Determination of the Perception of Students Regarding Mathematics Lesson: "Geometric Objects" Unit

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ABSTRACT The purpose of this research is to determine students' perceptions regarding "Geometric Objects" unit. In this study, mixed method was used as a research model since both qualitative and quantitative research methods were used. Content analysis, which is among qualitative research methods, was used in the research. The sample of the research consists of 8th grade students who study in 6 different secondary schools affiliated to the Ministry of National Education of Northern Cyprus in 2016-2017 academic years. The "Perception Scale regarding the Geometric Objects Unit" developed by the researchers, was used as a data collection tool. As a result of the research, the perceptions of the students about the geometric objects were collected in 3 different categories. These are teacher, student, and geometric objects. It is seen that perceptions belonging to these categories are mostly evaluated as "Sometimes" and that many items are collected under the teacher factor.

INTRODUCTION

Mathematics is a science whose direct reflections sometimes we see in our lives and sometimes we use it to make our lives gain meaning (Zerafa 2017). Therefore, its place in our schools as a lesson of mathematics is also very important since it affects our lives so much. For this reason, it is necessary to do mathematics lessons in a way that will teach the ability to solve real life problems. It may be useful to consider what mathematical concepts are related to events we encounter in everyday life and present them as problem situations (Güzel 2016; Tezer and Ozcan 2015).

Geometry is the subdivision of mathematics, a theoretical system in which definitions play a critical role. In addition, it is an important branch in which forms and space are studied (Gökbulut and Ubuz 2013). The main aims are to recognize geometric objects and to know their properties, to find relationships between these objects and to prove geometric proposals. It is impossible to see a single drawing of the two dimensional drawings of a three dimensional object on a piece of paper as it is either missing or causing eyes to misinterpret and causing different perceptions, or even if the drawings are flawless as the environment is static, the shapes appear from different facades. Learning difficulties and misconceptions can arise due to two-dimensional drawings while teaching prisms, which are three-dimensional objects (Yenilmez and Elif 2008).

Objects taught to students at primary school level are cylinders, prisms, pyramids, cones and spheres. The basic properties and the basic elements of these objects, surface areas and volumes are taught in a spiral structure. In addition, it is also aimed at solving the problems related to objects (MEB 2009).

The NCTM (2016) suggests that effective mathematics education requires students to understand what they need to know and learn, as well as the attention and support of students for learning well. It was reported that teachers need to know and use math in depth in order to be effective and to be able to use their knowledge flexibly while teaching (Virtop 2016). However, researches in the literature review agree that prospectus teachers and teachers have poor knowledge of geometric objects.

Perception is the signals in the nervous system that are formed by physical stimulation of sensory organs. Another definition of perception is the acquisition, interpretation, selection and organization in psychology and scientific sciences (Babacan 2014). Problem-solving skills,

one of the meta-cognitive characteristics, are not sufficient to reveal the academic achievement of students in mathematics education, but perceptions within affective traits help to establish this relationship. Thus, dealing with cognitive features as well as affective characteristics will help both to understand the current situation and to predict future behaviour (Usta 2013; Bal 2016; Polat et al. 2017).

In mathematics education, there are affective factors among the factors affecting problem-solving skills of students. These include factors such as willingness to solve problems, self-confidence, stress and anxiety, uncertainty, patience and perseverance, interest in problem solving or problem situations, motivation, desire to succeed, desire to satisfy the teacher. These factors are factors that affect student perceptions both positively and negatively (Türkkan and Uyar 2016; Ozdemir and Ummanel 2016; Baglama et al. 2017).

For these reasons, it was aimed in our study to determine how the 8th graders perceive the prisms, surface areas and volumes in the Geometric Objects (GO) unit, and what are the factors affecting the student perceptions in the positive and negative aspects that were mentioned above.

Since the Geometric Objects unit is one of the last and most difficult subjects in the 8th grade mathematics curriculum, the limited number of articles and theses in the literature search reveal that few researchers regarding the 8th class GO unit. Therefore, it is aimed to determine the perceptions of the students about the prism, surface areas and volumes of the 8th class GO unit, considering that this study will shed light on many researchers and educators.

Sub-objectives of the Study

1) What are the perceptions of the secondary school 8th graders regarding the teaching of the GO unit?

2) What are the perceptions of the secondary school 8th grade students regarding the GO unit grade teachers?

