THE CONTRIBUTION OF COGNITIVE STYLE AND PRIOR KNOWLEDGE ON SIXTH GRADE STUDENTS' KNOWLEDGE ACQUISITION IN POLYGONS IN DRAMA BASED LEARNING ENVIRONMENT

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submitted by **BURÇİN ATAR KOÇKAR** in partial fulfillment of the requirements for the degree of **Master of Science in Department of Secondary Science and Mathematics Education, Middle East Technical University** by,

Prof. Dr. Canan Özgen _____
Dean, Graduate School of **Natural and Applied Sciences**

Prof. Dr. Ömer Geban _____
Head of Department, **Secondary Science and Mathematics Education**

Assoc. Prof. Dr. Behiye Ubuz _____
Supervisor, **Secondary Science and Mathematics Education Dept., METU**

Examining Committee Members:

Prof. Dr. Şeref MİRASYEDİOĞLU _____
Elementary Education Dept., Başkent University

Assoc. Prof. Dr. Behiye UBUZ _____
Secondary Science and Mathematics Education Dept., METU

Assoc. Prof. Dr. Halil YURDUGÜL _____
Computer Education and Instructional Technology Dept., Hacettepe University

Assist. Prof. Dr. Çiğdem HASER _____
Elementary Education Dept., METU

Assist. Prof. Dr. Ali ERYILMAZ _____
Secondary Science and Mathematics Education Dept., METU

Date: 05.05.2010

I hereby declare that all information in this document has been obtained and presented in accordance with academic rules and ethical conduct. I also declare that, as required by these rules and conduct, I have fully cited and referenced all material and results that are not original to this work.

Name, Last Name : Burçin ATAR KOÇKAR

Signature :

ABSTRACT

THE CONTRIBUTION OF COGNITIVE STYLE AND PRIOR KNOWLEDGE ON SIXTH GRADE STUDENTS' KNOWLEDGE ACQUISITION IN POLYGONS IN DRAMA BASED LEARNING ENVIRONMENT

Atar Koçkar, Burçin
M.S., Department of Secondary Science and Mathematics Education
Supervisor: Assoc. Prof. Dr. Behiye UBUZ

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The purpose of this study is to investigate the contribution of cognitive style and prior knowledge on 6th grade students' knowledge acquisition in polygons in drama based learning environment.

The sample of the study was composed of 112 sixth grade students from a public school in Altındağ district of Ankara. There were 9 drama based lesson plans lasting 16 lesson hours in the study.

The data was collected through Group Embedded Figure Test (GEFT), and three types of knowledge tests: Declarative Knowledge Test (DecKT), Conditional Knowledge Test (ConKT), and Procedural Knowledge Test (ProKT). GEFT developed by Witkin, Oltman, Raskin and Karp (1971) was used to determine cognitive styles of the students as field dependent (FD), field independent (FI), and field mix (FM). Three types of knowledge tests developed by Erdoğan (2007) were used as pretests and posttests.

The quantative analysis was carried out by using standard multiple regression analysis. The results revealed that students' cognitive style was the most predictive variable in explaining students' declarative, conditional and procedural knowledge Moreover, students' prior declarative knowledge explained statistically significant amount of variance in students' declarative and procedural knowledge acquisition, while students' prior conditional knowledge explained statistically significant amount of variance in students' declarative, conditional, and procedural knowledge acquisition. On the other hand, students' prior procedural knowledge failed to explain declarative, conditional, and procedural knowledge acquisition of students.

Key words: Mathematics education, Cognitive style, prior knowledge, declarative knowledge, conditional knowledge, procedural knowledge, and drama based instruction.

ÖZ

DRAMA TEMELLİ ÖĞRENME ORTAMINDA ALTINCI SINIF ÖĞRENCİLERİNİN BİLİŞSEL STİL VE ÖNCEKİ BİLGİLERİNİN ÇOKGENLER KONUSUNDA BİLGİ KAZANIMINA KATKISI

Atar Koçkar, Burçin
Yüksek Lisans, Orta Öğretim Fen ve Matematik Alanları Eğitimi Bölümü
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Bu çalışma, drama temelli öğrenme ortamında altıncı sınıf öğrencilerinin bilişsel stil ve önceki bilgilerinin çokgenler konusunda bilgi kazanımına katkısını araştırmayı amaçlamaktadır.

Bu çalışmanın örneklemi Ankara'nın Altındağ ilçesindeki bir devlet okulundaki 112 altıncı sınıf öğrencisinden oluşmaktadır. Çalışmada toplam 16 ders saati süren toplam 9 drama temli öğretim planı bulunmaktadır.

Veriler Gizlenmiş Şekiller Grup Testi ve üç tür bilgi testi: İfadesel Bilgi Testi, Koşullu Bilgi Testi, İşlemsel Bilgi Testi ile toplanmıştır. Witkin, Oltman, Raskin and Karp (1971) tarafından geliştirilen Gizlenmiş Şekiller Grup Testi öğrencilerin bilişsel stillerini alan bağımlı, alan bağımsız ve alan karışık olarak belirlemek için, Erdoğan (2007) tarafından geliştirilen üç tür bilgi testi ise ön test ve son test olarak kullanılmıştır.

Elde edilen niceliksel veriler standart çoklu regresyon analizi kullanılarak analiz edilmiştir. Sonuçlar bilişsel stilin ifadesel, koşullu ve işlemsel bilgiyi en iyi açıklayan değişken olduğunu, ayrıca öğrencilerin önceki ifadesel bilgilerinin ifadesel ve işlemsel bilgi kazanmalarına anlamlı katkı sağladığını, bunun yanında öğrencilerin önceki koşullu bilgilerinin ifadesel, koşullu ve işlemsel bilgi kazanmalarına anlamlı katkı sağladığını göstermiştir. Diğer taraftan, araştırma sonuçları, öğrencilerin önceki işlemsel bilgilerinin ifadesel, koşullu ve işlemsel bilgi kazanmalarına katkısı olmadığını göstermiştir.

Anahtar Kelimeler: Matematik eğitimi, bilişsel stil, önceki bilgi, ifadesel bilgi, koşullu bilgi, işlemsel bilgi ve drama temelli öğretim.

To my mother, father and sisters
my nephew and niece
Barış and Deniz
my husband Özgür and
my daughter Irmak

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LIST OF ABBREVIATIONS

GEFT	: Group Embedded Figure Test
DecKT	: Declarative Knowledge Test
ConKT	: Conditional Knowledge Test
ProKT	: Procedural Knowledge Test
PreDecKT	: Students' Declarative Knowledge Pretest Scores
PreConKT	: Students' Conditional Knowledge Pretest Scores
PreProKT	: Students' Procedural Knowledge Pretest Scores
PosDecKT	: Students' Declarative Knowledge Posttest Scores
PosConKT	: Students' Conditional Knowledge Posttest Scores
PosProKT	: Students' Procedural Knowledge Posttest Scores
GAINDecKT	: Students' gain scores of Declarative Knowledge
GAINConKT	: Students' gain scores of Conditional Knowledge
GAINProKT	: Students' gain scores of Procedural Knowledge
N	: Sample size
SD	: Standard Deviation
p	: Significance
F	: F statistics
Skew.	: Skewness
Kurt.	: Kurtosis

CHAPTER 1

INTRODUCTION

For many years, mathematics educators have been concerned with the factors that influence learning mathematics. One of these factors is individual differences of students. In this context, many researches showed that students can learn more when a classroom environment was organized considering their individual differences (Duatepe-Paksu & Ubuz, 2009; Pesen & Özgen, 2008; Saab, 1987; Stansberry, 1996; Yoon, 1993; Zakaria, Chin & Daud, 2010). Considering these facts, there was a new reform in Turkey's mathematics programs in 2004. This new elementary mathematics program emphasizes students' individual differences and provides them to be active cognitively and physically in learning process, to be able to think, discuss, understand, solve problems, work collaboratively, and take responsibility of their learning. Therefore, some teaching methods such as problem based, cooperative, and computer based learning and drama based instruction become important in which individual differences of students are taken into consideration. Drama based instruction is one of the teaching method that can make this kind of learning possible in classroom environments. San (1996) explained the drama based instruction as an instructional method which allows a group of people to improvise a subject, a word, a concept or an idea by utilization of improvisation and role playing techniques with using their own experiences in playing processes. In literature, there are few of the studies focused on drama in mathematics. Duatepe- Paksu and Ubuz (2009) carried out a study to investigate the effects of drama based instruction on seventh grade students' geometry achievement, Van Hiele geometric thinking levels, attitudes toward mathematics and geometry. Sample consisted of 102 seventh grade students from a public school. In the study, a pretest-posttest control group design was used. The results revealed that drama based instruction had a significant effect on students' angles and polygons achievement, circle and cylinder achievement,

retention of these achievement, Van Hiele geometric thinking level, mathematics attitude, and geometry attitude compared to the traditional teaching. Omniewski (1999) investigated the effects of an arts infusion approach on the mathematics achievement of 49 second-grade students. There were three groups in the study. The first group was taught with an arts infusion approach in which music, art, dance, and drama were used. The second group was taught with an innovative manipulative approach in which tactile or hands-on methodology was used. The control group was taught using a traditional textbook approach. All three groups were pre- and post tested using the textbook unit math test and the number patterns test. The results showed that there were significant mean differences between all three groups' pre and posttest scores, however the biggest difference between pre and posttest of students in the art infusion group. Saab (1987) investigated the effects of creative drama methods on sixth grades' mathematics instruction. He analyzed experimental and control differences and gender differences by using student scores of mathematics achievement, attitudes toward mathematics, and creativity. He compared drama activities to textbook-oriented mathematics instruction. The results showed that drama based activities caused a significant increase in levels of mathematics achievement related mathematics computation. However, attitudes toward mathematics and levels of creativity were not affected by the use of drama based activities.

Students have most of individual differences and these differences affected their learning mathematics. Cognitive style and prior knowledge are the important ones of them. Cognitive style refers to an individual's way of processing information (Sternberg & Grigerenko, 2001). Between the early 1940s and 1980s students were categorized with respect to their cognitive styles by many researchers. One of the most prevalent categorization is the cognitive style of field dependence-independence (FDI) (Witkin, Moore, Goodenough & Cox, 1977). FDI dimension is defined as "the extent to which a person perceives part of a field as discrete from the surrounding field as a whole, rather than embedded in the field; the extent to which a person perceives analytically" (Witkin et al., 1977, p. 7). There were many studies about the relation of cognitive style and mathematics or geometry performance of students (McLoad & Briggs, 1980; McLeod, Carpenter, McCornack & Skvarcius,

1978; Noraini, 1998; Roberge & Flexer, 1983; Threadgill, 1979; Yoon, 1993). For instance, McLeod, Carpenter, McCornack, and Skvarcius (1978) investigated the relationship of the field-dependence-independence dimension of cognitive style to instructional treatments based on two levels of guidance crossed with two levels of abstraction. The treatments were different from each other according to the level of guidance and the level of abstraction. These treatments were minimum guidance with manipulative materials, maximum guidance with manipulatives, minimum guidance with only a symbolic presentation, and maximum guidance with a symbolic presentation. The results of multiple regression analysis indicated that there was a significant interaction between field independence and level of guidance of mathematics instruction. Moreover, field-independent students learned more when the treatment provided minimal guidance whereas the field-dependent students learned more under conditions of maximal guidance. McLeod and Briggs (1980) conducted a research to investigate the relationship of field independence to a different dimension of discovery learning-the use of inductive and deductive sequence of instruction in the topic of reflective, symmetric, and transitive properties of equivalence relations. In the inductive treatment; definitions of the concepts were given after the examples, while in the deductive treatment; firstly definitions and then examples were given. The results of multiple regression analysis showed that there was a significant interaction between field independence and sequence of the instruction on the transfer test, however there was no interaction between field independence and sequence of the instruction on immediate achievement test.

The other factor influencing mathematics learning of students was prior knowledge. Dewey, Piaget, Vygotsky, Bruner, and Ausubel agreed that learning can not be meaningful without making connections to students' own prior knowledge. Moreover, Dochy and Alexander (1995) stated that individual differences in the prior knowledge base are a primary source of differences in student achievement. Jonassen and Graboswki (1993) defined prior knowledge as "the knowledge, skills, or ability that students bring to the learning process (p. 417). Although, prior knowledge has a positive effect on learning mathematics (Clarke, Ayres & Sweller, 2005; Hailikari, 2009; Hailikari, Nevgi & Lindblom-Ylanne, 2007; Mack, 1995), inaccurate prior knowledge or misconception may interfere with learning mathematics (Gourgey,

1984). For this reason the focus should not only be on what students know but also on how well they know it (Hailikari, Nevgi & Lindblom-Ylanne, 2007). To do this, there is a need to investigate the effect of types of prior knowledge on learning mathematics. Many researchers distinguish between declarative and procedural knowledge (Anderson, 1995; Dochy, Segers & Buehl, 1999) and others add them conditional knowledge (Smith & Ragan, 2005).

Declarative knowledge refers knowing that something is the case (Smith & Ragan, 2005). For declarative knowledge performance, learners are expected to explain, describe, summarize, and list the knowledge, but learners are not required to apply it. Procedural knowledge refers knowing how to apply the knowledge (Smith & Ragan, 2005). For procedural knowledge performance, learners are expected to use procedures, rules, algorithms and symbols. Conditional knowledge refers to knowing why (Smith & Ragan, 2005). For conditional knowledge performance, learners are expected to make connections among concept definitions, generate explanations regarding facts, and create meaningful links among definitions, principles and procedures. There were most of the studies which investigated the effect of prior knowledge on students' learning in mathematics (Clarke, Ayres & Sweller, 2005; Hailikari, 2009; Hailikari, Nevgi & Lindblom-Ylanne, 2007; Mack, 1995; Rittle-Johnson & Kmicikewycz, 2008). Only two of them (Hailikari, 2009; Hailikari, Nevgi & Lindblom-Ylanne, 2007) investigated the effect of prior knowledge on students' learning in mathematics by distinguishing between declarative and procedural knowledge. Hailikari, Nevgi & Lindblom-Ylanne (2007) investigated the effect of different types of prior knowledge (declarative and procedural knowledge) on student achievement and different assessment measures influence the observed effect of prior knowledge. There were 202 mathematics students from University of Helsinki in the study. Data were collected prior knowledge test developed by the researchers and the students' final grades on the course were used to achievement scores. Final exam focused on tasks that measure procedural knowledge of the students which required ability to see interrelations between concepts and phenomena, and to solve mathematical problems. The regression analysis results indicated that the type of prior knowledge makes a difference: Procedural knowledge predicted the final grades best and was also

strongly related to previous study success, however declarative knowledge did not predict final grades. Hailikari (2009) conducted four studies to explore the components of the different types of prior knowledge (declarative and procedural knowledge) such as previous study success, academic self-beliefs, prior knowledge from previous courses, and study pace on student achievement, and different assessment measures influence the observed effect of prior knowledge on various science disciplines. Two of these studies related to mathematics. Study I aimed to explore whether giving feedback about the prior knowledge test influenced student achievement in the context of mathematics. Study II aimed to analyze the interrelations between academic self-beliefs, prior knowledge and student achievement in the context of mathematics. The participants of study I were 202 mathematics students, study II were 139 mathematics students, in the studies prior knowledge tests and final grades of the courses were used. The results of study I showed that procedural knowledge predicted the final grades best and was also closely related to previous study success. Feedback from the prior knowledge test did not influence student performance. The results of study II indicated that prior knowledge was more predictive of student achievement than were other variables included in the study. Self-beliefs were also strongly related to student achievement, but the predictive power of prior knowledge overruled the influence of self-beliefs when they were included in the same model. There was also a strong correlation between academic self-beliefs and prior knowledge performance.

Considering the results of the studies above, it can be said that what students get while entering the classroom and the way of their processing information which is called as cognitive style have great importance in learning mathematics. In this study, the contribution of these individual differences on students' knowledge acquisition were investigated in drama based learning environment.

1.1 Purpose of the Study

The purpose of this study is to investigate the contribution of cognitive style and prior knowledge on 6^{th} grade students' knowledge acquisition in polygons in drama based learning environment.

1.2 Research Questions and Hypotheses

The present research addresses the following question and hypotheses:

What is the contribution of cognitive style and prior knowledge on 6th grade students' knowledge acquisition in polygons in drama based learning environment?

Hypotheses of the study were formulated as follows:

1. There is no significant contribution of cognitive style, preDecKT, preConKT, and preProKT in the prediction of 6th grade students' gain scores of declarative knowledge test on geometry including polygons in drama based learning environment.
2. There is no significant contribution of cognitive style, preDecKT, preConKT, and preProKT in the prediction of 6th grade students' gain scores of conditional knowledge test on geometry including polygons in drama based learning environment.
3. There is no significant contribution of cognitive style, preDecKT, preConKT, and preProKT in the prediction of 6th grade students' gain scores of procedural knowledge test on geometry including polygons in drama based learning environment.

1.3 Definitions of Important Terms

The terms used in this study can be defined as follows:

Drama Based Instruction: The drama based instruction is an instructional method which allows a group of people to improvise a subject, a word, a concept or an idea by utilization of improvisation and role playing techniques with using their own experiences in playing processes (San, 1996).

Cognitive Style: Cognitive style refers to an individual's way of processing information (Sternberg & Grigerenko, 2001).

Prior Knowledge: "The knowledge, skills, or ability that students bring to the learning process" (Jonassen & Grabowski, 1993).

Declarative Knowledge: Declarative knowledge refers knowing that something is the case (Smith & Ragan, 2005). For declarative knowledge performance, learners are expected to explain, describe, summarize, and list the knowledge, but learners are not required to apply it.

Conditional Knowledge: Conditional knowledge refers to knowing why (Smith & Ragan, 2005). For conditional knowledge performance, learners are expected to make connections among concept definitions, generate explanations

regarding facts, and create meaningful links among definitions, principles and procedures.

Procedural Knowledge: Procedural knowledge refers knowing how to apply the knowledge (Smith & Ragan, 2005). For procedural knowledge performance, learners are expected to use procedures, rules, algorithms and symbols.

1.4 Significance of the Study

Learning and teaching mathematics especially geometry have a great importance in all
over the world. For this reason, there is a need to consider the factors influencing learning geometry while conducting a study. Most of the researches indicated that prior knowledge and cognitive style made a significant effect on learning mathematics or geometry (Clarke, Ayres & Sweller, 2005; Hailikari, 2009; Hailikari, Nevgi & Lindblom-Ylanne, 2007; Mack, 1995; McLoad & Briggs, 1980; McLeod, Carpenter, McCornack & Skvarcius, 1978; Noraini, 1998; Rittle-Johnson & Kmicikewycz, 2008; Threadgill, 1979; Yoon, 1993). But, these studies only investigate the achievement on mathematics or geometry disregarding the knowledge types discrimination as declarative knowledge, conditional knowledge, and procedural knowledge. On the other hand there were many researches in literature investigating the relationship between some instructional methods and cognitive style or prior knowledge on learning mathematics or geometry (Mack, 1995; McLoad & Briggs, 1980; McLeod, Carpenter, McCornack & Skvarcius, 1978; Rittle-Johnson & Kmicikewycz, 2008; Threadgill, 1979) but none of them studied the relationship between drama based instruction and cognitive style or drama based instruction and prior knowledge on learning geometry.

