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8th Grade Mathematics Subjects within the Scope of TIMSS: The Opinions of Prospective Mathematics Teachers

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ABSTRACT

The purpose of TIMSS which is an international project is to evaluate mathematics and science achievement of students on the basis of countries with programs, teaching methods and schools. It is known that we do not have satisfactory results from this examination. For this reason, teaching mathematics subject within the scope of the project, the opinions of teachers, students and prospective teachers on the difficulties and solution strategies of this process and solution strategies are important for having satisfactory results. In this sense, the purpose of this study is to find out the opinions of prospective primary mathematics teachers on the 8th grade mathematics subject within the scope of TIMSS. Besides, the aim is to determine the difficulties that prospective teachers think that they will encounter during the process of conducting lessons on these subjects and to determine solution strategies for these stated difficulties. The study which is designed according to these purposes is a qualitative study which is organized according to the phenemology design and in which document analysis technique is used. The study group is consisted of 99 third and fourth year prospective mathematics teachers in Kocaeli University, Education Faculty. Document analysis method was selected in this study. Opinion form which was validated in accordance with an expert's opinions and developed by the researcher, included 8 open-ended questions and was used for document analysis. Prospective teachers were given 25 minutes for filling opinions forms during data collection process. The obtained data were evaluated with content analysis. In conclusion, it was appeared that prospective teachers stated that they would not have difficulties in teaching the subject of 'Numbers' but they would have difficulties in teaching the subjects of 'Algebra', 'Geometry' and ' Data and Chance'. The difficulties were stated as in the following; difficulties coming from students, not knowing how to teach the subject and having abstract subjects. The solution strategies were stated as in the following; solving plenty of relevant examples, carrying out activities, using material and modelling/concretization.

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Keywords:
TIMSS, teaching mathematics subject, difficulties, solution strategies

Introduction

Trends in International Mathematics and Science Study-TIMSS is a scanning research which is organized by International Association for the Evaluation of Educational Achievement-IEA in every four years. This examination is conducted for evaluating the performance of 4th and 8th grade students (Şişman, Acat, Aypay & Karadağ, 2011). The purpose of conducting this examination on these grades and in every four years is to observe trends of students' achievements according to years. Students who are in the fourth grades during an application period are becoming 8th grade students in another application period. Therefore, it provides information about the transition between grades. *For example; 4th grade students in 2007 examination became 8th grade students in 2011 examination* (Yücel, Karadağ & Turan, 2013). The sampling method also ensures the characteristics that the results can be generalized to a large extent (Berberoğlu,

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Çelebi, Özdemir, Uysal & Yayan, 2003). It is also aimed to provide feedback to school administrators, teachers, students and parents about the fields such as program, teachers' competencies and students' school satisfaction (Gonzalez & Miles, 2001). Turkey participated in this examination which has been conducted for approximately fifty years in 1997 and 2007 at 8th grade level (Şişman, Acat, Aypay & Karadağ, 2011).

In the examination, the questions at the 8th grades are classified in four mathematics domains. These domains are: 'Numbers', 'Algebra', 'Geometry' and 'Data and Chance'. The distribution of questions according to domains is as in the following; 30% from Numbers, 30% from Algebra, 20% from Geometry and 20% from Data and Chance (Mullis, Martin, Ruddock, O'Sullivan & Preuschoff, 2009). Our 8th grade students became 27th in numbers learning domain, 24th in algebra domain, 21st in geometry domain and 20th in data and chance learning domain among 42 countries in TIMSS 2011 (Yücel, Karadağ & Turan, 2013).

There are three cognitive levels in each of these domains. These levels are; knowing, applying and reasoning. The questions at the knowing level require knowing mathematical facts, methods and concepts; at the applying level they require knowing and conceptual understanding; at the reasoning level they require solving non-routine problems (Mullis & et al., 2009). In this examination 35% of the questions is at knowing level, 40% of the questions is at applying level and 25% of them is at reasoning level (Güner, Sezer & Akkuş-İspir, 2013). Our 8th grade students became 26th in knowing skills, 20th in transforming what they know to application and 21st in reasoning skills among 42 countries in TIMSS 2011 (Yücel, Karadağ & Turan, 2013).

There is an increase in mathematical achievement scores of Turkey in 1999, 2007 and 2011. However, in 2011, when this increase is compared with the mean of all the other countries, it is understood that there is not an increase according to the previous term. Eight grade scores increased approximately 28 points from 2007 to 2011 (Yücel, Karadağ & Turan, 2013). Most of the Turkish students are able to answer questions at the knowing level. In addition to that it was determined that they had difficulties in the applying and reasoning questions (Güner, Sezer & Akkuş-İspir, 2013). It is stated that very little students have high level skills such as generalizing, solving multi-stepped and complex problems and making inferences (Yayan, 2009).

