him and his mother to become a good student is important for me. Mothers of other students are generally not interested with their children’s situation in the school. That is why her interest and her effort are valuable for me. Although I know he gives a wrong answer, I let him

reply. I try to motivate him to study for giving right answer. I say him that if he gives right answer, I will call his mother. The Orange and I are seeking to find his effective learning method for mathematics with counseling and research center of school. We never want to lose any student, especially this much willing student to the lessons.

The Orange has three siblings. His elder brother had left the high school after repeating twice the first level of high school. He is maintaining the high school with distance education program. The elder brother of the Orange also helps their father in the street market. The little brother of the Orange is one year younger than the Orange and he is in our school. He is my student, too. His grades are better than the Orange. Sometimes he helps the Orange in homework. The little sibling of the Orange has not born yet. We do not know gender of baby.

As I mentioned before, despite of her enthusiasm about education of her children, the mother of the Orange graduated from elementary school. She was born in an eastern city of Turkey. Her family did not let her to go school, so she could not. She is a housewife. Her childhood dream was to go to university. Therefore, she really cares about the education of her children. She loves reading but only religious books. She generally reads the life of Prophet Mohammad. On the other hand, the father of the Orange is not interested with the school and education. He was born and grown up in Ankara. He also graduated from the elementary school, but he had a chance to maintain his education life. He did not choose this and became a street-marketer. The Orange said that he has never seen his father while reading. Actually, they have a small library in their house. Library contains a few shelves to put in books. Books are not miscellaneous. The majority of them are textbooks and religious books.

They live in their own house in the same neighborhood with our school. Their house has three rooms. Only the family members stay in the house: Father, mother, three children. The Orange stays with his brother. There is a table for studying in their room. Although they have some technological devices as washing machine, dish washer and television, they do not have computer and the Internet.

The Orange does not have any relatives or neighbors who went to college or university. Actually he does not know anyone to get further education than high school, except his teachers. The Orange wants to be a policeman in future. He knows how to be a policeman, but he is aware of that he needs to study much more than now.

The Orange and his two brothers work with their fathers in the street markets. The Orange goes to street market at least two days in school time and whole vacation. His contributions to family budget are the same with the Kiwi who is described below. He works as apprentice in the street market but this important for his family budget. More apprentices mean that more sales and more money earning. He does not get any money from working. He only gets pocket money weekly during school times.

3.2.2.5 The Student Sugar.

“Cık! (Nope!)”

Yes, there is only one sound above: Cık! (Nope!). The Sugar replies all questions with movements of his head and with this sound. If it is not a Yes/No question, you should guess his answer and convert your question to Yes/No question. For example, a usual day in the classroom:

Me: “Do you want to reply the Sugar?”

S: Cık! (He nods his head in meaning “No”)

(After a while)

Me: “Which group do you want to join the Sugar?”

S: (He just looks and says nothing)

Me: “The red ones?”

S: Cık! (He nods his head in meaning “No”)

Me: “The blue ones?”

S: Cık! (He nods his head in meaning “No”)

Me: “So, the yellow ones?”

S: (He nods his head in meaning “Yes”)

(After a while)

Me: “Have you done your homework the Sugar?”

S: (He just looks and says nothing.)

Me: (Anymore, I can understand him. If he did not nod his head in meaning Yes or No, it means that he has done half of the homework.) “You have done half of it, right?”

S: (He nods his head in meaning “Yes”)

I know it seems really annoying. In first times, I thought that he did not want to talk with me since he abstained of the teachers. After I observed him, I noticed that he also abstained of his friends. At first, he did not have friends. After one year in the school, he has male and female friends now; however, he still does not speak too much. We have short conservations with him now.

His friends say that the Sugar is a good friend even if he does not speak much. According to my observations, the other reason that his friends love him is that he is a good soccer player. As I mentioned before, playing soccer well is important for choosing friend in the classroom. This is “cool” for them.

When he came to say me that he wanted to participate in my study, I was surprised. I did not expect this because I thought that I had no connection with him. I did not want to make him upset, and I accepted. When I said “Yes, of course, you

can be participant of my study”, I immediately visualized how difficult it would be. He does not like to speak, but I need my participants to tell me their stories. I imagined that the most difficult part of studying with him would be the part of learning workplace experiences of him, more specifically the interview parts. However, I was wrong. I can accept that all parts are more difficult than each other while studying with him, but the most difficult one was to understand how he did the calculations in the tests. I had to ask more than Yes/No questions to him to discover his thinking via the problems. I could learn less from him. That is why I had to make reasoning by myself in some problems. I have explained them in the Findings, Chapter IV.

After mentioning his participation story to this study, I can describe him and his family. As I mentioned, he is a silent student. He sits on the desk at the back row lonely. If he wants to sit somewhere in front of the blackboard, he can easily sit, but he does not want. His grades are low in all major courses. He generally does not do his homework no matter what the course is. He sometimes escapes from the school in the afternoons. His parents are not interested with him. Actually, I have not seen his parents until a money issue has risen. The parents would not pay money for extra courses, but his mother misunderstood. She thought that the school wanted them money. She came to reject giving money. Vice-president explained that no one wanted money from her. That day I mentioned her about this study and desire of the Sugar to participate in this study. She asked me whether she would pay or not. I said her no payment is needed. She then accepted and signed the voluntary document. These little events may help to understand how much his parents support and care about his education.

The Sugar lives with his family in the same neighborhood with the school. Their house is a shanty with one room. Five people stay in the same room: The mother, the father, the uncle (younger brother of the mother), the Sugar and his brother. Their house is not their own possession. They live in a rented shanty. For a one room shanty, they have belongings that can be thought as luxury. For example,

they have dish washer. Lots of people still do not have it because of electricity bills. Dish washer machines are also expensive for family of the Sugar. Their four-month rent is equal to the price of a dish washer. Besides dish washer, they also have television in their one room rented shanty. Clothes of the Sugar and his mother are really old but they prefer to buy television and dish machine. The need pyramid of Maslow seems a bit rearranged in this house.

The parents of the Sugar came from a village of a city in the middle of Anatolia, near Ankara. They moved this neighborhood because of economic reasons when the Sugar was a little boy. He cannot remember how they came from there to this neighborhood.

While I asked to the Sugar whether their family is educated or not, he said that they are educated. Then, I asked the graduation levels of each of them. His mother graduated from primary school in the village. His father graduated from the high school. His uncle graduated from the high school. His little brother is in the fourth grade of a state primary school. I asked him whether he has any relatives that graduated from university or college. He said that his uncle (not in the house, he is elder brother of his mother) graduated from university and he is hodja in a mosque now. I have learnt after a while that his uncle graduated from high school, not a university. He passed the exams and became hodja. Therefore, he has no relatives who graduated from university or college.

All men in the house (the father, the uncle, the Sugar and his brother) work in the same place. They sell fried dough desserts. They do not have a bakery house. They make the fried dough desserts in their home, and they sell them in a wheelbarrow as street hawkers. There is a fried dough dessert wheelbarrow photograph in *Figure 3.2.2*. I have thought the role of the Sugar in this study as baker because although they have not a bakery, they exactly do what bakeries do.



Figure 3.2.2: A fried dough dessert wheelbarrow photograph from Ulus, Ankara

The father and mother of the Sugar prepare the dough in their house in the nights. In the mornings, while his mother fries the dough, his father prepares the wheelbarrow. They arrange the fried dough desserts to the wheelbarrow together. His uncle and the Sugar ride the wheelbarrow to the city center by walking. They have permission from Ankara Metropolitan Municipality to sell their desserts in a determined location in the center of Ankara. The distance of their home to the selling location is approximately three kilometers. While his uncle and the Sugar are walking, his father and his little brother get on the bus. They meet in the selling location.

The mission of the Sugar at the workplace is sometimes package delivery and sometimes selling fried dough desserts from the wheelbarrow while the others

are doing package delivery. Although his father gives him 10 TL for each week, his contribution to family budget is important. The more people work, the more money is earned since package service is crucial part of the daily earnings. The Sugar uses 10 TL as pocket money in the school.

Working with his father and uncle is not his choice, but he has no opinion about this. It does not matter for him to work or not to work. He works after school in weekdays and whole weekends. He works three months all day in summer vacations and fifteen days in semester vacations.

3.2.2.6 The Student Salt. I do not want to write any word here, because the characteristics of the Student Salt are not his words, but it is his way of speaking. He cannot say the letter “r”. Instead of the letter “r”, he uses “ğ”.

He is a silent student generally. When he sits with his friends he loves playing with small car toys. He is a bit older for those toys but he and his friends love them.

He seems that he is not listening anything in the lesson. His teachers complain about that. His grades are low. I cannot say he is smarter than the other students in the classroom. He barely passes his classes.

He lives with his family in the same neighborhood with our school. Their house is rent. He has two elder siblings. His sister goes to high school. She is disabled. She wants to go university next year. His brother started to high school this year. He also works in a barbershop to have contributions for family budget.

The father of the Salt graduated from the primary school. He comes to Ankara from a city of middle Anatolia for economic reasons. He works for a bakery shop as a driver. He drives the breads to the markets. The mother of the Salt graduated from the primary school, too. She was born in Ankara. She is not working; she is a housewife. I can say that she cares about the education of their children,

although the Salt does not want to study. She pushes him to study and maintaining to school. She also tries to make life easier for her disabled daughter. She has taken her to the school throughout 12 years, and she continues.

Only family members stay in house. The Salt shares his room with his sister. They have some technological devices in their home includes computer and the Internet. They do not have a table for studying but they use the computer table while studying. They do not have library in the house. The Salt does not have any relatives or neighbors that go to university or college. I hope his sister will be the first university student in his family.

The Salt works in the bakery shop which his father drives for. He works in vacations as apprentice. He sweeps the floor, he weighs the dough, and he puts the breads to the boxes etc. He does not earn money for them; however, his father gets extra wage for the days who W works. W takes only pocket money weekly in school times.

He wants to be a pilot in future. He does not know how to be a pilot but he wants it.

3.2.2.7 The Student Kiwi.

“Ma’am, OK, ma’am, I, ma’am, will, ma’am, do, ma’am, my homework, ma’am”

This is not a usual sentence of the Student Kiwi, but the usual one is “ma’am”. His every sentence begins and ends with “ma’am”. This is because of his endless respect to his teachers. I can say if I removed “ma’am” words from the transcription of the interview that I conducted with him; the transcription would be half of it. For example, let me throw the “ma’am” words out from the sentence above:

“OK, I will do my homework.”

Now, you can imagine the transcription of the interviews and my endless effort to write thousands of “ma’am”.

The Kiwi was really difficult student at the first times. If there was a fight, the Kiwi definitely was part of it. His parents do not come to school too much. After every fight, he left the school for a few days. Then, he came back as if nothing had happened. He argued with his teachers. His grades were low. His friends love him and respect him. He is one of the popular boys in the school.

One day, a discussion between students was misunderstood. The parents of other students were angry with the Kiwi. We, all teachers, supported him. We explained his innocence to those parents. After that day, the Kiwi changed a lot. He started to come to teachers’ room to ask whether we have any commands. He started to carry our books and materials to the classroom. We gave him the assignment to be vice class president. The Kiwi and the Scissors made the classroom ready for lessons together. Now, his respect to his students should be seen. He participates in all school activities voluntarily. He started to care about his grades and lessons. His grades are higher than the previous years. He does his homework in all lessons. His teachers love him. His contribution this study is priceless.

The Kiwi lives with his family. They were staying in a rent in the same neighborhood with our school. But this year, they bought a house moved another neighborhood. Their house has four rooms. Only the family members stay in home: The father, the mother, two sisters and the Kiwi. The Kiwi has no private room; he stays in the living room at a couch. They are four siblings, two girls and two boys. His brother works in İstanbul with his uncles. He did not continue to his education life after graduating high school. One of his sisters is a teacher in kinder garden. She has graduated from the early childhood education department of distance education program. The other sister of him is in a private medical high school.

Both father and mother of the Kiwi had graduated from the primary school. Although they had graduated from the same level, his mother generally forgot how to

read and write but his father both can read and write. His mother is not illiterate; she barely reads and writes if she has to. The mother and the father both were born in an eastern city of Turkey. Actually the Kiwi was also born there, but after his birth, the family moved to Ankara because of economic reasons.

There is no library in their houses. There is only a chest to put in books. The books are miscellaneous. There are novels, story books, religious books and textbooks in that chest. There is also a table for studying. There are general technical devices in their home but there is no computer. They use the Internet if they need from their smart phones.

The Kiwi works in the street-markets with his father three days in a week during school times and everyday in vacations. They do not own their own spot in any street-markets. His father and the Kiwi work for the daily wage. Their boss takes the yields for them from the major marketplace. The Kiwi and his father take those yields and sell in the street-markets. The Kiwi earns 50 TL for a day. He and his father work independently. So, his contribution to family budget is important.

I want to give an explanation about really important point. I have mentioned that they do not have their own place in street markets and they work for a boss. On the other hand, one of his sisters goes to a private high school with high payments. If his father did not send his daughter to that private school, they could take a place in the street market. However, his father sent his daughter to a private medical high school that gives guarantee to get job after graduation. I have given this detail to tell importance of education for his father.

The Kiwi has some educated relatives. I have asked him that “Do you want to continue to work in street market when you grow up?” He replied me: “I want a well-paid and more respectful job in future. People do not respect any of street-marketers. I want to be respectful man. I will be a policeman when I grow up.” I did not expect this answer actually. Generally the students want to be a policeman

because they like their guns, their dresses and their looks. Dreaming a respectful job is extraordinary with respect to other students in the classroom.

3.2.2.8 The Student Comb.

“Yes, ma’am!”

One of the most vulnerable male students of the school is the Student Comb. He never breaks the rules. He listens to his teachers carefully. Everybody in the school-students, teachers and workers- loves him. He never becomes a part of trouble or fight. He does his homework on time. I cannot say that he is smarter than other students, but he studies well. His grades are generally higher than his friends in his classroom.

The Comb lives with his family in their own home which is in the same neighborhood with our school. Their house has three rooms. Two people stay in each room. The Comb has four siblings. The elder brother left the high school and works with his father in the constructions (building sites). One of his elder sisters is married. She does not live with them. She graduated from secondary school. She did not go to high school. She was married at 18 years old. The other elder sister of him has exact same faith with her sister. She is engaged now. She also graduated from secondary school and she will be married at 18 years old. The little sister of the Comb is only 4 years old, so he does not go to school yet.

Both father and mother of the Comb come from a northern city of Turkey because of economic reasons. The Comb was born in there, after his birth they moved to Ankara. His mother graduated from second level of primary school. She is a house wife. His father graduated from primary school. He is a construction worker.

The Comb has no family member, relatives or neighbors who graduated from university or college. They have some technological devices but there is no

computer in their house. If they need, they use their smart phones to connect the Internet.

The Comb works in the barbershop of his sister's husband. He works in vacations. While he is working, he stays in his sister's home because the barbershop is far away from home of his family. The money that he earns depends on the number of customers and the amount of their tips. He works as apprentice there and learns how to become a barber. He gives his money to his mother for kitchen spending.

His duty in the barbershop is cleaning the floor, throwing out the hair, bringing lunch packages, taking jackets of clients, saying them "Good Morning, Welcome", holding up the hair drier and sometimes calculating money and giving back the change. If costumers are generous, they give good tips. He does not take any money from his brother-in-law.

Although he is shy, he wants to participate in this study. His contributions to this study are priceless.

3.3 A General Look to the Workplace Life for Little Street Marketers, Bakers and Barbers:

There are general daily life stories of little bakers, barbers and street marketers below by help of workplace observations.

"Once upon a time, a little poor boy lives in a little neighborhood (Figure 3.3.1). He works in a street market and sells fresh fruits and vegetables to earn pocket money for his school. He screams that: "Come on ladies and men! Here are the most delicious apples! Here are the best strawberries! Come and taste them!!!"



Figure 3.3.1: The little street marketer

One day, as usual, he woke up at seven o'clock. He went to the city street market with his father to buy fruits and vegetables. They buy wholesale because the wholesale is cheaper, so they could sell the goods with higher profits.

After they bought the goods, he and his father went to the street market in their neighborhood. They had hired a place there from the municipality to sell their fruits and vegetables. They set the tables as in Figure 3.3.2 and started to arrange the goods on the table.

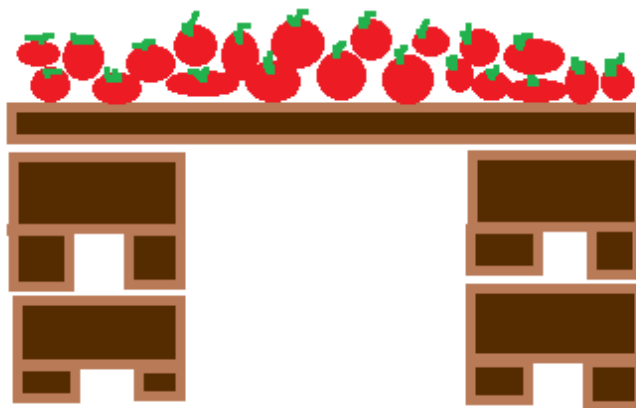


Figure 3.3.2: Tables and strawberries

The little street-marketer was carefully aligning the goods with respect to their weights because he did not want to roll them when the street market became crowded. The fruits could lose their fresh looking easily, so the fruits should be in the front side. If there were some spoiled fruits, they should be in the back; thus, the customers would not see them.

He asked his father the prices of strawberries. His father told him three different prices: for morning, for afternoon and for evening. He wrote all these prices on different tables as Figure 3.3.3.

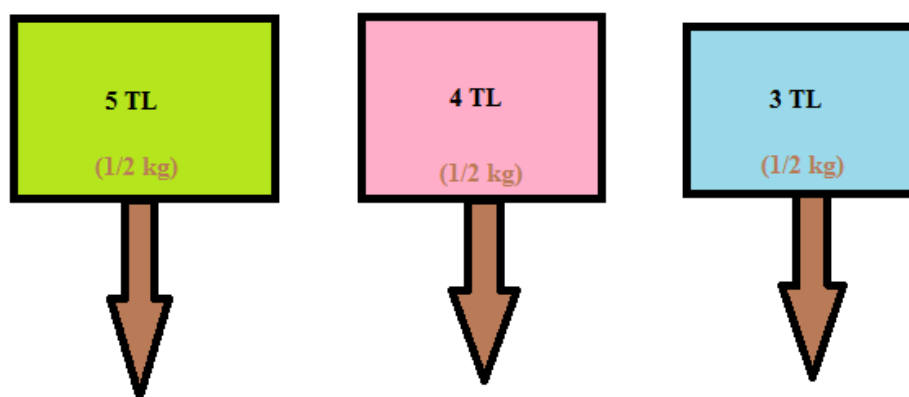


Figure 3.3.3: The little street marketer boy's price tables of strawberries for morning, for afternoon and for evening respectively.

They usually were writing the price tables in that way. Through the evening, they lessened the prices because they did not want to have unsold goods. Remained goods were also not sold in the other days since they lost their freshness. He knew that and screams in the evenings louder than in the mornings "Come and buy!!! These are the freshest strawberries!"

A woman came in front of the table in the morning and wanted one kilogram of strawberries. The little street marketer filled a plastic bag by rule of thumb. He weighed it. It came 950 grams. He added some spoiled strawberries without she noticed and he said loudly "This extra is our present ma'am!" as if he added extra good strawberries. The woman thanked and held out 5 TL. The little street marketer

said that “But ma’am, the half kilogram is 5 TL, so one kilogram is 10 TL”. After that the woman noticed the tiny note in the price table. She looked angry but said nothing. She paid 10 TL, and went away.

In the afternoon, his father went to have lunch and the little street marketer started to sell on his own. He felt himself as a young responsible man. He screamed “These are the most delicious strawberries in the street market! Come and buy now!” An old man came and asked “How much money are these strawberries young man?” He said proudly “A half kilogram is 4 TL Sir!” The old man wanted one and half kilograms of strawberries. The little street marketer weighed and gave the package to the old man. The old man gave him 15 TL and waited for the change. The little boy calculated immediately and gave back him 3 TL. The old man thanked and went away.

At ten o’clock, when he was really tired, his father said him “Tidy out the tables, we are leaving!” But at that time, the fuzz noticed the price table and came near it. The fuzz asked “Whose is this price table?” The father of little street marketer said “It is ours!” The fuzz said angrily “How dare you trick the customers!” and pointed the little note under the price tag as “(1/2 kg)”. The father could not say anything. The fuzz fined money punishment and gave him.

The father of the little street marketer felt sorry and regret, because all the earnings of the day had gone because of the fine. The little street marketer decided that he will never cheat people anymore.”

This is a fairy tale of a little street marketer. This fairy tale contains the real life of them. I have written this fairy tale to make you imagine the daily life of a little street marketer.

“Once upon a time, there was a little baker in a small and poor neighborhood. He goes to school in the mornings in weekdays. After the school and all vacations, he wears his uniform and goes to his workplace. (Figure 3.3.4)



Figure 3.3.4: The little baker

In vacations, he wakes up at six o'clock and goes to the bakery shop. He sweeps the floor. He helps to his masters while the masters prepare the dough.

After the breads are cooked, he places them on a table. The breads taste bad if they are put in a box while they are hot. That is why he waits for them to be cool a bit. As soon as they become cooler, the little baker starts to put them in boxes as in Figure 3.3.5.

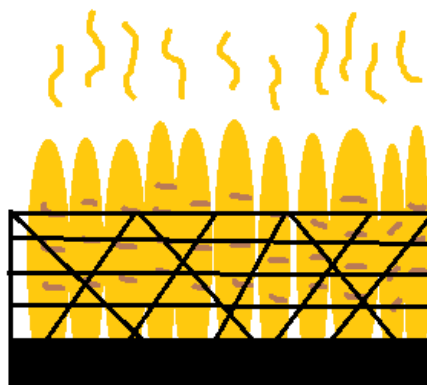


Figure 3.3.5: The breads in the box

After the little baker puts the breads into the boxes, he takes the boxes to the outside where the van waits. The van is the bakery shop's van. It is used for taking the breads to the little markets in everywhere of the neighborhood. So the breads which are cooked in this little bakery shop achieve each market in the neighborhood.

The little baker takes the empty boxes from the van and cleans them. This is time for the cooking of the customers' individual orders. Sometimes the customers from the same neighborhood bring their uncooked meals to make them cook in the bakery shop because they love the taste of food that is cooked in the bakery shop.

The little baker takes their uncooked foods and gives them back when the foods are cooked. The customers give tips to the little baker. These tips are the only earnings of the day for the little baker.

At the evening, the closing time comes. The little baker is ready to go his home. He is really tired to do his homework. Even if he does his homework, what will change? He will be a master baker when he grows up. His master had graduated from primary school, so he does not have to go school anymore. He wants to be as big as his master and to earn his own money. That is all..."

This is a fairy tale about a little baker who lived too far away and too many times ago. This fairy tale contains the real life of the little bakers. I have written this fairy tale to make you imagine the daily life of a little baker.

"Once upon a time, a little boy (Figure 3.3.6) lives in a little town. This little boy works in a barbershop. He is a little barber who goes to school in the mornings and goes to work in the afternoons.

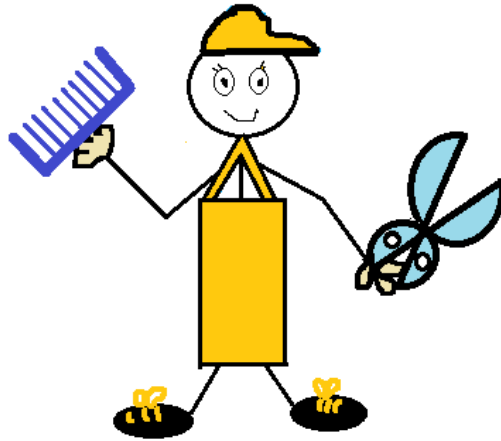


Figure 3.3.6: The little barber

In the vacation mornings, he wakes up early and leaves home. He runs to the barber shop and opens the door with the key. He immediately dusts and tidies up the barber shop. He prepares the breakfast, buys the loaf and waits for his master.

After a while his master comes to the barbershop. They have breakfast together. While the little barber tidies up the breakfast table, the first customer of the day comes in the shop. He immediately takes the coat of the customer and says “Welcome Sir!” with smiley face.