Consequently, this study is important due to several reasons. Firstly, the results of the study will provide mathematics teachers to construct their instruction by considering prior knowledge of students and cognitive styles of them. Secondly, the lesson plans of the study will help mathematics teachers who want to use drama based instruction while teaching polygons. Thirdly, the findings of the study will provide an insight to the educators and researchers about the effect of prior knowledge and cognitive style of the students on declarative, conditional, and

procedural knowledge acquisition of them in geometry in drama based learning environment.

1.5 Assumptions

The study is based on the following assumptions:

1. The subjects of the study responded to the items of the tests and interview questions accurately and sincerely.
2. All tests were administered under the same standard conditions.
3. The subjects were able to understand the test items correctly.

1.6 Limitations

1. The research is limited 6^{th} grade students studying Public Elementary school in Altındağ district of Ankara.
2. In this study, convenient sampling is used instead of random sampling.

CHAPTER 2

LITERATURE REVIEW

In this chapter, the review of literature on cognitive style will be presented under three sections: cognitive style, categorization of cognitive style, the effect of field dependency on learning mathematics, and prior knowledge and the effects of prior knowledge on learning mathematics will be explained. Lastly, drama based instruction, phases of drama based instruction, the relationship between drama based instruction and prior knowledge, and the relationship between drama based instruction and field dependency were mentioned.

2.1 Cognitive Style

Several theories have emerged in education and psychology suggesting that individual learners construct various strategies in processing information during classroom experiences. These strategies are different from each other. Werner calls this difference as a psychological differentiation in 1957 firstly. Then many professors of education and psychology such as Sigmund Freud, Erik Erikson and Jean Piaget have pursued the concept of psychological differentiation and termed it as cognitive styles (Morgan, 1997).

There are several definitions of cognitive style however all the definitions are similar to each other. Witkin, Moore, Goodenough and Cox (1977) defined cognitive style as the individual way a person perceives thinks, learns, solves problems and relates to others. Sternberg and Grigerenko (2001) stated that cognitive style refers to an individual's way of processing information. Jonassen and Grabowski (1999) told that Cognitive styles reflect the ways in which individuals process information and make sense of their world.

2.2 Categorization of Cognitive Style

Between the early 1940s and 1980s, various investigators developed their own instruments for assessment and gave their own labels to the style they were studying with little reference to work of others. This led to the development of a large variety of style labels (Riding & Cheema, 1991).

Riding and Cheema (1991) classified the different labels into two groups that are wholistic-analytic and verbal-imagery dimensions. The wholistic-analytic dimension measures whether an individual is predisposed to organize information into wholes or parts and the verbal-imagery dimension assesses whether an individual has a tendency to process information verbally or in images. The most prevalent style label for wholistic-analytic dimension of cognitive styles is field-dependence/field-independence (FD/FI). Witkin , Oltman, Raskin, and Karp (1971) studied field-dependence/field-independence dimension firstly, and several researchers investigated these dimensions extensively.

2.2.1 Characteristics of the Field-Dependent and the Field-Independent Styles

Witkin describes field dependence/independence domain the following manner: "The person with a more field independent way of perceiving tends to experience his surroundings analytically, with objects experienced as discrete from their backgrounds. The person with a more field dependent way of perceiving tends to experience his surroundings in a relatively global fashion, passively conforming to the influence of the prevailing field or context" (Witkin et al., 1977, p. 5).

Saracho (2003) pointed out that field dependent people use external referents to guide them in processing information, while the field independent people use internal referents. McLeod, Carpenter, McCornack and Skvarcius (1978) stated that field-independent students prefer to solve problems by using their own strategies and utilization of their background, but field-dependent students need guidance and structured learning environment to solve problem and they learn more in a social way. Saracho (2003) summarizes the characteristics of field dependent and independent people.

Table 2.1 Characteristics of the field-dependent and field-independent people (Saracho, 2003, p. 162)

Field-dependent individuals	**Field-independent individuals**
rely on the surrounding perceptual field	perceive objects as separate from the field
experience their environment in a relatively global fashion by conforming to the effects of the prevailing field or context	can abstract an item from the surrounding field and solve problems that are presented and reorganized in different contexts
are dependent on authority	are independence from authority, which leads them to depend on their own standards and values
search for facial cues in those around them as a source of information	are oriented towards active striving
are strongly interested in people	appear to be cold and distant
get closer to the person with whom they are interacting	are socially detached but have analytic skills
have a sensitivity to others that helps them to acquire social skills	are insensitive to others, lacking social skills
prefer occupations that require involvement with others	prefer occupations that allow them to work by themselves

2.3 The Effect of Field Dependency on Learning Mathematics

Many researches in the learning of mathematics suggested that there were not only one instructional treatment to provide every student to learn the topic best. For this reason, several researchers investigated the relationship between individual differences and learning mathematics. Some of these studies were related to the effect of cognitive style dimension on students' learning mathematics (McLoad & Briggs, 1980; McLeod, Carpenter, McCornack & Skvarcius, 1978; Noraini, 1998; Roberge & Flexer, 1983; Threadgill, 1979; Yoon, 1993).

Mcleod and Briggs (1980) conducted a research to investigate the relationship of field independence to a different dimension of discovery learning-the use of inductive and deductive sequence of instruction in the topic of reflective, symmetric,

and transitive properties of equivalence relations. In the inductive treatment; definitions of the concepts were given after the examples, while in the deductive treatment; firstly definitions and then examples were given. However these two treatments were differed in the sequence of instruction, both of them included the same concept, problems and the same amount of practice. The study was conducted with 66 prospective elementary school teachers from upper-division mathematics course. The students were randomly assigned the two treatment groups. There were 33 prospective elementary school teachers in each group. To collect data students were given immediate achievement test and transfer test. Immediate test consisted of 13 multiple-choice questions designed to assess mastery of the concepts as they were presented in the materials; this test dealt only with relations on finite sets. Transfer test included 21 questions on properties of relations on infinite sets. Four weeks later, these two tests were given again. The results of multiple regression analysis showed that there was a significant interaction between field independence and sequence of the instruction on the transfer test, however there was no interaction between field independence and sequence of the instruction on immediate achievement test. Both two treatments were highly structured may caused it.

McLeod, Carpenter, McCornack, and Skvarcius (1978) investigated the relationship of the field-dependence-independence dimension of cognitive style to instructional treatments based on two levels of guidance crossed with two levels of abstraction. The researchers studied with 116 prospective elementary teachers. Four parallel instructional treatments were prepared on the topic of the addition and subtraction of whole numbers. The treatments were different from each other according to the level of guidance and the level of abstraction. These treatments were minimum guidance with manipulative materials, maximum guidance with manipulatives, minimum guidance with only a symbolic presentation, and maximum guidance with a symbolic presentation. The students and the two instructors were randomly assigned to treatment groups. All subjects were given a pretest, two posttests, two retention tests. The pretest assessed the subjects' knowledge of prerequisite concepts involving the representation of numbers in bases other than ten, changing number bases, and applications of these concepts. In the posttest 1, all problems were presented symbolically and no blocks available. In the second

posttest, students were encouraged to use multibase blocks, and certain problems were presented as pictures of blocks. Multiple regression analysis was used in the study and the researchers found a significant interaction between field independence and level of guidance of mathematics instruction. Field-independent students learned more when the treatment provided minimal guidance whereas the field-dependent students learned more under conditions of maximal guidance.

Noraini (1998) investigated the relative importance of spatial visualization, field dependence/independence, and van Hiele level of geometric thought in predicting achievement in geometry of middle school students. The design of the study pretest- posttest experimental and control group design. The students were categorized as field-dependent and field-independent by using Group Embedded Figure Test (GEFT) scores of them. There were 25 multiple choice questions about polygons in geometry test and to be able to answer all of the questions, there was a need to have procedural knowledge about polygons. The multiple regression results revealed that cognitive style was the best significant predictor for achievement in geometry.

Roberge and Flexer (1983) conducted a study to investigate the effect field dependence/ independence cognitive styles and cognitive development levels on mathematics. Group Embedded Figure Test (GEFT) was used to categorize students as field-dependent and field-independent. The sample of the study was 450 sixth, seventh, and eighth grade students.

Formal Operational Reasoning Test (FORT) was constructed by the researchers to evaluate subjects' level of reasoning for three essential components of formal operational thought: combinations, propositional logic, and proportionality and Metropolitan Achievement Tests (MAT) comprises The Mathematics Computation, Mathematics Concepts, and Mathematics Problem Solving tests were used as the measures of mathematics achievement. The results of the study indicated that field-independent students obtained higher scores in mathematics than field-dependent ones; high operational level students obtained higher scores than low operational students. Moreover, researchers found that cognitive style had a significant influence on mathematics achievement at sixty, seventy and eight grade level when IQ scores of the students were used as covariate.

Threadgill (1979) conducted a study to investigate the interaction between field- dependence and two methods of instruction such as discovery method and didactic mode of teaching in the topic of traversability of graphs. There were sixty seventh-grade students in six groups. Three groups received the meaningful didactic treatment and the other three received the guided discovery treatment. There were 20-items related to identify new complex traversable networks and apply traversability rules to new situations in posttest. The results of the study showed that field independent students achieved significantly higher posttest scores than did field-dependent students when IQ scores of the students were used as covariate. The students were required perceptually organize and conceptually categorize networks and traversability rules, Field-dependent behavior apparently inhibited recognition of those components critical to the identification of traversable networks. On the other hand, field-independent students demonstrated an ability to recognize and evaluate relevant attributes of network stimuli. For this reason, instructional treatments were not found to interact with field-dependence in this study.

Yoon (1993) studied the effect of instructional control strategies (program control, learner control, and learner control with advisement), cognitive style (field-dependence and field-independence), and prior knowledge (high prior knowledge and low prior knowledge) on arithmetic skills of 166 second and third grade students in computer-based instruction. The Children Embedded Figure Test (CEFT) was used to categorize students as field-dependent and field-independent. The design of the study was pretest and posttest design. The pretest and a posttest consist of all multiplication combinations (1x0 through 9x9), resulting in 90 problems with two different formats, half displayed in vertical format and half displayed in horizontal format. The score is to be calculated on the number of correct answers. The ANOVA results showed that types of instructional control strategies interact with levels of prior knowledge and types of cognitive styles. Moreover, students with low prior knowledge with field-dependence performed their tasks most effectively under program control. Students with low prior knowledge with field-independence performed their tasks most effectively under learner control. However students with high prior knowledge, regardless of their cognitive style were not affected the treatment.

Although these researches above used the effect of cognitive style on students' achievement instead of types of mathematical knowledge such as declarative refers to knowing that, conditional refers to knowing when and why, and procedural knowledge refers to knowing how, it can be said that all of them focused on the effect of the cognitive style on procedural mathematical knowledge because of the necessity of applying the knowledge in posttests.

There was only one study which investigated the effect of cognitive style on procedural and conceptual mathematical knowledge of students. Kadijevic and Krnjaic (2003) examined the relation between cognitive style and link between conceptual and procedural mathematical knowledge (P-C link) of 34 mathematically talented eleventh-grade students. There were two groups. The competition group consisted of particularly talented students who participated in mathematical competitions and the control group comprised other talented students. The study was correlative design. Procedural and conceptual knowledge scores were obtained from only one problem which has many different solutions. The students categorized as field-dependent and field-independent by using Embedded Figures Tests (EFT). The results of the study revealed that there was a significant positive correlation between cognitive style and link between procedural and conceptual mathematical knowledge. The more competitors' cognitive style was field- independent, the stronger P-C link he/she established, but it was not the same as control group.

Considering the characteristic of drama based learning environment such as flexibility and the role of a teacher and the findings of the studies above (McLeod & Briggs, 1980; McLeod, Carpenter, McCornack & Skvarcius, 1978), it was hypothesized that cognitive style dimension is positively related to declarative, conditional, and procedural knowledge in geometry in drama based learning environment.

2.4 Prior Knowledge

For many years, educational psychologists have been concerned with the factors that influence performance. Prior knowledge is one of the most important factors. Jonassen and Graboswki (1993) defined prior knowledge as "the knowledge, skills, or ability that students bring to the learning process (p. 417). Dochy, Segers and Buehl (1999) explained that prior knowledge is "the whole of a person's actual

knowledge that: (a) is available before a certain learning task, (b) is structured in schemata, (c) is declarative and procedural, (d) is partly explicit and partly tacit, (e) and is dynamic in nature and stored in the knowledge base" (p. 3).

As Dochy, Segers and Buehl (1999) stated that prior knowledge includes both declarative and procedural knowledge. Declarative knowledge refers knowing that something is the case (Smith & Ragan, 2005). For declarative knowledge performance, learners are expected to explain, describe, summarize, and list the knowledge, but learners are not required to apply it. Moreover for declarative knowledge learning to ocur, learners should link of new knowledge to the existing knowledge (Jonassen, 1991), organize new information (Smith & Ragan, 2005), and elaborate of information (Smith & Ragan, 2005). “What” and “Which” type of questions are in the context of declarative knowledge.

Procedural knowledge refers knowing how to apply the knowledge (Smith & Ragan, 2005). For procedural knowledge performance, learners are expected to use procedures, rules, algorithms and symbols. Smith and Ragan (2005) emphasized that solving mathematical problems and proving geometry problems are in the context of such processes.

Smith and Ragan (2005) add them conditional knowledge which means knowing when and why. It comprises “if-then” or “condition-action” statements, which describe the relationships between two or more concepts in a particular domain. For conditional knowledge performance, learners are expected to make connections among concept definitions, generate explanations regarding facts, and create meaningful links among definitions, principles and procedures (Smith & Ragan, 2005).

Dewey, Piaget, Vygotsky, Bruner, and Ausubel were the educational theorists and cognitive psychologists who agree that children learn through making connections to their own prior knowledge. Ausubel stated that to be able to learn meaningfully learners should make connection between prior knowledge and new learning materials and defined advance organizers as “bridge the gap between what the learner already knows and what he needs to know before he can meaningfully learn the task at hand” (Ausubel, Novak & Hanesian, 1978, p.171). Piaget pointed out that learning occurs through two aspects of adaptation; assimilation and

accommodation. Assimilation refers to the process of fitting external reality to the existing cognitive structure and accommodation refers to the process of changing internal structures to provide consistency with external reality (Schunk, 2000). In Vygotsky's view students learn trough reconstructing prior knowledge by means of social experiences. He defined "Zone of Proximal Development (ZPD) as the difference between what a child can do without help and the capabilities of the child in interaction with others. Dewey emphasized that learning occurs by transforming and reorganizing existing knowledge by real life experiences. Bruner expressed that learning is a social process and students construct new concepts based on current knowledge. The student selects information, constructs hypotheses, and makes decisions, with the aim of integrating new experiences into his existing mental constructs.

2.5 The Effect of Prior Knowledge on Learning Mathematics

Most of the researchers suggest that students' prior knowledge is one of the strongest
factors influencing mathematical performance (Clarke, Ayres & Sweller, 2005; Hailikari, 2009; Hailikari, Nevgi & Lindblom-Ylanne, 2007; Mack, 1995; Rittle-Johnson & Kmicikewycz, 2008). Only two of them (Hailikari, 2009; Hailikari, Nevgi & Lindblom-Ylanne, 2007) investigated the effect of prior knowledge on students' learning in mathematics by distinguishing between declarative and procedural knowledge. On the other hand, there is no research related to the effect of conditional prior knowledge on students' learning in mathematics.

Clarke, Ayres and Sweller (2005) conducted a study to investigate the effect of prior knowledge about spreadsheets of ninth- grade high school students on learning mathematics on the topic of graphical representations. There is an experimental (sequential) and control (concurrent) group in the study. In the sequential group, instructions on spreadsheets were given to the students prior to applying this knowledge on learning mathematics, in the concurrent group, spreadsheet skills and mathematical concepts were given in an integrated format. The achievement test of the study includes nine questions the nine problems were divided into 14 parts consisting of 1 recall question, 9 application problems, and 4 synthesis problems. The results of the study indicated that the less experienced spreadsheet

group scored higher on the math test if they received sequential instruction compared with a concurrent format, however, for the more experienced spreadsheet group there was no significant difference found.

Mack (1995) examined the development of students' understanding of fractions during instruction with respect to the ways students' prior knowledge of whole numbers influenced the meanings and representations students constructed for fractions as they built on their informal knowledge of fractions. There were four third-grade and three fourth-grade students in the study and they received individualized instruction on addition and subtraction of fractions in a one-to-one setting for 3 weeks. All seven students' understanding was assessed by a screening test that focused on posing corresponding problems verbally and symbolically for situations involving identifying fractions, recording representations for fractions, comparing fractions, adding and subtracting like fractions, and subtracting a fraction from a whole number. The results of the study suggested that students' ability to relate symbolic representations for fractions to their informal knowledge is influenced by their prior knowledge of symbolic representations for whole numbers.

Rittle-Johnson and Kmicikewycz (2008) conducted a study with 55 third grade students to investigate the importance of prior knowledge while comparing third graders' success on studied and unstudied multiplication problems after they spent a class period generating answers to problems or reading the answers from a calculator. The students were assessed by 12 multiplication problems consisting of the numbers 3 or 4 times 11, 12, or 13 (e.g., 3 x 11) as well as their commutative pairs (e.g., 11x 3). There were pre-test, post-test, and retention test in the study. The results of the study indicated that students with low prior knowledge had higher accuracy in the generate condition, but as prior knowledge increased, the advantage of generating answers decreased. The benefits of generating answers may extend to unstudied items and to classroom settings, but only for learners with low prior knowledge.

Hailikari, Nevgi and Lindblom-Ylanne (2007) investigated the effect of different types of prior knowledge (declarative and procedural knowledge) on student achievement and different assessment measures influence the observed effect

of prior knowledge. There were 202 mathematics students from University of Helsinki in the study. Data was collected prior knowledge test developed by the researchers and the students' final grades on the course were used to achievement scores. Final exam focused on tasks that measure procedural knowledge of the students which required ability to see interrelations between concepts and phenomena, and to solve mathematical problems. The regression analysis results indicated that the type of prior knowledge makes a difference: Procedural knowledge which requires higher-order cognitive skills predicted the final grades best and was also strongly related to previous study success, however declarative knowledge did not predict final grades. The results imply that in mathematics it is essential that one has reached the level of procedural knowledge with higher-order thinking skills in order to succeed in the course at hand and future courses.