As it is seen, the poor results of Turkish students are raising concerns and it is necessary to study on the factors that affected these poor results. Teachers are one of the most important factors that affect students' achievement. When related literature is reviewed, many studies can be seen in which the opinions of students on TIMSS, their TIMSS achievements, science and mathematics achievements of students and their attitudes towards science and mathematics, the opinions of teachers and prospective teachers, the features of course books that affect TIMMS are analyzed (Erbaş & Alacacı, 2007; Güner, Sezer & Akkuş-İspir, 2013; Haggarty & Pepin, 2002; House, 2006; Küçük, Şengül & Katrancı, 2014; Leung, 2002; Li, 2000; Özdemir, 2003; Papanastasiou & Papanastasiou, 2004; Papanastasiou & Zembylas, 2004; Shen, 2002; Webster & Fischer, 2000; Yayan & Berberoğlu, 2004; Yore, Anderson & Shymansky, 2002). However, in literature review a study about the opinions of prospective teachers on teaching mathematics subject within the scope of TIMSS was not recognized.

Vlaardingerbroek and Taylor (2003) found out in their studies that there was a strıng correlation between student achievement and teacher characteristics. Menon (2000), searched for the reasons of students' failure. Two of the five factors that affected student achievement were identified as a centralized education program and a high quality mathematics and science teacher training. As Güner, Sezer and Akkuş-İspir (2013) stated in their studies that all teachers should have been informed about TIMSS; they also stated that educational faculties had most of the responsibility on this issue. They expressed that in addition to train teachers who are qualified in educational methods and techniques, it is necessary for future teachers to have established information about the purposes of international mathematics education.

The opinions of prospective teachers on teaching 8th grade mathematics subjects within the scope of TIMSS was tried to be identified with this study, a continuation of the study which was carried out by Küçük, Şengül and Katrancı (2014). After the opinions of prospective teachers have been identified, the awareness of them towards mathematical subjects within the scope of this examination will be revealed. Besides, it is predicted that this study will offer an insight into the related literature. Karamustafaoğlu and Sontay (2012) pointed out the facts that teachers participating in TIMSS project did not have any information about an international examination such as TIMSS and the awareness levels of teachers and students

towards TIMMS were in low level. From this perspective, it is seen as important to determine the opinions of prospective teachers. In this sense, the purpose of this study is to take the opinions of prospective teachers who are studying in teaching primary mathematics department on 8th grade mathematics subject within the scope of TIMSS. In order to achieve this goal, the answers of the following problems were searched.

1. When you start your career, do you think that you might encounter difficulties when teaching 'Numbers' subject? If so, please indicate these difficulties.
2. What do you suggest to overcome these difficulties that you indicated when teaching numbers?
3. When you start your career, do you think that you might encounter difficulties when teaching 'Algebra' subject? If so, please indicate these difficulties.
4. What do you suggest to overcome these difficulties that you indicated when teaching algebra?
5. When you start your career, do you think that you might encounter difficulties when teaching 'Geometry' subject? If so, please indicate these difficulties.
6. What do you suggest to overcome these difficulties that you indicated when teaching geometry?
7. When you start your career, do you think that you might encounter difficulties when teaching 'Data and Chance' subject? If so, please indicate these difficulties.
8. What do you suggest to overcome these difficulties that you indicated when teaching data and chance?

Method

Research Model

The study is a qualitative study which is organized according to the phenemological design and in which document analysis technique is used. The purpose of phenemology is to investigate phenomena which we cannot fully comprehend but also which is not completely a stranger to us (Yıldırım & Şimşek, 2008). In this study, it is aimed to get information about the opinions of prospective teachers on TIMSS project that we know but cannot fully comprehend.

Study Group

The study group is consisted of 99 prospective teachers who are studying in third and fourth year in Kocaeli University, Education Faculty, Elementary Mathematics Teacher Education. 59 (59,59%) of the prospective teachers who participated in the study are third year students and 40 (40,41%) of them are fourth year students. 47 of the third year students are female and 12 of them are male. 25 of the fourth year students are female and 12 of them are male. 72 (72,73%) of the prospective teachers who participated in the study are female and 27 (27,27%) of them are male. The age of participating prospective teachers differs between 20 and 30.

Data Collection Tools and Data Collection

The three data collection method which is common in Qualitative studies are; observation, interview and written document analysis. Document analysis method was selected in this study. Document analysis is analyzing the materials which have information about the fact or facts that are intended to search (Yıldırım & Şimşek, 2008). Opinion form which was validated in accordance with an expert's opinions and developed by the researcher, included 8 open-ended questions and was used for document analysis. A text which informed prospective teachers about TIMSS examination was given at the first page of the opinion form. The purpose of this text is to make prospective teachers remember their knowledge about this examination. These opinion forms were used as a data collection instrument. Prospective teachers were given 25 minutes for filling opinion forms during data collection process. At the end of this time, the opinion forms which were filled by the prospective teachers were collected by the researchers.