The little street marketer brings the towels, places the towels to the customer’s shoulders and shows to customer the washing hair coach. The master comes and washes the customer’s hair. Then, the little barber companies with the customer to the hair cut chair. He makes him sit down comfortably and asks whether he wants some drinks. In winter, the customers generally want tea and in summers they want cola or lemonade. The little barber runs to the kitchen and brings the drink.

The master makes the haircut and the little barber watches him carefully because he knows that one day the master will let him to make haircut. But until that day, he has permission only to watch in silence.

After master completes the haircut, the little barber brings the cologne and mirror to show the haircut of back head to the customer. Then, he brings customer's coat.

While the little barber sweeps the hair on the floor, the customer wears his coat and chats with the master. The customer gives money to the master for haircut.

The little barber waits excitingly because his only earnings are the tips of customers. If the customer does not give tip, he will do the entire job for nothing.

The customer and the master come to the end of their conversation. The customer is ready to go. The little barber says "Have a nice day, Sir!" with the hope of reminding the tip. The customer replies "Thanks, son!" but no, his hands do not go to his wallet.

The customer leaves the barbershop. He forgets the tip. The little barber feels sorry but this is not the only customer of the day. Of course, the other customers would remember the tip. He tries to feel better and hopeful for the rest of the day.

Then suddenly the customer who left shortly before appears. He calls to the little barber and says:

"Hey son, I have almost forgotten your tip, here, take this!"

This is half real life story-half fairy tale about the life of a little barber. I have written this fairy tale to make you imagine the daily life of a little barber.

3.4 Instruments and Data Collection

3.4.1 Contextualized real life problems tests. There are several forms of definitions of real life problems. I have accepted the problem definition in the study of Hiebert, Carpenter, Fennema, Fuson, Wearne, Murray and Human (as cited in Van de Walle, Karen, Bay-Williams, & Wray, 2013) that is any task or activity that the

students do not have any prescribed or memorized rules or methods to solve it, and there is not a perception by students that there is a specific “correct” solution method.

There are common points of this definition and the explanation of problem in middle school-taught mathematics teaching program (MEB Talim Terbiye Kurulu Başkanlığı Ortaokul Matematik Öğretim Programı, 2013) of Ministry of National Education which was published 2013-2014 education and teaching year lastly. As explained in this teaching program;

“In this program, problems -in general consideration- are accepted as the questions that the solution methods of them are unknown and the solution methods of them are not obvious.” (p. III)

Both of the definitions are emphasized the points “the problems do not have prescribed or memorized rules or obvious methods of solutions”.

In teaching program of Ministry of National Education (MEB, 2013, p. III), it is also explained that the problem can be considered in two types: routine problems and non-routine problems. Routine problems are described as the problems that can be solved by directly using mathematical knowledge. On the other hand, non-routine problems are not the problems that can be solved in a trice because of their nature. For this reason, the teachers and the students need time and patience to activate problem solving skills and to develop these skills.

There is an example of problem in the mentioned teaching program (MEB, 2013, p. III) as below:

“If Emine has 315 TL, how many 15-liras-pen can she buy?”

This problem may lead the second graders to find solution strategies by reasoning, while it is a routine application of division for fifth graders. That is why this problem is regarded as routine problem for fifth graders; on the other hand, it is accepted as non-routine problem for second graders.

There are lots of real life mathematics word problems that are appropriate to the definitions in seventh graders' mathematics textbook which is given by Ministry of National Education (MEB, 2013). Since those problems are written and checked by Board of Education and to get answer for the third research question of this present study, I have decided to use them in my study.

To make the problems non-routine, I have selected the problems that I did not solve in the classroom or give as homework (The given textbooks are only as recommended documents for lessons, so the teachers are not forced to use the given textbooks in their courses. They do not have to solve each problem in the classroom or give as homework). After long selection process, I have got thirteen problems that could be non-routine problems for my students (see Appendix-A). Generally, we ask to the students ten or twenty questions in exams. Therefore, thirteen problems would be suitable number of problems for one test.

I have to make clear an important point here. All of the participants have difficulties even in four basic operations. Although after I taught them, they could not give the right answers. As I mentioned while describing participants, they did not care about school or education. Thus it might be appropriate not to think of these participants as average seventh graders. After reading their solutions of the problems, it will be clearer why I consider these problems as non-routine problems.

To compare their achievements of the similar tests which include different work places problems, textbook problems, and mathematical words questions of the middle school level street-marketers, bakers, and barbers, I have converted the problems which I have taken from the seventh grades book published by Ministry of National Education (2013).

As it can be seen in Appendix-A, the problems that I have selected from the seventh graders' textbook are real life word problems with different contents. After I learnt what the routines of working day for street-marketers, bakers and barbers, I change the content of each problem without changing the numbers and needed

solution methods (see Appendices C, E and G). To get mathematical word questions, I have eliminated the contents of the problems. Only the mathematical expressions were left (see Appendix-I).

For example;

The problem taken from the textbook (MEB, 2013, p. 68):

“To obtain 1 kg sugar, approximately 7 kg sugar beet is needed. In this case;

a) Draw a table that shows the relationship between amount of used sugar beet and amount of obtained sugar. Write the expression that shows the relationship between amount of used sugar beet and amount of obtained sugar by using the pattern in the table.

b) Draw a line graph with the data on the table.”

The street-market problem:

“One box contains 7 kg bananas. In this case;

a) Draw a table that shows the relationship between amount of boxes and amount of bananas. Write the expression that shows the relationship between amount of boxes and amount of bananas by using the pattern in the table.

b) Draw a line graph with the data on the table.”

The bakery house problem:

“One box eggs costs 7 TL. In this case;

a) Draw a table that shows the relationship between the amount of boxes and price that is paid for them. Write the expression that shows the relationship between the amount of boxes and price that is paid for them by using the pattern in the table.

b) Draw a line graph with the data on the table.”

The barbershop problem:

“Haircut costs 7 TL. In this case;

a) Draw a table that shows the relationship between the number of men and price that is paid for haircuts. Write the expression that shows the relationship between the number of men and price that is paid for haircuts by using the pattern in the table.

b) Draw a line graph with the data on the table.”

The mathematical word question (numerical expression):

“

<i>1</i>	<i>7</i>
<i>2</i>	<i>14</i>
<i>3</i>	<i>21</i>
<i>4</i>	<i>28</i>
<i>5</i>	<i>35</i>
<i>..</i>	<i>..</i>
<i>..</i>	<i>..</i>
<i>n</i>	<i>?</i>

Find the expression that is placed question mark in terms of “*n*”. Draw a line graph to show data in the table.”

As it is seen in the examples, only the contents are changed. The mathematical content and the structure are the same for each problem.

After I set up these problems, to check whether I missed some calculations or deep meanings in the problems, I asked for help a mathematics teacher who is

experienced about writing problems. She was working for a company that serves online mathematics courses. She controlled the problems that I have converted to different contents. With respect to her comments, I have rearranged the problems. All problems are given with their last versions (Turkish & English) in Appendices A, B, C, D, E, F, G, H, I, and J.

I have faced with two kinds of difficult issues when I planned to conduct the tests. The first problems are the time problems that how much time should be between the tests, when I should start to conduct the tests, what if I conduct the tests before I taught the related subjects or after I taught the related subjects. The second problem that I have faced with is the order of the tests problem that which test should be applied firstly, whether the order of the tests should be the same for each participant or different, if I would apply different how it would differs for different participants. I have explained below how I applied the tests regarding these raising questions and how I have dealt with them.

Time Related Issues: To deal with time related issues, I firstly tried to focus on the reasons behind the question that why the time was important for conducting the tests. All these time issues were for one reason: To remain the problems in the tests non-routine for students. Therefore, the students could not use the memorized rules and patterns that I had taught in the lesson in their solutions. And thus, I could interpret their solutions of problems with different contents.

As I have written before, the majority of participants even do not know the basic four operations. This is not because of that they had not been taught before. This is the result of that they did not want or try to learn. Even the most hardworking one loses his interest when he faces with a different subject or a difficult question. They tend to remain their primary school knowledge because they feel that they cannot understand or learn new thing.

I taught from the beginning multiplication table at least five times in these two years. I know it looks weird because they are middle school students. Not only

had I taught, I have also asked in the quizzes and exams, requested to help from their families, played games with multiplication table, prepared painted wall charts, etc. However, the students still have troubles with multiplication table. After long meetings with counseling teacher, I decided to move on to catch the teaching plan which is determined by the Ministry of National Education. Now, I try to teach the same things with other same level students but only the basics of the subjects with repeating prerequisite knowledge. This is a pity coincidence of this classroom's students. My other classrooms are not like this classroom. There are very intelligent and hardworking students there. They feel secure about learning new things.

You can imagine levels of the participants even with the better grades. Whether I taught or did not teach, the problems maintain their non-routine characteristics for these participants as in example of problem in the mentioned teaching program (MEB, 2013, p. III) as below:

“If Emine has 315 TL, how many 15-liras-pen can she buy?”

As it is mentioned before, this problem is regarded as routine problem for fifth graders; on the other hand, it is accepted as non-routine problem for second graders in Ministry of National Education teaching program of 2013.

Regarding their academic levels, I decided not to give that much importance to the time issues.

Order Related Issues: To solve the order of the tests problems that which test should be applied firstly, whether the order of the tests should be the same for each participant or different, if I would apply different how it would differs for different participants; after getting meetings with my advisor and some researches I have some clues about what should I do.

The order problem is a kind of internal validity problem. It is mentioned under “Internal Validity” heading and “Testing” subheading at the “How to Design

and Evaluate Research in Education” which is written by Fraenkel and Wallen (2005, p. 175). The testing threat is explained in this book as below:

“In intervention studies, where data are collected over a period of time, it is common to test subjects at the beginning of the intervention(s). By testing, we mean the use of any form of instrumentation, not just “tests”. If substantial improvement is found in posttest (compared to pretest) scores, the researcher may conclude that this improvement due to the intervention.” (p. 174)

“The use of a pretest in intervention studies sometimes may create a “practice effect” that can affect the results of a study. A pretest can also sometimes affect the way subjects respond to an intervention.” (p. 183)

Although this present study is not an intervention study, the mentioned “practice effect” is also important for my study because the students might memorize the solutions and, they could apply these solutions to the other tests. So, the scores of the tests might be higher and higher with time.

I implemented the tests to the participants with two weeks interval. I told them that they have different tests but I have applied the tests with the same order to all of them as in the order of Appendices (B, D, F, H, and J). I strictly had forbidden them to talk to each other about problems. I perseveringly told them the results or solution methods would not affect their grades, whether they were correct or false. I said only I needed to their opinions about the problems and the solutions methods. So, they did not need to learn how the problems were solved.

I could interpret after I got the results of the tests that the participants remembered the types and numbers in the problems with different contents. However, their approaches to the problems, their solution methods, their answers were not changed dramatically.

Since I have explained in details about their test results in Findings, Chapter IV, I can only make clear here that internal validity has not interrupted during

implementation of the test. Testing thread has been kept away from by guidance of the participants.

3.4.2 The Interviews. To get a deeper understanding about participants' workplace practices, overall work-related mathematical practices, their views and thoughts about school-taught mathematics and workplace mathematics, their responses to each other's' workplace mathematics; I have conducted semi-structured interviews with participants. These interviews were semi-structured because of several reasons. Firstly, I knew their potential answers generally, so I had different reasonable questions for different participants. A structured interview would not be enough for this colorful sample. Semi-structured interview gave me a chance to be relaxed for asking students regarding to aims of my study. Secondly, I generally had one-to-one conversations with my students. They feel themselves relax while asking and answering. Because of the record machine, they felt excited more than enough. If I conducted structured interview, they would feel themselves more excited and panic. I tried to create a natural conversation environment for us. We could change the questions together, we could pass some of them and we could emphasize the important parts for this study together. All of us, participants and I, gave direction to this study together.

I can classify the interview that I have conducted into two groups.

- 1) Semi-Structured Interview for Problems
- 2) Semi-Structured Interview for Others

The half of the interview time is spent for to understand their responses to the tests at Appendices B, D, F, H, and J. The other half of the interview time is spent for to get clues about socio-economic levels of the participants, workplace mathematics, their feelings about school-taught mathematics and workplace mathematics, and the thoughts and feelings about the others' workplace mathematics.

The semi-structured interviews for problems are conducted to get a deeper understanding about how the students answer the problems, what their reasoning methods are, and their attitudes towards the problems with different contents. To get clues about answer of the forth research question of this study and to have a deeper understanding about their problem solving; I have asked to the participants for each problem in each test: “How did you solve it? Why do you think it is true? Why could not you understand? What is the confusing point for you in this problem? What if it was 5 TL, instead of 4 TL? ... etc.”

The semi-structured interviews for others are conducted to have some clues about the first, second, third and fourth research questions. I have asked semi-structured questions to the participants under four titles.

1) *Socio-Economic Situation*: I generally knew the students’ socio-economic situations, but I have asked to make the information tidier. I have asked about their birth, their family, their hometown, the education levels and some characteristics of the family members, their home, their salary and the future dreams of the participants.

2) *Workplace Mathematics*: I have asked the students about a routine day at their workplaces, the time management (school, home and work), some mathematical questions about their work (the area of a table at street market, the amount of flour for making a bread, daily money calculations, etc.), and the difficulties that they faced in their workplaces.

3) *School-taught Mathematics vs. Workplace Mathematics*: I have asked the questions about general thoughts and feelings about school-taught mathematics, workplace mathematics, the real life word problems in their textbooks, how many of the problems in their textbooks are real life problem for them, if they wanted to grow up a street marketer-baker-barber how the mathematics courses would be, what the contributions of the school are for their workplaces, whether they used at the school

the information that learnt in their workplaces, what the contributions of their work are, etc.

4) *Others' Workplaces:* I have asked the questions about their feelings and thought about the workplace mathematics of other participants.

The interviews have been applied to all participants. Since the interviews include semi-structured questions, the time spending is different for each interview. Therefore, the lengths of the transcriptions of the interviews are too different from each other. For example, the Sugar is a silent participant and the transcription of his interview has taken forty pages; on the other hand, the Kiwi is a fast speaker and each word of him starts with “ma’am” so his interview has taken seventy one pages.

I have separated into two parts the interviews because their application dates and techniques are made them two classes. First one is the interviews for problem solving and the second one is the interviews for others.

The Interviews for problems: I have conducted the semi-structured interviews after the participants completed all of the tests at the Appendices B, D, F, H and J.

Before I asked the questions, I gave their tests that they solved in the semester to the participants back. I let them half an hour to look at their answers and remember what they did. If they could not remember, I gave extra time to solve the problem again.

I have asked my questions one by one while voice recording machine was working. The students knew I was recording them, even if they were excited, they did not hesitate to answer my questions clearly. I have written all of the things that they said and I have used these answers in Findings, Chapter IV to answer research questions of this present study.

The Interviews for others: As I explained before, I have asked the questions about their socio-economic situations, their workplaces, their houses and families,

their feelings and thoughts about school-taught mathematics, workplace mathematics, and other participants' workplace mathematics.

I have conducted these interviews at the start of this study. Before I have converted the problems that I have taken from the seventh graders' textbook (MEB, 2013) to participants' workplace contents, I should have idea about their workplaces. Therefore, I have started these semi-structured interviews. I used voice recorder machine and the students knew that their voices are being recorded. I have also written all conversations as the other interviews. I have used these semi-structured interviews in Finding, Chapter IV to answer the research questions.

3.4.3 The workplace observations. Before I have mentioned about how I observed the participants, I should repeat some details about the participants of this present study. As I emphasized several times, the participants are my students. I have courses with them average ten lesson hours per week. Five hours are Mathematics courses; four hours are for English courses and one hour is for Physical Education courses since there are not English and Physical Education teachers in our school (After three months I wrote this paragraph, those courses' teachers were assigned to our school and my courses dropped to six hours).

I met their families. I almost phone every week to their families, not only the participants of this present study, all my students to check their study environment in their house. Families almost firstly call me if they have trouble in their houses, even if the trouble is private and it is not about my students.

I sometimes went to the participants' workplaces to support the obtained answers from the semi-structured interviews for the first research question: "What is the structure of middle school level street-marketers', bakers' and barbers' overall work-related mathematical practices?"

I have conducted these observations as onlooker (outsider observer). The participants and their families did not know that observations were being made. They did not aware of that I was observing them. I explained them what I observed and

asked for permission from them to use what I observed in their workplaces after I completed my observations. For some participants I have got only few observations with five minutes each, for some other participants I have got three observations with half an hour each. I changed because of environmental issues.

I have observed the workplaces of the participants to have some clues in searching for the answer for the first research question of this study. In the interviews, I tried to understand the structure of middle school level street-marketers', bakers' and barbers' overall work-related mathematical practices by using the participants' speeches. To support this understanding, I used my observation in workplace of the participants.

I have to write here some details here about my being in the workplace of the participants'. Although all the participants work with their families or relatives, and I have good and respectful relations with their families; I have got some troubles in their workplaces.

Ankara is a big and peaceful metropolitan. The people of this city are warm and modern. As every person who reads this sentence will understand and agree with it, there are some places where are scary to walk around alone even if in the most safe metropolitans.

Despite the fact that the families and the relatives of my students were with me, I feel insecure in those workplaces sometimes. I have described of the neighborhood of our school and I have told that the students generally live in this neighborhood. The majority of their workplaces are in this neighborhood or the neighborhoods with the same characteristics. They work generally male dominated places and I felt a bit nervous because of being there alone or with my friend as second observer.

Some days I could stay half an hour to chat their parents and had chance to observe overall work-related mathematical practices; on the other hand, sometimes I could have only five minutes to stay there.

These troubles change the status of these observation reports in my study. I had wanted to use observation reports as main instrument for my study at first; however, it could not be as I imagined. Firstly, I imagined that I and my friend would go to the workplaces and we could have time to write observation reports neatly. Because of feeling insecure in the workplaces, I could only use this observation reports as supportive of interviews.

To give more details, there are the stories that how I observed different participants' workplaces.

Street-marketers: The observations of the workplaces of the students the Pineapple, the Grape, the Kiwi and the Orange were the easiest observations for me. In Turkey, generally women go to street markets. Although the street markets sometimes built in some places that I felt unsafe, the majority of the population was women and I felt safe myself. Therefore, I could have gone to there by myself and I could I have time to observe their mathematical practices and their mathematical computational practices while shopping at the street markets.

The Students Pineapple, Grape, Kiwi and Orange sometimes work in the same street market. I tried to go to make observation especially those days. I could pass time at least five minutes with each participant's table. I could get at least half-an-hour observation report in one day for four participants. I have shared some of these observations in Findings, Chapter IV, while explaining the answer of the first research question.

Barbers: These observations were the hardest ones because both the students Scissors and Comb are working in the barbershop at male-dominant streets. The barbershops were already for the men. Being a woman there was weird, especially while making an observation without telling it. It was also weird to speak with their parents for the lessons and grades of the students. While I was there, the work was not going on because my student left to bring me tea and the barber was

talking to me while the customers were waiting. Therefore, I could not observe anything.

After a while, I tried another way. My husband came with me to barbershop. While my husband was waiting his turn and while he was shaving, I could have chance to observe their mathematical practices and their mathematical computational practices while shopping at the street markets. Now, I have two half-an-hour observation reports for each student.

I have also shared some of these observations in Findings, Chapter IV, while explaining the answer of the first research question.

Bakers: I should describe separately the workplaces observations of the two students Salt and Sugar, since their workplaces are too different from each other although they were both baker.

I could not observe workplace of the Salt because the bakery that he works is not working by retail. That bakery is only for wholesale. I could not even enter the place that is prepared dough. Father of the Salt met me outside and we have talked. Therefore, I have only information about the mathematical practices of the Salt at his workplace as much as the Salt had told me in the interviews.

On the other hand, I could have much more time for observation of workplace of the Sugar. I was lucky because the Sugar is the most silent participant. I could not get enough information from the interviews with him. Since the kitchen of the Sugar's home is the baking place, his mother told me all procedures of the baking sweet fried dough in their kitchen. I went the spot of wheelbarrow that they sale sweet fried dough in it. I bought some. While I was talking with his father, the Sugar was continuing to sell. I have four observation reports for the Sugar's workplace; three of them are five-minute-reports and one of them is half-an-hour report.

There is an example of my observation card (*Figure 3.4.1*) below (See for real sized observation paper Appendix K):

Name-Surname:	Date:
Business:	Time (Duration):
Events and Speeches: (Objective Observation)	
My opinions and feelings:	

Figure 3.4.1: An example of the workplace observation card

I wrote two rows because I wanted to separate my feelings from my observations to get objective results. After I took notes to support the results of interviews, I folded the observation papers as “Events and Speeches” section looked upward and gave them to the other mathematics teacher. I did not want to show her my opinions and feelings about my observation not to affect her decisions about the answers. That is why I folded the observation papers while I gave her. She took some notes to answer the first research question and gave them back to me with her opinions.

I have also shared some of these observations in Findings, Chapter IV, while explaining the answer of the first research question.

3.5 Evaluations of the Instruments for Research Questions

In this part of my study, I have described how to evaluate the results of the instruments that I implemented. The results of the instruments are in the Findings,

Chapter 4. How to evaluate the results of the implemented instruments is below for each research question separately.

3.5.1 Exploring the structure of middle school level street-marketers', bakers' and barbers' overall work-related mathematical practices. The first research question of this present study is:

“What is the structure of middle school level street-marketers', bakers' and barbers' overall work-related mathematical practices?”

To find an answer to this research question, I have used the semi-structured interviews. I have also used the workplace observation reports to support the findings of the semi-structured interviews. Therefore, I have explained this section under two subheadings:

- The evaluation of the semi-structured interviews for the first research question
- The evaluation of the workplace observation reports

I have focused to describe how to evaluate the semi-structured interviews and the workplace observation reports only for the first research problem. Of course, those instruments have more than one perspective. I have described the other perspectives in the other parts that explain how to evaluate the instruments for other research questions.

The semi-structured interviews for the first research question: I have used the semi-structured interviews to answer the first research question. I have generally asked to the participants to understand the structure of their overall work-related mathematical practices the below questions in the semi-structured interview:

- Where do you work?
- How often/When do you work?
- Could you tell me one working day from morning to the night?

- What is your assignment in your workplace?
- How do you buy the goods (vegetables, fruits, hair jelly, Gillette, flour, salt...etc)?
- Who makes the time management/schedule in the workplace?
- How much meter square your workplace?
- Who makes the money calculations?
- Who gives the change?
- What is the biggest challenge for you in your workplace?
- How much money do you earn in a day/week/month?
- How much money do the other workers earn in a day/week/month?
- How do you spend your money?
- What are the profits, losses, and costs of your business?
- How many kilograms do the tables take goods in the street market? (The similar questions for other workplaces)
- Could you tell me some examples about the prices of the things that you sell? (The price of one kilogram oranges / one kilogram strawberries / one loaf / one circle of sweet fried dough / one haircut / one beard cut...)
- What is the relationship between the number of customers and the earned money?
- What is the relationship between time and the number of customers?
- What is the relationship between cost and profit?
- Do you think that whether there is any mathematics in your business?

- What kind of mathematics do you do in your workplace?
- Could you give me an example of a sale?
- Could you give me an example of mathematics that you faced with in your workplace?... etc.

With these questions, I have aimed to learn the answer of the first research question. After I had asked these questions to the participants while recording their voices, I wrote every tiny second of these conversations to a Word Document. I analyzed this written document with respect to the first research question. I have taken some notes as answers and kept them.

After I had some answers in my hands, I gave both the voice records and the transcripts of those speeches to the mathematics teacher mentioned before. I requested her to write answers for the first research question without knowing my answers. She wrote her answers and gave them to me. I have analyzed the similarities and differences of my answers and her answers. They were nearly the same.

The workplace observation reports for the first research question: I have observed the workplaces of the students as I described before.

I have used both my and her feelings, opinions, decisions and answers while answering the first research question. As I emphasized before, these observations and events that I observed are used to support interviews because they are not strong evidences to get answers by themselves. Although I did not take the observation reports as strong evidences to get answers, I have tried to be less manipulative with help of the other mathematics teacher while analyzing the observations.