Hailikari (2009) conducted four studies to explore the components of the different types of prior knowledge (declarative and procedural knowledge) such as previous study success, academic self-beliefs, prior knowledge from previous courses, and study pace on student achievement and different assessment measures influence the observed effect of prior knowledge on various science disciplines. Two of these studies related to mathematics. Study I aimed to explore whether giving feedback about the prior knowledge test influenced student achievement in the context of mathematics. Study II aimed to analyze the interrelations between academic self-beliefs, prior knowledge and student achievement in the context of mathematics. The participants of study I were 202 mathematics students and study II were 139 mathematics students, in the studies prior knowledge tests and final grades of the courses were used. The results of study I showed that procedural knowledge which requires higher-order cognitive skills, predicted the final grades best and was also closely related to previous study success. Feedback from the prior knowledge test did not influence student performance. The results of study II indicated that prior knowledge was more predictive of student achievement than were other variables included in the study. Self-beliefs were also strongly related to student achievement, but the predictive power of prior knowledge overruled the influence of self-beliefs when they were included in the same model. There was also a strong correlation between academic self-beliefs and prior knowledge performance.

Prior knowledge can be a positive effect on learning mathematics (Clarke, Ayres & Sweller, 2005; Hailikari, 2009; Hailikari, Nevgi & Lindblom-Ylanne, 2007; Mack, 1995), or inaccurate prior knowledge may interfere with learning mathematics (Rittle-Johnson & Kmicikewycz, 2008). For this reason the focus should not only be on what students know but also on how well they know it (Hailikari, Nevgi & Lindblom-Ylanne, 2007). To do this, there is a need to investigate the effect of types of prior knowledge on learning mathematics. As seen in the studies above, declarative prior knowledge did not contribute to students' procedural knowledge on mathematics. On the other hand, procedural prior knowledge which requires higher-order cognitive skills helped students be a successful on learning mathematics. There was no idea about the impact of conditional prior knowledge on the students' learning mathematics. By considering, significant positive effect of prior procedural knowledge on learning mathematics, it was hypothesized that prior conditional knowledge needed to construct a bridge between relevant declarative and procedural knowledge make a significant contribution on declarative, procedural, and conditional knowledge in mathematics.

2.6 Drama Based Instruction

Drama in education or drama based instruction is a pedagogical method which focuses on process of learning instead of learning outcomes. San (1996), explains the drama based instruction as an instructional method which allows a group of people to improvise a subject, a word, a concept or an idea by utilization of improvisation and role playing techniques with using their own experiences in playing processes. Improvisation is referring to the spontaneous use of movement and speech to create a character or an object in a particular situation (Gallagher, 1997).

The basic purpose of drama based instruction is to improve cognitive, sensory and kinesthetic behavior fields of individual's. In this process, a leader or a drama teacher/educator and a group of people become together and they carry out a drama study in a designated place suitable for the requirements of the group by utilization of the general characteristics of play (Adıgüzel, 1994).

In drama based learning environment, drama teacher/educator is a facilitator, she/he plans, shapes, and guides the process (Adıgüzel, 1994; Wilhelm, 1998). But in

drama activities drama teachers/educators are never the one who know everything (Andersen, 2000). On the contrary they are taking role just as students (Wilhelm, 1998). Students are active learners in drama based learning environments. The students can comprehend and correctly infer attributes of another person's thinking, attitudes, and feelings by taking role in drama process (Wagner, 2002). Furthermore, they can have a chance of taking risk in their learning without fear, or punishment (Farris & Parke, 1993).

2.7 Phases of Drama Based Instruction

Drama based instruction consists of three parts: Introduction / Preparations, Development /Animation, Result/ Evaluation (Adıgüzel, 2006).

The basic purpose of Introduction / Preparations part is to construct a group dynamic, prepare them to work together with harmony, and prepare them also later part of the lesson. In this part, leader/ teacher is more effective for guiding the process, he/she utilizes from children plays or relaxing exercises (Adıgüzel, 2006). Cottrell (1987) stated that students need to "shift the gears and recharge their imaginations" at the beginning of the lesson so that they can be ready and confident for the rest of lesson (p.87).

In the Development /Animation part, there is a product. Drama techniques such as improvisation, role-playing, mantle of expert, and meetings are used in this part to enable to achieve objectives of the lesson. Nobody knows how will end the process. One of the important concerns of the drama is creating dramatic moment. Dramatic moment, means that conducting conflict or tension between opposing forces (Adıgüzel, 2006; Andersen, 2000).

In the last part called as Result/ Evaluation part, the feelings, ideas and all process are shared and discussed and the key points of the activities are summarized after the animations. The evaluation phase is important to see whether learning and progress are accomplished, or not (Adıgüzel, 2006).

2.8 The Relationship between Drama Based Instruction and Prior Knowledge

When the definition of drama based instruction is considered San (1996) explains the drama based instruction as an instructional method which allows a group of people to improvise a subject, a word, a concept or an idea by utilization of improvisation and role playing techniques with using their own experiences in

playing processes, in drama based learning environment students are required to use their own experiences including their
knowledge, skills, and abilities while learning the objective of the lesson. For this reason, in drama based learning environment, it has great importance what students get while entering the class. Most of the researchers found that students' prior knowledge is one of the strongest factors influencing mathematical performance (Clarke, Ayres & Sweller, 2005; Hailikari, 2009; Hailikari, Nevgi & Lindblom-Ylanne, 2007; Mack, 1995; Rittle-Johnson & Kmicikewycz, 2008). Two of them found that that types of prior knowledge such as declarative and procedural knowledge also influenced students learning mathematics differently (Hailikari, 2009; Hailikari, Nevgi & Lindblom-Ylanne, 2007). Although there was no previous research investigating the relationship between drama based instruction and prior knowledge, considering the results of these studies, it was expected that types of prior knowledge such as declarative, conditional, and procedural knowledge would have a significant effect on students' learning mathematical knowledge such as declarative, conditional and procedural knowledge in drama based learning environment.

2.9 The Relationship between Drama Based Instruction and Field Dependency

Saracho (2003) stated that field-dependent individuals are interested in people and use external referents while field-independent individuals appear to be cold and distant and use internal referents. McLeod, Carpenter, McCornack, and Skvarcius (1978) expressed that field-dependent students need guidance and structured learning environment to solve problem and they learn more in a social way while field-independent students prefer to solve problems by using their own strategies and utilization of their background. Some researches related to learning mathematics and field dependency proved that there was a significant interaction between field dependency and some instructional methods. For instance, McLeod, Carpenter, McCornack, and Skvarcius (1978) investigated the relationship of the field-dependence-independence dimension of cognitive style to instructional treatments based on two levels of guidance crossed with two levels of abstraction and found that field-independent students learned more when the treatment provided minimal guidance whereas the field-dependent students learned more under conditions of

maximal guidance. On the other hand, Mcleod and Briggs (1980) conducted a research to investigate the relationship of field independence to a different dimension of discovery learning-the use of inductive and deductive sequence of instruction in the topic of reflective, symmetric, and transitive properties of equivalence relations and found that there was a significant interaction between field independence and sequence of the instruction on the transfer test.

Although there was no previous research investigating the relationship between drama based instruction and field dependency, when the characteristics of drama based learning environment are considered, in drama based learning environment, teacher is a facilitator, she/he plans, shapes, and guides the process, but she/he is never the authority in contrary she/he takes some roles just as students. Furthermore, the students are required to work together in a meaningful context, enjoy while learning, see and touch the materials of the lesson. It is expected that students will be affected differently with respect to their cognitive styles. For this reason, it is hypothesized tat field dependency is positively related to the students' learning mathematical knowledge such as declarative, conditional, and procedural knowledge in drama based learning environment.

CHAPTER 3

METHODOLOGY

The aim of this chapter is to give the information about the research design, population and sample, variables of the study, data collection instruments, development of lesson plans, treatment, and data analysis.

3.1 Design of the study

The purpose of the study was to investigate the contribution of cognitive style and prior knowledge on 6th grade students' knowledge acquisition in polygons in drama based learning environment. To be able to investigate the research question, correlational design was used in the study. In correlational studies the possibility of relationships between two or more variables are investigated (Fraenkel & Wallen, 2000, p.359).

3.2 Population and Sample

The target population of this study consists of all sixth grade students from Public schools of Altındağ district of Ankara. There are 76 public elementary schools in this region. However one school in which the researcher worked from this region is determined as the accessible population of this study. This is the population for which the results can be generalized. Since it was difficult to select a random sample of individuals, convenience sampling was used in this study. The sample was the 6th grade students in a public elementary school in Altındağ district of Ankara. There were 112 sixth grade students from in total. 55 (49.1%) students were girls, 57 (50.9%) students were boys. The students were in the range of 12-13 years of age enrolled in three classes each including approximately 37 students. The researcher was the mathematics teacher of all three classes at the time of the study.

3.3 Variables of the study

In this study there were seven variables that can be classified as criterion and predictor variables. There were three criterion variables and four predictor variables.

3.3.1 Criterion Variables

The criterion variables of the study are the students' gain scores on three types of knowledge tests. These gain scores were obtained from Declarative Knowledge Test (DecKT), Conditional Knowledge Test (ConKT), and Procedural Knowledge Test (ProKT). Gain scores were calculated by subtracting pretests mean scores of students from posttest mean scores on three types of knowledge tests. These three criterion variables are continuous and measured on interval scale.

3.3.2 Predictive Variables

The predictive variables of the study are the students' pretest scores on three types of knowledge tests and raw scores on Group Embedded Figure Test (GEFT). These pretest scores were obtained from DecKT, ConKT, and ProKT. These predictive variables are continuous and measured on interval scale.

3.4 Instrumentation

Instruments used in this study were GEFT, DecKT, ConKT, and ProKT. GEFT was used to determine the contribution of cognitive styles of the students to their three types of knowledge acquisition on geometry including polygons, and to assess students' knowledge acquisition on geometry including polygons; DecKT, ConKT and ProKT were used as pre and posttests.

3.4.1 Group Embedded Figure Test (GEFT)

Group Embedded Figure Test (Witkin, Oltman, Raskin and Karp, 1971) was used to determine cognitive styles of the students in the study. The test first translated and validated into Turkish by Cebeciler (1988). The KR-21 internal consistency reliability of test was calculated as 0.74 for present study. The test consisted of three sections. The first section included 7 items for practice purposes. Both second and third sections included 9 items. The assessment was made on the second and the third parts. In these sections, students are required to find the embedded figures given in the complex figures. This is a sample question in GEFT:

Try to find simple form named "B" in the complex figure and trace it in pencil directly over the lines of the complex figure.

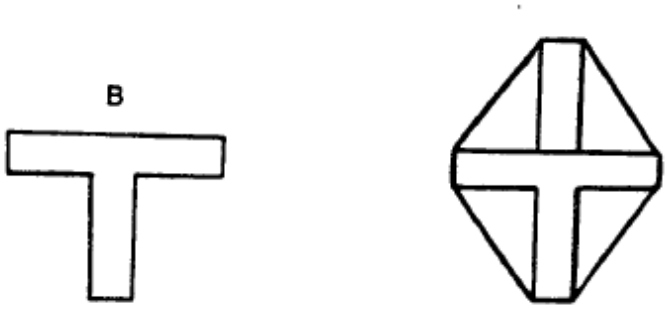


Figure 3.1 The sample question of GEFT (Witkin, et. al, 1971).

One point was given for each true response to the items and zero point was given for each incorrect response. The possible score that one could make ranged from 0 to 18. It was important that each part of GEFT was administered in a limited time. The time given for the first part was two minutes and for the second and the third parts each was five minutes.

GEFT was used to determine the contribution of cognitive styles of the students to their three types of knowledge acquisition on geometry including polygons.

3.4.2 Declarative Knowledge Test (DecKT)

Erdoğan (2007) developed Declarative Knowledge Test (see Appendix A) considering the general and specific objectives of polygons unit in sixth grade elementary mathematics curriculum to assess students' declarative knowledge related to Polygons unit. DecKT included 18 multiple-choice items based on Polygons unit (polygons, similarity and congruency of polygons, classification of the triangles according to their sides and angles, properties of square and rectangle, perimeter of polygons, area of rectangle, square, triangle and mixed shapes).

Eight of 18 questions were identifying polygons and the rests were on knowing the definitions and properties of polygons. The possible score on DecKT was ranged from 0 to 18. DecKT questions were scored "0" for incorrect answer and "1" for correct answer. The KR-21 internal consistency reliability was obtained as 0.76 for preDecKT for present study.

3.4.3 Conditional Knowledge Test (ConKT)

Erdoğan (2007) developed Conditional Knowledge Test (see Appendix A) considering the general and specific objectives of polygons unit in sixth grade

elementary mathematics curriculum to assess students' conditional knowledge related to Polygons unit.

ConKT questions focused on understanding a network of "if-then" statements, which describe the relationships between two concepts; congruent triangles and isosceles triangle, congruent and similar polygons, scalene, and right triangle, sides and angles relations of polygons, square and rectangles, and the relationship between area and perimeters of polygons.

ConKT questions were assessed by means of the rubric developed by Lane (1993) see Appendix B. The researcher assigned a four-score level (0-3) for each question of the test. If a student gave no answer to the question, the lowest score of zero was given. If a student gave entirely correct response, the highest score of three was awarded. The possible scores on ConKT ranged from 0 to 18. The Croanbach alpha of preConKT was obtained as 0.77 for present study.

In order to establish the extent of consensus on use of the scoring rubric for the ConKT inter-rater reliability coefficient was computed. The researcher and the supervisor of the thesis who is specialized in mathematics education scored randomly selected 20 tests from each one. Intraclass correlation (ICC) was used to measure inter-rater reliability in terms of providing subjective decisions. The ICC value of 0.97 indicated a quite high reliability and the internal consistency of the scoring rubric as used by two raters.

3.4.4 Procedural Knowledge Test (ProKT)

Erdoğan (2007) developed Procedural Knowledge Test (see Appendix A) considering the general and specific objectives of polygons unit in sixth grade elementary mathematics curriculum to assess students' procedural knowledge related to Polygons unit.

Questions were based on polygons unit (polygons, similarity, and equality of polygons, properties of square and rectangles, perimeter of polygons, area of rectangle, square, triangle and mixed shapes). Four of the ten questions were related with finding the perimeter of given shape. Two of the ten questions were related with finding area. Two of the ten questions were related to find the sides of square and equilateral. Two of ten questions were related to the relationship perimeter and area.

A scoring rubric was developed by the researcher based on Lane (1993) see Appendix B. The researcher assigned a four-score level (0-3) for each question of the test. If a student gave no answer to the question, the lowest score of zero was given. If a student gave entirely correct response, the highest score of three was awarded. The possible scores on ProKT ranged from 0 to 30. The Croanbach alpha of ProKT was obtained as 0.80.

In order to establish the extent of consensus on use of the scoring rubric for the ProKT inter-rater reliability coefficient was computed. The researcher and the supervisor of the thesis who is specialized in mathematics education scored randomly selected 20 tests from each one. Intraclass correlation (ICC) was used to measure inter-rater reliability in terms of providing subjective decisions. The ICC value of 0.95 indicated a quite high reliability and the internal consistency of the scoring rubric as used by two raters.

3.5 Development of Lesson Plans

First of all, the objectives of the sixth grade mathematics course on Polygons unit defined by Turkish Ministry of Education were considered, while developing lesson plans. In these lesson plans students are required to define polygons and non-polygons, regular and non-regular polygons, classify triangles with respect to their sides and angles, identify the properties of square and rectangle, find perimeter and area of regular and non-regular polygons, define the relationship between congruent and similar polygons. To be able to prepare drama based lesson plans, approach of Mantle of Expert was used. In this approach, students and the teacher take some roles as experts, students work in groups and learn from each other. The teacher guides them for learning. There were nine lesson plans include 16 lesson hours (see Appendix C). In these lesson plans, students took some roles as architects, municipal workers, scientists, ceramic factory workers, citizenships, flat dwellers, and journalists and tried to solve some problems related to the topic of the lesson in role. While preparing the lesson plans, phases of drama based instruction and developing students' three types of knowledge were considered. These phases were introduction, development, and evaluation. In all parts of the lessons, the activities should be related to the objectives of the lessons and each other too. In the introduction part, there were warm-up activities to make the students ready to work in groups and learn

the topic of the lesson. In these warm-up activities, visualization, linking with the students' prior knowledge, daily life, mathematical concepts and other lessons were used to develop students' declarative and procedural knowledge especially. In development parts of lesson plans students were required to work together in role to achieve the objectives of the lesson. This part was used for improving students' conditional knowledge, and in the last part, students were assessed whether they learnt the topic of the lesson, or not. The supervisor of the thesis and a mathematics instructor from a university specialized in mathematics education certified on drama as well controlled the lesson plans whether they were mathematically correct and appropriate for achieving the objectives of the lesson. For instance, a mathematics instructor suggested the researcher to change some activities because they took a long time. The nine lesson plans were reviewed with their comments and recommendations. For instance, some activities were changed because they took a long time and they did not appropriate for the classroom environment or the age of the students. Then, pilot study was carried out with 85 seventh or eight grade students in the fall semester of 2008-2009 academic years in the same school the researcher worked. Pilot study was conducted in order to control the applicability of the lesson plans in classroom settings such as whether the lesson plans could be applied crowded classrooms, how the classroom management could be accomplished, whether the directions were clear and the objectives could be achieved on time. The lesson plans reviewed after the pilot study. Some activities of the lessons were changed, because they were not appropriate for the number of the students and they took a long time. For instance, in the plan of lesson 1, there were some pictures on the blackboard. Some were polygons, and some were non-polygons. The students walked with music and when music stopped, they stand in front of the picture which they thought that it was polygon. While doing this activity students squeezed themselves for this reason this activity was cancelled for main study. Moreover, in development parts of the lessons, students worked together and the student chosen by the group members talked about the studies of the group. During the pilot study, the researcher observed that some students did almost all the studies and the others watched them. Moreover members of the groups always chose the hardworking students to talk about their studies, so the other students could not

learn anything. For this reason, both the pilot and main study**,** the researcher told that all the group members would work together and the student who would talk about the studies of the group would be chosen by the teacher. So all the students attended and concentrated what the teacher wanted all the groups to do.

3.6 Treatment

Treatment took sixteen lesson hours and it completed in four weeks and in order to be able to administer drama-based lessons regular classroom organization was changed. Students' desks were combined two by two and three banks were put around the desks, so that the students could work in groups, and move easily. The arrangement of the classroom for drama activities was as below:

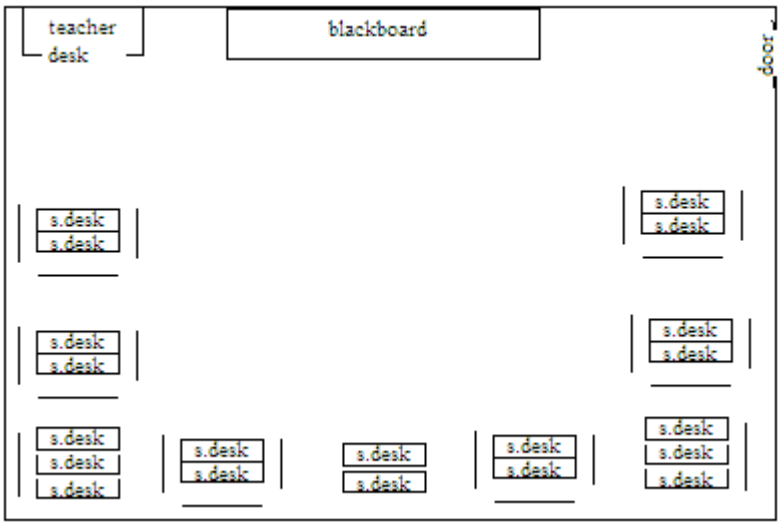


Figure 3.2 The arrangement of the classroom for drama activities

Each drama based lesson began with introduction part. In this part, there were warm-up activities to make the students ready to work in groups and learn the topic of the lesson. Because, students would be relaxed by warm-up activities, they could adapt the development part of the lesson easily. In the introduction parts of the lessons, it was aimed to develop students' declarative and procedural knowledge especially.