Data Analysis

The data of the study was evaluated by using content analysis. The purpose of content analysis is to get correlations and concepts which can explain the collected data. The reality that can be hidden in these data is tried to be uncovered with this analysis. The basic operation is organizing and interpreting the data in a way that readers can understand by combining similar data around certain concepts and themes (Yıldırım & Şimşek, 2008).

The first step of content analysis is coding the data (Yıldırım & Şimşek, 2008). Strauss and Corbin (1990) mentioned about three kinds of coding. These are; coding according certain concepts specified before, coding according to concepts inferred from the data and coding in a general framework. In this coding according to concepts inferred from the data was carried out. In this kind of coding, the data is read by the researcher line by line and important dimensions in accordance with the purpose of the study are determined. The researcher produce certain codes according to the meaning appeared. In this way, the code list is made and this list generates a conceptual structure for processing all of the data (Yıldırım & Şimşek, 2008). The data collected in this study was read by the researchers line by line and a list was created by obtaining certain codes.

It is not enough to code the data and classify the data according to these codes. It is necessary to find themes which gather the codes under certain categories and which can explain the codes in a general level. The codes should be combined and common features should be found. The process is, in a sense, a thematic coding and categorizing collected data through codes (Yıldırım & Şimşek, 2008). In this study, the list which was created by obtaining certain codes was deeply analyzed; separate themes were created by the researchers by finding the common aspects of the codes. The agreement between themes was calculated with the formula which was developed by Miles and Huberman (1994) as in the following; *'Agreement Percentage = [Agreement /(Agreement + Disagreement)] x 100'*. As a result of this calculation it was seen that reconciliation percentage of the researchers about the themes differed between 0,82 and 0,90.

Later on, it is necessary to define, explain and present the data in a language that readers can understand. It is necessary for the researcher to be descriptive as possible and to present the findings to readers. At this stage, the researcher does not express his/her opinions and interpretations but only presents the collected data in a processed way (Yıldırım & Şimşek, 2008). Also in this study, themes were explained in details by analyzing the codes and themes obtained in this study deeply by the researchers and necessary descriptions and definitions were made. Besides, the persuasiveness of the study was tried to be ensured by creating examples from the collected data. The frequency (f) and percentage (%) were used in the correlations and categorizations of the data and interpretations were definitely not made at this stage but the collected data were presented to the readers in a processed way.

Findings

The findings obtained in this study were presented to the reader according to the order of the research problems. In this sense; the answers of the prospective teachers for the question stated as *"When you start your career, do you think that you might encounter difficulties when teaching 'Numbers' subject?"* were displayed in Table 1.

Tablo 1. Do you think that you might encounter difficulties when teaching 'Numbers' subject?

		Yes		No		Total
Grades	3	26	%44,07	33	%55,93	59
	4	16	%40,00	24	%60,00	40
Gender	F	35	%48,61	37	%51,39	72
	M	7	%25,93	20	%74,07	27
Total		42	%42,42	57	%57,58	99

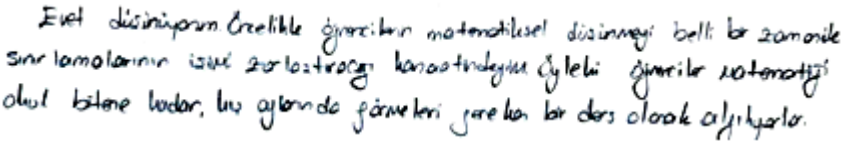
When Table 1 was analyzed, it was found that 26 (44,07%) third year prospective teachers thought that they might encounter a difficulty but 33 (55,93%) of them thought that they might not encounter any kind of difficulty. 16 (40%) fourth year prospective teachers thought that they might encounter a difficulty but 24 (60%) of them thought that they might not encounter any kind of difficulty. When it was analyzed according to their genders, 35 (48,61%) female students thought that they would encounter a difficulty and 37 (51,39%) of them thought that they might not encounter any kind of difficulty but 7 (25,93%) male students thought that they might encounter a difficulty and 20 (74,07%) of them thought that they might not encounter any kind of difficulty.

In general, 42 (42,42%) prospective teachers stated that they might encounter a difficulty when teaching 'Numbers' subject, 57 (57,58%) of them think that they might not encounter any kind of difficulty when teaching 'Numbers' subject. The themes about the data of the prospective teachers who stated they might encounter a difficulty regarding the first research problem were given in Table 2.