We analyzed the answers of students and observations by coding data. We both tried to make concept map by using these codes. I have used these concept maps, our observations and the semi-structured answers of the participants to answer first research question with sense of wholeness.

3.5.2 Exploring the views of the middle school level street-marketers', bakers' and barbers' about interaction of the formal school-taught mathematics with their workplace mathematics. The second research question of this present study is:

“What are those students’ views how the formal school-taught mathematics is related to the middle school level street-marketers’, bakers’ and barbers’ workplace mathematics”

To find an answer the second research question, I have directly used the semi-structured interviews that I have conducted with participants. I have asked to students the below questions to understand their views about the interaction of formal school-taught mathematics with their workplace mathematics:

- Do you use the mathematics that you learn in school in your workplace?
- How do you use school-taught mathematics in your workplace?
- Do you use the mathematics that you learn in workplace in your school?
- How do you use workplace mathematics in your school?
- What are the differences between educated person and uneducated person in your workplace?
- Are there any benefits of being educated in your workplace? If yes, what are these benefits?
- Is there any problem that you can solve with your school-taught mathematics knowledge in your workplace?
- Is there any problem that you can solve with your workplace mathematics knowledge in your school?
- If you were charged to build an education and training program by the Ministry of National Education for a school that only raises the street-

marketers/bakers/barbers, what would you add to or subtract from our education and training program that we use now?

I have asked my participants these kinds of questions in the semi-structured interview that I have conducted.

To explore the views of the participants about the formal school-taught mathematics interact with their workplace mathematics, it is used narrative data analysis. I have directly used their conversations in the semi-structured interview by sense of wholeness. I have synthesized their experiences about interaction of workplace mathematics and school-taught mathematics. I have grouped them by their workplaces. I have shared these conversations and my comments about them in details Findings, Chapter 4.

3.5.3 Exploring to what extend the real life problems in the mathematics textbooks refer to the real lives of middle school level street-marketers, bakers and barbers according to those students' thoughts. The third research question of this present study is:

“According to those students’ views, to what extend do the real life problems in the mathematics textbooks are related to their real lives as level street-marketers, bakers and barbers?”

To find an answer to the third research question, I have implemented the semi-structured interview to each participant. I have directly asked to the students their thoughts and feelings about the textbooks as below:

- How many of the problems in our textbooks refer to your real life?
- (After randomly selecting a real life problem during interview) Have you ever faced with this kind of problem in your real life?
- Have you ever faced with the problems that we solved in our classroom in your real life?

- What kind of problems should be added to our textbook to make it more real for you?

I have directly used the answers of the participants to answer this research question. I have synthesized their comments by sense of wholeness. I have grouped the answers of the participants with respect to their workplaces.

3.5.4 Exploring the responses of the middle school level street-marketers, bakers and barbers to each other's workplace mathematics. The fourth research question of this present study is:

“How do those students perform in solving mathematical problems and doing computations given in the context of street-market, bakery and barber shop?”

To find an answer to the fourth research question of this present study, I have directly asked to the participants that:

- What do you think about others' workplace mathematics?
- Which one of the workplaces has the most mathematical practices?
- Which workplace mathematics is the hardest one?

I have used the answers of these questions directly to give an answer for the fourth research question. I also have used the answer of the fifth research question here to have more clues about the answer of the fourth research question.

To get answer for the fourth research question, data are gathered from the participants with semi-structured interviews and contextualized real life problems test by the methodological triangulation design. Each solution in the tests of each participant was examined. The different answers or solution ways to the similar problems in different contextualized tests of the same participants were determined. The comments about these differences were asked to the participants during interviews. Their answers were given and interpreted in Findings, Chapter IV.

3.5.5 Exploring the difference between achievements of the similar tests which include different workplaces problems, textbook problems and non-contextualized mathematical questions of the middle school level street-marketers, bakers and barbers. The fifth research question of this present study is:

“What are the differences between scores of the similar tests which include different work places problems, textbook problems and non-contextualized mathematical questions of the middle school level street-marketers, bakers and barbers?”

To find an answer to fifth research question of my study, I have used the tests that contain the problems taken from the participants’ official textbook with different workplace contents as in Appendices A, B, C, D, E, F, G, H, I. I have implemented these tests as I mentioned before. I and the other mathematics teacher have evaluated the tests with a rubric that we designed together (see Appendix L).

I have given ten points to each totally correct problem, and thus, the whole test is evaluated out of 130 points (13x10). After all tests were graded, the averages of the points which the other mathematics teacher and I had given were taken. The scores and the averages were compared separately to gain an idea about the differences between scores of similar tests.

CHAPTER 4

FINDINGS

4.1 The Structure of Middle School Level Street-marketers', Bakers' and Barbers' Overall Work-related Mathematical Practices:

4.1.1 The street markets. There is concept map which is prepared by the help of codes that are gathered from the observations and semi-structured interviews in *Figure 4.1.1*

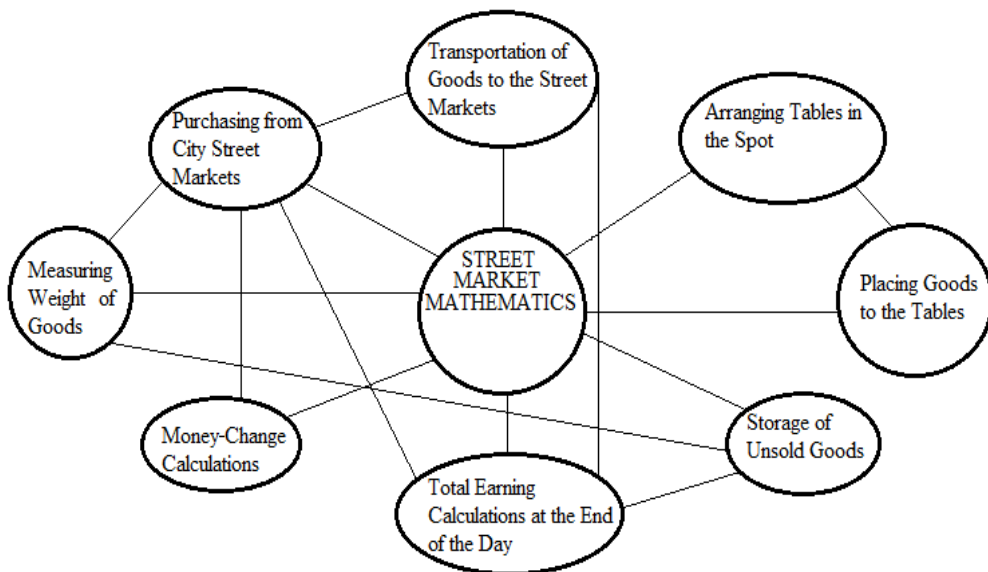


Figure 4.1.1: Concept map of street market mathematics practices and their relations

The relations which are shown in the *Figure 4.1.1* are explained with examples below.

4.1.1.1 To buy from the city street markets and to bring the goods from the city street markets to the local street markets. Each street marketer every morning goes to the big street market where the goods (vegetables and fruits) are sold wholesale. The street marketers buy their goods from the sellers in these city street markets. In general, those sellers are producers, villagers, and the importers. They determine the prices generally and these prices are lower than the retail prices. The bargains are usual in these places, so the street marketers may buy the goods much cheaper than they expect.

The most important mathematical practice in here is estimating the price of a product by analyzing the lowest and the highest prices that can be sold in the street marketers. They should not buy a product higher than the lowest price of it.

After the street marketers buy the fruits and vegetables (generally goods as they said), they bring the goods generally with the vans as in *Figure 4.1.2*.



Figure 4.1.2: An example of transportation vehicles of street marketers
(<http://m.arabam.com/>)

Some of these vehicles have close haulages; some of them have not as in the *Figure 4.1.2*. The open-haulage vans are closed with plastic awnings.

The carrying of the goods is a mathematical practice because the street marketer should know the optimum capacity of his van's haulage. If he takes more amounts of goods than the haulage capacity, the goods may spoil until arriving to the street market. If he takes fewer amounts of goods than the capacity of haulage, he makes loss of time and money when considered the gas spent.

The carrying goods are changing with seasons. The street marketer sometimes sells tomatoes and sometimes sells watermelons. While he considers what he sells, he thinks about the capacity of his haulage, the resistance of the goods and the amount of goods that can be squeezed into the haulage without any crushes.

If the goods are bought by really low prices and this is a chance hard to catch, the street marketer may bring the goods in two times. The street marketer has to compare the amount of spent gasoline and the bigness of caught chance.

The example that was given by the Kiwi was the price of strawberries. One day, he and his father bought strawberries with 50 Kr of one kilogram. He said that the strawberries were good and this was profitable purchase. When I asked the reason, he said that "Because, at the end of the day, the strawberry could be still sold at least 1 TL (100 Kr). It means that, at the end of the day, we still earned 50 Kr per kilogram. So we bought haulage of strawberries." I asked why they did not buy more strawberries. He said that "We would have to go one more time to the city street market. We would miss the customers in the street market if we were late. Furthermore, the city market is far away from our street market. The gasoline prices are high. Going again to the street market to buy strawberries was meaningless."

4.1.1.2 To arrange the tables to the spot. After arriving to the street market, the street marketers should immediately arrange the tables. This is because of two reasons. The first reason is not to let the goods crush or spoil, the second reason is to be ready to sell for customers as soon as possible.

The tables contain the boxes of goods and a plate as in *Figure 4.1.3*.



Figure 4.1.3: An example of a table in the street market

These tables are generally covered by an awning as in *Figure 4.1.4*, so the street marketers have a close space under the table that they can put their own materials.



Figure 4.1.4: An example of a table in the street market covered by an awning.

These tables are built by the laws of the balance and the centre of gravity. I and my street marketer participants have some exercises of building table by drawings. I have asked them “what if” questions about the building tables as below.

Me: How do you arrange the tables and the goods?

The Pineapple: It is a routine; we put the boxes under the plate. That is all.

The Kiwi: Yes ma’am! There is nothing extra.

Me: Ok then, you said that I should the boxes under the table. So, may I put them like these? (*Figure 4.1.5*)

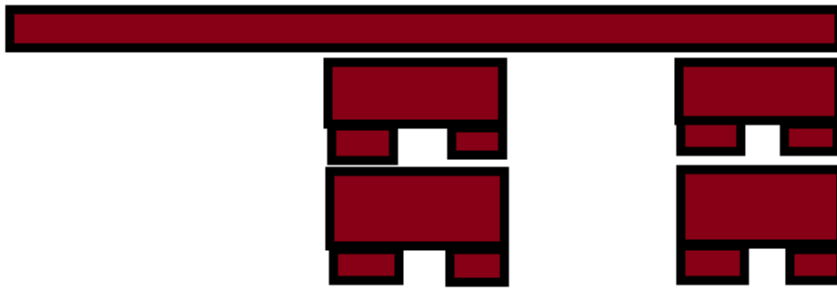


Figure 4.1.5: Drawing of an assumption (1) of designing a street market table

The Pineapple: No, no, you cannot put them that way. They collapse.

Me: What if I put them like that? (*Figure 4.1.6*)

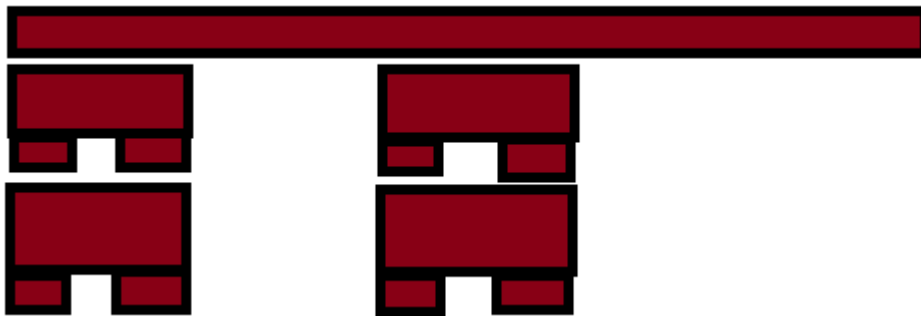


Figure 4.1.6: Drawing of an assumption (2) of designing a street market table

The Pineapple: Again it is the same thing. If you them this way, it collapses.

The Kiwi: If you ma'am want to put them like this, you should put the goods here. (*Figure 4.1.7*)

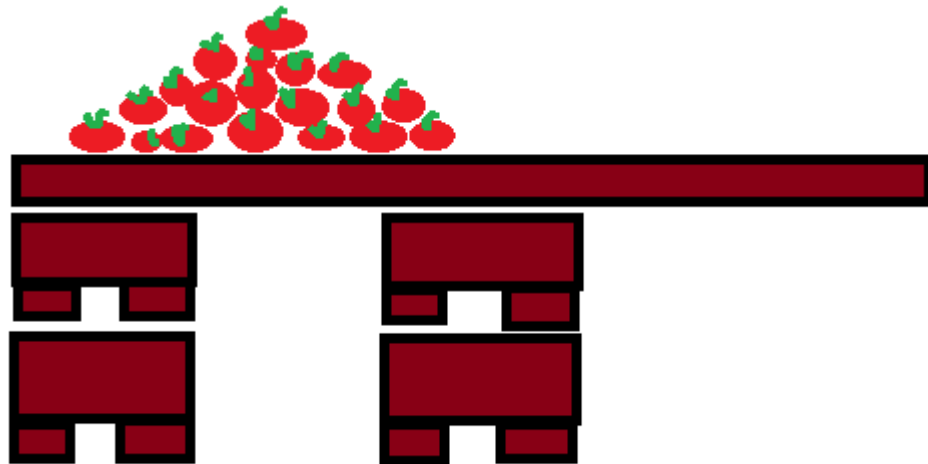


Figure 4.1.7: Drawing of an assumption (3) of designing a street market table

The Kiwi: But ma'am the rest of the table would be wasted. Ma'am, you cannot use the half of table ma'am. If you ma'am want to use it in this way, may be you can put the heavier goods such as watermelons between the boxes ma'am, the slighter ones such as strawberries to the empty side. (*Figure 4.1.8*)

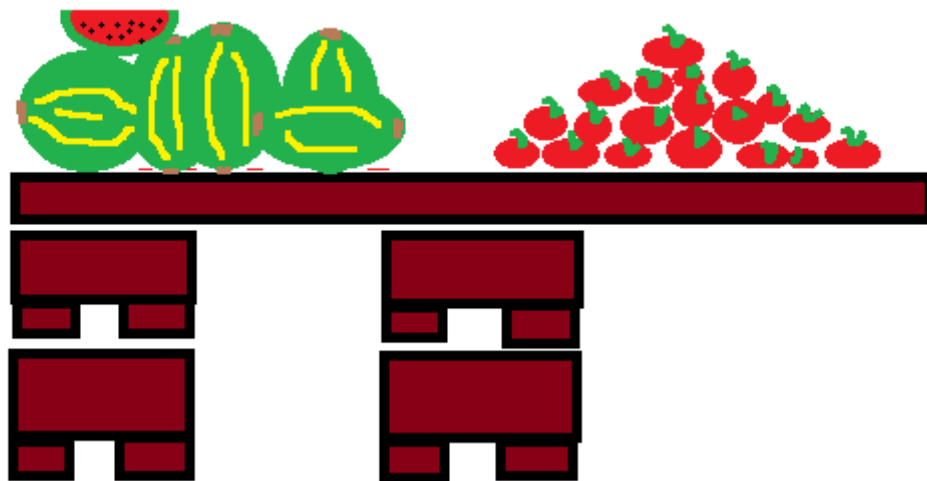


Figure 4.1.8: Drawing of an assumption (4) of designing a street market table

The Pineapple: Yes, ma'am. The Kiwi is right. But, if we put the boxes as this (*Figure 4.1.9*), we can have the maximum space to put the goods.

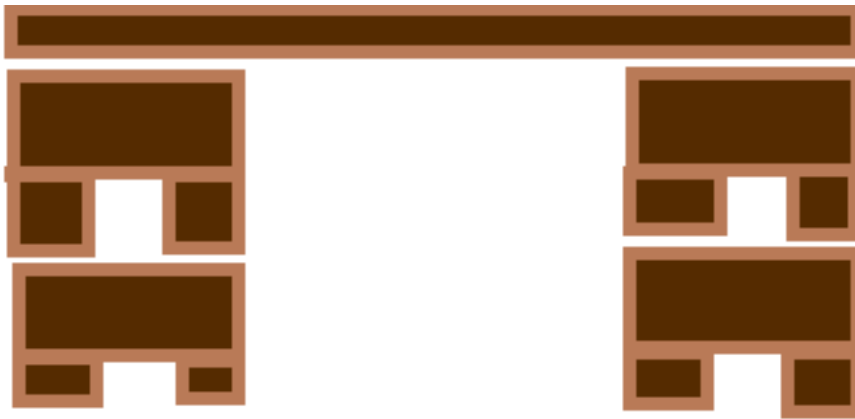


Figure 4.1.9: Drawing of an assumption (5) of designing a street market table

The Pineapple: But we do not use only one table in our place. We use the boxes and plates as this (*Figure 4.1.10*). And thus, we need fewer boxes to build a table.

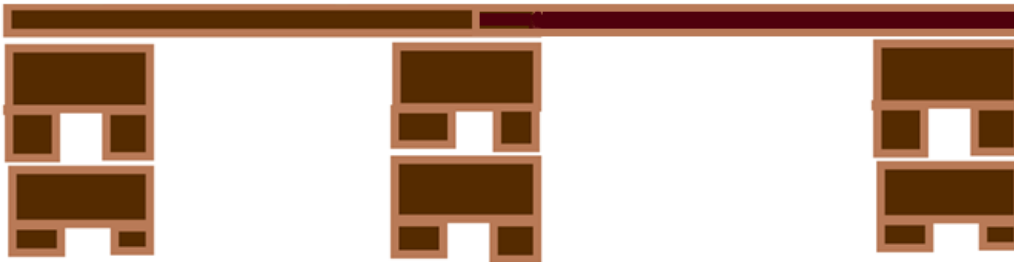


Figure 4.1.10: Drawing of an assumption (6) of designing a street market table

As it is seen in the above conservations, to build tables and to arrange goods on them need mathematical reasoning. The participants can imagine the alternative ways of designing tables without experiencing in the real world. They can imagine that the tables collapse under what conditions and the tables can endure under what conditions. These are the mathematical experiences that the participants faced with in their workplaces.

4.1.1.3 To place the goods to the tables. Another mathematical practice in the street markets is arranging the goods on the tables. The important thing that should be considered during arranging the goods is the resistance of the goods.

The street marketer should place the vegetables and fruits with respect to their endurance. For example, one cannot simply place a watermelon on a box of strawberries. This seems like a basic logic. But when the similar goods are considered, there are other parameters like how they should be ordered to make them look fresher for customers, how the spoiled goods are sold to the customers without showing them, how the harvest day of a product can be understood, how the stale fruits and vegetables should be aligned not to spoil the other fresh goods, etc. All these are related with the mathematical reasoning in the street markets.

The Pineapple gave a trick as example about placing goods which is common in the street-marketers. The goods that are not fresh any more (for example the goods that were not sold the day before) are hidden behind of the fresh goods. During the sale, the street marketers do not let the customer choose the goods by themselves. The street-marketers choose the goods and weigh them for customers. So, the street-marketers could sell the goods that are not fresh, even the spoiled goods. There is an important thing that the street-marketer should know when the spoiled goods should be sold and when they should be thrown out. If the fuzzi notices this trick, the street-marketer might be punished by the fuzzi, and he may lose more money that he earned with this trick. Furthermore, even the fuzzi did not notice this; the customers may not come again. Gradually, that street-marketer could not sell any goods in that street market because of his infamy. Another issue about this trick is that the spoiled goods may spoil the fresh goods, and the street-marketer might have to throw out all of the goods while he tries to make more profit. The street-marketers do these profit-loss calculations, and try to find optimum solution that makes the maximum profit.

4.1.1.4 To measure of the weight. Although some of the goods are sold by rice of piece such as watermelons, melons, cabbages; the majority of the goods are

sold in terms of kilogram price. These goods are put in a plastic bag. They are weighed by the street marketer with help of an electronic weighing scale (*Figure 4.1.11*).



Figure 4.1.11: A picture of an electronic weighing scale used in a street market
(<http://www.tuketiciler.com.tr>)

The street marketers used to use two-pan balance scales (*see Figure 4.1.12*) where they had to do more calculations compared to the modern electronic weighing scales. The electronic weighing scales can give the weight and the exact prices of the goods. Therefore, the only mathematical practice about weighing is adding and subtracting the goods to the plastic bags.



Figure 4.1.12: A picture of a two-pan scale widely used in street markets
(<http://www.kuleliterazi.com/>)

The customer comes and says how many kilograms of which goods s/he wants. The street marketer fills the plastic bag by rule of thumb. Then, he puts the plastic bag on the electronic weighing scale. If the weight of the bag is fewer than the wanted amount, he adds more goods into the bag. If the weight of the bag is more than the wanted amount, he takes back some of the goods from the bag until it weighs the desired amount. The mathematical practice here is this mathematical estimation process.

Sometimes, weighing the goods may needs more complicated mathematical skills. The Kiwi gave an example. One of the most annoying things for him during the sale in the street market is to be asked to cut the stalks of the bananas while weighing. The customers recommend that because the stalks of the bananas were heavy and they affect the price. The Kiwi said that “If we cut the stalks, the bananas spoils too fast. The rest of bananas without stalks cannot be sold because they become black immediately, and the customers do not want to buy black bananas. We have to think about which one is more important for us: Cutting the stalks to make customer happy or not cutting the stalks and saving the rest of bananas. The pleasure of customers is important because they might be our regular customers, so we might earn money more. That is because regular customers may bring more customers. On the other hand, if we cut the stalks, we lose money because of spoilt bananas. The other issue about cutting the stalks is that we buy the bananas with their stalks from the city markets. In the city street market, the sellers weigh the bananas with stalks. Why do the customers want us to cut the stalks that we paid?”

It can be seen from this example that even the stalks might be the problematic issue with different perspectives. The street marketers try to solve this problem with an optimum solution which provides the maximum profit. The street marketers obviously need to have mathematical reasoning to get this solution.

4.1.1.5 To calculate money and to give change. The money-change process is the most mathematical computational process in the street markets. The participants of this present study replied the question of “Do you do any mathematics in the street markets?” as;

“Yes, of course, we do money calculations in the street markets. We use always addition and subtraction.”

Actually, until we discussed their workplace mathematics, they had agreed with the idea that the only mathematics in their workplace was money-change calculations.

I have observed the money-change calculations of the participants in their workplaces. I have also done simulation of a shopping in the street market during the semi-structured interviews. The participants are familiar with these calculations in their workplaces. They can do these calculations rapidly.

For example, there are two conversations from my mathematic courses between me and the Student the Grape below:

Me: Could you please subtract one point five from ten, the Grape?

The Grape: Hmm, I don't know ma'am. Is it seven point seventy five?

Me: OK, could you please subtract one and half from ten, the Grape?

The Grape: This is the same, seven point seventy five.

Me: OK, now, could you please subtract one and half TL from ten TL?

The Grape: 10 TL... One and half TL... Is it eight and half TL?

(Another lesson)

Me: What is the answer of 20 minus 18.5?

The Grape: One and half TL

Me: TL? But, I did not talk about the money?

The Grape: Hmm, sorry ma'am.

Me: No, your answer is correct. Could you say me what is the answer of 6 minus 2.5?

The Grape: 3.5 TL

Another Student: The teacher says it is not money!

The Grape: I am sorry ma'am, I cannot calculate without money.

These examples give clues about the way of thinking of the Grape during subtraction. If he thinks that he calculates money, he can do the basic subtractions. However, if he thinks that he is doing mathematics, he cannot give the correct answer and he seems like he is nervous and restless. This is not only true for the Grape; the other students also seem as the Grape while doing mathematical calculations.

There are many computational practices in the street markets. All of these are mathematical practices. To make the mathematical computations easy, the street marketers find a solution. They round the money.

For example, when I ask the Student Orange to give me one and half kilogram of strawberries which cost 3 TL per kilogram, he asked me that "Can I make it 5 TL?". Since he did not want to struggle with change calculation, he wanted to round the amount of strawberries to 5 TL-package which was more than one and half kilogram.