METHODOLOGY

In this study, mixed method was used as a research model since both qualitative and quantitative research methods were used. Content analysis, which is a qualitative research method, was used. Content analysis; "is a technique used to characterize and compare documents, interview transcriptions, or records. The aim is to systematically define the content of the participants' views" (Sali et al. 2014). In the quantitative part of the study, the survey method was used to determine student perceptions. According to Karasar (2009), the survey model is a research approach based on revealing the existing situation.

Population and Sample

The population of the research is the 8th grade students (N=3827) studying in North Cyprus in 2016-2017 academic year. The survey sample is composed of randomly selected 600 students through random sampling. As a result of the application, 537 students answered the ques- tionnaire. The reason for choosing the sample at the 8th grade level is due to the assumption that the students gained the GO Unit's achieve- ments at the mathematics lesson until the end of this level. In Table 1, the frequencies of the students regarding gender were given.

Data Collection Tool and Application

As a means of data collection in the study, a questionnaire form with 35 items about the student perception scale for the GO unit, which was developed by the researchers, was used. In the selection of the items included in the scale, the mathematics achievement levels by taking the mathematics lesson grades of 30 students who

Table 1: The frequencies of the students regarding gender

Participants	Gender				
	Girl		Boy		Total
	N	%	N	%	N
	267	49.7	270	50.3	537

are weak (N= 10), moderate (N = 10) and good (N = 10), studying in a secondary school affiliated to the Ministry of National Education of Northern Cyprus and their common concepts from compositions written under the heading "What are your perceptions regarding the GO unit?" were used. Thus, it was aimed to reveal the perceptions of the students about the GO unit and to determine the causes of under-learning. After the preliminary application, the questionnaire was finalized at the end of the literature review and expert opinions, which were applied at the final version too.

In order to determine the validity of the scale, an exploratory factor analysis (EFA) was performed to determine the factor structure of the scale. Factor analysis, which is prepared to measure a specific subject and informs about the validity of the scale, is done to reduce the number of variables by defining the basic vari- ables or factors from among the many observed variables. Each defined basic variable is related to each other and measures the same property.

The Kaiser Meyer Olkin (KMO) values and the Bartlett test results were checked before the analysis to determine whether the data obtained were appropriate for the factor analysis and to determine the suitability of the sample size for factoring. The results were given in Table 2.

Table 2: KMO and Bartlett's test results of the GO unit perception scale

Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy		0.913
Bartlett's Test	Chi-square	5131.632
	df	630
	Sig.	.000*

*p<0.01

According to Saritac (2014), the KMO test to evaluate whether the selected data is suitable for performing factor analysis, is between 0 and 1. The KMO value should be greater than .50,

and the closer to 1, the more appropriate it is for factor analysis. The result was considered significant if p <.01 as a result of Bartlett's test.

If we consider that the KMO value should be larger than 0.50 in order to be able to perform factor analysis, we can say that 0.913 value obtained from the analysis of basic components is quite suitable for analysis. One of the criteria that is taken into account in the application of factor analysis is that the measured characteristic shows the normal distribution property. In the universe it is useful to understand the existence of this assumption by looking at the results of the Bartlett's test to determine whether the correlation is sufficient. The Bartlett's test results are significant according to the Table 2. This shows us that the data has the appropriate conditions for doing EFA.

The breaking points in the line graph obtained by combining the material values of the materials show us the factor number of the scale. The Scree Plot graph of the scale is given in Figure 1.

It was understood that the Scree Plot graph and the mentioned value in the Table 3 have more than one factor. The names of the subfactors, the factors of scale, the ratios of the subscales in the total variance, and the value ranges were given in Table 3.

When Table 3 was examined, the first subfactor accounts for 9.939 percent of the total variance, the second sub-factor accounts for 35.35 percent of the total variance and the third sub-factor accounts for 7.230 percent of the total variance. The total variance explained by the three factors is 52.204 percent.

The factor loadings of EFA designed to determine the factor structure of this scale were given in Table 4.