Table 2. The difficulties encountered when teaching Numbers

	Grades		Gender		Total
	3	4	F	M	
Studens	12	10	20	2	22 (%61,11)
How can I teach?	7	7	9	5	14 (%38,89)
Total					**36 (%100)**

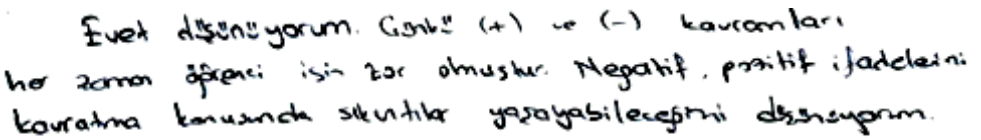
When Table 2 was analyzed, it was seen that 12 third year prospective teachers stated that they might have difficulties according to 'student' theme and 10 fourth year prospective teachers stated that they might have difficulties according to this theme. When gender was considered, it was seen that 20 females and 2 male prospective teachers stated they might have difficulties according to this theme. When the data regarding the theme specified as 'Students' were analyzed, it was seen that they stated that they might have difficulties when the subject was difficult for the students and according to the perceptions of students. For instance;



Yes, I think so. First off, for me the fact that students limit mathematical thinking to a certain time makes my job difficult. I mean, students perceive mathematics as a lesson that they should take during winter months until schools will be closed.

Figure 1. The answer of S37

The second main point that they might encounter difficulties was 'How do I teach?' theme. According to this theme, it was seen that they stated that they might have difficulties at the points such as not knowing numbers subject completely and not knowing how to transfer the subject to students. For instance;



Yes, I think so. Because (+) and (-) concepts are always difficult for the students. I think they might have difficulties in understanding negative and positive expressions.

Figure2. The answer of S51

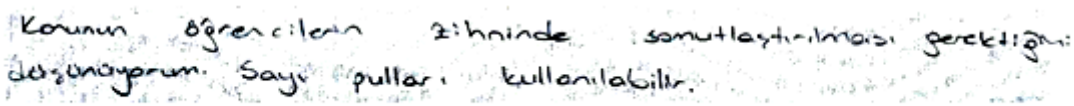
In total, it was appeared that 14 (38,89%) prospective teachers stated that they might have difficulties in knowing how to teach number subject and 22 (61,11%) prospective teachers stated that they might have difficulties about the fact that the subject could not be understood by students.

When the data regarding the second research problem of the study which was asked as '*What do you suggest to overcome these difficulties that you indicated when teaching numbers?*' were analyzed, it was seen that prospective teachers who stated that they might not encounter difficulties also made suggestions in addition to prospective teachers who stated that they might encounter difficulties before. Besides, it was appeared that some prospective teachers made more than one suggestion. The findings regarding the second research problem were given in Table 3.

Table 3. Solution strategies about overcoming the difficulties when teaching Numbers

	Grade		Gender		Total	
	3	4	F	M		
Plenty of examples	15	6	17	4	21	%38,18
Activity/Material	7	7	9	5	14	%25,45
Modelling/Concretization	3	9	8	4	12	%21,81
Teaching method	5	3	5	3	8	%14,55
Total					**55**	**%100**

When Table 3 was analyzed, it was seen that the suggestions for overcoming the difficulties grouped under four different themes. 15 third year prospective teachers stated that it was necessary to solve plenty of examples about the subject for overcoming the difficulties in teaching Numbers subject. When forth year prospective teachers were analyzed, it was found out that making modelling/concretization was the most frequently repeated solution strategy. In gender based analysis, it was determined that female prospective teachers stated that it was necessary to solve plenty of examples about the subject but male prospective teachers focused on conducting activities/using materials. When Table 3 is analyzed in general, it is seen that 21 (38,18%) prospective teachers stated the necessity of solving plenty of examples, 14 (25,45%) prospective teachers focused on conducting activities/using materials related with the subject. For instance;



I think it is necessary to concretise the subject in the minds of the students. Number sequences can be used.

Figure 3. The answer of S99.

The answers of the prospective teachers whether or not they would have difficulties about the subject regarding the third research problem which was asked as *"When you start your career, do you think that you might encounter difficulties when teaching 'Algebra' subject? If so, please indicate these difficulties'* were given in Table 4.

Table 4. Do you think that you might encounter difficulties when teaching 'Algebra' subject?

		Yes		No		Total
Grade	3	43	%72,88	16	%22,22	59
	4	21	%52,50	19	%47,50	40
Gender	F	51	%70,83	21	%29,17	72
	M	13	%48,15	14	%51,85	27
Total		64	%64,65	35	%35,35	99

When Table 4 was analyzed, it was seen that 43 (72,88%) third year prospective teachers thought that they might encounter a difficulty but 16 (22,22%) of them thought that they might not encounter any kind of difficulty and 21 (52,50%) fourth year prospective teachers thought that they might encounter a difficulty but 19 (47,50%) of them thought that they might not encounter any kind of difficulty. When it was analyzed according to their genders, 51 (70,83%) female students and 13 (48,15%) male prospective teachers thought that they would encounter a difficulty but 21 (29,17%) female students and 14 (51,85%) male prospective teachers thought that they would not encounter any kind of difficulty.