4.1.1.6 To calculate the benefits and losses of the day. At the end of the day, the street marketers calculate the money that they earn. This money is shared between the street marketers and the apprentices. There are some procedures to partition of the money.

Firstly the benefit of the day is calculated. The benefit of the day equals to the total money that earned in that day minus the price of the goods that is paid in that morning in the city street market.

If all of the goods could not be sold, there are other parameters to calculate the benefit. How much goods have been left? How many days can the left goods resist in the haulage? How many days can the left goods resist in the ice house/cold room? How much money should be paid to the store house / cold room / ice house? Costs of all these parameters are considered and subtracted from the daily earnings before the money is shared by the street marketers in the same plot.

I did not hear loss at the end of the day from the participants. Sometimes they get more benefit, and sometimes they get less benefit. Therefore, the benefit division is absolutely done in all working nights.

All these benefit calculations and handling with the left goods are mathematical practices in the street markets. They all need to be done by the street marketers by using mathematical computations.

To sum up, generally, it can be said that the street markets have several mathematical practices throughout the process of street-marketing as it is described above. The participants and all street marketers face with these mathematical practices and they have own ways to do mathematics in their workplaces.

4.1.2 The bakery shop. There is concept map which is prepared by the help of codes that are gathered from the observations and semi-structured interviews in *Figure 4.1.13*.

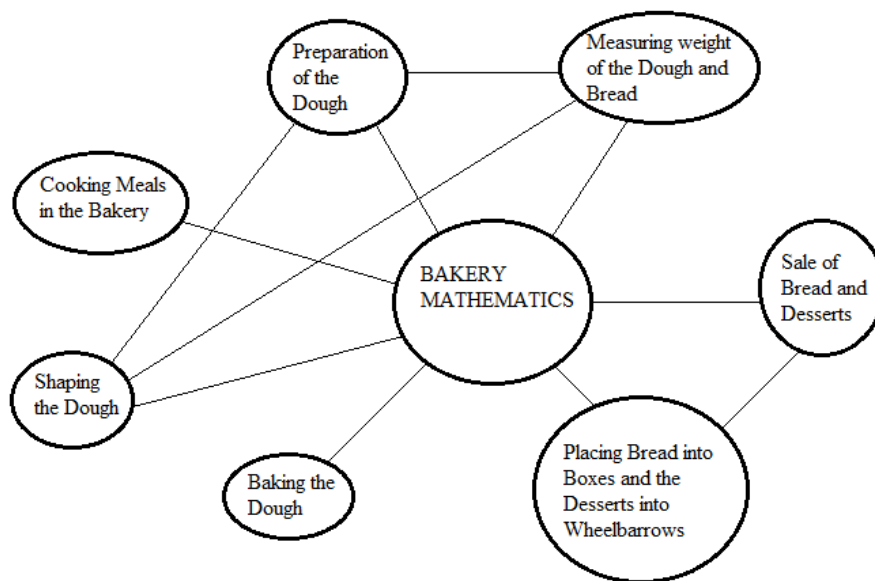


Figure 4.1.13: Concept map of bakery mathematics practices and their relations

The relations which are shown in the Figure 4.1.13 are explained with examples below.

4.1.2.1 To prepare the dough. The little bakers' first mathematical experiences in the bakery shop are the experiences with the dough. Dough is the combination of specific measures of water, flour, ferment, salt or sugar, sometimes vanillin, cocoa or spices. All the measures are important to make perfect dough, and then perfect breads, cakes or other baked foods. If the water is added too much, the dough will be too soft to give a shape. If the water is added too less, the dough will not be put together.

The family of Sugar prepares the dough in their kitchen. Although his mother said that she prepares the dough by the rule of thumb, I have observed that they use approximately 5 kg flour, 10 packages of dry ferment, 5 L oil, 7 L water and 5 kg sugar. Preparing the dough for sweet fried dough is not only bringing the materials together. There is also a process to wait for fermenting. This waiting time is important to get well-fermented dough. The better fermented dough, the tastier fried dough desserts. The Sugar's family gets up early and prepared dough. The fermentation takes 30 minutes. While the dough is fermenting, the Sugar and his

father have breakfast. Then, the frying process begins. All these preparing dough ratios and fermentation process needs mathematics such as measuring volume, measuring weight, ratios, counting, measuring time etc.

4.1.2.2 To weigh of the dough and bread. During preparing the bread, the weight of them is really important because the government determine the weight and price of bread for different cities. Some bakers make special breads which are more expensive than the usual breads, but these are not general. In Table 4.1.1, there some bread price-weight regulations of the government for some cities (Turkey Bakers Federation, 2015).

Table 4.1.1: The Price-Weight of Bread of Some Cities In Turkey (Turkey Bakers Federation, 2015)

City	Gram	Price	Price of one kilogram	Decision Date
ADANA	250	0,90 TL	3,60 TL	20.09.2013
ADYAMAN	250	0,80 TL	3.20 TL	07.07.2014
AFYON	250	0,70 TL	2,80 TL	2013
AĞRI	250	0,90 TL	3.60 TL	20.11.2014
AKSARAY	250	0,80 TL	3.20 TL	30.04.2014
AMASYA	250	0,75 TL	3.00 TL	20.06.2014
ANKARA	250	1,00 TL	4,00 TL	31.01.2014
ANTALYA	250	1,00 TL	4,00 TL	02.01.2014

To get a desired weight of bread, a baker should consider the weight of dough and the weight of it after baked. Since the dough losses weight while baking and the government have strict rules about the price of breads, bakers should be careful about the weight of dough.

Weighing the dough is not the job of the apprentices; in general, the experienced bakers do it without using a weighing scale. They can measure it by using their hand. The apprentices just observe while their experts measure the dough.

The family of Sugar does not weigh the dough because the fried dough desserts are sold as pieces. Although the breads are also sold as pieces, the weight of breads is important since the bread is basic need for the people. Therefore, the government regulates the weight/price ratio of bread. On the other hand, since the fried sweet dough is not a basic need, the government only regards the health issues during the controls. The family of Sugar uses a metal creamer to prepare standardized weigh of fried dough desserts. They use spoons to fill the metal creamer. Each fried dough desserts is approximately made by three spoons of dough. Therefore, the mathematics is also needed to weigh the dough and breads to standardize them.

4.1.2.3 To shape the dough. The bread is generally shapes as in the Figure 4.1.14. The boxes are designed to take these shapes of bread. If some of them bigger or smaller than the usual shapes, the boxes cannot be filled appropriately. The customers also do not want to buy weird shape of bread. That is why the shaping bread is important.



Figure 4.1.14: Various shapes of breads produced in Turkish bakeries

The dough is generally shaped by the experienced bakers. The apprentices help to the experienced baker while shaping the dough. Since the weight of the dough is determined, while shaping the dough, this determined piece of dough is used. The piece of dough is sometimes divided into seven pieces to make daisy shaped bread, sometimes it is shaped elliptically, or sometimes it is rounded to make circular shaped bread.

The shape of the fried dough desserts is circular as in *Figure 4.1.15*. As it is mentioned, the fried dough desserts are made by the help of a metal creamer. Some sellers shape the fried dough desserts as little balls with approximately 1 cm radiuses. However, the shapes of these desserts are generally circles.



Figure 4.1.15: The Fried Dough Desserts

Finally, it can be concluded that the shaping process includes many mathematical practices such as using geometrical shapes knowledge, sense of the ratio, measuring weight and sense of comparison of the size, etc.

4.1.2.4 To bake of the dough. Baking of the bread is a vulnerable process. The oven should be heated firstly and the desirable temperature should be constant throughout the baking process. If the temperature changes while baking, the dough will not rise enough.

The passing time while the dough is baked is important, because the bread may half-baked or burnt if the time is not determined well.

The fried dough desserts are fried by 5-7 minutes. After frying them, the bakers leave the dessert into the hot sugar-water mix for 5 minutes. These amounts of times are important to make delicious fried dough desserts. Baking process needs time measuring. That means mathematics is also included in the baking dough process.

4.1.2.5 To place bread in boxes. After baking process, the bread should be waited enough time at outside to become cooler. That is because the bread tastes as unbaked dough if the hot bread place in box without waiting them to get cooler.

The apprentices place the loaves to the boxes without squeezing them. Each box has capacity. If the apprentices pass this capacity, the shapes of loaves ruin. If the loaves are placed under capacity, the boxes are wasted and the place in the van is wasted.

At the fried dough selling process, there is no box to fill desserts. However, the capacity of the wheelbarrow is limited. Although it can contain 500 fried dough desserts, the bakers do not put more than 300 fried dough desserts. The reason of this is explained by the Sugar as “the desserts would be dough”. He meant that the desserts may lose their crispiness because of the humidity. Thus, the bakers may lose money while they try to make more profit because the customers want to

buy crispy and fresh desserts. They should fix the amount of desserts to an optimum number to make maximum profit.

4.1.2.6 To sell the bread and desserts. The selling process of bread includes transportation, delivery to the markets and money calculations.

The placed loaves are carried to the van of the bakery by apprentices. As many boxes as possible should be loaded to the van. That is because the gasoline prices are high and as fewer numbers of trips as possible should be done by the van not to waste gasoline.

The van goes to the markets that are compromised before. These markets are generally in the same neighborhood with the bakery shop. The number of loaves that are bought by the markets is determined before. The driver of the van and the apprentices leave the determined number of boxes in front of the markets. The money is monthly paid by the marketers to the bakers. Customers buy the loaves from the markets.

Some customers who are generally owners of cafes, restaurants or canteens may buy the loaves with the same way of the marketers. Generally the retail sale is not done by the bakers.

The fried dough desserts are sold in wheelbarrow by the family of Sugar. The price of one fried dough dessert is 1 TL (=100 Kr). The sugar told that he can easily make the money calculations mentally. I asked him a lot of questions about the money calculations as below:

Me: “If I wanted one fried dough dessert, and I gave you 5 TL, what would you do?”

The Sugar: “I would give you 4 TL back and give you one dessert.”

Me: “If I wanted two fried dough desserts, and I gave you 5 TL, what would you do?”

The Sugar: "I would give you 3 TL back and give you two desserts."

Me: "If I wanted 27 fried dough desserts, and I gave you 50 TL, what would you do?"

The Sugar: "Hmm, I do not know. I gave you 17 TL back, I guess."

Me: "Why did you struggle with this question?"

The Sugar: "I did not meet anybody who wants 27 fried dough desserts, and people do not give us 50 TL. They generally give the coins."

It can be seen that the Sugar could easily do the calculations that he experienced similar calculations before. Money calculations are the most faced mathematics in the bakery workplaces.

4.1.2.7 To cook the meals. Besides making bread, the majority of the bakers cook the meals that are prepared by the customers. Turkish people prefer the tastes of food which is cooked in the bakery instead of the cooked in the kitchen with gas range. In the bakery, the meal smells as barbeque and cooks better. Therefore, generally the housewives prepare the meal and call the bakery. The baker sends the apprentices to that house. The housewives give the meal to the apprentices and the apprentices bring the meals to the bakery. After baking the meal, the apprentices take the meal to the houses and get the money. Sometimes the apprentices are given tips.

Cooking meals prices change city to city, even bakery to bakery. There is no regulation about this. There is also no bills or legal document about this.

Finally, it can be said that the bakers have lots of mathematical practices throughout the process of baking as I have tried to explain above. The bakers and the apprentices of these bakers face with these mathematical practices and they have own ways to do mathematics in their workplaces.

4.1.3 The Barber Shop. There is concept map which is prepared by the help of codes that are gathered from the observations and semi-structured interviews in *Figure 4.1.16*.

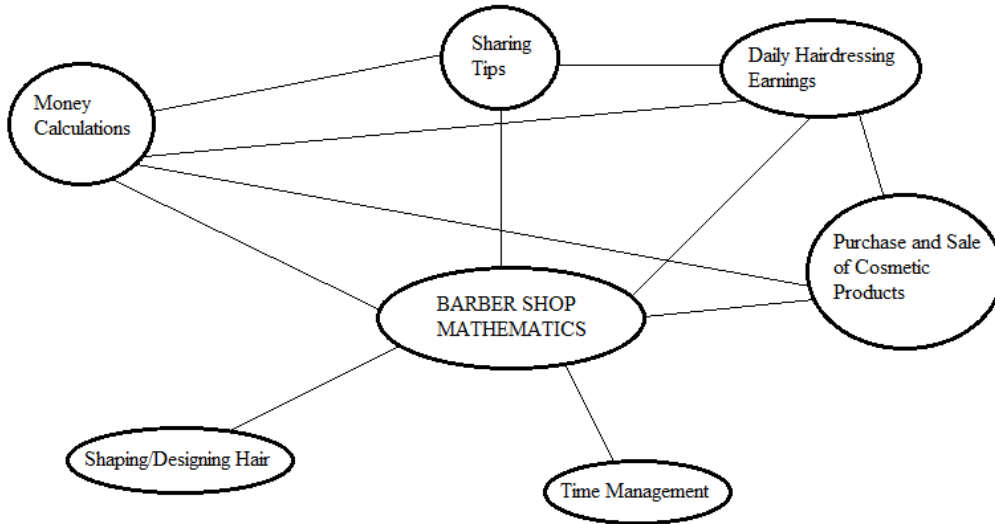


Figure 4.1.16: Concept map of barber shop mathematics practices and their relations

The relations which are shown in the *Figure 4.1.16* are explained with examples below.

4.1.3.1 To make money calculations. The little barbers' initial mathematical practices and the experiences that are related with computational abilities are the money calculations. They calculate the paid money, the change, and the tips. Sometimes they have to share the tips with other apprentices with respect to the number of customers whom the apprentices are cared.

The Scissors and the comb are working as apprentices in the barber shops. They generally work with other apprentices. Their only earnings are the tips given by the customers. If the customers give the tip when there is only one apprentice in the barbershop, the tips are not shared. However, if there is more than one apprentice in the barbershop, the tips are shared between them equally.

The money calculations in the barbershop are not only sharing tips. The customers should pay for hair cut approximately 10 TL. The price of hair and

mustache cut is 15 TL together. The price of hair cut of groom is approximately 50 TL. These prices can change. The Scissors said that “There was a man with really messy and long hair. We washed his hair, beard and mustache. Then, we cut his hair and facial hair. This process took long time. So, we wanted him to pay 20 TL.” I have asked him the reason of price increasing. He said that “To shave him took long time. The other customers waited him. We deserved that money.” I asked how they decide the amount of rise of prices. He said that it depended on the amount time to shave, the length of the hair and facial hair, the tidiness and hygiene of the hair etc. There is no special ratio for that but the Scissors and the Comb said that they did not meet any customer who rejects to pay the price determined by the barber.

The other money related practices in the barber shops are the purchase of the cosmetic products. Some of the big cosmetic firms distribute the samples of products to the barbershops. The barbers may purchase those products after using those sample products. They may use them for their customers (hair cream, shampoo, facial massage cream etc.). They may also sell these products to their customers and earn money from these sales with permission of the cosmetic firms.

For example, the Scissors’ barber shop sells natural shampoo for fast hair growing. The Shampoo is 8 TL, but the barber shop sells this 9 TL. Therefore, they can earn 1 TL from the sale of each box of shampoo. The Scissors and the Comb agree about that bulk purchases are cheaper for the barber shops; therefore, their shops are taken this way with certain periods. This period may change with respect to the product and the season (wedding seasons are crowd).

4.1.3.2 To cut hair as desired shape. The little barbers generally do not have permission to do haircut. The masters do the haircuts generally and the apprentices watch. Although they do not do haircuts, they need to learn the haircuts styles. That is because one day they have to do haircut by themselves.

The haircut styles include lots of geometrical shapes, especially different kinds of triangles. Sometimes the customers want to buzz cut their hair as fractal

shapes. The barber should estimate and measure carefully to make a good and exactly desired shape.

The real difficulty here is the exact opposite difficulty of the drawing map of the Earth. The shape of the Earth is three-dimensional sphere and map is two-dimensional paper. That is why all the details cannot be transferred with perfect scale. The haircuts is exactly opposite of this. The customers come with a shape on a paper and want this shape on their head. Since the customers cannot imagine that shape on their head, they may not be happy after the shaving.

4.1.3.3 To manage time. The apprentice barber should be careful about time management because the apprentices are assigned to care with the customers and tidiness of the barbershop. The barbershop should be clean and tidy always. The apprentices also should welcome all customers nicely. To do this, the apprentices need to manage time carefully.

The managing time is not mentioned specifically in the other workplaces mathematical practices. The apprentice street-marketers may sell the fruits and vegetables and the apprentice bakers may sell the breads or desserts even they are middle school students. However, the apprentice barbers cannot cut hair or facial hair by themselves. They are usually observers about shaving because customers may not feel themselves relax while a child holds a razor blade behind them. The customers may not let the apprentice to shape their hair. That is why the apprentices of barbers are generally assigned with caring customers and tidiness the barber shop. These assignments are directly related with time management. After one customer went out, his hair should be removed immediately while the other customer is welcomed. They need to calculate the time and watch for the clock all the time.

To summarize, it can be said that the barbers have several mathematical practices in their workplaces and they use their computational skills throughout their work day. They develop their own ways to solve these mathematical problems in their workplaces.

4.2 The Views of the Middle School Students Working as Street-marketers, Bakers and Barbers about How the Formal School-taught Mathematics is Related to Their Workplace Mathematics:

The views of the participants about the relation of the formal school-taught mathematics and their workplace mathematics are analyzed separately with respect to their workplaces by the help of semi-structured interviews.

4.2.1 The street-marketers. The street-marketers (the Pineapple, the Grape, the Orange and the Kiwi) love both the formal school-taught mathematics and the street-market mathematics. The Grape loves formal school-taught mathematics more than street-market mathematics, and the Orange loves street-market mathematics more than the formal school-taught mathematics. The Pineapple and the Kiwi love both of them at same level.

All of the participants think that the formal school-taught mathematics and the street-market mathematics have common points such as addition, subtraction etc. The Kiwi and the Pineapple think that the common points of those mathematics were in the primary school. They could use the formal school-taught mathematics in their workplaces and the workplace mathematics in the school. The Pineapple had an experience about how workplace mathematics helped him for the school exam in primary school: *"When I was fourth grader, I had a mathematics exam. I could not study but I had ninety or ninety five points out of one hundred from that exam. That was because the questions were about the benefits-loss-debt and I knew these from the street markets."*

According to the participants, the middle school-taught mathematics is useless for the workplace. The Pineapple has a comment about the middle school-taught mathematics that: *"We use in street markets the primary school level mathematics; we do not use the middle school-taught mathematics. If we use all the things in the middle school-taught mathematics in the street markets, the customers cannot understand us for example the fractions, decimal numbers etc. Besides that,*

these subjects are confusing. We can make the calculations from our mind at the workplace thanks to middle school-taught mathematics"

The participants claim that if there were more money-related problems in the mathematics courses, they would learn mathematics easily in the classroom and school-taught mathematics would help the workplace mathematics. The Grape supports this with his comment: *"I can solve the mathematical problems about money and street-markets easily, but I cannot solve the mathematical problems about other things. I do not know the reason. Maybe I am excited in the courses, or I am used to the street-market problems."*

The participants are asked that if they had never been in school and they were uneducated how their workplace mathematics would affect. The Pineapple answered that *"A man who does not have any education cannot do mathematics as an educated man in the street market. There was an illiterate man in the street market, he did wrong calculations and we took wrong number of boxes. If he was educated, that would not happen."* On the other hand, the Kiwi said that: *"My father graduated from primary school, I am a seventh graders. We both do the same mistakes in the street-market. This two-year difference may not teach anything extra to me for the street-market. My father can calculate well. The calculation may not be taught by someone. It may be gift. Doing calculations does not depend on the age but experience. An old man may not calculate well, but an experienced man may calculate well."* Although it seems that there are two different views about the effect of school-taught mathematics on the workplace mathematics, the participants generally accept that besides experiences, especially primary school-taught mathematics is necessary for the street-market mathematics.

When it is asked to the participants that if they charged to build an education and training program by the Ministry of National Education for a school that only raise the street-marketers, what they would do, the Pineapple answered that: *" I would teach the students four operations, how to design the goods, and money calculations."* The Grape and the Orange answered that: *"We would teach the*

students the same mathematics as in our mathematics courses but with more practical chances and in more enjoyable way. We would start to the courses with addition, subtraction and purchasing goods." The Kiwi answered that: *"I would teach the students the addition, subtraction and some calculations."* It can be concluded that besides four mathematical operations, they would teach mathematics to the students by using real street-market practices.

4.2.2 The barbers. The Scissors and the Comb love both the formal school-taught mathematics and the barber shop mathematics. While the scissors think that the school-taught mathematics is more difficult than the workplace mathematics, the Comb thinks that the formal-school taught mathematics and the barber shop mathematics are totally same because they both have addition, subtraction and some calculations.

The Scissors and the Comb think that formal school-taught mathematics help the workplace mathematics. The Comb said in the interview that: *" I learn in the school, I apply in the workplace"*. According to Scissors, the four operations which are learnt in the school are useful for the workplace. Besides four operations, he explained the contributions of school-taught mathematics to the barber shop mathematics as:

"We use school-taught mathematics in the workplace. For example, the additions with the integers are related with the length of hair or diving swimming pool. We use the measurements of liquids while the measuring with glasses because one glass is 250 ml. For example, we have a hair style about the polygons as triangle Italian. The school-taught mathematics is related with the barber mathematics because sometimes the problems in the tests may confront in the workplace. We learn mathematics in the school; we use this mathematics at the outside."

Both of the participants claim that workplace mathematics does not help to the formal school-taught mathematics. The Scissors added here an exception that: *"Sometimes, I learn in the workplace and I can solve the problems in the school. For*

example, I have learnt the subtraction in the barber shop; I used this in the school. This generally happened in the primary school."

According to the Comb, an uneducated man cannot be successful at the barber shop because addition, subtraction, multiplication and division are needed in the barber shop. He added that: "*If he cannot do these operations, he cannot work in the barber shop*".

When it is asked to the participants that if they charged to build an education and training program by the Ministry of National Education for a school that only raise barbers, what they would do, they answered that they would teach the four operations. The comb added that: "*I would teach the students how much money should be in the safe, money calculations, integers, rational numbers, patterns etc.*"

4.2.3 The bakers. The Salt and the Sugar love both the formal school-taught mathematics and the workplace mathematics; however, the Sugar feels himself more successful at his workplace mathematics, and the Salt feels himself more successful at school-taught mathematics.

The Sugar believes that the school-taught mathematics is helpful and necessary for the workplace mathematics, and sometimes workplace mathematics may also be helpful in the classroom. He explained that: "*The school-taught mathematics is important for the workplace because we learn in the school divisions and multiplications. A person who does not attend to school cannot successful at the workplace because if you do not go to school, you cannot do mathematics. The workplace mathematics sometimes helps in the school. There are some problems that I could solve in the mathematics courses because I have met those questions in the workplace.*" On the other hand, according to the Salt, the workplace mathematics and the formal school-taught mathematics are totally different. They cannot be helpful for each other. He added that: "*If they were same, it would be helpful for both school and workplace*". After a few minutes, the Salt wanted to add an exception to his idea that: "*There are only few cases related with mathematics in the*

bakery shop such as money calculations, the number of bread in the box or buying goods, etc."

When it is asked to the participants that if they charged to build an education and training program by the Ministry of National Education for a school that only raise bakers, what they would do, the Sugar answered that: *"I would teach the students firstly calculations and then how they would be vigilant."* The Salt answered that: *"I do not know what I should teach to the students. I could not prepare an education and training program."* Therefore, it seems that the barber participants do not have very common views about relation of the formal school-taught mathematics and the bakery shop mathematics.

4.3 Discovering to What Extend the Real Life Problems in the Mathematics Textbooks are Related to the Real Lives of Middle School Students Working as Street-marketers, Bakers and Barbers According to Those Students' Views:

The semi-structured interviews were conducted to discover the views of the participants about to what extend the real life problems in the textbook are related to their real lives as street-marketers, barbers and bakers.