The second phase of the drama based lessons was development activities. In this part, students were required to work together to achieve the objectives of the lesson by taking roles. Development parts of the lessons were used for improving students' conditional knowledge.

The last part of the lessons was evaluation part. In this part, students were assessed whether they learnt the topic of the lesson, or not. The evaluation of each drama based lesson in terms of the phases and techniques were below:

Table 3.1 The Evaluation of Lesson 1

Introduction	
Warm-up Activity	There were some pictures on the blackboard. Some were polygons, and some were non-polygons. Students looked over all of them carefully and teacher arranged them in two groups and wanted the groups to determine the number of polygons on the blackboard.
Development	
Social Metaphor	The environment for producing polygonal gardens by using gene technology and press conference setting.
Make Believe Play	The role of scientists and journalists
Dramatic Moments	Producing more beneficial polygonal trees for humanity by using gene technology
Drama Techniques	Mantle of expert, role playing, holding a meeting
Evaluation	
	There was a carton on the blackboard. Students were asked to draw polygons whatever they wanted and give them a name.

In lesson 1, students were required to draw and construct polygons. In the introduction part of the lesson, there were some pictures on the blackboard. Some were polygons, and some were non-polygons. Students looked over all of them carefully and the researcher arranged them in two groups and wanted the groups to determine the number of polygons on the blackboard. The researcher guided them to remember the characteristics of polygons. The students called the shapes which have more than two corners and be closed as polygons. Two of the groups gave the wrong answer at first and the researcher wanted them to think and discuss again. Then the researcher showed this shape  and told that it had more than two corners and it was closed, Was it a polygon? The student -who got 8 points from GEFT- claimed that it was a polygon, the student -who got 15 points from GEFT- expressed that it cannot

be a polygon because of the point in the middle of the shape. Then all of the students discussed again during the discussion, the student -who got 2 points from GEFT- tried to pursue the student- who got 14 points from GEFT- about the shape ▢ was polygon. The student- who got 14 points from GEFT- explained that it can not be a polygon because of not having corners after the discussion, the two groups gave the right answers. By means of this activity students learned the characteristics of polygon which was in the context of declarative knowledge. In the development part of the lesson, the students were required to produce more beneficial polygonal trees as scientists by working in groups for humanity and presented them to the citizenships by means of journalists. They worked in four groups and constructed gardens with polygonal trees. While the groups were presenting their polygonal trees, the speakers of the groups tried to explain the benefits of the trees as if they were real scientists. The student- who got 17 points from GEFT- expressed that they produced the tree with this shape;  to make simple birds' nesting on the tree. The student- who got 9 points from GEFT- explained that they produced the tree with this shape;  to benefit large shadow of the tree, and the student- who got 1 point from GEFT- told that they produced the tree with this shape;  to reach fruits of it easily. The aim of this activity was drawing polygons and constructing them. The students learned to construct kinds of polygons by this activity which was in the context of conditional knowledge. In the evaluation part, students were asked to draw polygons whatever they wanted and give a name to them. After completing this activity the researcher investigated the drawings of the students, and she corrected the wrong drawings by reminding the characteristics of polygons again. For instance, some students did not care the corners of the polygons, or they used the same letter while giving a name to their polygons.

Table 3.2 The Evaluation of Lesson 2

Introduction	
Warm-up Activity	Teacher pasted some pictures from daily life and some places from Çanakkale on the blackboard. Students were supposed to look over the pictures as if they strolled around an art exhibition, find the polygons in the pictures and determine the numbers of corners, sides, and angles of the polygons.
Development	
Social Metaphor	Çanakkale setting
Make Believe Play	The role of students who were going to Çanakkale
Dramatic Moments	Finding the right key of the room with regular polygonal shape
Drama Techniques	Role playing, teacher in role
Evaluation	
	There were two cartons on the blackboard named "panel of regular polygons' hotel" and "panel of non-regular polygons' hotel" Students were asked to paste the polygon which teacher gave them to the right panel.

In lesson 2, students were supposed to differentiate regular and non-regular polygons. In the introduction part, teacher pasted some pictures from daily life and some places from Çanakkale on the blackboard. These pictures were the examples of polygons from daily life such as honeycomb, triangular flag, square chessboard, kite, Çanakkale Martyrs Memorial, Trojan horse, and some photos from Çanakkale museum. Students were supposed to look over the pictures as if they strolled around an art exhibition, find the polygons in the pictures and determine the numbers of corners, sides, and angles of the polygons. After the students looked over the picture the researcher asked the numbers of the sides and angles of the polygons they saw. The students replied. Then she asked the reason of the difference between the polygons which have the same number of sides. The student- who got 10 points from GEFT- expressed that the angles or the length of the sides of them could be different. The aim of this activity was providing students to realize polygons can be different with each other even if they have the same number of sides or angles. In the

development part of the lesson, the researcher told that they would go to Çanakkale and stay at the hotel for two days. The students constructed a bus by using desks and they got on the bus for going to Çanakkale. The researcher and students went to Çanakkale, when they arrived at their hotel, there was a problem about the key of their room. The researcher took a role as receptionist and told that he dropped the panel with the keys of the rooms and all of them were mixed and they could not find the key of the students' room. He added that the key of the students' room was regular polygonal shape. He gave all keys to the students and wanted them to find their room's key and left. The researcher wanted the students to think the characteristics of regular polygons. The students discussed. The student- who got 2 points from GEFT- told that the sides were equal in length. The student- who got 7 points from GEFT- added that angles were equal. The student -who got 16 points from GEFT- gave a sample as equilateral triangle. In this part of activity the students activated their prior knowledge about regular polygons which was in the context of declarative knowledge. In the second part of the activity the students worked in 5 groups. Each group had three keys with polygonal shape. The researcher wanted the groups to find the key with regular polygonal shape by measuring lengths of the sides and angles of them. While they were measuring the keys, the receptionist gave two clues about the key -because there were more than one regular polygons- the students expressed their studies then. The student- who got 4 point from GEFT showed a rectangle and told that it was a regular polygon. The student- who got 2 points from GEFT claimed that it could not be a regular polygon because only the angles of it were equal, not the length of the sides. The students shared their opinions and after the discussion the students agreed that a rectangle was not a regular polygon. The student- who got 8 points from GEFT showed a rhombus and explained that it could not be a regular polygon because only the sides were equal in length, not the angles of it. The researcher asked the students whether a rhombus was a regular polygon, or not. After the discussion they agreed that a rhombus was not a regular polygon. The researcher emphasized these two polygons could not be regular polygons. In that activity the students learned the characteristics of a regular polygon and a non-regular polygon which was in the context of conditional knowledge. In the evaluation part, there were two cartons on the blackboard named "panel of regular

polygons' hotel" and "panel of non-regular polygons' hotel" the researcher gave each student a polygon and wanted them to paste it to the right panel. After the activity was completed, the researcher investigated the cartons, and controlled the polygons whether they were at the right place, or not. She corrected the mistakes by asking the reason of it to the students.

Table 3.3 The Evaluation of Part 1 of Lesson 3

Introduction	
Warm-up Activity	There were two small and two big forms of the same polygon (two small squares and two big squares, big squares are the same and small squares are the same) and every student has one of them. They walked with music and when music stopped they found the same polygon or same polygon with different sizes on their hands.
Development	
Social Metaphor	Ceramic factory setting
Make Believe Play	The role of ceramic factory workers
Dramatic Moments	Proving there is no difference between two products of the ceramic factory to the boss.
Drama Techniques	Mantle of expert, role playing, teacher in role, writing in role
Evaluation	
	There was a carton on the blackboard includes congruent and similar polygons. Students were asked to find congruent polygons and write them with using symbol of congruent.

In lesson 3, students were expected to define the characteristics of congruent and similar polygons, explain the relationship between them, and produce patterns from congruent and similar polygons. Lesson 3 includes two parts, in the introduction phase of the first part, the researcher gave a polygon to each student. There were two small and two big forms of the same polygon (two small squares and two big squares, big squares are the same and small squares are the same). The students walked with music and when music stopped they found the same polygon on their hands. Music started again and when it stopped, they found the same

polygon with different sizes on their hands. Lastly, music started again and when it stopped four polygons would together (two small and two big forms of the same polygon). Whenever music stopped, all of the students tried to find the researcher wanted. While coming together, the students enjoyed very much. Seeing congruent and similar polygons made them more concrete and enabled the students' understanding the characteristics of congruent and similar polygons. In the development part, students worked in four groups as ceramic factory workers and they should prove that there is no difference between two products of the ceramic factory with the same polygonal shapes to the boss. To do this they measured the lengths of the sides and angles of the products and wrote a report about them. Students learned the characteristics of congruent polygons by this activity which was in the context of declarative knowledge. In the evaluation part, there was a carton on the blackboard includes congruent and similar polygons. Students were asked to find congruent polygons and write them with using symbol of congruent.

Table 3.4 The Evaluation of Part 2 of Lesson 3

Introduction	
Warm-up Activity	Students were asked many questions about polygons
Development	
Social Metaphor	Computation setting
Make Believe Play	The role of students having competition for wonderful polygonal patterns
Dramatic Moments	Trying to win the competition producing patterns by using congruent and similar polygons
Drama Techniques	Mantle of expert, role playing
Evaluation	
	There was a carton on the blackboard includes congruent and similar polygons. Students were asked to find congruent and similar polygons and write them with using symbol of congruent and similarity.

In the introduction phase of the second part, students were asked many questions about polygons. The researcher arranged students in two groups, they sequenced in front of the blackboard and replied the questions related to the polygons by competing each other. In the development part, the students competed for producing wonderful polygonal pattern by using congruent and similar polygons. The researcher gave polygons to all the groups and wanted them to produce polygonal patterns by using similar or congruent of it. All of the students produced polygonal patterns made by carton. After the groups completed the patterns, the researcher chose one student from all groups to determine the best pattern. In this activity, students produced polygonal patterns by constructing similar or congruent of the polygon the researcher gave them, for this reason they learned conditional knowledge of similar and congruent polygons. In the evaluation part, there was a carton on the blackboard includes congruent and similar polygons. Students were asked to find congruent and similar polygons and write them with using symbol of congruent and similarity.

Table 3.5 The Evaluation of Lesson 4

Introduction	
Warm-up Activity	Constructing kinds of triangles by using elastic band
Development	
Social Metaphor	The environment for producing kinds of triangular roofs as architects
Make Believe Play	The role of architects
Dramatic Moments	Producing kinds of triangular roofs to help their colleague
Drama Techniques	Mantle of expert, role playing, letters, teacher in role
Evaluation	
	Students were asked to reply many questions about kinds of triangles.

In Lesson 4, students were required to classify triangles with respect to their sides and angles. In the introduction part of the lesson, the students constructed

isosceles, equilateral, acute, right, and obtuse triangles by using elastic band. By this activity students prior knowledge about the kinds of triangles was activated which was in the context of declarative knowledge. In development part, the students got a letter from their colleague in Canada, He wanted them to help him produce triangular roof for his exacting customer. The students worked in three groups as architects and produce kinds of triangular roofs. They used isometric sheets to construct triangles and then they made it from carton, called their roof with respect to the characteristics of it, and used as the roof of the houses. Because all of the students measured, cut and construct the triangles, shared and discussed the names of them, they learned to categorize the triangles with respect to angles and sides which were in the context of conditional knowledge. In the evaluation part, students were asked to reply many questions about kinds of triangles and the answers were discussed in the classroom.

Table 3.6 The Evaluation of Lesson 5

Introduction	
Warm-up Activity	Finding samples of square and rectangle in the classroom
Development	
Social Metaphor	Country of Squares setting
Make Believe Play	The role of citizenships of country of Squares
Dramatic Moments	Investigating the rightness of the explanation of the president of country of Rectangles
Drama Techniques	Mantle of expert, role playing, writing in role, holding a meeting, teacher in role
Evaluation	
	Teacher wrote some characteristics of rectangle or square or both of them and wanted students to determine which ones belong to only square, rectangle or both of them.

In lesson 5, students were expected to define the relationships between sides, angles, and diagonals of rectangle and square. In the introduction part, the researcher wanted the students to find samples of square and rectangle in the classroom and explain the reason of choosing the object. The students expressed the reason of their

choice by using the characteristics of rectangle or square. For instance, the student- who got 2 points from GEFT told that blackboard was the sample of rectangle because the opposite sides were equal in length. The student- who got 11 points from GEFT explained that socket was a sample of square because all sides were equal in length, and the student- who got 9 points from GEFT expressed that desk was a sample of rectangle because all angles were 90 degrees. By means of this activity students thought the characteristics of square and rectangle. Thus, they activated their prior knowledge related to the characteristics of rectangle or square and used their knowledge to find examples of these polygons from the classroom which was in the context of declarative and conditional knowledge. In the development part, there was news on the newspaper that "The president of the Country of Rectangles claimed that the physical characteristics of the country of Rectangles were superior to the country of Squares." Students were expected to investigate the rightness of the explanation by measuring the maps of two countries, answering the questions about the two countries on the table given, and comparing them according to the results they found. The students worked in four groups as citizenships of Squares' country. They compared rectangle and square in terms of the length of the sides, the angles, and diagonals of them. After they replied all the questions on the table, they determined the rightness of the explanation in terms of their findings. In that activity students were expected to learn "Square is a rectangle with equal lengths." For learning it, they needed to learn both the characteristics of square and rectangle and compare them which were in the context of conditional knowledge. In the evaluation part, the researcher wrote some characteristics of rectangle or square or both of them and wanted students to determine which ones belong to only square, rectangle, or both of them. After the students replied the questions, the researcher asked some students their answers and wanted the other students to share their opinions about the answer such as whether the answer was right or false.

Table 3.7 The Evaluation of Lesson 6

Introduction	
Warm-up Activity	Playing a game related to perimeters of polygons
Development	
Social Metaphor	Setting the environment for deciding the sequence of the land with polygonal shape which is surrounded with wire
Make Believe Play	The role of workers
Dramatic Moments	Deciding the sequence of the land with polygonal shape which is surrounded with wire
Drama Techniques	Mantle of expert, role playing, teacher in role
Evaluation	
	Students were asked some problems related to calculating perimeters of polygons.

In lesson 6, students were supposed to guess the perimeters of polygons by using strategy and explain the relationship between the length of the sides and perimeters of the polygons. In the introduction part of the lesson, the researcher drew a square on the floor and students stand on it. A student run around the square and touched one of his friend's shoulders. Then his friend started to run to opposite way and when they met, they stopped and said one of the characteristics of square and then run to reach the gap on the square. The students played it on pentagon and hexagon again. In this activity students needed to activate their prior knowledge of square, pentagon, and hexagon which was in the context of declarative knowledge. In the development part, the students worked in four groups to decide the sequence of their land with regular polygonal shape such as equilateral triangle, square, regular pentagon, and regular octagon which is surrounded with wire. They first guessed the perimeters of regular polygons and then calculated them. The students learned the relationship between the sides of the polygons and perimeters of them and constructed a formula which were in the context of conditional and procedural knowledge. In the evaluation part, students were asked some problems related to calculating perimeters of polygons.

Table 3.8 The Evaluation of Lesson 7

Introduction	
Warm-up Activity	Drawing polygons by using their finger, elbow, and foot and calculating their perimeters
Development	
Social Metaphor	Setting the environment for solving problems about the perimeters of the land plans with polygonal shapes
Make Believe Play	The role of architects
Dramatic Moments	Solving problems about the perimeters of the land plans with polygonal shapes
Drama Techniques	Mantle of expert, role playing
Evaluation	
	Students were asked to construct a problem related to perimeters of polygons and solve it

In lesson 7, students were required to construct a problem related to the perimeters of polygons and solve these problems. In the introduction part of the lesson, students drew regular polygons such as equilateral triangle, square, regular pentagon on the wall by using their finger, elbow, and foot and calculated their perimeters. The researcher asked to the students how they calculated the perimeters of regular polygons. They were expected to remember the formula of finding perimeters of regular polygons and use it which was in the context of declarative and procedural knowledge. In the development part, there were some problems about the perimeters of the county's land plans with polygonal shapes and the students were required to solve them by measuring as architects. They worked in four groups. By means of this activity, students could learn to construct the problems about the perimeters of polygons (regular and non-regular) and solve them which were in the context of procedural knowledge about the polygons. In the evaluation part, students were asked to construct a problem related to perimeters of polygons and solve it.

Table 3.9 The Evaluation of Lesson 8

Introduction	
Warm-up Activity	Touching objects with rectangular and square shape and guess the area of them.
Development	
Social Metaphor	Setting the environment for finding the best plan of holiday site
Make Believe Play	The role of flat dwellers
Dramatic Moments	Finding the best plan of holiday site which is most suitable for flat dwellers
Drama Techniques	Mantle of expert, role playing, teacher in role
Evaluation	
	Students were asked to prepare holiday site in their dreams and calculate the areas between buildings.

In lesson 8, students were supposed to construct relation of areas about triangle, rectangle, and square. In the introduction part of the lesson, the researcher wanted students to touch the objects with rectangular and square shape in the classroom and guess the area of them. They touched on the blackboard, desk, teacher's table, and socket and guessed the areas of them. Students activated their prior knowledge about the areas of square and rectangle and used it for guessing their areas which were in the context of procedural knowledge. In the development part, the students worked in four groups and the researcher showed them four holiday site plan and wanted them to choose the best plan as flat dwellers by obeying some rules about the plan. The students chose the best plan by calculating the areas of the buildings which were square, rectangle and triangular shape by counting the squares between buildings. The researcher asked them to use another strategy while calculating the areas, they constructed formulas of the square, rectangle, and triangle' areas. They learned to make connections between the concepts by this activity which was in the context of conditional knowledge. In the evaluation part, students were

asked to prepare holiday site in their dreams and calculate the areas between buildings.

Table 3.10 The Evaluation of Lesson 9

Introduction	
Warm-up Activity	Guessing the area of the classroom, desks, blackboard
Development	
Social Metaphor	Setting the environment for solving problems about the areas of the objects in the room with polygonal shapes
Make Believe Play	The role of interior designers
Dramatic Moments	Solving problems about the areas of the objects in the room with polygonal shapes
Drama Techniques	Mantle of expert, role playing
Evaluation	
	Students were asked to construct problems related to areas of polygons and reply them.