In total it was determined that 64 (64,65%) prospective teachers stated that they might encounter a difficulty when teaching 'Algebra' subject, 35 (35,35%) of them stated that they might not encounter any kind of difficulty when teaching 'Algebra' subject. The findings of the analysis which was carried out in order to understand their thoughts about what kind of difficulties they might encounter were displayed in Table 5.

Table 5. The difficulties encountered when teaching Algebra

	Grade		Gender		Total	
	3	4	F	M		
Student	16	11	26	1	27	%50,94
Complex	10	1	8	3	11	%20,75
How can I teach?	4	6	5	5	10	%18,87
Class management	3	2	3	2	15	%9,43
Total					**53**	**%100**

When Table 5 was analyzed, it was seen that 16 third year prospective teachers stated that they would encounter difficulties first in 'student' theme then secondly in 'complex' theme and 11 fourth year prospective teachers stated that they would encounter difficulties first in 'student' theme then secondly in

'How can I teach?'. When it was analyzed generally, it was appeared that they expressed that they would frequently encounter difficulties in 'student' and 'complex' themes. For instance;

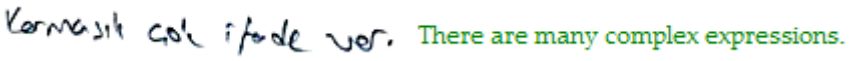


Figure 4. The answer of S4

When the data regarding the fourth research problem of the study which was asked as '*What do you suggest to overcome these difficulties that you indicated when teaching algebra?'* were analyzed, it was seen that prospective teachers who stated that they might not encounter difficulties also made suggestions in addition to prospective teachers who stated that they might encounter difficulties before. Besides, it was appeared that some prospective teachers made more than one suggestion. The findings regarding the fourth research problem were given in Table 6.

Table 6. Solution strategies about overcoming the difficulties when teaching Algebra

	Grade		Gender		Total	
	3	4	F	M		
Modelling	16	8	20	4	24	%30,38
How can I teach? (Teaching style)	12	7	13	6	19	%24,05
Activity	9	6	13	2	15	%18,99
Plenty of examples	7	7	9	5	14	%17,72
Pedagogic content knowledge	5	2	5	2	7	%8,86
Total					79	%100

When Table 6 was analyzed, it was appeared that 5 different solution strategies were offered to overcome the difficulties when teaching Algebra subject. It was seen that both third year and fourth year prospective teachers stated that they could overcome the difficulties by using modelling most frequently. In the analysis carried out by considering gender, it was seen that female prospective teachers mostly selected modelling as a solution strategy and male prospective teachers mostly selected teaching style and solving plenty of examples as a solution strategy. In general, it was found out that they stated the necessity of selecting modelling solution strategy mostly. For instance;

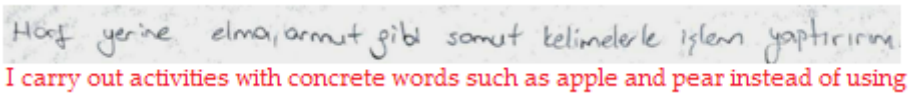


Figure5. The answer of S56

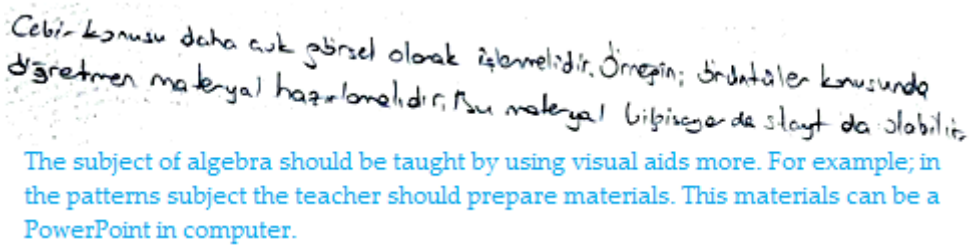


Figure 6. The answer of S24

The answers of the prospective teachers whether or not they would have difficulties about the subject regarding the fifth research problem which was asked as *"When you start your career, do you think that you might encounter difficulties when teaching 'Geometry' subject? If so, please indicate these difficulties'* were given in Table 7.

Table 7. Do you think that you might encounter difficulties when teaching 'Geometry' subject?