When Table 4 is examined, it is seen that when the factor loads of the 35 items analysed in the geometric objects unit perception scale are examined, the lowest value is .410 and the highest value is .680. As a result of the reliability

Table 3: Items recognized by the GO unit perception scale, value ranges of items and percentages in total variance

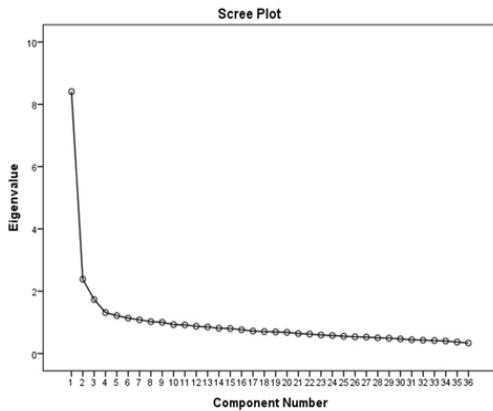| Sub-factors	Items	Value ranges	Ratio in total variance (%)
Student	1,2,3,4,5,6,7,8,9,10,	376-680	9.939
Teacher	11,12, 13,14,15,16,17,18,19,20,21,22,23,24,25,26,27,28,29	344-580	35.035
GO Unit	30,31,32,33,34,35	410-674	7.230

Fig. 1. The scree plot graph of the scale

Table 4: Item factor loads of the GO unit perception scale

Item	Factor loadings of perception scale		
	1. Factor	2. Factor	3. Factor
Item 1	.635		
Item 2	.623		
Item 3	.588		
Item 4	.580		
Item 5	.571		
Item 6	.526		
Item 7	.503		
Item 8	.470		
Item 9	.420		
Item 10	.303		
Item 11		.615	
Item 12		.614	
Item 13		.603	
Item 14		.586	
Item 15		.578	
Item 16		.578	
Item 17		.560	
Item 18		.557	
Item 19		.554	
Item 20		.542	
Item 21		.532	
Item 22		.516	
Item 23		.516	
Item 24		.490	
Item 25		.420	
Item 26		.394	
Item 27		.378	
Item 28		.365	
Item 29		.315	
Item 30			.645
Item 31			.615
Item 32			.579
Item 33			.529
Item 34			.504
Item 35			.477

analysis for the remaining 35 items, the Cronbach Alpha coefficient was found to be .88. It can be said that this value is quite good. In general, we can say that the scale of EFA is 3 factors and that the items of these factors are collected under the headings of teaching, teacher and student. The scale, which was the final form of validity, reliability analysis and pre-test, was applied to 600 students.

RESULTS AND DISCUSSION

As a result of analysing the GO Unit regarding perception scale, which is a data collection tool in this section, in the SPSS 20.00 program, the obtained data were tabulated and interpreted.

In Table 5, perceptions of students' teaching of the GO unit were given.

According to Table 5, the items teaching GO unit with the question-and-answer technique by the teacher makes me become distracted, using computer while the GO unit is being taught, decreases my motivation and the GO unit makes it easy for me to give daily life examples to 3D objects were replied as *"Always"*. The other items, supporting the GO unit with computer aided training makes me learn more easily, when GO unit is taught, only the use of the textbook decreases my motivation for the lesson, doing origami work when the GO unit is taught increases my interest in the lesson, teaching the GO unit via education software makes me learn more easily, the GO unit makes it possible for me to calculate the surface area of 3D objects, the GO unit makes it possible for me to calculate the volume of 3D objects and the GO unit allows me to visualize without seeing the 3D shape were replied as *"Sometimes"*.

During the teaching of the GO unit, the teacher responded *"Always"* to items that indicated that the process of question-and-answer technique distracted students, weakened their motivation in computer use, and made it easier to give day-to-day samples to 3D objects. In other materials, the GO unit facilitates learning by supporting with computer-aided education, only weakens the motivation of the use of the bookkeepers, increases the score of the origami study, facilitates the use of educational software, enables 3D objects to calculate surface area, volume and visualize these objects without seeing them they responded *"Sometimes"* in their perception.