In lesson 9, students were required to construct a problem related to the areas of triangle, rectangle, and square and solve them. In the introduction part, students walked in the classroom and while they were walking, the researcher wanted them to guess the area of the classroom, blackboard, desks, and teacher's table. They guessed the areas of them and the researcher wanted them to share their strategy of guessing the areas. For instance, the student- who got 5 points from GEFT- only guessed the areas of the objects without using the strategy, while the student- who got 18 points from GEFT- guessed them by thinking the lengths of the objects' sides while calculating the areas of them. By this activity, the students needed to activate their prior knowledge about the formulas of the square's and rectangle's areas and use this knowledge while guessing the areas of them which were in the context of procedural knowledge. In the development part, students tried to solve some problems about areas of room plan and the objects in the room with polygonal shapes as interior designers and constructed some problems about the areas of objects in another room plan. The students- who got 0 and 7 points from GEFT- constructed easy problems

such as “Find the area of the lamp or mirror.” On the other hand, the student- who got 14 points from GEFT- constructed more complex problem than the others such as “Find the area of the space of the wall.”By this activity, the students learned to construct and solve the problems related to the areas of the objects with polygonal shapes which were in the context of procedural knowledge. In the evaluation part, students were asked to construct problems related to areas of polygons and reply them. The student- who got 1 point from GEFT- constructed a routine problem such as “Find the area of a square with side 5 cm long.” On the other hand the student- who got 16 points from GEFT constructed a problem related to daily life such as “My mother wants to carpet her room with rectangular shape. The room’s length is 5 m and its width is 3 m. Find the area of the carpet needed.”

3.7 Data Analysis

The data gathered the three types of knowledge tests and GEFT were analyzed both descriptive and inferential statistics by using Statistical Package for Social Sciences 15.0. Descriptive statistics were used in order to see the development of students between pre and posttest scores of three types of knowledge tests by subtracting their pretest mean scores from posttests. Inferential statistics were used in order to answer the contribution of cognitive style and prior knowledge on knowledge acquisition of students in drama based learning environment. Standard Multiple Regression Analysis was used to analyze data. Pallant (2007) stated that the regression analysis is used to analyze the associations between one dependent variable and several independent variables (p.146). In this analysis the relationship between pretest mean scores of students on three types of knowledge tests and students’ mean scores of GEFT and students’ gain scores of three types of knowledge tests were investigated. The alpha level, a criterion of statistical significance, was accepted as 0.05 for statistical procedures.

CHAPTER 4

RESULTS

This chapter includes three sections. In the first section, descriptive statistics results of the data collected by means of GEFT and declarative, conditional, and procedural knowledge tests are presented. The second section is inferential statistics section where the results of the multiple regression analyses which were employed to investigate the predictors of 6^{th} grade students' knowledge acquisition are presented. The third section includes summary of the findings of the study.

4.1 Descriptive Results

In this section, descriptive statistics results of the research data obtained from raw scores are given. Table 4.1 shows maximum possible scores or differences of all tests, mean, standard deviation, skewness, and kurtosis values of GEFT, pretests and gain scores of knowledge tests. According to the results in Table 4.1, the mean scores of GEFT were found 5.49 and standard deviation was calculated as 4.92 for entire sample. The mean scores of students' preDecKT were found 7.43 with standard deviation of 2.09 and after drama based instruction students' mean scores of DecKT increased 4.42 points with standard deviation of 2.86. Moreover, the mean scores of students' preConKT were found 5.77 with standard deviation of 2.99 and after drama based instruction students' mean scores of ConKT increased 4.83 points with standard deviation of 3.44. Lastly, the mean scores of students' preProKT were found 7.74 with standard deviation of 3.48 and after drama based instruction students' mean scores of ProKT increased 7.32 points with standard deviation of 4.25. According to the results, we can say that the students' declarative, conditional, and procedural knowledge were improved by means of drama based instruction.

Table 4.1 Descriptive Statistics for the GEFT and the pretest, posttest, and gain scores of Declarative, Conditional and Procedural Knowledge tests.

		Pretests			**Posttests**			**Gain Scores**		
	GEFT	DecK	ConK	ProK	DecK	ConK	ProK	DecK	ConK	ProK
Max. Poss. Score	18	18	18	30	18	18	30	18	18	30
N	112	112	112	112	112	112	112	112	112	112
Mean	5.49	7.43	5.77	7.74	11.86	9.58	13.30	4.42	4.83	7.32
SD	4.92	2.09	2.99	3.48	3.27	3.80	4.45	2.86	3.44	4.25
Skew.	1.08	.087	-.315	.007	-.491	-.710	.300	-.378	.669	.712
Kurt.	.272	-.633	-.584	.150	-.232	.434	-.215	-.318	-.207	.327

4.2 Inferential Results

In this section, standard multiple regression analysis was used for investigating the contribution of cognitive style and prior knowledge on 6th grade students' knowledge acquisition in polygons in drama based learning environment.

4.2.1 Assumptions of Multiple Regression

Multiple regressions have a number of assumptions such as multicollinearity, sample size, outliers, normality, linearity, homoscedasticity, and independence of residuals assumptions.

For sample size assumption, Tabachnick and Fidell (2001) give a formula for calculating sample size requirements, taking into account the number of predictive variables used; N > 50 + 8m (where m = number of predictive variables). In this study, number of predictive variables was four and from formula (N>50+8. (4); N>82) we need more than 82 cases. Sample size in this analysis was 112 and 112 > 82 so sample size of this analysis encountered this assumption. For the multicollinearity assumption the bivariate correlations among the predictive variables

were calculated (Table 4.2). All correlation coefficients were below .70 showing that there was no violation of the multicollinearity assumption (Pallant, 2007, p.155).

Table 4.2 Correlation matrix for GEFT and three types of knowledge tests

Correlation						
	GEFT	**PreDecKT**	**PreConKT**	**PreProKT**	**GAINDecKT**	**GAINConKT**
PreDecKT	.594**					
PreConKT	.108	.095				
PreProKT	.083	.193*	.234*			
GAINDecKT	.277**	-.155	.246**	.087		
GAINConKT	.582**	.448**	.278**	.169	.360**	
GAINProKT	.638**	.540**	.290**	.176	.335**	.620**

* $p<0.05$
** $p<0.01$

To check normality assumption, skewness and kurtosis values for all of the dependent variables should be controlled (Pallant, 2007, p. 57). As seen in Table 4.1, all the skewness and kurtosis values are between ± 2.0 for gain scores of three types of knowledge tests, they were in an acceptable range for a normal distribution (Tabachnick & Fidell, 2001, p.135). Additionally, Tabachnick and Fidell (2001) stated that "examination of residuals scatterplots provides a test of assumption of normality, linearity, and homoscedasticity between predictive variables scores and errors of prediction" (p.136). Outliers have too much impact on the regression solution, and should be deleted or the variable transformed. Outliers can be identified from the standardized residual plot (Pallant, 2007, p.156). Tabachnick and Fidell (2001) define outliers as those with standardized residual values above about 3.3 or less than -3.3 (p.136). As seen in Figure 4.1, 4.2, and 4.3 it was found that all values were between -3.3 and 3.3. For this reason, it was claimed that there were no outliers in the data. Moreover, Tabachnick and Fidell (2001) stated that if all assumptions are met, the residuals will be nearly rectangularly distributed with a concentration of

scores along the center (p.137). Because all the residuals were rectangularly distributed (see Figure 4.1, 4.2, and 4.3), the assumptions were met with no serious violations.

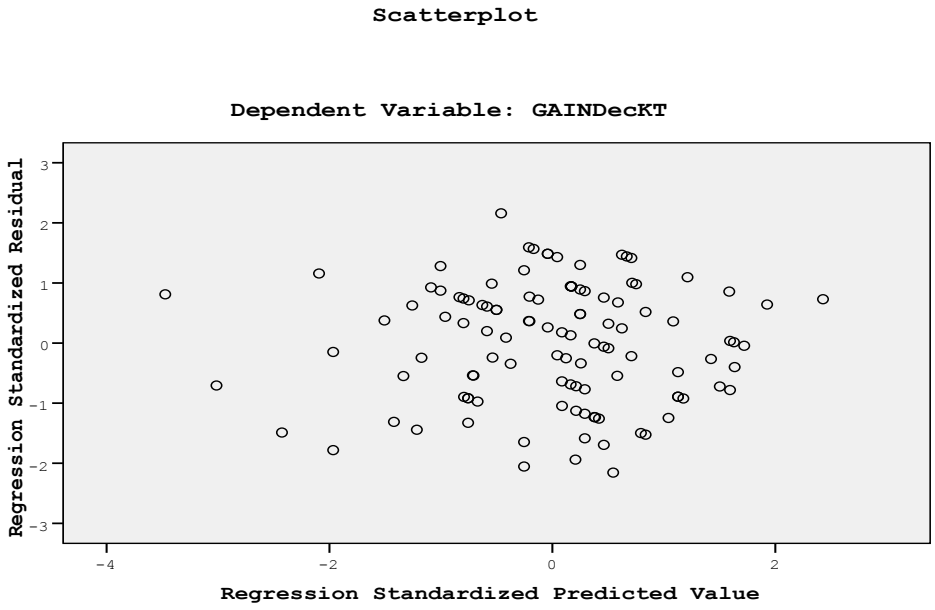


Figure 4.1 Scatterplot for Gain Scores of Declarative Knowledge Test

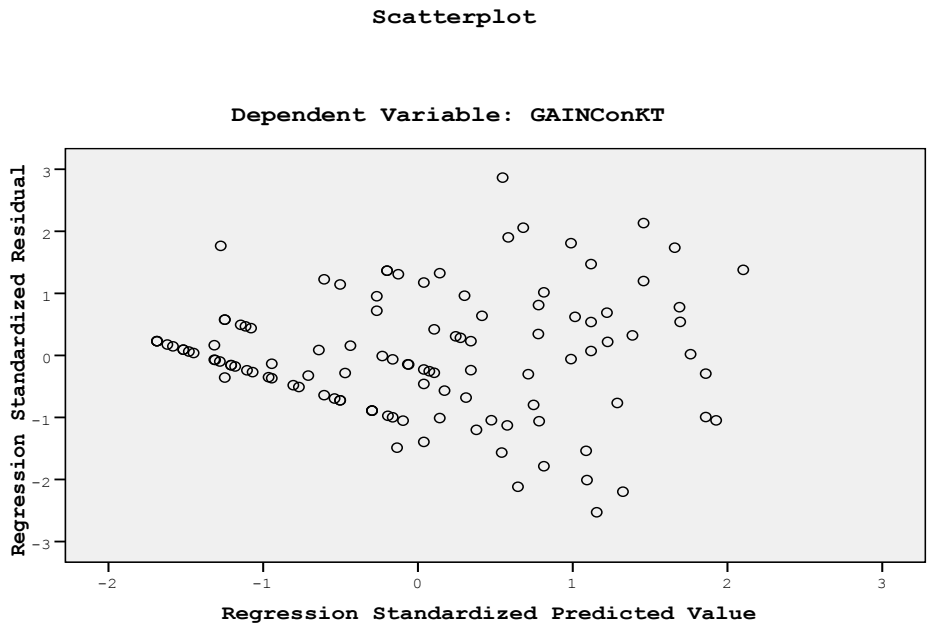


Figure 4.2 Scatterplot for Gain Scores of Conditional Knowledge Test

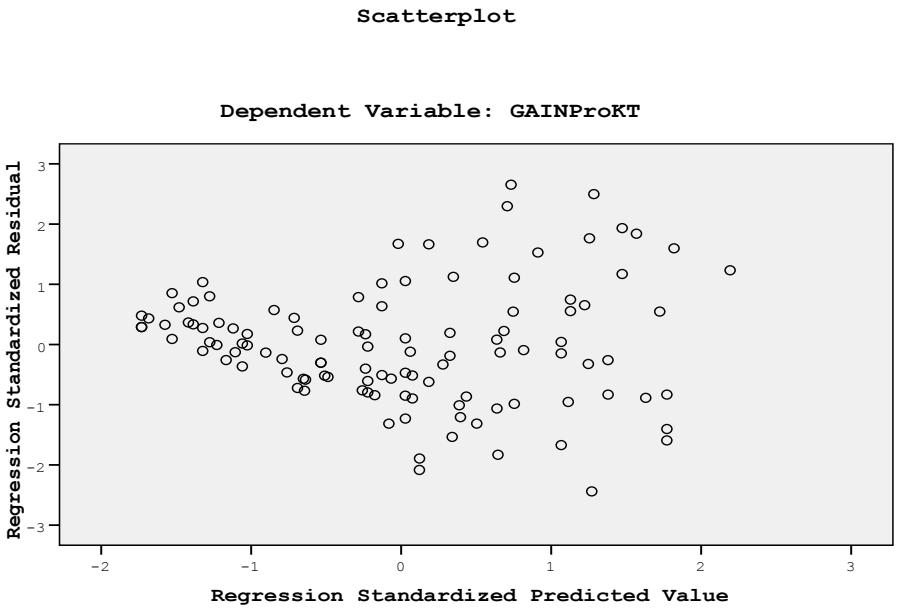


Figure 4.3 Scatterplot for Gain Scores of Procedural Knowledge Test

4.2.2. Results Concerning First Hypothesis of the Study

The first hypothesis was stated and given below:

$H_0$1: There is no significant contribution of cognitive style, preDecKT, preConKT, and preProKT in the prediction of the gain scores of 6th grade students' declarative knowledge test on geometry including polygons in drama based learning environment.

The results of the multiple regression analysis showed that the four predictive variables (cognitive style, preDecKT, preConKT, preProKT) explained 29.6 % of variance in 6th grade students' declarative knowledge acquisition on geometry including polygons ($R= 0.544$, $F= 11.244$, $p \leq 0.05$). For this analysis Cohen's f^2 is appropriate effect size measure which was found 0.420 by using the formula R^2 / 1-R^2. Because $f^2 > 0.35$ it means large effect size in Cohen's categorization (Cohen, 1988, p.414). This large effect size claimed that the practical significance of this result. More specifically, it was found that cognitive style, preDecKT and preConKT each made a statistically significant contribution to the prediction of the gain scores of 6th grade students' declarative knowledge test ($p \leq 0.05$), while preProKT failed to achieve significance ($p > 0.05$). The largest beta coefficient was 0.557, which was for the cognitive style indicating that this variable made the strongest unique contribution to explaining the dependent variable, when the variance explained by all other variables in the model is controlled for (Pallant, 2007, p.159). Cognitive style has a part correlation coefficient of 0.447. If we square this, we get 0.199, indicating that cognitive style uniquely explained nearly 20 % of the variance in declarative knowledge acquisition of 6th grade students with medium effect size ($f^2=0.25$). Moreover, preDecKT uniquely explained 17 % with medium effect size ($f^2=0.20$), while preConKT uniquely explained 4 % of the variance with small effect size ($f^2=0.04$) in declarative knowledge acquisition of 6th grade students. Beta coefficients and related significance values are presented in Table 4.3.

Table 4.3 Contribution of each predictive variable to declarative knowledge acquisition of students

Predictive Variables	**Beta**	**p**
Cognitive Style	.557	.000
PreDecKT	-.523	.000
PreConKT	.214	.012
PreProKT	.091	.285

Table 4.4 shows the number of the students giving right or wrong answers to each question of declarative knowledge test. Zero point is given for wrong answer and one point is given for right answer. The percentages of the students are given in parentheses. As seen in Table 4.4, after drama based instruction, students' right answers for every question increased, while wrong answers decreased. It means that students' declarative knowledge about polygons, similarity and congruency of polygons, classification of the triangles according to their sides and angles, properties of square and rectangle, perimeter of polygons, areas of rectangle, square, triangle and mixed shapes was improved.

Table 4.4 The number and percentages of students giving right or wrong answers to each question of declarative knowledge test.

	Pre-DecKT scores		**Post-DecKT scores**	
Questions	**0**	**1**	**0**	**1**
1	48(43)	64(57)	14(12)	98(88)
2	30(27)	82(73)	8(7)	104(93)
3	60(54)	52(46)	34(30)	78(70)
4	83(74)	29(26)	41(37)	71(63)
5	26(23)	86(77)	23(20)	89(80)
6	79(70)	33(30)	41(37)	71(63)
7	61(55)	51(45)	36(32)	76(68)
8	84(75)	28(25)	66(59)	46(41)
9	71(63)	41(37)	37(33)	75(67)
10	54(48)	58(52)	49(44)	63(56)
11	52(46)	60(54)	27(24)	85(76)
12	49(44)	63(56)	24(21)	88(79)
13	87(78)	25(22)	59(53)	53(47)
14	7(6)	105(94)	12(11)	100(89)
15	104(93)	9(7)	61(54)	51(46)
16	53(47)	59(53)	12(11)	100(89)
17	84(75)	28(25)	31(28)	81(72)
18	98(88)	14(12)	71(63)	41(37)

Table 4.5 indicates the number of the students who gave right or wrong answers to each question of declarative knowledge test with respect to GEFT scores of them. Zero point is given for wrong answer and one point is given for right answer. The percentages of the students are given in parentheses. As seen in Table 4.5 no matter which scores the students got from the GEFT, the right answers of all the students for each question increased and their wrong answers decreased from pretest to posttest. On the other hand, the students whose GEFT scores were between 12 and 18 have the highest percentage in answering the questions rightly in posttest, but this result was not valid for pretest. It means that, after the drama based instruction these students have more declarative knowledge about characteristics of polygons, similarity and congruency of polygons, classification of the triangles according to their sides and angles, properties of square and rectangle, perimeter of polygons, areas of rectangle, square, triangle and mixed shapes than other students.

Table 4.5 The number of students giving right or wrong answers to each question of declarative knowledge test with respect to GEFT scores of them.