The most optimist views came from the barbers. The Scissors and the Comb are agree with that there are lots of problems in their textbooks that can be related with their lives. The Scissors said that: *"Our textbook is related with our real lives. There are lots of problems and issues in our textbooks that can be related with our real lives."*, and the Comb said that : *"I have met the real life problems in our textbook in my life. More than half of the textbook problems can be seen in my real life. The textbook problems are similar to my life problems."*

The most pessimist views came from the bakers. While the Sugar claimed that: *"There are only a few problems in our textbooks that are related with our real lives"*, the Salt said that: *"I have never faced with any of the problems in our textbooks in my real life."*

The street-marketers have different answers about their textbooks refer to their lives or not. The Pineapple and the Orange think that there are a few problems in their textbooks about their real lives. The Pineapple gave an explanation as: *“There are a few problems in our textbook about real life for example the problems with apples, pears, street markets, benefits, loss, debts etc. But we do not use the terms decimals, fractions, negatives etc.”* The Grape thinks that there are no problems in their textbook that he met in his real life before, but he added: *“Only once, when I was second grader, I saw a problem in textbook that I had faced with in real life.”* The view of the Kiwi is the similar to the view of the Grape. He could not remember whether there are real life problems in their textbook or not; however, he said that: *“There were real life problems in our textbook that I met in my real lives when I was in primary school.”*

If the views of participants are concluded, it can be claimed that the mathematics textbooks that are used in the mathematics courses generally do not refer to the real lives of the participants except a few problems.

4.4 The Performances of the Middle School Level Street-marketers, Bakers and Barbers in Solving Mathematical Problems and Doing Computations given in the Context of Their Workplaces:

The contextualized real life problem tests which are designed in street-market, bakery and barber shop contexts are conducted to the participants to understand how they perform in solving problems and doing computations given in the context of their workplaces. The scores of each participant which are calculated with respect to the rubric in Appendix L are given in Table 4.4.1. (see Appendix M for more detailed scores)

Table 4.4.1: The Scores Of Participants That They Got From Street-Market, Bakery And Barber Shop Tests

Participants	Street Market Test Scores	Bakery Test Scores	Barber Shop Test Scores
The Student Pineapple	110	89	82
The Student Grape	15	25	25
The Student Scissors	47	45	45
The Student Orange	35	41	33
The Student Sugar	7	15	10
The Student Salt	37	38	44
The Student Kiwi	54	69	71
The Student Comb	27	25	27

Note. All scores are out of 130

In the Table 4.4.1, the scores of the participants from contextualized workplace problem tests are given. For example, the score of the street market problems test of the Student Comb is 27, the score of bakery problems test of the Student Orange is 41, the score of barber shop problems test of the Student Salt is 44, etc.

With respect to Table 4.4.1, I have analyzed separately how participants respond other workplaces' questions by help of semi-structured interviews.

4.4.1 The Student Pineapple. The Pineapple is a street marketer. His score of the test with street market context is 110. His score of the test with bakery context

is 89 and his score of the test with barber shop context is 82. It is clear that his highest score is from the test with street market context.

During the interview, while we were discussing which workplace has more mathematics than others, he said that “Street markets have more mathematics than others because we weigh the fruits and vegetables and we calculate the money for different weights of goods.” If it is considered that, he loves mathematics and his grades are not bad at mathematics courses and he is familiar with the street market context, it can be understood that why his highest score is the score of the test with street-market context.

As an example in *Figure 4.4.1* it can be seen the answer The Pineapple to the first street market problem.

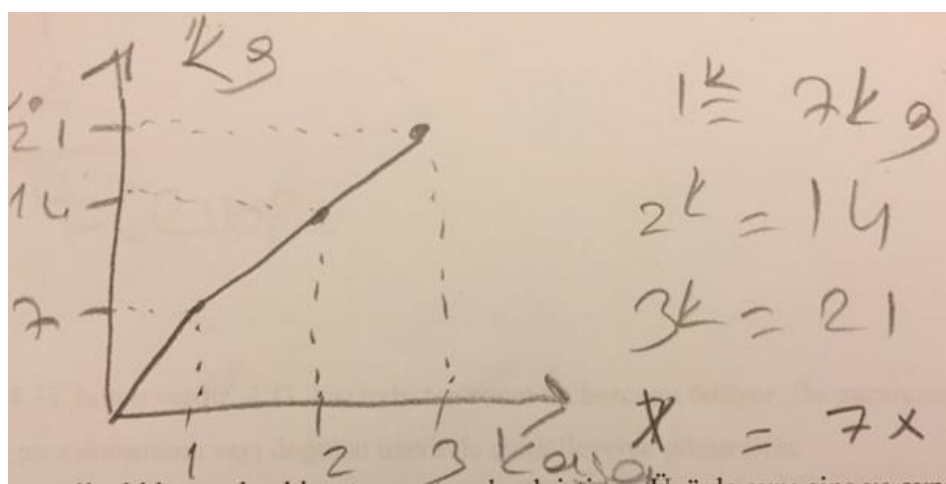


Figure 4.4.1: The Student Pineapple’s solution of the first street market problem

I and the other mathematics teacher gave this solution 10 point out of 10. He also explained clearly his solution in the interview. On the other hand, he could not get 10 points from the other tests’ 1st problems. (see *Figure 4.4.2* and *Figure 4.4.3*)

anlamadım, çünkü kutulardaki yumurta sayısı eksik...

Figure 4.4.2: The Student Pineapple’s solution of the first bakery problem (Turkish: “I did not understand because the number of eggs in the boxes is not given”)

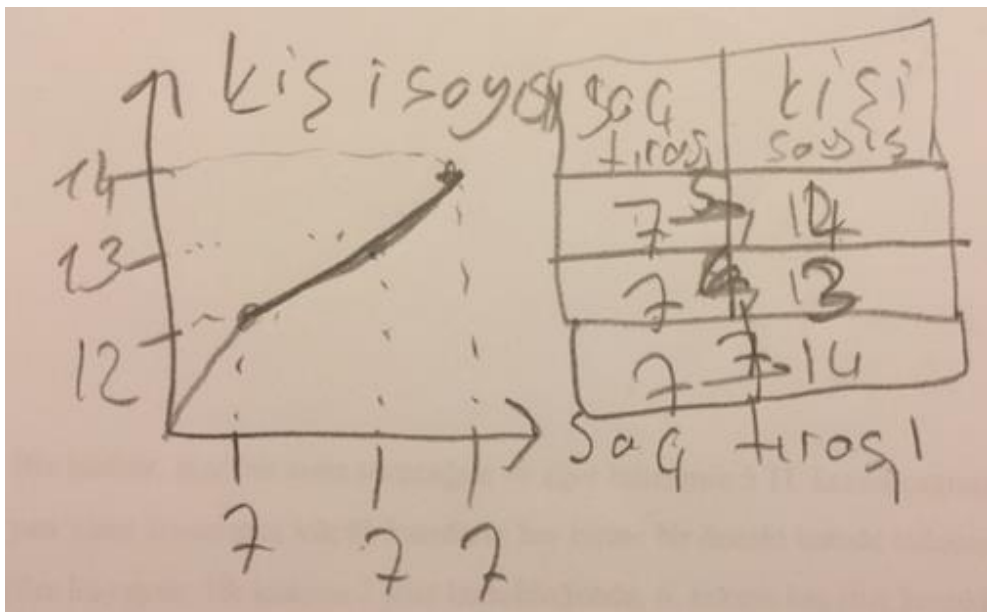


Figure 4.4.3: The Student Pineapple’s solution of the first barber shop problem (Turkish: “The x-axis is haircut, the y-axis is number of people”)

Although all of the problems in the tests have the same answers and same solution methods and the only difference is the context of them, The Pineapple could not answer the problems in bakery and barber shop contexts. He explained this in the interview as “I could not understand the question; I do not know what is meant in the problem.”

I showed him the three tests together and let him to compare the questions. He said “Ooo! These are the same questions! You just wrote haircut and eggs instead of bananas here.” And, he could solve the problems.

It is important that he could not solve the problem at first. After he compared the problems, he could solve by help of his solution in the street market test.

He said that the street market problems in the test are generally similar with the real situations. The Student Pineapple solved the other problems in the tests in similar ways. Except the first problem, he solved the other problems in similar ways. It can be concluded that his solution methods do not depend on whether he faces the problems or he does not. And thus, we cannot conclude that he respond different workplaces problems differently.

4.4.2 The Student Grape. The Student Grape is a street marketer. His grades from the tests of street market, bakery and barber shop are 15, 25, 25 respectively. These scores are not surprise for me because his grades are also low in the mathematics courses. However, there is a surprising thing here for me that the lowest score of those three tests is the test with street market.

He was the reason of starting this study because he inspired me before I started this study. Once, he could solve the problem with units of money in a street-market problem context although he could not solve the same problem with units of length in another context.

After these scores, I felt frustrated. I looked which problem he answered correctly in barber shop and bakery tests different from the street-market test. He solved the second problem (almost) correct in the bakery and barber shop tests. However, he could not answer correctly the similar problem in street market test (see *Figure 4.4.4, 4.4.5 and 4.4.6*).

15 TL 4'k kavun almış olur

Figure 4.4.4: The Student Grape's solution of the second street market problem
(Turkish: "She took 4 melons which are 15 TL each")

$$\begin{array}{r} 19 \\ 4 \\ \hline 75 \end{array}$$

$$\begin{array}{r} 15 \overline{) 15} \\ \underline{15} \\ 00 \end{array}$$

Figure 4.4.5: The Student Grape's solution of the second barber shop problem

$$\begin{array}{r} 19 \\ 4 \\ \hline 75 \end{array}$$

$$\begin{array}{r} 15 \overline{) 15} \\ \underline{15} \\ 00 \end{array}$$

Figure 4.4.6: The Student Grape's solution of the second bakery shop problem

In the *Figure 4.4.5* and *Figure 4.4.6*, although he divided 15 into 5 and found 5, he explained it in the interview that he meant to divide 3 instead of 5. He also checked his calculation by multiplying 3 and 5. That is why I gave 10 points (as it is correct) and the other mathematics teacher gave 8 points (since there is a little mistake). I took average of the scores and gave him 9 points out of 10.

The Grape said that mathematics is mostly needed in the street markets because of the same reasons of The Pineapple. However, I cannot make any inference from here to understand the reason of his mistake in the second street-market problem.

It seems that The Grape responded all the problems in similar way except the second problem. It can be concluded that there is no significant difference between the responding ways or solution methods of the problems in different workplace tests according to The Grape's solutions.

4.4.3 The Student Scissors. The Scissors is a barber. His grades from the tests of street market, bakery and barber shop are 47, 45 and 45 respectively. He also believes that mathematics is the mostly needed in the street markets although he is a barber.

His scores are really close to each other. There is no specific problem solution that is better in one of the tests. So, I could not give any example here.

It is clearly concluded that there is no significant difference between the responses of The Scissors in the tests with different workplace contents.

4.4.4 The Student Orange. The Orange who is a street-marketer got 35 points from the street market test, 41 points from the bakery test and 33 points from the barber shop test. Although he is a street-marketer, his highest score is not from the street market test. His scores, solution methods and answers are close to each other except the answers of 10th and 13th problems.

He could not get any points from the 10th and 13th problems in the street market problem test. He wrote "I could not understand the financial situation" for the 10th question and "I could not understand modeling" for 13th problem. However, in the barber shop and bakery tests, he solved the problems as in *Figure 4.4.7, 4.4.8, 4.4.9 and 4.4.10*:

$$\begin{array}{r}
 400 \\
 -125 \\
 \hline
 275
 \end{array}
 \quad
 \begin{array}{r}
 210 \\
 -185 \\
 \hline
 +025 \text{ dir}
 \end{array}$$

Figure 4.4.7: The answer of The Student Orange to the 10th problem in barbershop test

Borcunu öder.
0 TL kalır.

Figure 4.4.8: The answer of The Student Orange to the 13th problem in barbershop test (Turkish: “He paid his debt. 0 TL is left.”)

$$\begin{array}{r}
 400 \\
 -125 \\
 \hline
 275
 \end{array}
 \quad
 \begin{array}{r}
 210 \\
 -185 \\
 \hline
 -025 \text{ TL borcu kalır}
 \end{array}$$

Figure 4.4.9: The answer of The Student Orange to the 10th problem in bakery test (Turkish: “25 TL debts are left”)

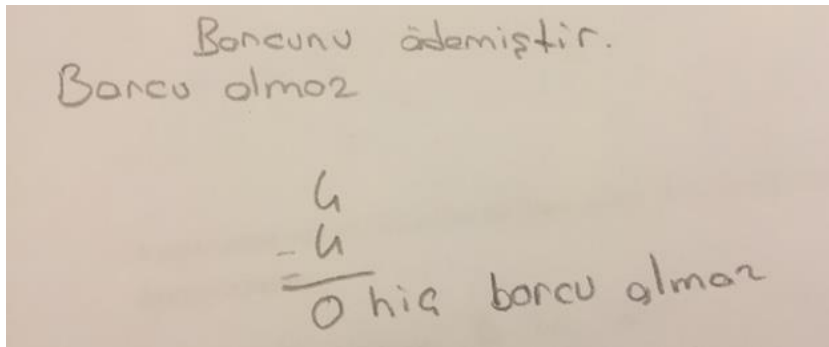


Figure 4.4.10: The answer of The Student Orange to the 13th problem in bakery test
(Turkish: “He has no debt. 0 debts is left”)

Although he said that he still did not know financial situations and modeling, he tried to solve these questions. He could not explain why he did not try for the problems in the street market test although he tried for the other tests. He said that the street marketers need mathematics more when compared with the other workplaces. He is a street marketer but he seemed confused in the street market problems.

It seems that there is some difference of responses of the Orange in different workplace tests. In spite of the fact that his computations were not true in 10th problems, he tried to solve them in barber shop and bakery tests. His solution ways were true although his computations were wrong. I think that the difference between street market test solution and other tests' solutions is psychological. But I do not have enough evidence to prove that. I only can say that there is little difference between his responses to other workplace tests.

4.4.5 The Student Sugar. The scores of The Sugar in the street market test, bakery test and barber shop test are respectively 7, 15 and 10. His scores are not surprising when considered his grades in school. Generally his grades from all courses are low. He also thinks that street market is the workplace that mathematics is mostly needed.

His answers in the tests are generally close to each other except 8th problem in the bakery. (See Figure 4.4.11)

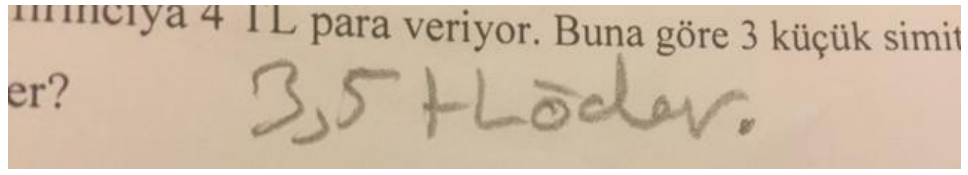


Figure 4.4.11: The answer of The Student Sugar to 8th problem in the bakery test
(Turkish: “He pays 3.5 TL.”)

In the street market test and barber shop test, he could not answer this problem. He even did not try to solve it. I have asked him how he could solve this problem in the bakery shop test while he could not the similar problems in different tests. He answered that “Because I knew that the price of big bagel is 1 TL and the price of small bagel is 0.5 TL (= 50 Kr), so I could solve it.” I said that “But the big bagel price is 1.5 TL and the small bagel price is 1 TL in the bakeries.” The Sugar replied that: “I know, but here the problem said three big bagels and two small bagels cost 4 TL, so in that bakery big bagel price is 1 TL and small bagel price is 0.5 TL.”

It is clearly seen that he made an inference from the real life situation and applied it to this problem. He was not familiar with the prices of onions, potatoes and haircuts. That is why he could not solve the similar problem in different workplace context tests.

It cannot be concluded that his responses to different workplace tests were different because this difference was observed in only one problem. It cannot be generalized to all of his answers.

4.4.6 The Student Salt. His street market test score is 37, his bakery test score is 38 and his barbershop test score is 44. He also thinks that street market needs more mathematics. Although The Salt is a baker, he got the highest score from the barber shop test surprisingly.

Generally his solutions were close to each other except the 10th and 11th problems. He got 5, 5 and 10 points from the 10th problem of street market test, bakery and barber shop tests respectively. He found 65 TL as a result but he could not interpret it was unpaid money or extra paid money. He clearly said that in the

barber shop test 10th problem there was still 65 TL to be paid. After I showed him his solution in the barbershop test, he said that “I got it, they are all same. The answer should be 65 TL to be paid also in other tests.”

His points are 5, 0 and 10 points from the 11th problem of street market test, bakery and barber shop tests respectively. He gave as answer “7 TL debts” to the barber shop problem. In street market problem, he found 7 TL, but he could not decide it is debt or profit. That is why he got 5 points there. The interesting thing is he found “5 TL debts” in the bakery shop problem. He could not explain how he found this solution.

It is concluded that there is no significant difference between his responses to different tests with different workplace contents.

4.4.7 The Student Kiwi. He got 54, 69 and 71 from the street market test, bakery test and barber shop test respectively. He thinks exactly as friends about being the most mathematics needed workplace is street market.

Although The Kiwi is a street marketer, his lowest score is the street market test score. When I asked him his thought about this situation, he said that “I do not know, ma’am. I have got familiar with the problems and I could solve others easily.” I said that “But, you did not learn the solution, how could you get better score in the other tests?” He replied that “I do not know ma’am, just I could.”

I think his trouble about the problems is related with understanding the problem and in each test he could get a better understanding. That is why he could answer better in the next tests.

The most important point difference is in the 9th problem. He got 0 points in the street market test from this problem. However, he got 10 points from this problem in the bakery and barber shop tests. He found the answer as 7 minute in the street market test; on the other hand he drew figures as in *Figure 4.4.12* and *Figure 4.4.13* to found answer in bakery and barber shop tests.

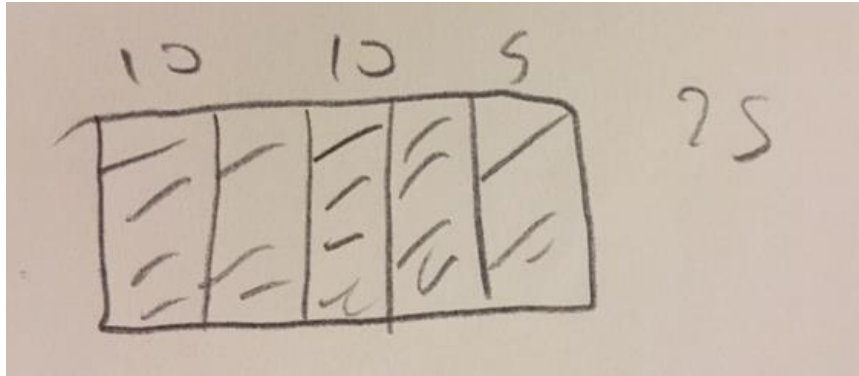


Figure 4.4.12: The answer of The Student Kiwi to 9th problem in barber shop test

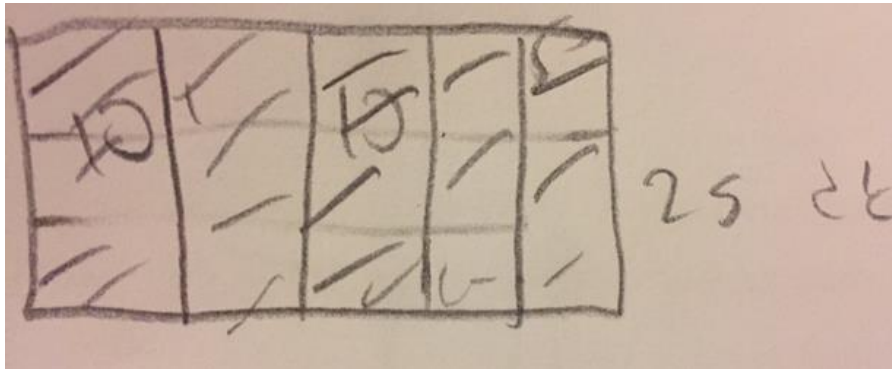


Figure 4.4.13: The answer of The Student Kiwi to 9th problem in bakery test
(Turkish: “25 minutes”)

It cannot be concluded that there is a significant difference between the responses of The Kiwi to different workplace context tests. His answers are too close to each other.

4.4.8 The Student Comb. His street market test score is 27, his bakery test score is 25 and his barbershop test score is 27. He also thinks that mathematics is mostly needed in the street markets because they always have to do calculations. He thinks that in barber shops and in bakeries, the calculations were not always done because the customers might not come to there as much as the street market customers. His score are low with respect to his grades. He explained that he could

not solve because he forgot how these problems were solved. That is why his scores are too low according to him.

There is almost no difference between his solution methods and responses in different workplace content test. That is why his scores are too close to each other.

Generally, the participants' responses to different tests with similar problems in different contexts are not different. They solved them by using their mathematical knowledge instead of their daily life or workplace experiences.

4.5 The Comparison of Achievements of the Similar Tests Which Include Different Workplaces Problems, Textbook Problems and Non-contextualized Mathematical Questions of the Middle School Level Street-marketers, Bakers and Barbers:

I and the other mathematics teacher prepared a rubric (see Appendix L) to evaluate the tests as it is mentioned before. We evaluated all tests separately. I took the averages of those scores that the other mathematics teacher and I gave. There are the test scores of each participant in each test in Table 4.5.1. (see for details Appendix M)

Table 4.5.1: The Scores Of Participants That They Got From Street-Market, Bakery Barber Shop Tests

The Participants	The Scores of Street Market Test	The Scores of Bakery Test	The Scores of Barber Shop Test	The Scores of MEB Textbook Problems	The Scores of Non-contextualized Mathematics Questions
The Student Pineapple	110	89	82	87	75
The Student Grape	15	25	25	13	15
The Student Scissors	47	45	45	56	0
The Student Orange	35	41	33	21	0
The Student Sugar	7	15	10	17	10
The Student Salt	37	38	44	47	5
The Student Kiwi	54	69	71	53	35
The Student Comb	27	25	27	51	0

Note. All scores are out of 130

To compare of achievements of the similar tests which include different workplaces problems, textbook problems and non-contextual mathematical questions of the middle school level street-marketers, bakers and barbers, the scores of them are compared.

As it is seen in Table 4.5.1, the street market test score of The Student Pineapple is 110. The average of other scores of The Pineapple is $(89 + 82 + 87 + 75) / 4 = 83.25$. The reason of getting average of his other scores is to get a standard score to compare with the street market score. In other words, the street market score is calculated out of 130. To compare the other tests scores with the score of street market, the other tests scores should also be out of 130. Therefore, it can be said that the street market test score of The Student Pineapple is higher than his average score of other tests.

If the similar comparison methods are followed for the other participants' scores, it is found that:

- The street market test score of The Student Grape is 15. The average of other scores of The Student Grape is $(25 + 25 + 13 + 15) / 4 = 19.5$. The street market test score of The Student Grape is not higher than his average score of other tests.

- The barber shop test score of The Scissors is 45. The average of scores of The Student Scissors is $(47 + 45 + 56 + 0) / 4 = 37$. The barber shop test score of The Student Scissors is higher than his average score of other tests.

- The street market test score of The Orange is 35. The average of other scores of The Orange is $(41 + 33 + 21 + 0) / 4 = 23.75$. The street market test score of The Orange is higher than his average score of other tests.

- The bakery test score of The Student Sugar is 15. The average of other scores of The Student Sugar is $(7 + 10 + 17 + 10) / 4 = 11$. The bakery test score of The Student Sugar is higher than his average score of other tests.

- The bakery test score of the Student Salt is 38. The average of other scores of The Student Salt is $(37 + 44 + 47 + 5) / 4 = 33.25$. The bakery test score of the Student Salt is higher than his average score of other tests.

- The street market test score of The Student Kiwi is 54. The average of other scores of The Student Kiwi is $(69 + 71 + 53 + 35) / 4 = 57$. The street market test score of The Student Kiwi is not higher than his average score of other tests.

- The barber shop test score of The Student Comb is 27. The average of scores of The Student Comb is $(27 + 25 + 51 + 0) / 4 = 25.75$. The barber shop test score of The Student A is higher than his average score of other tests.