Table 5: Student perceptions related to teaching GO unit as the first factor

Item codes	Items	N	Mean	Sd.	Evaluation outcome
I1	Supporting the GO unit with computer-aided training makes me learn more easily.	537	2.210	0.783	*Sometimes*
I2	When GO unit is taught, only the use of the textbook decreases my motivation for the lesson.	537	1.910	0.839	*Sometimes*
I3	Teaching GO unit with the question-and-answer technique by the teacher makes me become distracted.	537	2.353	0.773	*Always*
I4	Doing origami work when the GO unit is taught increases my interest in the lesson.	537	2.206	0.812	*Sometimes*
I5	Teaching the GO unit via education software (Morpa Campus, Vitamin, etc.) makes me learn more easily.	537	1.774	0.740	*Sometimes*
I6	Using computer while the GO unit is being taught, decreases my motivation.	537	2.260	0.805	*Always*
I7	The GO unit makes it possible for me to calculate the surface area of 3D objects.	537	2.288	0.765	*Sometimes*
I8	The GO unit makes it possible for me to calculate the volume of 3D objects.	537	1.931	0.846	*Sometimes*
I9	The GO unit allows me to visualize without seeing the 3D shape.	537	2.212	0.777	*Sometimes*
I10	The GO unit makes it easy for me to give daily life examples to 3D objects.	537	2.242	0.741	*Always*

In Table 6, perceptions of the learners regarding teachers are given. According to Table 6, for the items when the GO unit is being taught, it makes it easier forme to get information after making a discovery, teacher leading us to explore becomes a model and make me learn easily, also while the GO unit is being taught, it gives me opportunity to support the object with the concrete examples given by the teacher, it will make me memorize explanations when the teacher evaluates me and the teacher's oral questions allow me to self-assess the answer was as "Always" while the other items were "Sometimes". In the Table 7, students of GO Unit regarding the percep- tions of students were given.

According to Table 7, the answer was *"Always"* for the item while the GO unit is being taught it helps me to be active in-group work. While for the items - the GO unit allows me to be more active in taking part in the project work while it is being taught, using the smart board while the GO unit is taught, increases my motivation, using the tablet while the GO unit is taught makes me learn easier, the GO unit allows me to self-assess and to express what I have learned at any time and at the end of the GO unit, assessing via only written examinations will decrease my motivation towards the lesson items were selected as *"Sometimes"*.

We can say that the majority of perceptions are about teacher and once again it was seen that teacher factor is one of the most important and inseparable elements of mathematics education (Ünlü 2017).

Hülya and Demir (2017) examined the effect of basic geometric drawings using a compass-ruler on the geometric thinking levels and attitudes towards mathematics of pre-service teachers. As a result of the research, the basic geometric drawing applications using the compass-ruler have been achieved as a result of increasing the candidates' attitudes towards geometric thinking and mathematics.

According to Campbell (2006), the new generation students do not want a teaching environment in which mostly textbooks are used. For this reason, it is of great importance for the new generation students that the teacher has good knowledge of the profession and the field, is self-improving and renewing, and is an active user of the technology. For this reason, teachers have great responsibilities in training faculties (Tugun et al. 2017).

In mathematics education, it may not be possible for us to make a successful investment by considering only the cognitive factors. There are various problems and difficulties in solving these problems. It is thought that it is useful to determine the perceptions of the students for solving these difficulties and the problems encountered (Soylu and Soylu 2006).

Table 6: Second factor; student perceptions related to teaching GO unit

Item codes	Items	N	Mean	Sd.	Evaluation outcome
I11	The problem-solving method of the GO unit by the teacher enables me to be active during the lesson.	537	2.167	0.813	*Sometimes*
I12	When the GO unit is being taught, getting homework increases my performance for the lesson.	537	2.286	0.798	*Sometimes*
I13	While the GO unit is being taught, the teacher's warm up activities makes it easier for me to recall the previous knowledge.	537	2.238	0.732	*Sometimes*
I14	When the GO unit is being taught, the teachers' introduction activities make me become interested in the lesson.	537	2.204	0.762	*Sometimes*
I15	While the GO unit is being taught, it encourages me when the teacher leads us into discovery.	537	2.333	0.737	*Sometimes*
I16	When the GO unit is being taught, it makes it easier for me to get information after making a discovery.	537	2.298	0.763	*Always*
I17	When the GO unit is being taught, the teacher leading us to explore becomes a model and make me learn easily	537	2.338	0.758	*Always*
I18	While the GO unit is being taught, it will increase the prediction power of us when the teacher leads us to explore.	537	1.772	0.806	*Sometimes*
I19	When the GO unit is being taught, the fact that the teacher leads us to explore makes it possible for me to get rid of the prejudices about the lesson.	537	2.225	1.531	*Sometimes*
I20	When the GO unit is being taught, the teacher helps us to make suggestions for the lesson that lead us to explore.	537	2.312	0.774	*Sometimes*
I21	Clear explanation by the teacher while the GO unit is being taught makes the definitions clear.	537	2.257	1.548	*Sometimes*
I22	While the GO unit is being p taught, it allows me to reinforce my previous knowledge when the teacher repeats explanations.	537	2.203	0.731	*Sometimes*
I23	While the GO unit is being taught, when the tutor details, it allows me to talk about the new information I have learned.	537	2.184	0.787	*Sometimes*
I24	While the GO unit is being taught, it makes it easier for me to learn the details of the teacher's written material.	537	2.279	0.787	*Sometimes*
I25	While the GO unit is being taught, it gives me opportunity to support the subject with the concrete examples given by the teacher.	537	2.391	0.774	*Always*
I26	While the GO unit is being taught, it will make me memorize explanations when the teacher evaluates me.	537	2.495	0.740	*Always*
I27	While the GO unit is being taught, the teacher evaluation makes me learn my level of knowledge.	537	2.329	0.833	*Sometimes*
I28	While the GO unit is being taught, the teacher's assessment of me makes me learn my level of problem solving skills.	537	2.327	0.743	*Sometimes*
I29	When the GO unit is being taught the teacher's oral questions allows me to self-assess.	537	2.394	0.758	*Always*