	Pre-DecKT scores		**Post-DecKT scores**	
Questions & GEFT scores	**0**	**1**	**0**	**1**
1				
0-5	43(75)	14(25)	4(7)	53(93)
6-11	21(66)	11(34)	2(6)	31(94)
12-18	13(52)	12(48)	1(4)	24(96)
2				
0-5	38(67)	19(33)	3(5)	54(95)
6-11	25(78)	7(22)	0(0)	32(100)
12-18	18(72)	7(28)	0(0)	25(100)
3				

Table 4.5 Continued

0-5	33(58)	24(42)	6(10)	51(90)
6-11	18(56)	14(44)	3(9)	29(91)
12-18	11(44)	14(56)	1(4)	24(96)
4				
0-5	44(77)	13(23)	14(24)	43(76)
6-11	23(72)	9(28)	8(25)	24(75)
12-18	19(76)	6(24)	3(12)	22(88)
5				
0-5	40(70)	17(30)	8(14)	49(86)
6-11	23(72)	9(28)	3(9)	29(91)
12-18	19(76)	6(24)	1(4)	24(99)
6				
0-5	41(72)	16(28)	13(23)	44(77)
6-11	23(72)	9(28)	5(16)	27(84)
12-18	18(72)	7(28)	3(12)	22(88)
7				
0-5	41(72)	16(28)	10(17)	47(83)
6-11	14(44)	18(56)	6(19)	26(81)
12-18	7(28)	18(72)	2(8)	23(92)
8				
0-5	48(84)	9(16)	26(46)	31(54)
6-11	21(66)	11(34)	10(31)	22(69)
12-18	18(72)	7(28)	6(24)	19(76)
9				
0-5	43(75)	14(25)	17(30)	40(70)
6-11	18(56)	14(44)	4(12)	28(88)

Table 4.5 Continued

12-18	12(48)	13(52)	2(8)	23(92)
10				
0-5	30(53)	27(47)	12(21)	45(79)
6-11	16(52)	16(52)	8(25)	24(75)
12-18	13(52)	12(48)	4(16)	21(84)
11				
0-5	26(46)	31(54)	10(17)	47(83)
6-11	14(44)	18(56)	3(9)	29(91)
12-18	10(40)	15(60)	2(8)	23(92)
12				
0-5	29(51)	28(49)	17(30)	40(70)
6-11	14(44)	18(56)	3(9)	29(91)
12-18	8(32)	17(68)	1(4)	24(96)
13				
0-5	33(58)	24(42)	24(42)	33(58)
6-11	23(72)	9(28)	9(28)	23(72)
12-18	19(76)	6(24)	6(24)	19(76)
14				
0-5	7(12)	50(88)	10(17)	47(83)
6-11	3(9)	29(91)	0(0)	32(100)
12-18	1(4)	24(96)	0(0)	25(100)
15				
0-5	54(95)	3(5)	22(38)	35(62)
6-11	30(93)	2(7)	8(25)	24(75)
12-18	22(88)	3(12)	3(12)	22(88)
16				

Table 4.5 Continued

0-5	34(60)	23(40)	9(16)	48(84)
6-11	19(59)	13(41)	1(3)	31(97)
12-18	4(16)	21(84)	0(0)	25(100)
17				
0-5	50(88)	7(12)	21(37)	36(63)
6-11	21(66)	11(34)	10(31)	22(69)
12-18	17(68)	8(32)	0(0)	25(100)
18				
0-5	53(93)	4(7)	34(60)	23(40)
6-11	25(78)	7(22)	20(62)	12(38)
12-18	22(88)	3(12)	13(52)	12(48)

4.2.3. Result Concerning Second Hypothesis of the Study

The second hypothesis was stated and given below:

$H_0$2: There is no significant contribution of cognitive style, preDecKT, preConKT, and preProKT in the prediction of the gain scores of 6th grade students' conditional knowledge test on geometry including polygons in drama based learning environment.

The results of the multiple linear regression analysis showed that the four predictive variables (cognitive style, preDecKT, preConKT, preProKT) explained 40.2 % of variance in 6th grade students' conditional knowledge acquisition on geometry including polygons ($R= 0.634$, $F= 18.021$, $p < 0.05$). For this analysis, effect size was found 0.675 which means large effect size in Cohen's categorization (Cohen, 1988, p.414). This large effect size claimed that the practical significance of this result. More specifically, it was found that cognitive style and preConKT each made a statistically significant contribution to the prediction of gain scores of 6th grade students' conditional knowledge test ($p < 0.05$), while preDecKT and

preProKT failed to achieve significance ($p > 0.05$). The largest beta coefficient was 0.474, which was for the cognitive style indicating that this variable made the strongest unique contribution to explaining the dependent variable, when the variance explained by all other variables in the model is controlled for (Pallant, 2007, p.159). Cognitive style uniquely explained 14 % of the variance with medium effect size (f^2=0.16) and preConKT uniquely explained 3.8 % of the variance with small effect size (f^2=0.039) in conditional knowledge acquisition of 6th grade students. Beta coefficients and related significance values are presented in Table 4.6.

Table 4.6 Contribution of each predictive variable to conditional knowledge acquisition of students

Predictive Variables	**Beta**	**p**
Cognitive Style	.474	.000
PreDecKT	.137	.151
PreConKT	.201	.011
PreProKT	.056	.476

Table 4.7 shows the number of the students who got 0, 1, 2, or 3 points for their answers of conditional knowledge test's questions. Zero point is given for no answer, one point is given for wrong or irrelevant answer, two points are given for partially correct answer with some reasoning, or correct answer without necessary reasoning, and three points are given for correct answer with necessary reasoning. The percentages of the students are given in parentheses. As seen in table 4.7 after drama based instruction the number of students getting zero point for all questions of conditional knowledge test decreased, on the other hand the number of students giving correct answer with necessary reasoning (who got 3 points) increased from pretest to posttest. This result means that, after drama based instruction most of the students tried to reply all questions of conditional knowledge test. Moreover, except sixth question, more than fifty percentages of the students replied all the questions of posttest partially or totally correct. For instance, none of the students answered first and fifth questions of ConKT which are required to justify the relationship between

congruent and similar polygons and rectangle and square correctly in pretest, after the drama based instruction % 31 and % 43 of the students replied it totally correct. Similarly, second and third questions of ConKT which are required to justify the relationship between a scalene triangle's side and angles and equilateral and isosceles triangles was replied by % 4 of the students totally correct in pretest and this percentage increased % 27 for second question and % 47 for third question of posttest. %1 of the students replied fourth question of ConKT required justifying the relationship between a polygon's sides and angles totally correct in pretest and %16 of them replied it correctly in posttest. For the sixth question required to justify the relationship between perimeter and area of a polygon, the percentages of the students who gave no or totally wrong answer to the question decreased while the percentages of the students who gave partially or totally correct answer to the question increased from pre to posttest.

Table 4.7 The number and percentages of students getting 0, 1, 2 or 3 points for their answers to each question of conditional knowledge test.

	Pre-test scores				**Post-test scores**			
Questions	**0**	**1**	**2**	**3**	**0**	**1**	**2**	**3**
1	22(20)	25(22)	65(58)	0(0)	7(6)	11(10)	59(53)	35(31)
2	28(25)	37(33)	43(38)	4(4)	16(14)	37(33)	29(26)	30(27)
3	23(21)	42(38)	53(47)	4(4)	14(13)	16(14)	29(26)	53(47)
4	30(27)	58(52)	22(20)	2(1)	14(13)	37(33)	42(38)	9(16)
5	31(28)	54(48)	27(24)	0(0)	15(13)	18(16)	31(28)	48(43)
6	86(77)	16(14)	10(9)	0(0)	56(50)	11(10)	29(26)	16(14)

Table 4.8 indicates the number of the students who got 0, 1, 2, or 3 points for their answers of conditional knowledge test's questions with respect to GEFT scores of them. The percentages of the students are given in parentheses. As seen in Table 4.8 no matter which scores the students got from the GEFT, there was no totally correct answer in first, fifth, and sixth questions of pretest, on the other hand, the percentages of the students whose GEFT scores were between 12 and 18 increased more than the other students for these questions from pretest to posttest. It means that the students whose GEFT scores were between 12 and 18 gained more conditional knowledge than the other students after the drama based instruction. Moreover, except the second question of posttest, the students whose GEFT scores were between 12 and 18 have the highest percentage in answering the questions in posttest totally correct, but this result was not valid for pretest. It means that, after the drama based instruction these students have more conditional knowledge about polygons.

Table 4.8 The number and percentages of students with respect to GEFT scores getting 0, 1, 2 or 3 points for their answers to each question of conditional knowledge test.

	Pre-test scores				**Post-test scores**			
Questions & GEFT scores	**0**	**1**	**2**	**3**	**0**	**1**	**2**	**3**
1								
0-5	12(21)	18(32)	27(47)	0(0)	4(7)	9(16)	27(47)	17(30)
6-11	4(13)	5(16)	23(71)	0(0)	3(9)	2(7)	19(59)	8(25)
12-18	6(26)	2(9)	15(65)	0(0)	0(0)	0(0)	13(57)	10(43)
2								
0-5	17(30)	23(40)	17(30)	0(0)	9(16)	21(37)	15(26)	12(21)
6-11	8(25)	7(22)	17(53)	0(0)	6(19)	7(22)	8(25)	11(34)
12-18	3(13)	7(31)	9(39)	4(17)	1(4)	9(39)	6(26)	7(31)

Table 4.8 Continued

3								
0-5	16(28)	19(33)	22(39)	0(0)	8(13)	10(18)	14(25)	25(44)
6-11	5(16)	9(28)	16(50)	2(6)	5(16)	4(13)	8(25)	15(26)
12-18	2(9)	14(61)	5(21)	2(9)	1(4)	2(9)	7(30)	13(57)
4								
0-5	20(35)	27(47)	9 (16)	1(2)	7(12)	18(32)	23(40)	9(16)
6-11	8 (25)	17(53)	7 (22)	0(0)	6(19)	12(38)	9(27)	5(16)
12-18	2(9)	14(61)	6(26)	1(4)	1(4)	7(30)	10(43)	5(23)
5								
0-5	22(39)	24(42)	11(19)	0(0)	8(13)	10(18)	17(30)	22(39)
6-11	8(25)	13(41)	11(34)	0(0)	5(16)	4(13)	10(31)	13(40)
12-18	1(4)	17(74)	5(22)	0(0)	2(9)	4(17)	4(17)	13(57)
6								
0-5	44(77)	8(14)	5(9)	0(0)	30(53)	14(25)	12(21)	1(2)
6-11	23(72)	1(3)	8(25)	0(0)	18(56)	6(19)	7(22)	1(3)
12-18	19(82)	2(9)	2(9)	0(0)	8(35)	4(17)	10(43)	1(5)

4.2.4. Results Concerning Third Hypothesis of the Study

The third hypothesis was stated and given below:

$H_0$3: There is no significant contribution of cognitive style, preDecKT, preConKT, and preProKT in the prediction of the gain scores of 6th grade students' procedural knowledge test on geometry including polygons in drama based learning environment.

The results of the multiple regression analysis showed that the four predictive variables (cognitive style, preDecKT, preConKT, preProKT) explained 49.5 % of variance in 6th grade students' procedural knowledge acquisition on geometry including polygons ($R= 0.704$, $F= 26.259$, $p <0.05$). For this analysis, effect size was

found 0.980 which means large effect size in Cohen's categorization (Cohen, 1988, p.414). This large effect size claimed that the practical significance of this result. More specifically, it was found that cognitive style, preDecKT, and preConKT each made a statistically significant contribution to the prediction of the gain scores of 6th grade students' procedural knowledge test ($p < 0.05$), while preProKT failed to achieve significance ($p > 0.05$). The largest beta coefficient was 0.476, which was for the cognitive style indicating that this variable made the strongest unique contribution to explaining the dependent variable, when the variance explained by all other variables in the model is controlled for (Pallant, 2007, p.159). Cognitive style uniquely explained 14.5 % of the variance with medium effect size (f^2=0.16), preDecKT 3.3 % with small effect size (f^2=0.034), and preConKT 4% with small effect size (f^2=0.04) in procedural knowledge acquisition of 6th grade students. Beta coefficients and related significance values are presented in Table 4.9.

Table 4.9 Contribution of each predictive variable to procedural knowledge acquisition of students

Predictive Variables	**Beta**	**p**
Cognitive Style	.476	.000
PreDecKT	.230	.009
PreConKT	.207	.004
PreProKT	.044	.545

Table 4.10 shows the number of the students who got 0, 1, 2, or 3 points for their answers of procedural knowledge test's questions. Zero point is given for no answer, one point is given for wrong or irrelevant answer, two points are given for partially correct answer with some reasoning, or correct answer without necessary reasoning, and three points are given for correct answer with necessary reasoning. The percentages of the students are given in parentheses. As seen in table 4.10 after drama based instruction the percentages of students getting zero point for all questions of procedural knowledge test decreased, on the other hand the percentages of students giving correct answer with necessary reasoning (who got 3 points)

increased from pre to posttest. Moreover, except the second question required to find the perimeter of mixed shapes, the percentage of the students who gave partially correct answer to the questions increased from pretest to posttest. This result means that, after drama based instruction most of the students tried to reply all questions of procedural knowledge test and they have more procedural knowledge about polygons. On the other hand, after drama based instruction, the percentages of the students increased less (% 0 to % 2) from pretest to posttest for the fourth, fifth, and tenth questions which are required to find the sides of the rectangle with the given perimeter (Q-4), the sides of the square with the given area (Q-5), relationship between perimeter and area of mixed shapes (Q-10). The percentages of the students increased more for the sixth (%1 to % 28) and seventh (%1 to % 34) questions of procedural knowledge test which are required to find the area of mixed shapes, rectangle, and triangle from pretest to posttest.

Table 4.10 The number and percentages of students getting 0, 1, 2 or 3 points for their answers to each question of procedural knowledge test.

	Pre-test scores				**Post-test scores**			
Questions	**0**	**1**	**2**	**3**	**0**	**1**	**2**	**3**
1	33(29)	55(49)	22(20)	2(2)	9(8)	36(32)	26(23)	41(37)
2	14(13)	47(42)	42(37)	9(8)	10(9)	23(20)	39(35)	40(36)
3	37(33)	53(47)	14(13)	8(7)	21(19)	42(37)	11(10)	38(34)
4	47(42)	62(55)	3(3)	0(0)	39(35)	46(41)	25(22)	2(2)
5	46(41)	59(53)	7(6)	0(0)	42(37)	46(41)	22(20)	2(2)
6	33(29)	77(69)	1(1)	1(1)	9(8)	54(48)	17(15)	32(28)
7	24(21)	81(72)	7(6)	1(1)	12(11)	44(39)	18(16)	38(34)
8	44(39)	55(49)	13(12)	0(0)	19(17)	31(28)	52(46)	10(9)
9	41(36)	41(36)	30(28)	0(0)	14(13)	39(35)	40(36)	19(16)
10	98(88)	16(12)	0(0)	0(0)	54(48)	26(23)	30(27)	2(2)

Table 4.11 indicates the number of the students who got 0, 1, 2, or 3 points for their answers of procedural knowledge test's questions with respect to GEFT scores of them. The percentages of the students are given in parentheses. As seen in Table 4.9 no matter which scores the students get from the GEFT, there was no totally correct answer in fourth, fifth, seventh, eighth, ninth, and tenth questions of pretest. On the other hand, there was not any changing in the percentage of all the students who gave totally correct answer to the tenth question of procedural knowledge test from pretest to posttest. Moreover, none of the students whose GEFT scores were between 0 and 5 answered the fourth and fifth questions totally correct in both pretest and posttest. For the first question, the percentages of the students whose GEFT scores were between 0 and 5 gained more conditional knowledge than the other students after the drama based instruction. Moreover, except the second question of posttest, the students whose GEFT scores were between 12 and 18 have the highest percentage in answering the questions in posttest totally correct, but this result was not valid for pretest. It means that, after the drama based instruction these students have more conditional knowledge about polygons.

Table 4.11 The number and percentages of students with respect to GEFT scores getting 0, 1, 2 or 3 points for their answers to each question of procedural knowledge test

	Pre-test scores				**Post-test scores**			
Questions GEFT scores	**0**	**1**	**2**	**3**	**0**	**1**	**2**	**3**
1								
0-5	22(39)	29(51)	6(10)	0(0)	4(7)	27(47)	9(16)	17(30)
6-11	9(28)	18(56)	5(16)	0(0)	3(9)	7(22)	9(28)	13(41)
12-18	2(9)	8(35)	11(48)	2(9)	2(9)	2(9)	8(35)	11(47)
2								

Table 4.11 Continued

0-5	12(21)	29(51)	15(26)	1(2)	3(5)	17(30)	16(28)	21(37)
6-11	1(3)	16(50)	15(47)	0(0)	3(9)	2(6)	16(50)	11(35)
12-18	1(4)	2(9)	12(52)	8(35)	4(17)	4(17)	7(31)	8(35)
3								
0-5	22(39)	31(54)	1(2)	3(5)	9(16)	28(49)	2(4)	18(31)
6-11	11(34)	18(56)	2(6)	1(4)	8(25)	7(22)	6(19)	11(34)
12-18	4(17)	4(17)	11(48)	4(17)	4(17)	7(31)	3(13)	9(39)
4								
0-5	26(46)	31(54)	0(0)	0(0)	20(35)	28(49)	9(16)	0(0)
6-11	14(44)	16(50)	2(6)	0(0)	12(38)	8(25)	11(34)	1(3)
12-18	7(30)	15(65)	1(4)	0(0)	7(31)	10(43)	5(22)	1(4)
5								
0-5	25(44)	30(52)	2(4)	0(0)	23(40)	28(49)	6(11)	0(0)
6-11	9(28)	21(66)	2(6)	0(0)	12(38)	8(25)	11(34)	1(3)
12-18	12(52)	8(35)	3(13)	0(0)	7(31)	10(43)	5(22)	1(4)
6								
0-5	20(35)	37(65)	0(0)	0(0)	4(7)	30(53)	8(14)	15(26)
6-11	7(22)	24(75)	1(3)	0(0)	4(13)	15(47)	3(9)	10(31)
12-18	6(26)	16(70)	0(0)	1(4)	1(4)	9(38)	6(26)	7(32)
7								
0-5	11(19)	44(77)	2(4)	0(0)	5(9)	25(44)	8(14)	19(33)
6-11	6(19)	26(81)	0(0)	0(0)	6(19)	14(43)	6(19)	6(19)
12-18	7(30)	11(48)	5(22)	0(0)	1(4)	5(22)	4(17)	13(57)
8								

Table 4.11 Continued

0-5	23(40)	29(51)	5(9)	0(0)	10(18)	16(28)	29(50)	2(4)
6-11	11(34)	17(53)	4(13)	0(0)	7(22)	10(31)	10(31)	5(16)
12-18	10(43)	9(39)	4(18)	0(0)	2(9)	5(21)	13(57)	3(13)
9								
0-5	26(46)	23(40)	8(14)	0(0)	10(18)	20(35)	23(40)	4(7)
6-11	7(22)	13(40)	12(38)	0(0)	2(6)	11(34)	9(28)	10(32)
12-18	8(35)	5(22)	10(43)	0(0)	2(9)	8(35)	8(35)	5(21)
10								
0-5	51(89)	6(11)	0(0)	0(0)	35(61)	12(21)	10(18)	0(0)
6-11	27(84)	5(16)	0(0)	0(0)	15(47)	7(22)	10(31)	0(0)
12-18	20(87)	3(13)	0(0)	0(0)	9(39)	7(30)	12(31)	0(0)

4.3 Summary of the Results

The results of this study can be summarized as follows:

The mean scores of 6th grade students on three types of knowledge tests were increased; the mean scores of declarative knowledge test increased 4.42 points from 7.43, conditional knowledge test increased 4.83 points from 5.77, and procedural knowledge test increased 7.32 points from 7.74. Furthermore, the mean scores of GEFT were found 5.49 and standard deviation was calculated as 4.92 for entire sample.

6th grade students' cognitive style, and mean scores of preDecKT, preConKT, preProKT explained 29.6 % of variance in 6th grade students' gain scores of declarative knowledge on geometry including polygons with large effect size (f^2=.420), 40.2 % of variance in 6th grade students' gain scores of conditional knowledge on geometry including polygons with large effect size (f^2=.675), and 49.5 % of variance in 6th grade students' gain scores of procedural knowledge on

geometry including polygons with large effect size (f^2=.980). Large effect sizes mean that the results have practical significance.