As it is seen, except The Grape and The Student Comb, the participants have higher scores in the tests that have their own workplaces context than the average score of other tests that have different contexts.

If the scores are analyzed with respect to the workplaces separately, it is found that the middle school level street marketers (except the Grape) got higher scores in the test which contains street market workplace problems than the other tests. The middle school level bakers got higher scores in the test which contains bakery workplace problems. On the other hand, one of two middle school level barbers could not get higher scores in the test which contains barber workplace problems than the other tests.

To get a deeper understanding about the differences of test scores, the average of workplace context test scores and the average of other tests' (numerical expression test & MEB textbook real life problems test) scores of each participant were compared as in Table 4.5.2. The reason of getting averages is to get scores out of 130 to compare workplace context test achievement and the other tests achievement.

Table 4.5.2: Comparison of the Average of Workplace Context Test Scores and the Average of Other Tests' (Numerical Expression Test & MEB Textbook Real Life Problems Test) Scores of Each Participant

The Participants	The Average Scores of Workplace Context Tests (Street Market, Bakery, Barber Shop)	Comparison Symbol	The Average Scores of Other Tests (MEB Textbook, Non-contextualized)
The Student Pineapple	$(110 + 89 + 82) / 3 = 93.67$	$>$	$(87 + 75) / 2 = 81$
The Student Grape	$(15 + 25 + 25) / 3 = 21.67$	$>$	$(13 + 15) / 2 = 14$
The Student Scissors	$(47 + 45 + 45) / 3 = 45.67$	$>$	$(56 + 0) / 2 = 23$
The Student Orange	$(35 + 41 + 33) / 3 = 36.33$	$>$	$(21 + 0) / 2 = 10.5$
The Student Sugar	$(7 + 15 + 10) / 3 = 10.67$	$<$	$(17 + 10) / 2 = 13.5$
The Student Salt	$(37 + 38 + 44) / 3 = 39.67$	$>$	$(47 + 5) / 2 = 26$
The Student Kiwi	$(54 + 69 + 71) / 3 = 64.67$	$>$	$(53 + 35) / 2 = 44$
The Student Comb	$(27 + 25 + 27) / 3 = 26.33$	$>$	$(51 + 0) / 2 = 25.5$

As it is seen in the Table 4.5.2, except The Sugar, all participants have higher average scores in workplace context tests. With a closer look, it can be understood that the non-contextualized mathematical tests are the tests that all of the participants mostly struggled. It can be concluded that in this study, working students have better scores at the tests with workplace contexts.

CHAPTER 5

DISCUSSION

The general aim of this study was to gain an understanding the middle school level street-marketers', bakers' and barbers' workplace mathematics in Ankara, Turkey. To achieve this goal, five research questions have been conducted.

The first research question was about the structure of middle school level street-marketers', bakers' and barbers' overall work-related mathematical practices. To answer this question the semi-structured interviews and observation reports have been analyzed. Finally it is found that there are plenty of mathematical practices in street-markets, in barber shops and in bakery shops. General structure of these mathematical practices is based on four operations (addition, subtraction, multiplication and division) and mathematical reasoning (such as smaller than, bigger than, close to, equal to etc.). Their workplaces are shaped by the context and the materials. It was observed that the street-marketers have slightly more mathematical practices in their workplaces than the barbers and bakers.

Although the participants have lots of mathematical practices in their workplaces, in the interviews they generally claim that they do not have too many mathematical experiences except money calculations while working. The study of bus conductors' mathematics (Naresh, 2008) and the study of carpenters' mathematics (Millroy, 1992) were given the similar results about the awareness of the workers about the mathematics that they used in their workplaces. This could be the result of the blame of mathematics as "it cannot be understood by ordinary people, it is too complex to do". These views may show that Platonic view to the mathematics is still alive. To make people more conscious about the daily life

mathematics may make the mathematics less threatfull and more achievable for majority of people.

As a mathematics teacher, I was aware of this blame of mathematics between the students. The mathematics was difficult and mass of complex formulas that were never faced with in the real live. I was expecting this result while the participants claimed that they did not have any mathematics in their workplaces because I knew that they did not know what mathematics was. This is not their fault because we-the mathematics teachers- do not show them the funny and real face of mathematics to the students. The mathematics teaching program is heavy, the time is not adequate to teach, and the national exams do not ask the funny and real mathematics. We do not have enough time to let them learn by doing mathematics. According to Brown, Collins and Duguid (1988), knowing and doing are interlocked and inseparable. We are separating knowing and doing while teaching mathematics. Maybe by the help of these studies, the negative attitude towards to the mathematics may change with different teaching methods, with different textbooks and less heavy training program. Therefore, the students may be aware of the mathematics in their lives and they can internalize the mathematics. And thus, the mathematics achievement level can be higher in our country.

The second research question is about the views the participants about how the formal school-taught mathematics is related to the middle school level street-marketers', bakers' and barbers' workplace mathematics. The participants' views were directly asked and taken their comments. In the lights of these comments, the interaction between the school-taught mathematics and workplace mathematics with respect to the views of participants can be interpreted as in *Figure 5.0.1*.

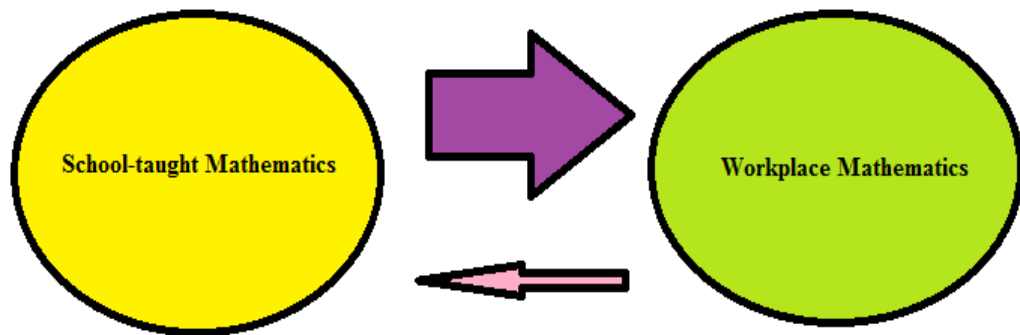


Figure 5.0.1: The interaction between the school-taught mathematics and workplace mathematics with respect to the views of participants

The participants of this present study generally think that the mathematics that they learn in the school affects their workplace positively. Majority of them claim that school-taught mathematics helps them in the workplace mathematics. A person who knows school-taught mathematics can do easily workplace mathematics. On the other hand, the participants generally think that workplace mathematics does not affect the school-taught mathematics as much as the effect of school-taught mathematics on workplace mathematics. That is why I have illustrated the purple arrow bigger than the pink arrow. There is a detail here that the participants generally think that the interaction between the primary school-taught mathematics and workplace mathematics is more than the interaction between the middle school-taught mathematics and workplace mathematics with respect to the views of participants.

Masingila, Davidenko and Prus-Wisniowska (1996) claimed that many of the differences could be narrowed by creating experiences that engage students in doing mathematics in school in ways similar to mathematics learning and practice outside of school. If those engaged experiences are increased, the interaction between school-taught mathematics and workplace mathematics can be stronger. According to Torpey (2012), workers with a strong background in mathematics are increasingly in demand. This means that the interaction between school-taught mathematics and workplace mathematics is important in two perspectives. Firstly, the working

students may be more enthusiastic towards mathematics because they find something in their real lives. Secondly, they can use this strong interaction to organize their future professional work plans. They may see more alternatives in their future by learning work mathematics.

The third research question of this study is conducted to understand whether the real life mathematics problems in the middle school mathematics textbooks are related with those students' real lives or not. Those students' views were directly asked as to what extent the real life problems in the mathematics textbooks are related to your real lives as street-marketers, bakers and barbers. The barbers are agree with the opinion that there are lots of problems in their textbooks that can be related with their lives. On the other hand, bakers generally say that there are only a few problems in their textbooks which are related to their real lives. The street-marketers have different answers about their textbooks refer to their lives or not. While the Pineapple and the Orange think that there are a few problems in their textbooks about their real lives, the Grape and the Kiwi think that there are no problems in their textbook that he met in his real life before. If the views of participants are concluded, it can be claimed that the mathematics textbooks that are used in the mathematics courses generally do not refer to the real lives of the participants except a few problems.

The textbook that is mentioned in the third research question is published and distributed by the Ministry of National Education. The teachers especially in the state schools follow these textbooks. These textbooks are generally criticized by the teachers from lots of perspectives such as inadequate examples, wrong answers and solutions etc. The answers of the participants to the research question of this study have brought another criticism to the textbooks. Those textbooks do not contain problems that refer to the participants' real lives. If the textbooks are prepared to help teaching to the students, how can those textbooks appeal the attractions of students without including anything of their lives?

As in Dewey's pedagogic creed (1897), I -as a mathematics teacher- believe that the school must represent the real lives of students (home, neighborhood or playground). I also believe that not only the schools, but also the supplementary resources such as textbooks, classroom environments should represent the real lives of the students. Only the minority of the students may work after schools in Turkey; however, all students have money-related, shopping-related and measurement problems in their real lives. At least those problems may be chosen from the real lives of the students. The officers who prepare the problems in the Ministry of National Education may get help from teachers, but it seems that this help is not adequate. If those officers have difficulties to visualize real lives of students, the teachers may send problems that represent their students' real lives once in a year. These problems can be used not only in the textbooks, but also in the national exams. And thus, there will be plenty of real life problem examples in the sources of Ministry of National Education.

Forth research question of this study is about how those students perform in solving mathematical problems and doing computations given in the context of street-market, bakery and barber shop. It is found that the participants' responses to different tests with similar problems in different contexts are not different with a few exceptions. They solved the tests by using their mathematical knowledge instead of their daily life or workplace experiences.

The similarity of the participants' responses to different tests was a surprise for me because I did not expect this result because of my observations in the classroom. Whenever I ask a problem to the Grape during the courses, he could not solve it until I convert the problem to a street market context. The Sugar could answer the problems only if he convert them to money-related problems in the courses. The Kiwi struggles while answering the questions without the street market context. This surprising situation may have lots of reasons. I think the participants took these tests as school tests although they did not solve the tests in the school. This may be because of I am their mathematics teacher. They might think that if a

mathematics teacher applies a test, it should be an ordinary school test. Their responses might differ if someone from their workplace applied these tests to them.

The fifth research question of this present study is about determining the differences of the scores of the similar tests which include different workplaces problems, textbook problems and non-contextualized mathematical questions of the middle school level street-marketers, bakers and barbers. The participants had higher scores in the tests that have their own workplaces context than the average scores of other tests that have contexts. When the scores are analyzed with respect to the workplaces separately, it is found that the middle school level street marketers (except the Grape) got higher scores in the test which contains street market workplace problems than the other tests. The middle school level bakers got higher scores in the test which contains bakery workplace problems. On the other hand, one of two middle school level barbers could not get higher scores in the test which contains barber workplace problems than the other tests. When the scores of the tests with workplace contexts and the other tests (textbook and non-contextualized tests) are compared, except The Sugar, all participants have higher average scores in workplace context tests. The non-contextualized mathematical tests are the tests that all of the participants mostly struggled.

It can be concluded that in this study, working students have better scores at the tests with workplace contexts. This situation may be the result of being familiar with the money issues in all workplaces. Those workplace tests were generally about money. That is why student could have better scores at them. If we accept that being familiar is important at the success of a test, it can also be concluded that the MEB textbook real life problems are not from the real life of these participants while considered their scores of MEB textbook tests.

Under the lights of those data gathered from this present study, D'Ambrosio's (1999) proposal of a new conception of the curriculum can be considered for a new curriculum in our country. His proposal is to reorganize school curricula in three strands: Literacy, Matheracy and Technocracy. He explains literacy

as the new look to reading which includes competency on numeracy, interpretation graphs and tables, reading movie or a TV programme. Matheracy is defined by him as the capability of drawing data: inferring, proposing hypothesis and drawing conclusions. Technoracy is explained as the critical familiarity with technology. I support the idea of reorganizing mathematics curricula in these three strands, but with a few clarifications. All these three strands should be depended on the real lifes of the people who are being educated.

It can be assumed that the students learn how to interpret a graph; however, if that graph does not include anything from the life of students, they cannot internalize them. If the students find something in the graph from themselves, they can learn better.

I do not claim that the entire things in the course, textbooks and classroom should be the materials or the ideas exactly from the students' real lifes. I know this is impossible. But, at least, in the learning process, there may be different contexted textbook alternatives. The teacher may choose those textbooks for their classroom. After the knowledge level, the textbooks may be common again. But first, I think, students should find something from themselves in the courses. For example, while starting to teach statistics, a private school may use a book with full of the example of the popular video games, social media channels or the popular vacation places. For my school, I may choose a book that includes money examples, shopping examples, street game examples, the family examples with minimum wage, etc. After completing the knowledge and comprehension level in teaching statistics, a textbook may be chosen with more general examples. In the national exams, those general examples may be asked.

If the textbooks are not diversificated, at least, I –as mathematics teacher- may use my own teaching program first, and then I can teach by using the common textbook. All teachers may use this method in their courses. With this way, we may make mathematics less frightened for our students.

5.1 Limitations and Reflections:

When I started this study, I believed that I would be better teacher at the end of this study. I do not know whether I am a better teacher or not, but I feel different. This difference is not only about being teacher, this is about education of children totally. For example, I was against to child labor. Now, I am still against to the child labor but I do not think that the only reason of this problem is the family. I felt during the observations and interviews that working is mostly the participants' choices. Actually, I have tried to make them say that working is a compulsion for them. That is because I strongly believed that a child cannot want to work instead of being in school or studying. However, it seems that this was not true. The participants were generally happy to work. Actually they seem happier in their workplace than in the school.

As I mentioned before, the participants' school grades are generally low. They seem that they are trying to have higher grades but they barely pass their classes. Day by day, they lose their connection with the school with learned helplessness. On the other hand, in their workplaces, they are generally the most educated person in there. This situation may make them feel more comfortable and more successful in their workplace environment than the school environment where there are lots of students got higher grades than them.

I cannot say that "Working is a decision of the child so we should respect this decision". I know that a child at this age cannot decide to take such a big responsibility about his future by himself. I believe that we, educators, should focus on the reasons of this decision. We can make better learning environments for those who have tendency to be hopeless and to suffer from learned helplessness. I think it is possible only if the educators can understand the students' feelings and needs better.

This study has lots of strong sides and weaknesses. The strongest side of this present study is to rise naturally from the relationship between a teacher and her students. This natural relationship provides plenty of chances.

The first chance is to have more realistic and consistent observations. This is because I am teacher of these students for two years. If I was the researcher from outside, this study would not be the same. There would be lots of blank spaces in the observations and I would have to interpret these blank spaces even if I had conducted lots of observations. Without knowing the students well, an observer from the outside cannot know the natural behaviors of the participants. Because of human nature, the participants could act different in front of a stranger. Therefore, the observation could be less reliable than this present study.

The second chance is to have more honest answers during semi-structured interviews. The participants could answer the interview questions differently if a different researcher asked them. Sometimes, the researchers come to our school to conduct interviews with our students for their studies; the students try to answer as soon as possible to get rid of as immediate as possible. On the other hand, these participants are totally voluntaries to participate in this study; they are enthusiastic to answer the interview questions. Sometimes, they wanted to come at their vacations to participate in interviews. It seems that they were enjoying being part of this study. At the end of this study, they were sorry and they made me promise for making them participants again in another study.

The third chance is to collect missing data. After I had completed some of the semi-structured interviews, I had lost my voice-recorder before writing their transcripts. There were more than one hundred minutes of interviews in it and there were no copy. I felt deeply sorry, but I could have chance to do interviews again. If I were studying with the participants that I could not reach easily, it could be the end of this study.

The forth chance is to have wider perspective about being better teacher: I can understand my students and their educational and pedagogical needs deeper. This year, they are eight graders and still my students. I have chance to be better teacher for them in lights of the information that I got from this journey with them.

Besides these strong sides of studying with my own students, there were some negative perspectives. Being teacher of the participants might make them feel nervous about their grades in my courses. They could have thought they would get better grades if they became voluntaries. I explained lots of times that they would not have any extra points in the courses and this was totally different study. Being teacher of the participants might also make them give dishonest answers about their interest about my courses. They might say that they loved school-taught mathematics because I am their teacher. I repeatedly said that they should be honest and their answer would not make me sorry. However, they might still answer not to make me feel sorry.

The other limitation of this study is the generalization issue that is the result of being qualitative study. The participant number of this study could be increased to have more detailed results than this study.

The pilot study was not conducted. If there was a pilot study, some of the problems that were faced in the process might be eliminated. However, the pilot study might change the answers of the participants and results of this study. They might learn the solutions of the problems. They might answer purposively in the interviews. They might behave different in the observations. Therefore, the pilot study was not conducted in the same group. If the pilot study was conducted for another group, it would not eliminate the difficulties and that would be useless because each participant has different characteristics. Applying a pilot study to one participant would not help application on another participant.

The number of participants from each workplace could be equal. In this study, there are 4 street-marketers, 2 barbers and 2 bakers. 2 more bakers and 2 more barbers could be added to study.

Finally, the field observations were not adequate because of the security problems. The observation times could be longer.

5.2 Further Research and Implications:

The comparison of workplace environment and the school environment is a worldwide issue with different perspectives. That is why concern of this study is international, especially for developing and undeveloped countries. Maybe, if the number of these kinds of studies increases, the workplace and the school environment will be made supportive for each other. Thus, the negative effects of working on children will be decreased although the child labor problem could not be solved. As educators, we may not solve the socio-economic problems of the Earth, but we may diminish the negative effects of this unbalanced socio-economic life on children.

Limitations of this study are the sources of the suggestions. If the security measures are taken, the observation time can be increased to get better interpretations. The number of participants from each workplace may be balanced in further research to get better interpretations during the comparisons of the achievements. If the number of participants is increased, the findings can be more detailed.

5.3 Significance of the Study:

This study is significant because of several reasons. Firstly, this study is conducted to add the research field of workplace mathematics in Turkey, which is still in its formative years.

Secondly, this study is different from the other studies that were conducted before with respect to participant and researcher relation. That is because the weakest side and the strongest side of this study is the same: Teacher and Student Relationship. This relation may add to the literature review a different point of view.

The last, but not the least, the findings of this study may cause to query of the mathematics education system by the perspectives of workplace and daily life needs.

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APPENDIX A

REAL LIFE PROBLEMS FROM MINISTRY OF NATIONAL EDUCATION 7TH GRADE TEXTBOOK 2014-2015 EDUCATION SEASONS

1) (p. 68) To obtain 1 kg sugar, approximately 7 kg sugar beet is needed. In this case;

a) Draw a table that shows the relationship between amount of used sugar beet and amount of obtained sugar. Write the expression that shows the relationship between amount of used sugar beet and amount of obtained sugar by using the pattern in the table.

b) Draw a line graph with the data on the table.

2) (p. 61) 3 friends want to buy a book which they like. All of them order the same book and their order comes in the same package. They pay 19 TL including 4 TL courier fee. How much does each book cost?

3) (p. 61) The ticket fees of high-speed train in June of 2011 are given:

First Class Ticket: 30 TL

Second Class Ticket: 20 TL

Student Ticket: 16 TL

A group of friends take tickets. 3 of them take second class ticket, 4 of them take first class ticket. The rest of the group takes student tickets. Total fee is 212 TL. How many people take student tickets?

4) (p. 48) Owner of an electronic market tells 7th grade students that he will ask a question and give a music player to the student who find the answer. He says that there are six boxes on the table and there are 3 marbles in the first box. Each box contains the marbles that three times of the previous box. He asks how many marbles there are in the 6th box. What are the computations needed? What is the pattern that gives the number of marbles in each box?

5) (p. 45) A climber starts from the sea level and climbs 315 m in the first day. In the second day, he climbs 142 m more than the first day. In the third day, he climbs 275 m and starts to climb down. In the first day of climbing down, he walks down 345 m, in the second and the third days he climbs equal distances. How many meters does this climber walk down in the third day?

6) (p. 44) A petrol tank of a car is filled up to $\frac{1}{5}$ of the tank. When 12 L gasoline is added to the tank, half of the tank becomes full. How much gasoline can this tank take?

7) (p. 37) Two carpenters follow two different ways to make a house gate.

The first carpenter:

- a) He measures the place of the gate.
- b) He calculates the amount of the timber that will be used.
- c) He cuts and hammers the timber.
- d) He paints the door.

The second carpenter:

- a) He paints the timber that will be used.
- b) He cuts and hammers the timber.
- c) He calculates the amount of timber that will be used.
- d) He measures the place of the gate.

Which of the carpenters follows the true way? Why? Discuss with your friends how you decide to do which computation should be done first when you meet a mathematical expression that includes four operations.

8) (p.36) A pencil costs $\frac{1}{2}$ of a pen. 2 pencils and 3 pen cost 4 TL. According to given information, how much do 3 pencils and 2 pens cost?

9) (p. 27) Nasrettin Hodja did not notice the tear on the bag of wheat. When he noticed it after 10 minutes, he saw that $\frac{2}{5}$ of the wheat in the bag had poured. If he did not notice the tear on the bag, in how many minutes would all of the wheat pour? Discuss your solution way with your friends.

10) (p. 14) Ahmet has debt 400 TL to his friend. He pays 125 TL of his debt in the first month and pays 210 TL of his debt in the second month. What will Ahmet's debt situation be at the end of the second month?

11) (p. 8) A diver dives 25 m depth firstly and then he swims up 18 m. At the end, express the distance of the diver to the sea level as an integer. (Accept sea level as the initial point.)

12) (p. 7) While it is seen that the weather is -2°C at the mountainside, the weather is -11°C at the peak of the mountain. According to the given information, what is the temperature difference between peak and side of the mountain?

13) (p. 3) The weather in Ankara was -4°C at night. In the morning, temperature of the weather increased 4°C . According to the given information, what is the temperature of the weather in the morning? Show your solution by modeling on the number line.

APPENDIX B

MİLLİ EĞİTİM BAKANLIĞI DERS KİTABI 2014-2015 EĞİTİM-ÖĞRETİM YILI GERÇEK HAYAT PROBLEMLERİ

1) (sf 68) 1kg şeker elde etmek için ortalama 7 kg şeker pancarına ihtiyaç vardır. Bu durumda,

a) Şeker pancarı ile elde edilen şeker miktarı arasındaki ilişkiyi gösteren bir tablo düzenleyelim. Tablodaki örüntüyü kullanarak şeker pancarı miktarı ile elde edilen şeker miktarı arasındaki ilişkiyi gösteren ifadeyi yazalım.

b) Tablodaki verileri çizgi grafiği ile gösterelim.

2) (sf 61) 3 arkadaş, beğendikleri bir kitaptan birer tane satın almak istiyor. Üçü de aynı kitabı sipariş veriyor ve siparişleri aynı kolide geliyor. Gelen koliye 4 TL' si kargo ücreti almak üzere toplam 19 TL ödediklerine göre bir kitabın fiyatının kaç lira olduğunu bulalım.

3) (sf 61) Ankara - Eskişehir arasında sefer yapan hızlı trenin bilet ücretleri 2011 yılının Haziran ayında yandaki gibidir. Bir grup arkadaştan 3' ü A sınıfı bilet, 4' ü B sınıfı bilet almıştır. Grubun kalan yolcuları ise öğrenci bileti almıştır. Biletler için toplam 212 TL ödendiğine göre, öğrenci bileti alan kaç kişi olduğunu nasıl bulursunuz?

A Sınıfı Bilet: 20 TL

B Sınıfı Bilet: 30 TL

Öğrenci Bileti: 16 TL

4) (sf 48) Elektronik eşya satan bir mağaza sahibi 7. sınıf öğrencilerine bir soru soracağını, bilene bir müzik çalar hediye edeceğini söyler. Mağaza sahibi, yan yana konulmuş kutuların her birine bir önceki kutuda bulunan bilye sayısının üç katı bilye koyduğunu belirtir. İlk kutuya üç bilye konulduğunda 6. kutuya kaç bilye konulduğunu hangi işlemleri yaparak bulabilirsiniz? Her bir kutudaki bilye sayısının oluşturduğu sayı örüntüsünün kuralını bulabilir misiniz?