CONCLUSION

In this study, it was seen that students were trying to reveal their perceptions of GO unit. There was no response of "Never" to the data obtained from GO unit regarding perception scale consisting of 35 items, only nine items were answered as "Always" and the other twenty-six items were answered as "Sometimes". So, it can be seen that many perceptions are not clear.

Accordingly, the majority of the student perceptions of the second factor teachers' responses were "Sometimes", indicating that the

Table 7: Third factor; student perceptions related to GO unit

Item codes	Items	N	Mean	Sd.	Evaluation outcome
I30	The GO unit allows me to be more active in taking part in the project work while it is being taught.	53 7	2.059	0.707	*Sometimes*
I31	Using the smart board while the GO unit is taught increases motivation.	53 7	2.230	0.779	*Sometimes*
I32	Using the tablet while GO unit is taught makes me learn easier.	53 7	2.147	0.825	*Sometimes*
I33	While the GO unit is being taught, it helps me to be active in-group work.	53 7	2.404	0.898	*Always*
I34	When it is taught, the GO unit allows me to self-assesses and to express what I have learned at any time.	53 7	2.160	0.817	*Sometimes*
I35	At the end of GO unit, assessing via only written examinations will decrease my motivation towards the lesson.	53 7	2.314	0.786	*Sometimes*

students were not determined regarding teacher factors. The GO unit taught with the problem-solving method by the teacher improves the performance with the homework assignment. The teacher makes students remember previous knowledge with introduction activities and facilities students' interest in the topic. The teacher directing students to the discovery encourages them and facilitates their access to information, increasing their prediction on power and perceptions that they are helping them to get rid of their prejudices about the lesson and making suggestions for the lesson were chosen as "Sometimes".

In addition, for the items when the GO unit is being taught, the teacher making clear explanations, clarifying definitions, providing information reinforcement, teaching the new information makes students talk about the subject, making the subject easier to learn by detailing the subject with written materials, determining the level of knowledge so as to evaluate them, they chose *"Sometimes"* to show their perceptions. As a result of these perceptions, it can be concluded that the students are not determined when they express their perceptions on the teacher factor, and in parallel, mathematics teachers do not fulfil their duties and responsibilities as much as they do in the teaching process.

The perception of students regarding the GO unit, showing mostly *"Sometimes"* response, is evidence that research needs to be done to overcome many of the existing problems. In this regard, there is a great deal of work for educational researchers.

RECOMMENDATIONS

The most important structuring in mathematics education is realized in elementary school years as it was emphasized before. The most important factor affecting the quality of education offered to students in the classroom environment during these years is the teacher factor. Therefore, it is possible to conduct researches on teachers for geometry lesson.

Geometry is the subdivision and inseparable part of mathematics. Beginning from the period before the school, this lesson can be taught by using different teaching approaches within a separate class time from mathematics. It is also possible to make improvements by considering the above mentioned problems. It should be remembered that cognitive factors and affective factors are linked to one another and separating one from the other can lead to something missing and unfinished in mathematics education.

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