Cognitive style was found as the most important predictive variable in explaining 6th grade students' gain scores of three types of knowledge tests on geometry including Polygons in drama based learning environment. Moreover, cognitive style uniquely explained 20 % of the variance in declarative knowledge acquisition, 14 % of the variance in conditional knowledge acquisition, and 14.5 % of the variance in procedural knowledge acquisition 6th grade students in drama based learning environment.

PreDecKT explained statistically significant amount of variance in 6th grade students' gain scores of declarative and procedural knowledge tests on geometry including Polygons in drama based learning environment. Furthermore, preDecKT uniquely explained 17 % of the variance in declarative knowledge acquisition and 3.3 % of the variance in procedural knowledge acquisition 6th grade students in drama based learning environment.

PreConKT explained statistically significant amount of variance in 6th grade students' gain scores of declarative, conditional, and procedural knowledge tests on geometry including Polygons in drama based learning environment. Moreover, preConKT uniquely explained 4 % of the variance in declarative knowledge acquisition, 3.8 % of the variance in conditional knowledge acquisition, and 4 % of the variance in procedural knowledge acquisition 6th grade students in drama based learning environment.

PreProKT failed to explain statistically significant amount of variance in 6th grade students' gain scores of three types of knowledge tests on geometry including Polygons in drama based learning environment.

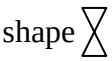
CHAPTER 5

DISCUSSION AND RECOMMENDATIONS

This chapter consists of five sections. First section presents the discussion of the findings and reasoning about the results of the study. Internal and External validity are given in second and third section, the implications are presented in the fourth section, and last section includes recommendations for further studies, respectively.

5.1. Discussion

The purpose of this study is to investigate the contribution of cognitive style and prior knowledge on 6th grade students' knowledge acquisition in polygons in drama based learning environment. The findings of the study are discussed below: In this study, cognitive style was found as the best significant predictor of three types of knowledge acquisition of the students and it uniquely explained 20 % of the variance in declarative knowledge acquisition, 14 % of the variance in conditional knowledge acquisition, and 14.5 % of the variance in procedural knowledge acquisition of 6th grade students in geometry in drama based learning environment. Moreover, the students who got higher mean scores from GEFT in other words who tend to be more field-independent (Witkin, et al., 1977) gained more declarative, conditional, and procedural knowledge in geometry in drama based learning environment. However, no previous research which was investigated the relationship between cognitive style and three types of knowledge acquisition of students in geometry was accessed. This finding is in line with previous studies (McLeod, Carpenter, McCornack & Skvarcius, 1978; Noraini, 1998; Roberge & Flexer, 1983, Yoon, 1993) which concluded that students' cognitive style is important predictor of students' geometry and mathematics achievement. In these studies only procedural knowledge acquisition was considered as geometry or mathematics achievement. The reason of this result can be that these students were more active in all phases of drama based instruction. They tried to answer all questions of the researcher in the

introduction parts of the lessons in which the students acquired declarative knowledge about polygons. For instance, in the introduction part of lesson 1, the student -who got 8 points from GEFT- claimed that this shape  was a polygon, the student -who got 15 points from GEFT- expressed that it cannot be a polygon because of the point in the middle of the shape. The student -who got 2 points from GEFT- tried to pursue the student- who got 14 points from GEFT- about the shape  was polygon. The student- who got 14 points from GEFT- explained that it can not be a polygon because of not having corners. Moreover, the students who tend to be more field-independent (Witkin, et al., 1977) facilitated the other students and answered their questions about the studies what the researcher wanted them while they were working in groups in the development parts of the lessons in which the students acquired conditional or procedural knowledge about polygons. The researcher told that all the group members can be chosen by the researcher to talk about the studies of the group. For this reason, the students who tend to be more field-independent help the other students attend and concentrate what the teacher wanted all the groups to do and learn the topic completely. Because these students behaved as if they were a teacher, they may learn more than the other students.

The second result of the study indicated that students' prior declarative knowledge explained statistically significant amount of variance in 6^{th} grade students' declarative and procedural knowledge acquisition on geometry including Polygons in drama based learning environment. On the other hand, this type of knowledge failed to predict students' acquiring conditional knowledge in drama based learning environment. The results showed that the students who have higher prior declarative knowledge tend to less positive growth in gaining declarative knowledge over time on geometry in drama based learning environment (Beta=-.523, $p<0.05$) (Duncan, Duncan & Strycker, 2006). A reason can be that in drama based learning environment, students are active learners, so they have opportunity to construct their own knowledge and teacher's role is a facilitator in this kind of learning environment. For this reason, students who have higher prior declarative knowledge may have misconceptions about their learning and they might reject accepting the new ideas because of related misconceptions. On the other hand, the more prior declarative knowledge the students have, the more procedural knowledge

they gain over time on geometry in drama based learning environment. This result of present study inconsistent with Hailikari, Nevgi and Lindblom-Ylanne's (2007) study which investigates the effect of different types of prior knowledge (declarative and procedural knowledge) on student achievement and found that declarative knowledge did not predict students' mathematics achievement. In this study students' achievement means that procedural knowledge acquisition in mathematics. The result of present study is explained such a way that in drama based learning environment, students are expected to construct their own knowledge by integrating their experiences to their prior knowledge. As Smith and Ragan (2005) stated that all procedures have declarative knowledge component, students' prior knowledge of definitions and symbols may provide them to apply algorithms and develop appropriate procedures easily in drama based learning environment. However, this kind of knowledge is inadequate while expressing making connections among concept definitions, generating explanations regarding facts, and creating meaningful links among definitions, principles and procedures which needs higher-order cognitive skills.

The third result of the study revealed that students' prior conditional knowledge explained statistically significant amount of variance in 6^{th} grade students' declarative, conditional, and procedural knowledge acquisition on geometry including Polygons in drama based learning environment. It means that the students who have higher prior conditional knowledge tend to more positive growth in gaining declarative, conditional, and procedural knowledge over time on geometry in drama based learning environment. However there is no previous research related to the effect of conditional prior knowledge on knowledge acquisition of students, a reason can be that learning occurs by students' transforming and reorganizing their prior knowledge by their experiences in drama based learning environment. For this reason, students' having high prior conditional knowledge which requires higher-order cognitive skills may help students acquire knowledge of definitions and symbols, apply this knowledge to the new situations, and make connections among concept definitions, generate explanations regarding facts, and create meaningful links among definitions, principles and procedures easily.

The fourth result of the study showed that students' prior procedural knowledge failed to explain statistically significant amount of variance in 6th grade students' declarative, conditional, and procedural knowledge acquisition on geometry including Polygons in drama based learning environment. It means that students' having high or low procedural prior knowledge does not affect their acquiring declarative, conditional, and procedural knowledge in drama based learning environment. This result is inconsistent with Hailikari, Nevgi and Lindblom-Ylanne's (2007) study which was found that prior procedural knowledge predicted students' mathematics achievement. In this study students' achievement means that procedural knowledge acquisition in mathematics. A reason of this result can be that procedural knowledge refers to knowing how to apply the knowledge and as Smith and Ragan (2005) stated that declarative knowledge is needed to list or describe the steps in a procedure, so declarative knowledge may be helpful in learning to apply it, but stating the procedure does not mean that it has been learned. In drama based learning environment, students need to have related prior knowledge to learn new concepts, as it was explained above prior procedural knowledge does not mean that students have the knowledge which is needed, prior procedural knowledge did not affect students' acquiring declarative, conditional, and procedural knowledge.

5.2 Internal Validity

Internal validity refers to observed differences on the dependent variable are directly

related to independent variables, it is not other uncontrolled variables (Fraenkel & Wallen, 2000). Subject Characteristics, location, instrumentation, testing, and mortality are internal validity threats of a correlational research (Fraenkel & Wallen, 2000).

In this study data was collected from sixth grade students from a public elementary school. These students were at same grade level, and their ages were close to each other. Moreover, all students were living at the same district and their socio-economic statuses were similar to each other. For this reason, subject characteristics was not a threat to internal validity for this study. The other threat is location, in which data are collected, could provide an alternative explanation for the

results of the study. In this study, location was three similar classrooms at the same school and during administration of the tests outside events that could influence the subjects' responses were not observed. The way of using the instruments may also lead a threat to internal validity. Declarative knowledge test was a multiple choice test, for this reason instrument decay in scoring procedure did not occur for this test. Moreover, for conditional and procedural knowledge tests the researcher and a mathematics instructor scored randomly selected 20 tests from each tests and calculated inter-rater reliability in terms of providing subjective decisions by using Intraclass correlation (ICC). ICC indicated quite high reliability for two tests and the data were collected in the same way from all the students by the researcher. So, instrument decay, data collector characteristics and collector bias could not be a threat for this study. Students' responding to the first instrument may influence their responses to the second instrument which includes similar content, this threat to internal validity called as testing, and the solution is to administer instruments at different times and in different context (Fraenkel & Wallen, 2000). The instruments of the study were knowledge test and GEFT. These instruments have different context and they administered at different times. For this reason, testing was not a threat to internal validity for this study. Another threat is mortality effect which means that the loss of subjects during the treatment. Mortality is not a problem of internal validity for correlational studies because lost subjects were excluded from the study since correlation could not be calculated if there were no scores for both variables (Fraenkel & Wallen, 2000). In this study all students responded knowledge tests and GEFT. If a student was absent in the class while these instruments were administering, the researcher provided him to respond the instruments at different time. For this reason, mortality was not an issue for this study.

5.3 External Validity

External validity of the study is defined as "the extent to which the results of a study can be generalized from a sample to a population" (Fraenkel & Wallen, 2000, p.119). Population generalizability and ecological generalizability are two dimensions of external validity.

Population generalizability is related to a sample's degree of representativeness of the intended population. The target population of this study was

all sixth grade students from Public schools of Altındağ district of Ankara and the accessible population was a public elementary school in this region. For this study convenience sampling was used which means choosing a group of individuals who are available for study (Fraenkel & Wallen, 2000, p.112). Fraenkel and Wallen (2000) stated that convenience samples cannot be considered representative of any population (p.112). For this reason, the population generalizability of the research findings is limited because of the sampling method of the study and there is a need to replicate the study with different groups of subjects and in different situations. On the other hand, ecological generalizability refers to "the degree to which results of a study can be extended to other settings and conditions" (Fraenkel & Wallen, 2000, p.122). This study was applied in a public elementary school in Altındağ district of Ankara. The students in this school have low level of socio-economic status, most of their parents are unlettered or graduated from elementary school. For this reason the results of the study could be generalized to the schools have similar conditions with the school that data were collected.

5.4 Implications

This study holds the following implications for educational practice:

The results indicated that cognitive styles of students have a critical role in learning declarative, conditional, and procedural knowledge on geometry. Because the students who were more field-independent gain more knowledge in drama based lessons, teachers should provide a suitable learning environment to the students who were more field-dependent or field-mix to be more active and learn more easily in drama based lessons. To be able to do this, the teacher should construct the groups with respect to students' cognitive styles. For instance, the teacher should provide field-dependent and field-mix students to work together, for this reason they can feel more comfortable and share their thoughts easily to their friends. Moreover, according to the findings of the study, students' prior declarative knowledge which comprises definition of concepts and symbols made a significant effect on students' acquiring procedural knowledge which refers to apply this knowledge. For this reason, teachers should provide students to learn definitions of concepts and symbols meaningfully before solving geometrical problems. Because students' prior procedural knowledge failed to predict students' acquiring declarative, conditional,

and procedural knowledge, teachers should avoid trying to teach solving geometrical problems by giving examples of most of routine problems ignoring definitions of concepts and symbols.

According to the results of the study students' prior declarative and conditional knowledge made a significant effect on declarative, conditional, and procedural knowledge acquisition of students. Thus, teachers should consider what students knew before teaching new concepts. Pretests related to the topic what teacher would teach can be applied on students or teachers can provide students to discuss what they knew about the topic before the lessons and then teachers should determine the students' lack of prior knowledge about the topic of the lesson and design all the introduction parts of drama based lessons to provide the students to learn the knowledge needed before learning new topic. Moreover, preservice teachers should be qualified on how geometry be taught by activating students' prior knowledge, also.

Authors of mathematics education books should consider the importance of prior knowledge and give suggestions to the teachers about activating students' prior knowledge related to the topic before teaching new concepts and they should suggest alternative learning ways for students with different cognitive styles in teachers' guide books.

5.5 Recommendations for Further Researches

Based on the results of this study, the following recommendations are made for further researches.

It is recommended the study should replicate with other samples selected randomly to generalize the results over a wider population.

Further researches can be conducted on different individual variables which can be related to knowledge acquisition in geometry.

A study to determine effects of drama based instruction on the students with different
cognitive styles would be fruitful.

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APPENDIX A

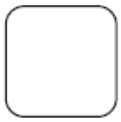
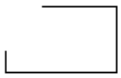
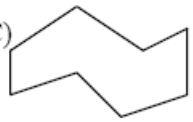
KNOWLEDGE TESTS

DECLARATIVE KNOWLEDGE TEST

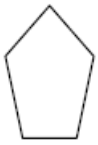
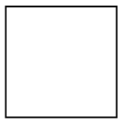
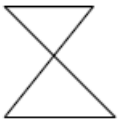
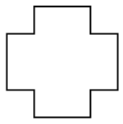
İsim: Soyisim: Sınıf: No:

Bu testte 18 tane çoktan seçmeli soru vardır.

1. Aşağıdakilerden hangisi çokgendir?

A)  B)  C)  D) 

2. Aşağıdakilerden hangisi çokgen değildir?

A)  B)  C)  D) 

3. Aşağıdakilerden hangisi daima doğrudur?

A) Bütün kapalı şekiller çokgendir.

B) Köşeleri olan bütün geometrik şekiller çokgendir.

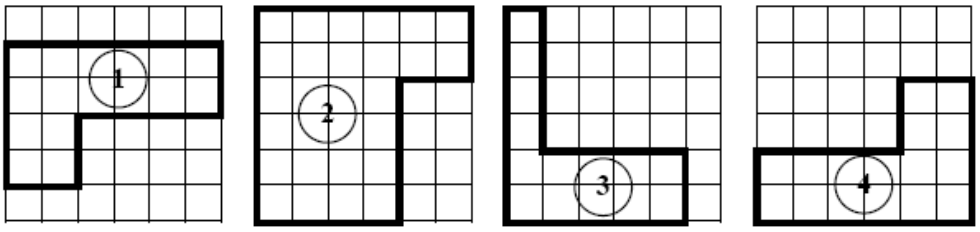
C) Üç veya daha fazla doğrunun kesişmesiyle oluşan kapalı şekiller çokgendir.

D) İki veya daha fazla doğrunun kesişmesiyle oluşan şekiller çokgendir.

4. Benzer üçgenler _____ açılara _____kenarlara sahiptir.cümlesinde boşluklara gelmesi gereken kelimeler aşağıdakilerden hangisidir?

A) eşit, eşit B) eşit, orantılı C) orantılı, eşit D) orantılı, orantılı

5. Aşağıdaki çokgenlerden hangileri benzedir?



A) 1 ve 2 B) 1 ve 3 C) 1 ve 4 D) 3 ve 4

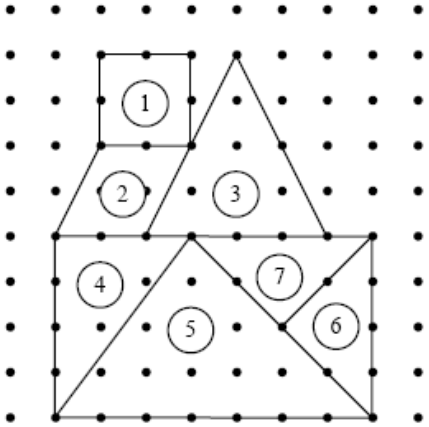
6. Düzgün çokgenler _____ açılara _____ kenarlara sahiptir cümlesinde boşluklara gelmesi gereken kelimeler aşağıdakilerden hangisidir?

A) eşit, eşit B) eşit, orantılı C) orantılı, eşit D) orantılı, orantılı

7. Yandaki şekilde eş çokgenler hangileridir?

A) 1 ve 2 B) 3 ve 5

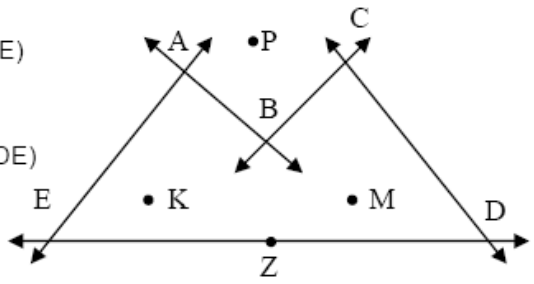
C) 4 ve 7 D) 6 ve7



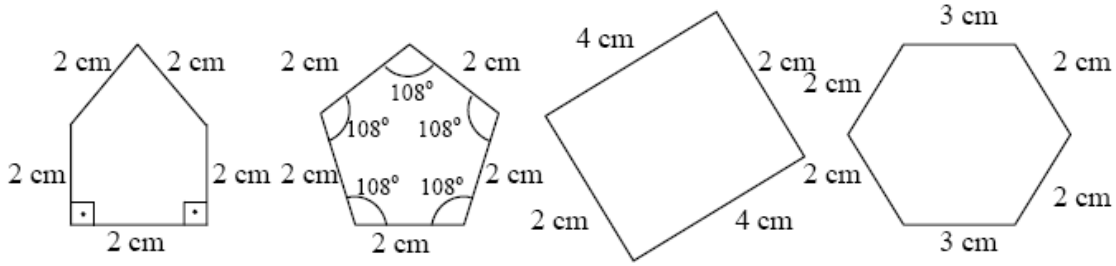
8. Yandaki şekile göre aşağıdakilerden hangisi doğrudur?

A) $p \in$ iç(ABCDE) B) $k \notin$ iç(ABCDE)

C) $z \in$ dış(ABCDE) D) $m \in$ iç(ABCDE)



9. Aşağıdaki şekillerden hangisi düzgün çokgendir?



1 2 3 4

A) 1 B) 2 C) 3 D) 4

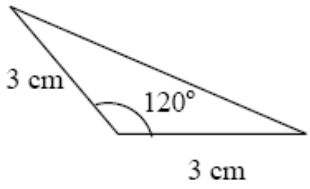
10. Bir üçgenin iki iç açısının ölçüsü 45° ise, bu üçgen aşağıdakilerden hangisidir?