5) (sf 45) Bir dağcı deniz seviyesinden başlayarak birinci gün 315 m, ikinci gün birinci günden 142 m fazla, üçüncü gün ise 275 m tırmandıktan sonra iniş yapmaya başlamıştır. Birinci gün 345 m, diğer iki gün ise birbirine eşit mesafede yol alarak inmiştir. Dağcının üçüncü gün kaç metre indiğini bulunuz.

6) (sf 44) Bir arabanın deposunun $\frac{1}{5}$ 'i doludur. Depoya 12 L benzin daha konulursa deponun yarısı doluyor. Deponun tamamı kaç litre benzin alır?

7) (sf 37) İki marangoz bir bahçe kapısını yapmak için iki farklı yol izliyor.

1. Marangoz

a) Kapının yapıldığı yerin the ölçüsünü alıyor.

b) Kullanacağı tahta miktarını hesaplıyor.

c) Tahtaları kesiyor ve çakıyor.

ç) Yaptığı kapıyı boyuyor.

2. Marangoz

- a) Kullanacağı tahtaları boyuyor.
- b) Tahtaları kesiyor ve çakıyor.
- c) Kullanacağı tahta miktarını hesaplıyor.
- ç) Kapının yapıldığı yerin the ölçüsünü alıyor.

Hangi marangoz işlem sırasını doğru izlemiştir? Neden? İçinde dört işlemin bulunduğu bir matematik cümlesinde hangi işlemin the önce yapılması gerektiğine nasıl karar verdiğinizi arkadaşlarınızla tartışınız.

8) (sf 36) Bir kurşun kalemin fiyatı, bir tükenmez kalemin fiyatının $1/2$ 'si kadardır. 2 kurşun ve 3 tükenmez kalem alan bir kişi satıcıya 4 TL para veriyor. Buna göre 3 kurşun kalem ve 2 tükenmez kalem için ödenecek para kaç liradır?

9) (sf 27) Nasrettin Hoca, buğdayını değirmene taşıırken çuvalının yırtıldığını fark etmiyor. Fark ettiğinde ise 10 dakikalık sürede çuvalda bulunan tüm buğdayın $2/5$ 'lik kısmının döküldüğünü görüyor. Nasrettin Hoca, durumu fark etmeseydi tüm çuval aynı hızla kaç dakikada boşalırdı? Problemi çözmek için hangi işlemi yapmanız gerektiğini arkadaşlarınızla tartışınız.

10) (sf 14) Arkadaşına 400 TL borcu olan Ahmet, ilk ay borcunun 125 TL'sini ödüyor. Kalan borcunun 210 TL'sini de ikinci ayda ödeyen Ahmet'in iki ayın sonundaki mali durumunun ne olacağını bulunuz.

11) (sf 8) Bir dalgıç önce 25 m su altına dalıp sonra 18 m yukarıya çıkıyor. Son durumda dalgıcın su yüzeyine olan mesafesini tam sayı olarak ifade ediniz. (Deniz seviyesini başlangıç olarak kabul ediniz.)

12) (sf 7) Bir dağın eteklerinde hava sıcaklığı -2°C iken, dağın zirvesine çıkıldığında hava sıcaklığının -11°C olduğu görülmüştür. Buna göre dağın eteğindeki hava sıcaklığı ile dağın zirvesindeki hava sıcaklığı arasındaki farkı bulalım.

13) (sf 3) Ankara'da gece -4°C olan hava sıcaklığı, gündüz 4°C arttığına göre son sıcaklığın kaç derece selsiyus olduğunu sayı doğrusu üzerinde modelleyerek gösterelim.

APPENDIX C

REAL LIFE STREET-MARKET PROBLEMS

- 1) One box contains 7 kg bananas. In this case;
 - a) Draw a table that shows the relationship between amount of boxes and amount of bananas. Write the expression that shows the relationship between amount of boxes and amount of bananas by using the pattern in the table.
 - b) Draw a line graph with the data on the table.

- 2) 3 women want to buy melons. All of them order the same types of melons and they buy apricots cost 4 TL. They pay 19 TL including 4 TL apricot fees. How much does each melon cost?

- 3) Watermelon prices in March of 2011 are as follows. From a group of friends, 3 of them take A quality watermelons and 4 of them take B quality watermelons. The rest of them take small watermelons. If they pay totally 212 TL, how can you find the number of people who take small watermelons?

A Quality Watermelon: (each) 20 TL

B Quality Watermelon: (each) 30 TL

Small Watermelon: (each) 16 TL

- 4) A street-marketer says that he will ask a question to you and if you know the answer, he will give you 5 TL. He says that there are six boxes on the table and there

are 3 potatoes in the first box. Each box contains the potatoes that three times of the previous box. He asks how many potatoes there are in the 6th box. What are the computations needed? What is the pattern that gives the number of potatoes in each box?

5) A street-marketer buys goods from the marketplace and takes to the storehouse for 3 days. In the first day, he buys 315 kg goods and takes to the storehouse. In the second day, he buys 142 kg more goods than the first day and takes to the storehouse. In the third day, he buys 275 kg goods and takes to the storehouse. In the next day, he starts to sell those goods. At the sale of first day, he sells 345 kg goods. After that, he finishes the goods completely at the sales of next two days. If the amount of goods that are sold in the last two days is equal, how much goods does this street-marketer sell in the last day?

6) Haulage of a truck that carries goods to the street market is filled up to $\frac{1}{5}$ of the haulage. When 12 kg goods are added to the haulage, half of the haulage becomes full. How many kg of goods can this haulage of truck take?

7) Two street-marketers follow two different ways to sell goods at the street market.

The first street-marketer:

- a) He goes to buy goods from the marketplace.
- b) He determines the fees of the goods.
- c) He aligns the goods to the stall.
- d) He starts to sell.

The second street-marketer:

- a) He determines the fees of the goods.
- b) He starts to sell.
- c) He goes to buy goods from the marketplace.
- d) He aligns the goods to the stall.

Which of the street-marketers follows the true way? Why? Discuss with your friends how you decide to do which computation should be done first when you meet a mathematical expression that includes four operations.

8) The price of one kg onion is $\frac{1}{2}$ of the price of one kg potatoes. Two kilograms of onions and three kilograms of potatoes cost 4 TL. According to the given information, how much does a person pay who buys three kilograms of onions and two kilograms of potatoes?

9) A street-marketer did not notice that the haulage of the truck had opened while he took the goods with the truck from the market place to street market. When he noticed it after 10 minutes, he saw that $\frac{2}{5}$ of the goods in the truck haulage had poured out. If he did not notice that the truck haulage had opened, in how many minutes would all of the goods pour out?

10) A street-marketer has debt 400 TL to his friend. He pays 125 TL of his debt in the first month and pays 210 TL of his debt in the second month. Find what the financial status of this street-marketer will be at the end of the second month.

11) A street-marketer loses 25 TL firstly and then he gains 18 TL. At the end, express the profit & loss situation of this street-marketer as an integer.

12) While the total debt of a street-marketer is 2 TL in the first day, in the second day the total debt of a street-marketer becomes 11 TL. According to the given information, let find what the difference is between the debt of the first day and the debt of the second day of this street-marketer?

13) A street-marketer has 4 TL debt. After earning 4 TL, he pays this debt. Let show the financial status at the end by modeling on the number line.

APPENDIX D

PAZAR GERÇEK HAYAT PROBLEMLERİ

- 1) Bir kasaya 7 kg muz sığmaktadır. Bu durumda,
 - a) Kasa sayısı ile muz miktarı arasındaki ilişkiyi gösteren tezgâha yerleştireceğiniz bir tabela düzenleyiniz. Bu tabeladaki sayıların arasındaki ilişkiyi anlatan ifadeyi yazınız.
 - b) Tabeladaki verileri bir de çizgi grafiği ile gösteriniz.

- 2) 3 teyze, komşu tezgâhtaki kavundan birer tane satın almak istiyor. Üçü de aynı cins ve aynı kilodaki kavundan alıyorlar. Yanına bir de toplam 4 TL'lik kayısı alıyorlar. Toplam 19 TL ödediklerine göre, bir kavunun fiyatının kaç lira olduğunu bulalım.

- 3) 2011 yılının mart ayında karpuz fiyatları aşağıdaki gibidir. Bir grup arkadaştan 3'ü A kalite karpuz, 4'ü B kalite karpuz almıştır. Geriye kalanlar küçük karpuz almışlardır. Karpuzlar için toplam 212 TL ödediklerine göre, küçük karpuz alan kaç kişi olduğunu nasıl bulursunuz?

A Kalite Karpuz: (Tane Fiyatı) 20 TL

B Kalite Karpuz: (Tane Fiyatı) 30 TL

Küçük karpuz: (Tane Fiyatı) 16 TL

4) Bir pazarcı, size bir soru soracağını ve eğer bilerseniz 5 TL kazanacağınızı söylüyor. Bu pazarcı yan yana konulmuş kasaların her birine bir önceki kutuda bulunan patates sayısının üç katı patates koyuyor. İlk kasaya 3 patates konulduğunda, 6. kasaya kaç patates konulduğunu bulunuz. Her bir kasadaki patates sayısının oluşturduğu sayı örüntüsünün kuralını bulabilir misiniz?

5) Bir pazarcı 3 gün boyunca halden mal alarak depoya götürüyor. Birinci gün halden 315 kg mal alıyor ve depoya götürüyor. İkinci gün birinci günden 142 kg fazla mal alıyor ve depoya götürüyor. Üçüncü gün is 275 kg mal alıyor ve depoya götürüyor. Ertesi gün malları satmaya başlıyor. İlk günkü satışta 345 kg mal satıyor. Sonraki iki günkü satışlarında malı tamamen bitiriyor. Son iki gün satışları birbirine eşit ise, bu pazarcı son gün ne kadar mal satmıştır?

6) Pazara mal taşıyacak bir kamyonetin kasasının $\frac{1}{5}$ 'i doludur. Kasaya 12 kg daha mal konulursa kasanın yarısı doluyor. Kamyonetin kasası toplam kaç kg mal alır?

7) İki pazarcı, pazarda mal satmak için iki farklı yol izliyor.

1. Pazarcı:

- a) Halden mal almaya gidiyor.
- b) Malların satış fiyatlarını belirliyor.
- c) Malları tezgâha diziyor.
- ç) Satışa başlıyor.

2. Pazarcı:

- a) Malların satış fiyatlarını belirliyor.

b) Satışa başlıyor.

c) Halden mal almaya gidiyor.

ç) Malları tezgâha diziyor.

Hangi pazarcı işlem sırasını doğru izlemiştir? Neden? İçinde dört işlemin bulunduğu bir matematik cümlesinde hangi işlemin önce yapılması gerektiğine nasıl karar verdiğinizi arkadaşlarınızla tartışınız.

8) Bir kg soğanın fiyatı, bir kg patatesin fiyatının $\frac{1}{2}$ 'si kadardır. 2 kg soğan ve 3 kg patates alan bir kişi satıcıya 4 TL para veriyor. Buna göre 3 kg soğan ve 2 kg patates alan bir kişi ne kadar öder?

9) Bir pazarcı, halden aldığı malları pazara taşıırken kamyonetin kasasının açıldığını fark etmiyor. Fark ettiğinde ise 10 dakikalık bir sürede kasada bulunan tüm malların $\frac{2}{5}$ 'lik kısmının döküldüğünü görüyor. Eğer bu pazarcı, durumu fark etmeseydi tüm kasa aynı hızla kaç dakikada boşalırdı?

10) Arkadaşına 400 TL borcu olan bir pazarcı, ilk ay borcunun 125 TL'sini ödüyor. Kalan borcunun 210 TL'sini de ikinci ayda ödeyen pazarcının iki ayın sonundaki mali durumunun ne olacağını bulunuz.

11) Bir pazarcı önce 25 TL zarar ediyor, sonra 18 TL kâra geçiyor. Son durumda bu pazarcının kâr-zarar durumunu tam sayı olarak ifade ediniz.

12) Bir pazarcının toplam borcu birinci gn 2 TL iken, ikinci gn 11 TL oluyor. Bu pazarcının birinci gnk borcu ile ikinci gnk borcu arasındaki farkı bulalım.

13) Bir pazarcının 4 TL borcu vardır. 4 TL kazandıktan sonra bu borcunu dyor. Bu pazarcının son durumdaki para durumunu sayı doęrusu zerinde modelleyerek gsterelim.

APPENDIX E

REAL LIFE BAKERY PROBLEMS

1) One box eggs costs 7 TL. In this case;

a) Draw a table that shows the relationship between the amount of boxes and price that is paid for them. Write the expression that shows the relationship between the amount of boxes and price that is paid for them by using the pattern in the table.

b) Draw a line graph with the data on the table.

2) If a baker who buys 3 packages of ferment and 4 TL of flour pays totally 19 TL, let us find the price of one package of ferment.

3) Prices of cookies cocktail packages in March of 2011 are as follows. From a group of friends, 3 of them take A packages and 4 of them take B packages. The rest of them take C packages. If they pay totally 212 TL, how can you find the number of people who take C packages?

Package A: 20 TL

Package B: 30 TL

Package C: 16 TL

4) A baker says that he will ask a question to you and if you know the answer, he will give you 5 TL. He says that there are six boxes on the table and there are 3 loaves in the first box. Each box contains the loaves that three times of the previous box. He asks how many loaves there are in the 6th box. What are the computations needed? What is the pattern that gives the number of loaves in each box?

5) Owner of a big bakery orders sizeable amount of flour. In the first day, 315 kg flour comes with cargo and the baker puts them in the storehouse. In the second day, he buys 142 kg more flour than the first day and takes to the storehouse. In the third day, he buys 275 kg flour and takes to the storehouse. In the next day, he starts to use that flour. In the first day, he uses 345 kg flour. After that, he finishes the flour completely in next two days. If the amount of flour that is used in the last two days is equal, how much flour does this baker use in the last day?

6) It is filled up to $\frac{1}{5}$ of a big sack of flour. When 12 kg flour is added to the sack, half of the sack becomes full. How many kg of flour can this sack take?

7) Two bakers follow two different ways:

The first baker:

- a) He opens the bakery.
- b) He heats up the oven.
- c) He prepares dough.
- d) He shapes and bakes the prepared dough.

The second baker:

- a) He prepares dough.
- b) He shapes and bakes the prepared dough.
- c) He heats up the oven.
- d) He opens the bakery.

Which one of the bakers follows the true way? Why? Discuss with your friends how you decide to do which computation should be done first when you meet a mathematical expression that includes four operations.

8) The price of small bagel is $\frac{1}{2}$ of the price of big bagel. Two small bagels and three big bagels cost 4 TL. According to the given information, how much does a person pay who buys three small bagels and two big bagels?

9) A baker did not notice that the sack of flour had torn. When he noticed it after 10 minutes, he saw that $\frac{2}{5}$ of the flour in sack had poured out. If he did not notice that the sack of flour had torn, in how many minutes would all of the flour pour out?

10) A baker has debt 400 TL to his friend. He pays 125 TL of his debt in the first month and pays 210 TL of his debt in the second month. Find what the financial status of this baker will be at the end of the second month.

11) A baker loses 25 TL firstly and then he gains 18 TL. At the end, express the profit & loss situation of this baker as an integer.

12) While the total debt of a baker is 2 TL in the first day, in the second day the total debt of a baker becomes 11 TL. According to the given information, let find what the difference is between the debt of the first day and the debt of the second day of this baker?

13) A baker has 4 TL debt. After earning 4 TL, he pays this debt. Let show the financial status of this baker at the end by modeling on the number line.

APPENDIX F

FIRIN GERÇEK HAYAT PROBLEMLERİ

1) Bir kutu yumurta 7 TL'dir. Bu durumda,

a) Kutu sayısı ile alınan kutular için ödenecek toplam para miktarını gösteren bir tablo hazırlayınız. Bu tablodaki sayıların arasındaki ilişkiyi anlatan ifadeyi yazınız.

b) Tablodaki verileri bir de çizgi grafiği ile gösteriniz.

2) 3 paket maya ve 4 TL'lik un alan bir fırıncı toplam 19 TL ödediğine göre, bir paket mayanın fiyatını bulalım.

3) 2011 yılının mart ayında karışık kurabiye paketi fiyatları aşağıdaki gibidir. Bir grup arkadaşın 3'ü A paketini, 4'ü B paketini almıştır. Geriye kalanlar C paketini almışlardır. Tüm paketler için toplam 212 TL ödediklerine göre, C paketini alan kaç kişi olduğunu nasıl bulursunuz?

A paketi: 20 TL

B paketi: 30 TL

C paketi: 16 TL

4) Bir fırıncı, size bir soru soracağını ve eğer bilerseniz 5 TL kazanacağınızı söylüyor. Bu fırıncı yan yana konulmuş kasaların her birine bir önceki kasada bulunan ekmek sayısının üç katı ekmek koyuyor. İlk kasaya 3 ekmek konulduğunda,

6. kasaya kaç ekmek konulduğunu bulunuz. Her bir kasadaki ekmek sayısının oluşturduğu sayı the örüntüsünün kuralını bulabilir misiniz?

5) Büyük bir fırının sahibi yüklü miktarda un sipariş veriyor. Birinci gün kargoyla 315 kg un geliyor ve fırıncı bunları depoya koyuyor. İkinci gün birinci günden 142 kg fazla un alıyor ve depoya götürüyor. Üçüncü gün is 275 kg un alıyor ve depoya götürüyor. Ertesi gün depodaki bu unları kullanmaya başlıyor. İlk gün 345 kg un kullanıyor. Sonraki iki gün kalan unları da kullanarak tüm unları bitiriyor. Son iki günlük un kullanımını birbirine eşit ise, bu fırıncı son gün kaç kg un kullanmıştır?

6) Büyük bir un çuvalının $\frac{1}{5}$ 'i doludur. Bu çuvala 12 kg un daha konulursa çuvalın yarısı doluyor. Bu un çuvalı toplam kaç kg un alır?

7) İki fırıncı, dükkânı açtıktan sonra iki farklı yol izliyor.

1. Fırıncı:

- a) Dükkânı açıyor.
- b) Fırını ısıtıyor.
- c) Hamuru hazırlıyor.
- ç) Hazırladığı hamura şekil vererek pişiriyor.

2. Fırıncı:

- a) Hamuru hazırlıyor.
- b) Hazırladığı hamura şekil vererek pişiriyor.
- c) Fırını ısıtıyor.

ç) Dükânı açıyor.

Hangi fırıncı işlem sırasını doğru izlemiştir? Neden? İçinde dört işlemin bulunduğu bir matematik cümlesinde hangi işlemin önce yapılması gerektiğine nasıl karar verdiğinizi arkadaşlarınızla tartışınız.

8) Bir küçük simidin fiyatı, bir büyük simidin fiyatının $\frac{1}{2}$ 'si kadardır. 2 küçük simit ve 3 büyük simit alan bir kişi fırıncıya 4 TL para veriyor. Buna göre 3 küçük simit ve 2 büyük simit alan bir kişi kaç TL öder?

9) Bir fırıncı un çuvalının yırtıldığını fark etmiyor. Fark ettiğinde is 10 dakikalık bir sürede çuvaldaki unun $\frac{2}{5}$ 'lik kısmının döküldüğünü görüyor. Eğer bu fırıncı durumu fark etmeseydi çuvaldaki tüm un aynı hızla kaç dakikada dökülürdü?

10) Arkadaşına 400 TL borcu olan bir fırıncı, ilk ay borcunun 125 TL'sini ödüyor. Kalan borcunun 210 TL'sini de ikinci ayda ödeyen bu fırıncının iki ayın sonundaki mali durumunun ne olacağını bulunuz.

11) Bir fırıncı önce 25 TL zarar ediyor, sonra 18 TL kâra geçiyor. Son durumda bu fırıncının kâr-zarar durumunu tam sayı olarak ifade ediniz.

12) Bir fırıncının toplam borcu birinci gün 2 TL iken, ikinci gün 11 TL oluyor. Bu fırıncının birinci günkü borcu ile ikinci günkü borcu arasındaki farkı bulalım.

13) Bir firincının 4 TL borcu vardır. 4 TL kazandıktan sonra bu borcunu ödüyor. Bu firincının son durumdaki para durumunu sayı doğrusu üzerinde modelleyerek gösterelim.

APPENDIX G

REAL LIFE BARBER SHOP PROBLEMS

1) Haircut costs 7 TL. In this case;

a) Draw a table that shows the relationship between the number of men and price that is paid for haircuts. Write the expression that shows the relationship between the number of men and price that is paid for haircuts by using the pattern in the table.

b) Draw a line graph with the data on the table.

2) 3 brothers get mustache cut in a barbershop. They also buy a box of hair gel together. If a box of hair gel costs 4 TL and they pay totally 19 TL for mustache cuts and hair gel, let find the price of mustache cut.

3) Prices of shaving packages in March of 2011 are as follows. From a group of friends, 3 of them take A packages and 4 of them take B packages. The rest of them take C packages. If they pay totally 212 TL, how can you find the number of people who take C packages?

Package A: (Washing + Shaving) 20 TL

Package B: (Washing + Shaving + Massage) 30 TL

Package C: (Shaving) 16 TL

4) A barber says that he will ask a question to you and if you know the answer, he will give you 5 TL. He says that there are six boxes on the table and there are 3 razors in the first box. Each box contains the razors that three times of the previous box. He asks how many razors there are in the 6th box. What are the computations needed? What is the pattern that gives the number of razors in each box?

5) A barber orders personal care products. In the first day, 315 products come with cargo and the barber puts them in the storehouse. In the second day, he buys 142 products more than the first day and takes to the storehouse. In the third day, he buys 275 products and takes to the storehouse. In the next day, he starts to sell those products. In the first day, he sells 345 products. After that, he finishes the products completely in next two days. If the number of products that are sold in the last two days is equal, how many products does this barber sell in the last day?

6) It is filled up to $\frac{1}{5}$ of a big bottle of shampoo. When 12 palms of shampoo are added to the bottle, half of the bottle becomes full. How many palms of shampoo can this bottle take?

7) Two barbers follow two different ways:

The first barber:

- a) He opens the barbershop.
- b) He determines the missing materials and gives daily orders.
- c) He deals with customers.
- d) He does the end of calculations and gives money to his apprentices.

The second barber:

- a) He does the end of calculations and gives money to his apprentices.
- b) He opens the barbershop.
- c) He deals with customers.
- d) He determines the missing materials and gives daily orders.

Which one of the barbers follows the true way? Why? Discuss with your friends how you decide to do which computation should be done first when you meet a mathematical expression that includes four operations.

8) The price of mustache cut is $\frac{1}{2}$ of the price of haircut. 2 mustache cut and 3 haircut cost 40 TL. According to the given information, how much does a person pay who buys 3 mustache cut and 2 hair cut?

9) A barber did not notice that the cover of the hair gel box had opened. When he noticed it after 10 minutes, he saw that $\frac{2}{5}$ of the hair gel in the box had dried. If he did not notice that the cover of the hair gel box had opened, in how many minutes would all of the hair gel dry?

10) A barber has debt 400 TL to his friend. He pays 125 TL of his debt in the first month and pays 210 TL of his debt in the second month. Find what the financial status of this barber will be at the end of the second month.

11) A barber loses 25 TL firstly and then he gains 18 TL. At the end, express the profit & loss situation of this barber as an integer.

12) While the total debt of a barber is 2 TL in the first day, in the second day the total debt of a barber becomes 11 TL. According to the given information, let find what the difference is between the debt of the first day and the debt of the second day of this barber?

13) A barber has 4 TL debt. After earning 4 TL, he pays this debt. Let show the financial status of this barber at the end by modeling on the number line.

APPENDIX H

BERBER GERÇEK HAYAT PROBLEMLERİ

1) Saç tıraşı 7 TL'dir. Bu durumda,

a) Kişi sayısı ile toplam saç tıraşı için ödeyecekleri para miktarını gösteren bir tablo hazırlayınız. Bu tablodaki sayıların arasındaki ilişkiyi anlatan ifadeyi yazınız.

b) Tablodaki verileri bir de çizgi grafiği ile gösteriniz.

2) 3 kardeş büyük tıraş oluyorlar. Bir de hep birlikte bir kutu jöle alıyorlar. Jölenin fiyatı 4 TL olduğuna ve tıraşlar artı jöle için toplam 19 TL the ödediklerine göre, büyük tıraşının fiyatını bulalım.