		Yes		No		Total
Grade	3	35	%59,32	24	%40,68	59
	4	20	%50,00	20	%50,00	40
Gender	F	44	%61,11	28	%38,89	74
	M	11	%40,74	16	%59,26	27
Total		55	%55,56	44	%44,44	99

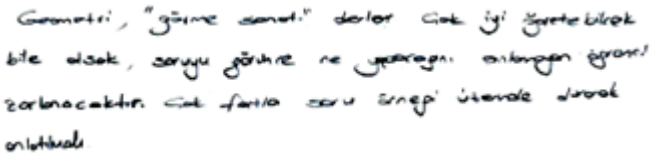
When Table 7 was analyzed, it was seen that 35 (59,32%) third year prospective teachers stated that they might encounter a difficulty but 24 (40,68%) of them thought that they might not encounter any kind of difficulty and 20 (50%) fourth year prospective teachers stated that they might encounter a difficulty but 20 (50%) of them thought that they might not encounter any kind of difficulty. When it was analyzed according to their genders, 44 (61,11%) female students and 11 (40,74%) male prospective teachers stated that they would encounter a difficulty but 28 (38,89%) female students and 16 (59,26%) male prospective teachers stated that they would not encounter any kind of difficulty.

In total it was determined that 44 (44,44%) prospective teachers stated that they might encounter a difficulty when teaching 'Geometry' subject, 55 (55,56%) of them stated that they might not encounter any kind of difficulty when teaching 'Geometry' subject. The findings of the analysis which was carried out in order to understand their thoughts about what kind of difficulties they might encounter were displayed in Table 8.

Table 8. The difficulties encountered when teaching Geometry

	Grade		Gender		Total	
	3	4	F	M		
Student	16	9	22	3	25	%54,38
Concretization	8	2	7	3	10	%21,74
Preparation to lesson	2	5	7	0	7	%15,22
Concrete	2	2	2	2	4	%8,69
Total					46	%100

When Table 8 was analyzed, it was seen that both third and fourth year prospective teachers stated that they would encounter difficulties about 'student' theme most. In the analysis carried out by considering gender, it was appeared that they stated that they would encounter difficulties in 'student' theme most. In general, it was ascertained that it was stated that with 25 (54,38%) repetition the difficulty regarding 'student' theme would appear most. It was appeared that they expressed that since geometry requires seeing, students would have difficulties and they would have difficulties in teaching the subject because of students' perception. For instance;



They say that Geometry is the "art of seeing". Although we can teach it very well, the student who does not understand what to do when he/she sees the question will have difficulties.

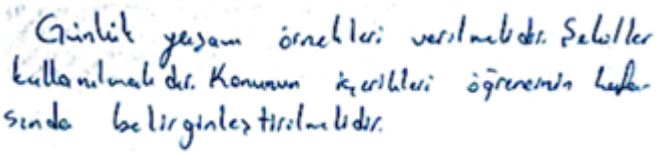
Figure 7. The answer of S11

When the data regarding the sixth research problem of the study which was asked as '*What do you suggest to overcome these difficulties that you indicated when teaching geometry?*' were analyzed, it was seen that prospective teachers who stated that they might not encounter difficulties also made suggestions in addition to prospective teachers who stated that they might encounter difficulties before. Besides, it was appeared that some prospective teachers made more than one suggestion. The findings regarding the sixth research problem were given in Table 9.

Table 9. Solution strategies about overcoming the difficulties when teaching Geometry

	Grade		Gender		Total	
	3	4	F	M		
Activity/Material	14	10	19	5	24	%33,80
Example	16	3	12	7	19	%26,76
Concretization	7	11	12	6	18	%25,35
Teaching style	7	3	7	3	10	%14,08
Total					71	%100

When Table 9 was analyzed, it was appeared that third year prospective teachers offered solutions regarding activity/material and solving plenty of examples most and fourth year prospective students stated that they could overcome the difficulties with activity/material most. While it was appeared that female prospective teachers stated that they would overcome difficulties by using activities/materials, it was seen that male prospective teachers selected the methods of concretization of the subject and solving plenty of examples. In general, it is seen that the difficulties about teaching geometry can be overcame by carrying out activities/using materials and solving plenty of examples about the subject. For instance;



Lives and experiences should be given. Figures should be used. The content of the subject should be concretized in the student's minds.

Figure 8. The answer of S2

The answers of the prospective teachers whether or not they would have difficulties about the subject regarding the seventh research problem which was asked as *"When you start your career, do you think that you might encounter difficulties when teaching 'Data and Chance' subject? If so, please indicate these difficulties'* were given in Table 10.

Table 10. Do you think that you might encounter difficulties when teaching 'Data and Chance' subject?