3) 2011 yılının mart ayında tıraş paketi fiyatları aşağıdaki gibidir. Bir grup arkadaştan 3'ü A paketini, 4'ü B paketini almıştır. Geriye kalanlar C paketini almışlardır. Tüm paketler için toplam 212 TL ödediklerine göre, C paketini alan kaç kişi olduğunu nasıl bulursunuz?

A paketi: (Saç-Sakal yıkama+tıraş) 20 TL

B paketi: (Saç-Sakal yıkama+tıraş+masaj) 30 TL

C paketi: (Saç-Sakal Tıraş) 16 TL

4) Bir berber, size bir soru soracağını ve eğer bilerseniz 5 TL kazanacağınızı söylüyor. Bu berber yan yana konulmuş küçük kutuların her birine bir önceki kutuda

bulunan jilet sayısının 4 katı jilet koyuyor. İlk kutuya 3 jilet konulduğunda, 6. kutuya kaç jilet konulduğunu bulunuz. Her bir kutudaki jilet sayısının oluşturduğu sayı örüntüsünün kuralını bulabilir misiniz?

5) Bir berber özel bir kişisel bakım ürününden sipariş veriyor. Birinci gün kargoyla 315 şişe ürün geliyor ve berber bunları depoya koyuyor. İkinci gün birinci günden 142 şişe fazla ürün alıyor ve depoya götürüyor. Üçüncü gün ise 275 şişe ürün alıyor ve depoya götürüyor. Ertesi gün depodaki bu ürünleri satmaya başlıyor. İlk günkü satışta 345 şişe ürün satıyor. Sonraki iki günlük satışlarında ürünleri tamamen bitiriyor. Son iki gün satışları birbirine eşit ise, bu berber son gün kaç şişe ürün satmıştır?

6) Büyük bir şampuan şişesinin $\frac{1}{5}$ 'i doludur. Şişeye 12 avuç şampuan daha konulursa şişenin yarısı doluyor. Bu şampuan şişesi toplam kaç avuç şampuan alır?

7) İki berber, dükkânı açtıktan sonra iki farklı yol izliyor.

1. Berber:

a) Dükkânı açıyor.

b) Eksik malzemelere bakıp günlük siparişini veriyor.

c) Müşterileriyle ilgileniyor.

ç) Gün sonu para hesabını yapıp çıraklarına para veriyor.

2. Berber:

a) Gün sonu para hesabını yapıp çıraklarına para veriyor.

b) Dükânı açıyor.

c) Müşterileriyle ilgileniyor.

ç) Eksik malzemelere bakıp günlük siparişini veriyor.

Hangi berber işlem sırasını doğru izlemiştir? Neden? İçinde dört işlemin bulunduğu bir matematik cümlesinde hangi işlemin önce yapılması gerektiğine nasıl karar verdiğinizi arkadaşlarınızla tartışınız.

8) Bir sakal tıraşının fiyatı, saç tıraşının fiyatının $1/2$ 'si kadardır. 2 sakal tıraşı ve 3 saç tıraşı yaptıran bir grup berbere 40 TL para veriyor. Buna göre 3 sakal tıraşı ve 2 saç tıraşı yaptıran bir grup ne kadar ödeme yapar?

9) Bir berber, jöle kutusunun kapağının açık kaldığını fark etmiyor. Fark ettiğinde is 10 dakikalık bir sürede kutudaki jölenin $2/5$ 'lik kısmının kurduğunu görüyor. Eğer bu berber durumu fark etmeseydi kutudaki tüm jöle aynı hızla kaç dakikada kururdu?

10) Arkadaşına 400 TL borcu olan bir berber, ilk ay borcunun 125 TL'sini ödüyor. Kalan borcunun 210 TL'sini de ikinci ayda ödeyen bu berberin iki ayın sonundaki mali durumunun ne olacağını bulunuz.

11) Bir berber dükânı önce 25 TL zarar ediyor, sonra 18 TL kâra geçiyor. Son durumda bu berber dükânının kâr-zarar durumunu tam sayı olarak ifade ediniz.

12) Bir berberin toplam borcu birinci gün 2 TL iken, ikinci gün 11 TL oluyor. Bu berberin birinci günlük borcu ile ikinci günlük borcu arasındaki farkı bulunuz.

13) Bir berberin 4 TL borcu vardır. 4 TL kazandıktan sonra bu borcunu ödüyor. Bu berberin son durumdaki para durumunu sayı doğrusu üzerinde modelleyerek gösterelim.

APPENDIX I

ALGEBRAIC EXPRESSIONS

1)

1	7
2	14
3	21
4	28
5	35
..	..
..	..
n	?

Find the expression that is placed question mark in terms of “n”. Draw a line graph to show data in the table.

2) If $3x + 4 = 19$, then $x = ?$

3) If $a=3$ and $b=4$, and $20a + 30b + 16c = 212$, then $c = ?$

4) Find the sixth term of the given number pattern that 3, 9, 27, 81, Write the general term of this number pattern in terms of “n”.

5) $315 + 315 + 142 + 275 = 345 + c + c$

According to given equation, what is c?

6) If $\frac{x}{5} + 12 = \frac{x}{2}$, then what is x?

7) What is the result of the given operation?

$$3 - 2 \cdot 3 + 4 : 2$$

8) If $b = 2a$ and $2a + 3b = 4$, then $3a + 2b = ?$

9) If $\frac{2a}{5} = 10$, then what is a?

10) $(-400) + (+125) + (+210) = ?$

11) $(-25) + (+18) = ?$

12) $(-2) - (-11) = ?$

13) $-4 + 4 = ?$

APPENDIX J

SAYI PROBLEMLERİ

1)

1	7
2	14
3	21
4	28
5	35
..	..
..	..
n	?

Yukarıdaki soruda soru işaretli yeri “n” cinsinden bulunuz. Tablodaki verileri çizgi grafiği ile gösteriniz.

2) $3x + 4 = 19$ ise $x = ?$

3) $a=3$ ve $b=4$ olmak üzere,

$20a + 30b + 16c = 212$ olduğuna göre $c = ?$

4) 3, 9, 27, 81, sayı örüntüsünün 6. terimini bulunuz. Bu örüntünün genel terimini “n” cinsinden gösteriniz.

5) $315 + 315 + 142 + 275 = 345 + c + c$

Yukarıdaki verilere göre c kaçtır?

6) $\frac{x}{5} + 12 = \frac{x}{2}$ ise x kaçtır?

7) $3 - 2 \cdot 3 + 4 : 2$ işleminin sonucu kaçtır?

8) $b = 2a$ olduğuna göre;

$2a + 3b = 4$ ise $3a + 2b = ?$

9) $\frac{2a}{5} = 10$ ise a kaçtır?

10) $(-400) + (+125) + (+210) = ?$

11) $(-25) + (+18) = ?$

12) $(-2) - (-11) = ?$

13) $-4 + 4 = ?$

APPENDIX K

OBSERVATION PAPER

OBSERVATION PAPER	
Name-Surname:	Date:
Business:	Time (Duration):
Events and Speeches: (Objective Observation)	
My opinions and feelings:	

APPENDIX L

CEVAP VE PUANLAMA ANAHTARLARI

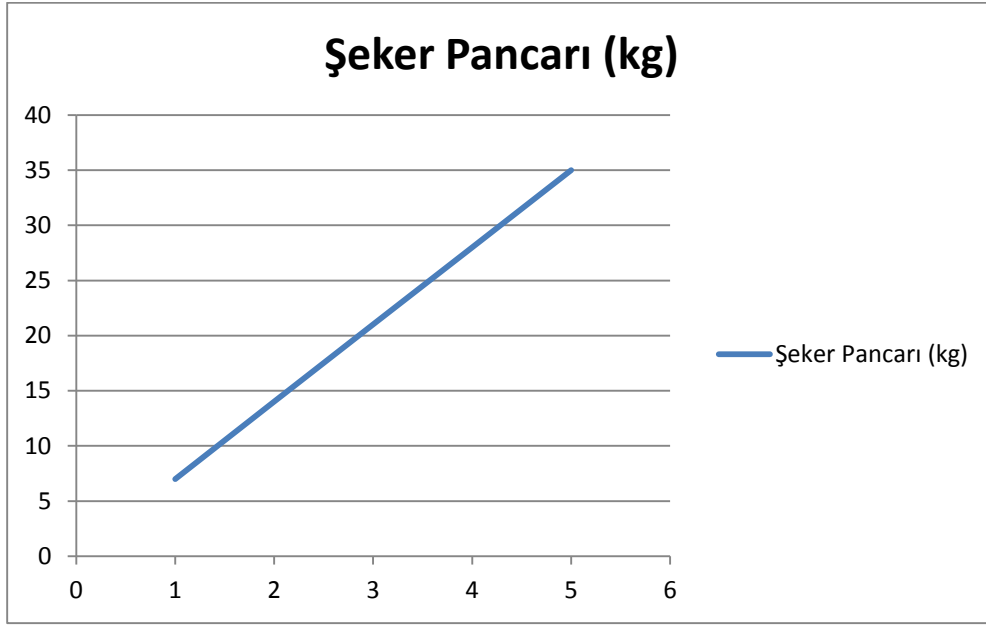
Milli Eğitim Bakanlığı Ders Kitabı 2014-2015 Eğitim-Öğretim Yılı Gerçek Hayat Problemleri, Pazar Problemleri, Berber Problemleri Ve Fırın Problemleri Cevap Ve Puanlama Anahtarı

1) (Şeker ve Şeker Pancarı değişkenleri, teste göre değişmektedir.)

Şeker Miktarı (kg)	Şeker Pancarı Miktarı (kg)
1	7
2	14
3	21
4	28
5	35
n	7n

} 3 puan

} 2 puan



5 puan

2)

$$3x + 4 = 19 \rightarrow 5 \text{ puan}$$

$$3x = 15 \rightarrow 2 \text{ puan}$$

$$x = 5 \rightarrow 3 \text{ puan}$$

3)

$$3 \cdot 20 + 4 \cdot 30 + a \cdot 16 = 212 \rightarrow 5 \text{ puan}$$

$$60 + 120 + 16a = 212 \rightarrow 1 \text{ puan}$$

$$16a = 32 \rightarrow 1 \text{ puan}$$

$$a = 2 \rightarrow 3 \text{ puan}$$

4) (Sözel ifadeler teste göre değişmektedir.)

$$1. \text{ kutu} = 3 \text{ bilye} = 3^1$$

$$2. \text{ kutu} = 9 \text{ bilye} = 3^2$$

$$3. \text{ kutu} = 27 \text{ bilye} = 3^3$$

$$4. \text{ kutu} = 81 \text{ bilye} = 3^4$$

$$5. \text{ kutu} = 243 \text{ bilye} = 3^5$$

2 puan

$$6. \text{ kutu} = 729 \text{ bilye} = 3^6 \rightarrow 3 \text{ puan}$$

$$n. \text{ kutu} = 3^n \rightarrow 5 \text{ puan}$$

5)

$$(+315) + (+315) + (+142) + (+275) + (-345) + x + x = 0 \rightarrow 4 \text{ puan}$$

$$(+1047) + (-345) + 2x = 0 \rightarrow 1 \text{ puan}$$

$$(+702) + 2x = 0 \rightarrow 1 \text{ puan}$$

$$2x = -702 \rightarrow 1 \text{ puan}$$

$$x = -351 \rightarrow 3 \text{ puan}$$

6)

$$\frac{x}{2} + 12 = \frac{x}{2} \rightarrow 4 \text{ puan}$$

$$\frac{2x+120}{10} = \frac{5x}{10} \rightarrow 1 \text{ puan}$$

$$2x + 120 = 5x \rightarrow 1 \text{ puan}$$

$$120 = 3x \rightarrow 1 \text{ puan}$$

$$40 = x \rightarrow 3 \text{ puan}$$

7) (Aşağıdaki sözel ifadeler, teste göre değişmektedir.)

Birinci marangoz işlem sırasını doğru izlemiştir. (2 puan) Kapının yapılacağı yerin ölçüsünü ve buna bağlı olarak kullanacağı tahta miktarını hesapladığı için, elindeki malzemeleri en verimli şekilde kullanabilir. (3 puan)

Matematikte işlem önceliği çarpma ve bölme işlemleri ve arkasından toplama ve çıkarma işlemlerindedir. (5 puan)

8) (Aşağıda verilen sözel ifadeler, teste göre değişmektedir.)

Kurşun kalem = x ise Tükenmez kalem = 2x 'tir. $\rightarrow 2$ puan

$$2x + 3 \cdot 2x = 4$$

$$8x = 4$$

$$x = 0,5 \rightarrow 3 \text{ puan}$$

$$3 \cdot 0,5 + 2 \cdot 2 \cdot 0,5 = ? \rightarrow 2 \text{ puan}$$

$$7 \cdot 0,5 = 3,5 \rightarrow 3 \text{ puan}$$

Berber problemleri için;

$$2x + 3 \cdot 2x = 40$$

$$8x = 40$$

$$x = 5 \rightarrow 3 \text{ puan}$$

$$3 \cdot 5 + 2 \cdot 2 \cdot 5 = ? \rightarrow 2 \text{ puan}$$

$$7 \cdot 5 = 35 \rightarrow 3 \text{ puan}$$

9)

$$\frac{2x}{5} = 10 \rightarrow 5 \text{ puan}$$

$$2x = 50 \rightarrow 2 \text{ puan}$$

$$x = 25 \rightarrow 3 \text{ puan}$$

10) (Aşağıdaki sözel ifade, teste göre değişebilir)

$$= (-400) + (+125) + (+210) \rightarrow 5 \text{ puan}$$

$$= -65 \rightarrow 2 \text{ puan}$$

$$65 \text{ lira borç} \rightarrow 3 \text{ puan}$$

11)

$$= (-25) + (+18) \rightarrow 5 \text{ puan}$$

$$= -7 \rightarrow 5 \text{ puan}$$

12)

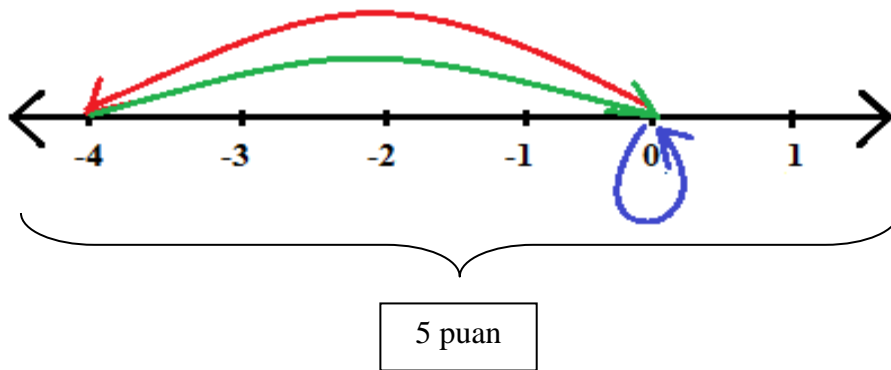
$$= (-2) - (-11) \rightarrow 5 \text{ puan}$$

$$= (+9) \rightarrow 5 \text{ puan}$$

13)

$$= (-4) + (+4) \rightarrow 2 \text{ puan}$$

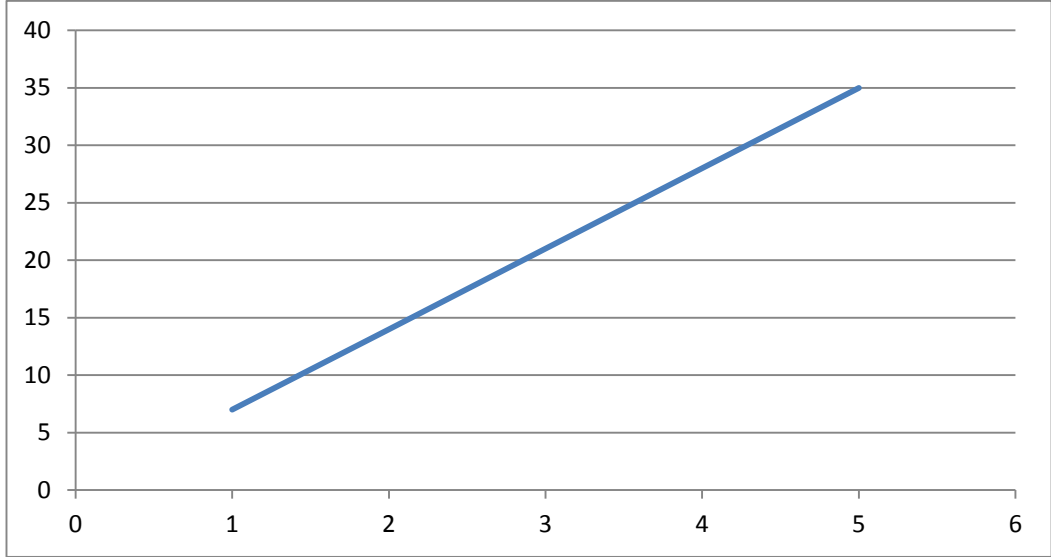
$$= 0 \rightarrow 3 \text{ puan}$$



Sayı Problemleri Cevap Ve Puanlama Anahtarı

1)

$$7n \rightarrow 5 \text{ puan}$$



5 puan

2)

$$3x = 15 \rightarrow 5 \text{ puan}$$

$$x = 5 \rightarrow 5 \text{ puan}$$

3)

$$20 \cdot 3 + 30 \cdot 4 + 16c = 212 \rightarrow 3 \text{ puan}$$

$$180 + 16c = 212 \rightarrow 1 \text{ puan}$$

$$16c = 32 \rightarrow 2 \text{ puan}$$

$$c = 2 \rightarrow 4 \text{ puan}$$

4)

$$1. \text{ terim} = 3^1$$

$$2. \text{ terim} = 3^2$$

$$3. \text{ terim} = 3^3$$

$$4. \text{ terim} = 3^4$$

$$5. \text{ terim} = 3^5$$

} 2 puan

$$6. \text{ terim} = 729 = 3^6 \rightarrow 3 \text{ puan}$$

$$n. \text{ terim} = 3^n \rightarrow 5 \text{ puan}$$

5)

$$1047 = 345 + 2c \rightarrow 2 \text{ puan}$$

$$702 = 2c \rightarrow 3 \text{ puan}$$

$$351 = c \rightarrow 5 \text{ puan}$$

6)

$$\frac{2x+120}{10} = \frac{5x}{10} \rightarrow 2 \text{ puan}$$

$$2x + 120 = 5x \rightarrow 2 \text{ puan}$$

$$120 = 3x \rightarrow 2 \text{ puan}$$

$$40 = x \rightarrow 4 \text{ puan}$$

7)

$$= 3 - 6 + 4 : 2 \rightarrow 3 \text{ puan}$$

$$= 3 - 6 + 2 \rightarrow 3 \text{ puan}$$

$$= -3 + 2 \rightarrow 1 \text{ puan}$$

$$= -1 \rightarrow 3 \text{ puan}$$

8)

$$b = 2a$$

$$2a + 3b = 4$$

$$2 \cdot a + 3 \cdot 2a = 4 \rightarrow 2 \text{ puan}$$

$$8a = 4 \rightarrow 1 \text{ puan}$$

$$a = 0,5 \rightarrow 2 \text{ puan}$$

$$b = 2 \cdot 0,5 = 1 \rightarrow 2 \text{ puan}$$

$$3 \cdot 0,5 + 2 \cdot 1 = 3,5 \rightarrow 3 \text{ puan}$$

9)

$$\frac{2a}{5} = 10$$

$$2a = 50 \rightarrow 5 \text{ puan}$$

$$a = 25 \rightarrow 5 \text{ puan}$$

10)

$$= (-400) + (+125) + (+210)$$

$$= (-275) + (+210) \rightarrow 5 \text{ puan}$$

$$= -65 \rightarrow 5 \text{ puan}$$

11)

$$(-25) + (+18) = -7 \rightarrow 10 \text{ puan}$$

12)

$$(-2) - (-11) = +9 \rightarrow 10 \text{ puan}$$

13)

$$-4 + 4 = 0 \rightarrow 10 \text{ puan}$$

APPENDIX M

SCORES OF THE PARTICIPANTS

Table M.0.1: The Scores of Participants in Mathematics Textbook Real Life Problems Tests

The problem	Pineapple	Grape	Scissors	Orange	Sugar	Salt	Kiwi	Comb
1	10	0	0	0	0	0	5	3
2	10	2	9	10	0	10	5	10
3	10	0	9	6	0	10	10	9
4	2	0	0	0	0	0	1	0
5	10	4	0	0	0	0	0	1
6	0	0	0	0	0	0	0	0
7	5	0	7	5	2	2	5	5
8	10	0	10	0	5	5	0	5
9	10	0	3	0	0	5	0	0
10	10	0	0	0	0	5	7	0
11	10	0	8	0	0	5	5	8
12	0	7	10	0	10	5	10	10
13	0	0	0	0	0	0	5	0
Total	87	13	56	21	17	47	53	51

Table M.0.2: The Scores of Participants in the Street Market Problems Tests

The problem	Pineapple	Grape	Scissors	Orange	Sugar	Salt	Kiwi	Comb
1	10	0	0	0	0	0	3	0
2	10	0	10	10	0	5	10	10
3	10	0	8	7	0	5	10	0
4	5	0	0	0	0	0	0	0
5	10	0	1	0	0	0	1	0
6	10	0	0	0	0	0	0	0
7	5	5	6	3	2	2	5	2
8	10	0	0	0	0	5	0	5
9	10	0	0	9	0	5	0	0
10	10	0	0	0	5	5	5	0
11	10	0	7	6	0	5	5	5
12	10	10	10	0	0	5	10	5
13	0	0	5	0	0	0	5	0
Total	110	15	47	35	7	37	54	27

Table M.0.3: The Scores of Participants in Barber Shop Problems Tests

The problem	Pineapple	Grape	Scissors	Orange	Sugar	Salt	Kiwi	Comb
1	0	5	0	0	0	0	8	3
2	10	9	10	5	0	5	10	10
3	10	0	9	6	0	7	7	2
4	5	0	0	0	0	0	0	0
5	10	1	1	0	0	0	1	0
6	0	0	0	0	0	0	0	0
7	5	5	5	2	2	2	5	2
8	10	0	0	0	0	5	0	5
9	10	0	0	0	0	5	10	0
10	7	0	5	5	5	10	5	0
11	5	0	5	5	0	10	5	0
12	10	5	5	5	0	0	10	5
13	0	0	5	5	3	0	10	0
Total	82	25	45	33	10	44	71	27

Table M.0.4: The Scores of Participants in the Bakery Problems Tests

The problem	Pineapple	Grape	Scissors	Orange	Sugar	Salt	Kiwi	Comb
1	0	5	0	0	0	0	10	3
2	5	9	10	10	0	5	10	10
3	10	0	9	6	0	10	5	0
4	5	0	0	0	0	0	0	0
5	10	1	1	0	0	1	1	0
6	3	0	0	0	0	0	0	0
7	5	5	5	5	2	2	2	2
8	10	0	0	0	5	5	0	5
9	10	0	0	0	0	5	10	0
10	6	0	5	5	5	5	6	0
11	5	0	5	5	0	0	5	5
12	10	5	5	5	0	5	10	0
13	10	0	5	5	3	0	10	0
Total	89	25	45	41	15	38	69	25

Table M.0.5: The Scores of Participants in Non-Contextualized Mathematics Tests

The problem	Pineapple	Grape	Scissors	Orange	Sugar	Salt	Kiwi	Comb
1	5	0	0	0	0	0	5	0
2	10	0	0	0	0	0	10	0
3	4	0	0	0	0	0	6	0
4	5	5	0	0	0	0	2	0
5	10	10	0	0	0	0	2	0
6	0	0	0	0	0	0	0	0
7	6	0	0	0	0	0	0	0
8	0	0	0	0	0	0	0	0
9	10	0	0	0	0	0	0	0
10	5	0	0	0	5	5	0	0
11	10	0	0	0	0	0	0	0
12	0	0	0	0	5	0	0	0
13	10	0	0	0	0	0	10	0
Total	75	15	0	0	10	5	35	0