		Yes		No		Total
Grade	3	35	%59,32	24	%40,68	59
	4	18	%45,00	22	%55,00	40
Gender	F	45	%62,50	27	%37,50	72
	M	8	%29,63	19	%70,37	27
Total		53	%53,53	46	%46,47	99

When Table 10 was analyzed, it was seen that 35 (59,32%) third year prospective teachers stated that they might encounter a difficulty but 24 (40,68%) of them thought that they might not encounter any kind of difficulty and 18 (45%) fourth year prospective teachers stated that they might encounter a difficulty but 22 (55%) of them thought that they might not encounter any kind of difficulty. When it was analyzed according to their genders, 45 (62,50%) female students and 8 (29,63%) male prospective teachers stated that they would encounter a difficulty but 27 (37,50%) female students and 19 (70,37%) male prospective teachers stated that they would not encounter any kind of difficulty. In total it was determined that 53 (53,53%) prospective teachers stated that they might encounter a difficulty, 46 (46,47%) of them stated that they might not encounter any kind of difficulty. The findings of the analysis which was carried out in order to understand their thoughts about what kind of difficulties they might encounter were displayed in Table 11.

Table 11. The difficulties encountered when teaching "Data and Chance"

	Grade		Gender		Total	
	3	4	F	M		
Student	14	6	20	0	20	%38,97
How can I teach?	2	3	5	0	5	%17,24
Abstract	2	2	4	0	4	%13,79
Total					29	%100

When Table 11 was analyzed, it was seen that both third and fourth year prospective teachers stated that they would encounter difficulties about 'student' theme most. It was appeared that they stated that they would have difficulties as they thought the subject could not be perceived by students, students could not understand the subject and the subjects would be difficult for the students. In the analysis carried out by considering gender, it was appeared that none of the male prospective teachers thought that they would have difficulties when teaching 'Data and Chance' subject. For instance;

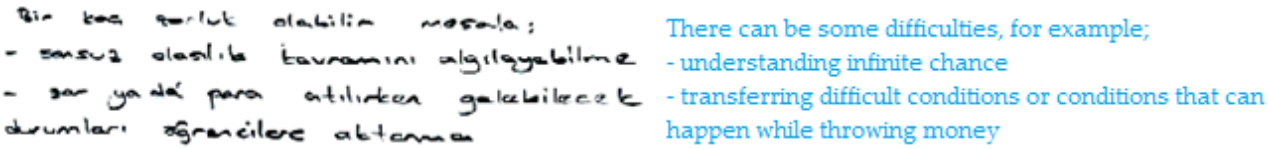


Figure 9. The answer of S9

When the data regarding the eight research problem of the study which was asked as '*What do you suggest to overcome these difficulties that you indicated when teaching Data and Chance subject?'* were analyzed, it was seen that prospective teachers who stated that they might not encounter difficulties also made suggestions in addition to prospective teachers who stated that they might encounter difficulties before. Besides, it was appeared that some prospective teachers made more than one suggestion. The findings regarding the sixth research problem were given in Table 12.

Table 12. Solution strategies about overcoming the difficulties when teaching "Data and Chance"

	Grade		Gender		Total	
	3	4	F	M		
Example	18	7	18	7	24	%40,32
Teaching	8	6	13	1	14	%25,58
Material/Activity	8	6	11	3	14	%25,58
Modelling/ Concretization	1	8	7	2	9	%14,52
Total					62	%100

When Table 12 was analyzed, while it was seen that 18 third year prospective teachers stated the necessity of giving plenty of examples about the subject, it was appeared that fourth year prospective teachers stated the necessity of making modelling/concretization about the subject most. When it was analyzed according to gender, it was understood that female prospective teachers stated that it was necessary to solve plenty of sample problems about the subject. In a general evaluation, the necessity of solving plenty of sample problems about the subject was appeared. For instance;

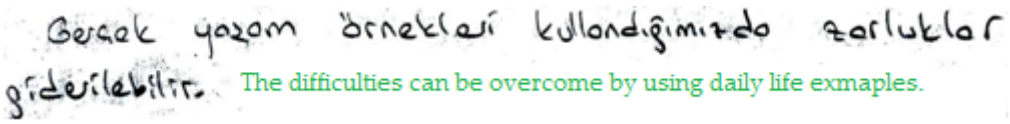


Figure 10. The answer of S7

Conclusions, Discussion and Recommendations

It was tried to determine whether or not prospective teachers would have difficulties in teaching subjects within the scope of TIMSS and if they thought that they would have, what kind of solution strategies they would offer. In this sense, the opinions of prospective teachers were taken according to four mathematics domains related with 8th grades within the scope of TIMSS.

While 42 (42,42%) prospective teachers stated that they might encounter difficulties in teaching numbers subject, 57 (57,58%) of the stated that they might not encounter any kind of difficulty. It was concluded that prospective teachers stated that they might not encounter any kind of difficulty in teaching numbers subject. It was appeared about this topic that there might be difficulties in terms of the facts that students cannot perceive the subject; students cannot understand the subject as they have negative attitudes about the subject because they think the subject is difficult, the subject is difficult for the students, not knowing how to teach the subject and concretizing the subject. It was determined that these difficulties could be overcame by solving plenty of examples about the subject, carrying out activities and using modelling.

While 64 (64,65%) prospective teachers stated that they might encounter difficulties in teaching algebra subject, 35 (35,35%) of them stated that they did not think that they might encounter any kind of difficulty. It was concluded that prospective teachers stated that they might encounter difficulties in teaching algebra subject. It was found on this subject that there could be difficulties in cases when students cannot understand the subject as it is complicated, students got confused because of using unknown expression in

addition to numbers and not knowing how to teach the subject to students. It was determined that these difficulties could be overcame by solving plenty of examples about the subject, carrying out activities and using modelling and concretizing.

While 44 (44,44%) prospective teachers did not think that they might encounter difficulties in teaching geometry subject, 55 (55,56%) of them thought that they might encounter any kind of difficulty. In this sense, it was concluded that prospective teachers stated that they might encounter difficulties in teaching geometry subject. It was appeared that there might be difficulties in terms of the facts that students cannot solve problems since geometry requires seeing, prospective teachers express that they cannot draw geometrical figures properly, the subject is abstract and it is hard to concretize the subject. The solution strategies for overcoming the stated difficulties were determined as in the following; using material, carrying out activities, solving plenty of examples and concretizing the subject.

While 53 (53,53%) prospective teachers stated that they might encounter difficulties in teaching data and chance subject, 46 (46,47%) of them did not think that they might encounter any kind of difficulty. It was concluded that prospective teachers stated that they might encounter difficulties when teaching data and chance subject. It was determined that they stated that they might encounter difficulties in points that students cannot understand the subject since the subject is perceived as difficult by students, the perception and attitudes of students, abstract subject and not knowing how to teach the subject. It was concluded that the stated difficulties could be overcame by solving plenty of examples, using materials, carrying out activities and modelling.

When findings were evaluated in general, it was appeared that prospective teachers stated that they might have difficulties in all other learning domains other than numbers subject. The stated difficulties were stated as; difficulties coming from students, not knowing how to teach the subject and abstract subjects. The solution strategies were determined as; solving plenty of examples related with the subject, carrying out activities, using materials and making modelling/concretizing. Karamustafaoğlu and Sontay (2012) suggested that it was necessary to spend more time with the activities that enabled students to understand the subjects and concepts easily in science and mathematics lessons. In this sense, it was determined that a similar suggestion was offered with the suggestions of prospective teachers. Berberoğlu and others (2003) found in their studies that the most important factors that affected achievements of students were the success-failure perceptions of students and their socio-economic levels. Similarly, Yayan and Berberoğlu (2004) stated that one of the most important factors that affected the achievements of students was the failure perceptions of the students. Also in that study prospective teachers stated that they had difficulties coming from students when teaching subjects. From this perspective, it can be said that prospective teachers have realistic concerns.

Yayan and Berberoğlu (2004) specified that the reason of students' failure in mathematics was student-centred activities. It was determined in the study that prospective teachers stated that it was necessary to use activities frequently in teaching subjects. In this case, it can be said that prospective teachers have focused on a subject that which should be solved. It was determined that in countries such as Japan, Singapore, Hong Kong and Korea which had higher rankings in TIMSS examination the time allocated for sports as an extracurricular activity was less than other countries participating the same examination (Leung, 2002). In this sense, it is appeared that the activities which are offered as a solution strategy should be prepared meticulously.

Güner, Sezer and Akkuş-İspir (2013) suggested in their studies to give the necessary support to novice teachers. They stated that in order to inform all teachers, it was necessary to provide teacher training courses. Karamustafaoğlu and Sontay (2012) found out in their studies that practitioner teachers accepted the seminar as beneficial but a late one. Prospective teachers stated also in their study that they might encounter difficulties when teaching mathematical subjects within the scope of TIMSS. In this regard, it is thought that the awareness of the prospective teachers should be raised. Prospective teachers should be informed about both the content of the examination and how the examination is implemented. In this way, it is thought that they will have pre-information about this examination that they can experience when they start their carriers as teachers.

Sarıer (2010) offered some solutions in his study that the results of international examinations should be evaluated entirely, the solutions for increasing the achievements of the students should be developed with the cooperation of Ministry of Education and the Council of Higher Education and educational policies that can produce active solutions to problems should be developed by considering these policies once again. When the findings of this study were evaluated, the suggestions of prospective teachers were attracted attentions. In this sense, it is suggested to carry out teaching lessons in more detailed way in educational faculties. The necessity for focusing on the teaching of mathematics subjects is appeared. In this study the opinions of the prospective teachers about the eighth grade mathematics subjects were analyzed. The reason of this, prospective teachers in the study group will teach at middle school level. From this perspective, another study for teaching subjects within the scope of fourth grades with prospective classroom teachers can be designed. Besides, the opinions of prospective classroom teachers can also be analyzed.

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