A) İkizkenar B) Çeşitkenar C) Geniş açılı D) Dar açılı

11. Açılarının ölçüleri 48, 62 ve 70 olan üçgen aşağıdakilerden hangisidir?

A) Geniş Açılı B) Dar Açılı C) İkizkenar D) Eşkenar

12. Yandaki üçgen için en uygun sınıflandırma aşağıdakilerden hangisidir?



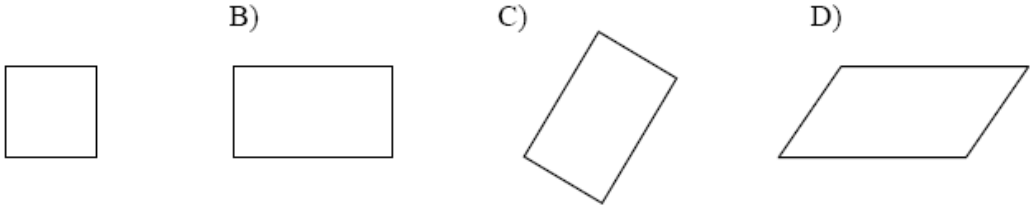
A) Geniş açılı, çeşitkenar üçgen

B) Geniş açılı, ikizkenar üçgen

C) Dar açılı, çeşitkenar üçgen D) Dar açılı, ikizkenar üçgen

13. Aşağıdakilerden hangisi dikdörtgen değildir?

A) B) C) D)



14. Aşağıdakilereden hangisi Karenin özelliklerinden biri <u>değildir?</u>

A) Dört kenarı eşittir. B) Dört açısının ölçüsü eşittir

C) Köşegenleri dik açı ile kesişir. D) Köşegenlerinin uzunlukları eşit değildir.

15. Aşağıdakilerden hangisi dikdörtgenin özellikden biridir?

A) Dört kenarı eşittir. B) Köşegenleri 90 lik açı ile kesişirler.

C) Köşegenler birbirini ortalar. D) Köşegenlerin uzunlukları eşit değildir.

16. Bir çokgeni tanımlamak için en az kaç kenara ihtiyaç vardır?

A) 2 B)3 C) 4 D) 5

17. Bir çokgenin çevresini hesaplarken;

A) çokgenin en dış kısmını oluşturan kenarların uzunluklarını toplarız.

B) çokgenin iç açıları toplanır.

C) çokgenin köşe sayıları toplanır.

D) çokgenin içinde veya dışındaki bütün kenar uzunlukları toplanır.

18. Çokgenlerin alanları ile ilgili olarak aşağıdakilerden hangisi yanlıştır?

A) Bir çokgenin alanı o çokgenin yüzeyini kaplayan birim karelerin sayısıdır.

B) Bir çokgenin alanı kenar sayısı arttıkça artar.

C) Bir çokgen birden fazla çokgenin birleşiminden oluşuyorsa, alanı kendisini oluşturan çokgenlerin alanları toplamına eşittir.

D) Çokgenlerin kenar uzunlukları değiştikçe alanları değişir.

CONDITIONAL KNOWLEDGE TEST

İsim: Soyisim: Sınıf: No:

1. “Eş çokgenler aynı zamanda benzerdir.” ifadesi doğru mu, yanlış mıdır? Doğru ise neden doğru olduğunu, yanlış ise neden yanlış olduğunu açıklayınız.

2. Bir çeşitkenar üçgen aynı zamanda dik açılı üçgen olabilir mi? Olabilirse neden olabilir? Olamazsa neden olamaz? Açıklayınız.

3. “Bir eşkenar üçgen aynı zamanda ikizkenar üçgendir” ifadesi doğru mu, yanlış mıdır? Doğru ise neden doğru olduğunu, yanlış ise neden yanlış olduğunu açıklayınız.

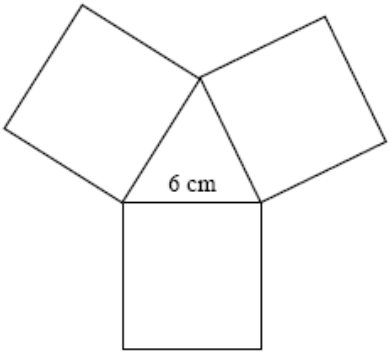
4. “Bir çokgende kenar uzunlukları eşit ise, açıları da eşittir” ifadesi doğru mu, yanlış mıdır? Doğru ise neden doğru olduğunu, yanlış ise neden yanlış olduğunu açıklayınız.

5. “Kare, dört kenarı eşit, bir dikdörtgendir” ifadesi doğru mu, yanlış mıdır? Doğru ise neden doğru olduğunu, yanlış ise neden yanlış olduğunu açıklayınız.

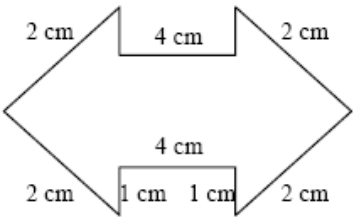
6. “Birim karelerle oluşturulan bir çokgenin alanı n birim kare ise, bu şeklin olası en büyük çevre uzunluğu 2n+2” ifadesi doğru mudur? Yanlış mıdır? Doğruluğunu veya yanlışlığını bir örnek üzerinde gösteriniz.

PROCEDURAL KNOWLEDGE TEST

İsim: Soyisim: Sınıf: No:

1. 

Yandaki şekilde bir eşkenar üçgenin üç kenarına kareler çizilmiştir. Eşkenar üçgenin bir kenarı 6 cm dir. Oluşan şeklin çevresi kaç cm dir? Açıklayarak yapınız.

2. 

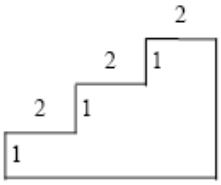
Yandaki şeklin çevresi kaç cm dir? Açıklayarak yapınız.

3. Çevre uzunluğu 44cm olan bir kare ile aynı kenar uzunluğuna sahip bir eşkenar üçgenin çevresi kaç cm dir? Açıklayarak yapınız

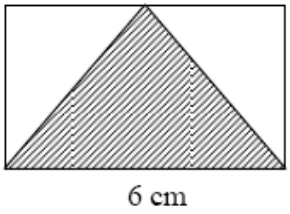
4. Dikdörtgen biçimindeki bir bahçenin çevresinin uzunluğu 260 m dir. Boyu eninin 2 katından 20 cm eksik ise bahçenin eni ve boyu cm dir? Açıklayarak yapınız

5. Alanı 49 m^2 olan karenin alanının 4 katı alana sahip karenin kenar uzunluğu kaç kaç cm dir? Açıklayarak yapınız

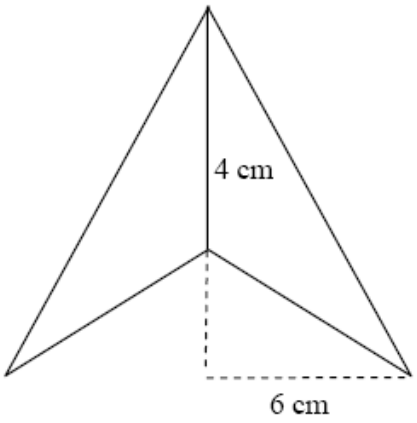
6. Yandaki şeklin alanı kaç cm^2 dir? Açıklayarak yapınız



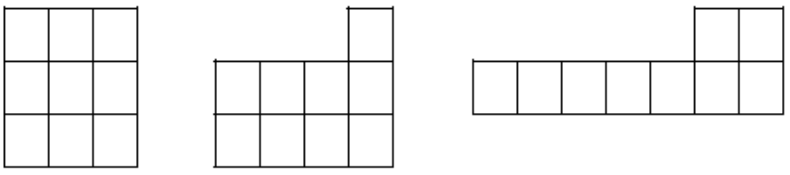
7. Yandaki taralı şeklin alanı kaç cm^2 dir?



8. Yandaki şekildeki üçgenler eş üçgenlerdir. Buna göre şeklin alanı kaç cm^2 dir? Açıklayarak yapınız



9. Aşağıdaki kare ve dikdörtgenin çevre ve alanları için neler söylenebilir? Açıklayarak yapınız

10. 

Alanları eşit olarak verilen şekillerin çevre uzunluklarını bulunuz. Aynı alana sahip olası en büyük çevre uzunluğunu veren cebirsel ifadeyi bularak uygun şekli çiziniz.

APPENDIX B

SCORING RUBRIC FOR THE GEOMETRY KNOWLEDGE TEST

CONDITIONAL KNOWLEDGE QUESTIONS

Score Description

0

-No answer attempted.

-Copies parts of the problem without attempting a solution.

-Uses irrelevant information.

1

-Gives wrong answer.

-Fails to identify the important parts of "if-then" statements.

-Gives incomplete evidence of the explanation process.

2

-Gives partially correct answer with some reasoning.

-Gives correct answer without necessary reasoning and explanation.

-Identifies some important parts when expressing the "if-then" statements.

3

-Gives correct answer with necessary reasoning.

-Identifies all the important parts when expressing the "if-then" statements.

-Shows understanding of the relations in the "if-then" statements.

SCORING RUBRIC FOR THE GEOMETRY KNOWLEDGE TEST

PROCEDURAL KNOWLEDGE QUESTIONS

Score Description

0

-No answer attempted.

-Copies parts of the problem without attempting a solution.

-Uses irrelevant information.

1

-Gives wrong answer.

-Reflects an inappropriate strategy for solving problem.

-Gives incomplete evidence of the explanation process.

2

-Gives partially correct answer with some reasoning.

-Gives correct answer without necessary reasoning and explanation.

-The solution process is nearly complete and systematic.

3

-Gives correct answer with necessary reasoning.

-The solution process is complete and systematic.

-Executes algorithm and rules completely and correctly.

APPENDIX C

LESSON PLANS

Ders Planı 1
Süre:2 ders saati

Kazanımlar:

1. Çokgenleri çizer ve inşa eder.

Kullanılan drama teknikleri: Uzman yaklaşımı, toplantı düzenleme, rol oynama

Araç-gereç: Çokgen ve çokgen olmayan şekiller, fon kartonu, cetvel, makas, kalem, yapıştırıcı, mukavva, torba.

Giriş Etkinlikleri:

Öğretmen tahtaya birçok çokgen ve çokgen olmayan şekiller asar. Öğrenciler 1-2 denerek iki gruba ayrılırlar. Her iki grup da en öndeki öğrencilerin yüzleri tahtaya bakacak şekilde tahtanın önüne tek sıra halinde dizilirler. Öğretmen 1. grubun en önündeki öğrenciye tahtada asılı şekillerden çokgen olanını göstermesini ister. Öğrenci gösterir. Diğer grubun en önündeki öğrenciye sence bu şekil çokgen mi? Diye sorulur. Öğrenci cevap verdikten sonra neden çokgen? Ya da neden çokgen değil? Sorularıyla cevabını açıklaması istenir. Öğrenci doğru cevap verirse grubu 10 puan alır. Her iki öğrenci de sıranın arkasına geçerler. Aynı oyun bu sefer 2. gruptan bir öğrenciye çokgen olmayan bir şekil göstermesi istenerek oynanır. Bu sefer 1. gruptaki öğrenciye sence bu şekil çokgen değil mi? Diye sorulur. Nedenini açıklaması istenir. Doğru açıklarsa grubu 10 puan alır. Öğretmen 1. ve 2. grup üyelerinin çember oluşturarak tahtada kaç adet çokgen ve kaç adet çokgen olmayan şekil olduğunu sorar. Gruplara yeterli süre verildikten sonra cevaplar alınır. Doğru cevaplayan grup 100 puan alır ve oyunu kazanan grup belirlenir. Öğretmen tahtada ki

şekillerin yanına giderek eliyle gösterdiği şeklin ne olduğunu tüm sınıftan söylemesini ister.

Geliştirme Etkinlikleri:

Öğretmen öğrencilere gazetede bir haber okudum çocuklar, bunu sizinle paylaşmak istiyorum der. Haber şöyledir:

Günümüzde gen teknolojisi kullanılarak üretilen bitkilerin sayısı hızla artmakta. Şu ana kadar, aralarında domates, patates, mısır, pirinç ve fasulye de olan hemen hemen 40 adet genetiği değiştirilmiş bitki üretilmiş. Genleri değiştirilmiş ürünler daha az tohumla daha çok ürün vermekte. Ayrıca şekli yuvarlak olan ve çok yer kaplayan bazı bitki türlerinin genleriyle oynanarak köşeli bir hale getirilmekte.

Bilim Adamları şimdide farklı geometrik şekillerde ağaçlar üretmeyi düşünüyorlar. Üçgen, kare, altıgen gibi şekilleri olan ağaçların olduğu bir bahçe ne kadar ilgi çekici olur bir düşünsenize...

Öğretmen öğrencilerin hayal edebilmelerini kolaylaştırmak için genetiği değiştirilerek oluşturulmuş bazı ürünlerin resimlerini gösterir. Ben bu haberi okuduğumda acaba bu ağaçlar nasıl olur diye merak ettim ve bence benim öğrencilerim geleceğin bilim adamları olarak bu tür ağaçlardan oluşan bir bahçe üretebilir diye düşündüm. Tabi bunun için önce gruplara ayrılmalıyız der. Öğrenciler üç, dört, beş, altı, yedi, sekiz diyerek 6 gruba ayrılırlar. Her gruptan gruplarının ismi kadar kenarı olan birbirinden farklı çokgen biçiminde ağaçlar üretmelerini ister. ("Üç" grubu üç kenarı olan çokgen ağaçlar üretecek.) Öğrencilere kullanmaları için fon kartonu, cetvel, makas, kalem, yapıştırıcı ve ağaçları yapıştırmaları için mukavva verilir. Ağaçların alt gövdeleri hazır olarak verilir. Yalnızca üst kısımlarını öğrencilerin oluşturması istenir. Gruplar bahçelerini hazırladıktan sonra, bahçelerine bir isim vermeleri istenir. Önce üç grubundan başlanarak tüm bahçeler gezilir ve tüm grupların bilim adamları olarak hazırladıkları bahçeleri bir basın toplantısı düzenleyerek tanıtmaları, bu ağaçların bu şekilde olmasının avantajları hakkında bilgi vermeleri istenir. (Daha önceden okulun Fen ve Teknoloji öğretmeniyle ağaçların gövdelerinin farklı şekillerde olmasının ne gibi yararları olabileceği konusunda fikir alınır.) Bir grup bahçesini tanıtırken diğer grupların üyeleri basın mensupları olarak bilim adamlarına sorular sorarlar.

Ardından öğretmen bahçelerdeki ağaçların çokgen olup olmadığını sorar. Bu ağaçların nasıl isimlendirileceği sorulur. Şekillerin köşelerine harfler verilerek isimlendirilirler. Bir şeklin çokgen olması için neler

gereklidir sorusuna cevap aranır. Öğretmen fikirleri tahtaya yazar. Kapalı, köşeli kelimelerinin özellikle söylenmesi beklenir. Ardından bir tanım oluşturmalarını ister. Hep birlikte " Üç veya daha fazla doğrunun kesişmesiyle oluşan kapalı şekillere çokgen denir." tanımı oluşturulur.

Sonuç Etkinlikleri:

Öğrencilerden çember olmaları istenir. Öğretmen çemberin ortasına geçerek elindeki mukavvadan yapılmış doğruları göstererek bu doğrulardan mümkün olan en azını kullanarak bir çokgen oluşturmalarını ister. Gönüllü öğrenciye doğrular verilir. Yapmasına izin verdikten sonra 3 ten fazla bir doğru kullanmışsa daha azıyla yapılamaz mı diye sorulur? Başka gönüllü istenir. Bir çokgenin oluşturulabilmesi için en az üç doğruya ihtiyaç olduğu tekrar vurgulanır. Öğretmen tahtaya bir fon kartonu yapıştırır ve kartona çokgen ailesinin en küçük üyesi olan üçgeni çizer, köşelerine harfler vererek çokgeni isimlendirir. "ABC üçgeni". Öğrencilerden ellerine birer kalem almaları istenir ve üçer üçer oraya giderek çokgen ailesinin diğer üyelerini çizmeleri ve isimlendirmeleri istenir. Çizme işlemi bitince öğretmen fon kartonunda çizili şekilleri inceler, çokgen olmayan varsa, o şeklin neden çokgen olamayacağı açıklanır. Çokgende kapalılık ve en az 3 doğrudan oluşması özelliklerine vurgu yapılarak atölye tamamlanır.

Ders Planı 1- Kullanılan Malzemeler

Genetiği değiştirilmiş ürünler:

Ders Planı 2
Süre:1 ders saati

Kazanımlar:

2. Düzgün olan ve olmayan çokgenler arasındaki farkı açıklar.

Kullanılan drama teknikleri: Öğretmenin role girmesi, rol oynama

Araç-gereç: Çanakkale'de var olan yerlerin çokgene örnek teşkil edecek olanlarının resimleri, günlük hayattan çokgen resim örnekleri, iki adet büyük fon kartonu, çok sayıda fon kartonundan yapılmış düzgün ve düzgün olmayan çokgenler, kalem, cetvel, açıölçer

Giriş Etkinlikleri:

Öğretmen duvara günlük hayattan ve Çanakkale'deki bazı yerlerden oluşan düzgün ve düzgün olmayan çokgen resim örneklerini asar. Bunlar: altıgen raf, beşgen flama, uçurtma, dörtgen saat, üçgen bayrak, yelkenli, satranç tahtası, sekizgen trafik levhası, üçgen bayrak, bal peteği, Çanakkale şehitlik abidesi, Çanakkale Müzesinde yer alan fotoğraflar, Truva atı. Öğrencilerden bir resim sergisi geziyorlarmış gibi birbirleriyle hiç konuşmadan yürümeleri ve duvarda asılı olan resimlerdeki çokgenleri incelemeleri istenir. Bu çokgenlerin kaç kenarı, kaç köşesi, kaç açısı var?

Ara değerlendirme:

Öğrencilere hangi çokgenleri gördükleri sorulur. Hangi resimlerdeki çokgenlerin kenar sayılarının aynı olduğu sorulur. Bu çokgenlerin kenar sayılarının aynı olmasına rağmen neden birbirlerinden farklı oldukları sorulur.

Geliştirme Etkinlikleri:

Öğretmen öğrencilerin yardımıyla sıralardan otobüs oluşturur. Ardından, çocuklar bildiğiniz gibi bugün Çanakkale'ye iki günlük bir gezi düzenleyeceğimizi duyurmuştuk. Hadi otobüsümüze binelim ve yola koyulalım der. Öğrenciler ve öğretmen sıralara oturur. Öğretmen Çanakkale'de nereleri gezeceklerini söyler, gezecekleri yerlerin fotoğraflarını onlara gösterir. Sonra yolumuz uzun şimdi biraz uyuyalım

der. Bir süre sonra öğretmen çocuklar Çanakkale'ye hoş geldiniz, şimdi kalacağımız Geometri oteline yerleşmek üzere otobüsten inelim der. Öğretmen siz burada bekleyin birazdan otel görevlisi gelecek der. (Öğretmen sınıftan dışarı çıkarak üzerine erkek ceketi giyerek geri döner.)Öğretmen role girerek otel görevlisi olarak konuşmaya başlar. Çocuklar hepiniz otelimize hoş geldiniz. Burada sizleri ağırlamaktan büyük mutluluk duyuyoruz. Ancak siz buraya gelmeden önce küçük bir aksilik oldu, sizin rahat etmeniz için otelimizin en büyük odasını ayırdık. Ancak az önce anahtarların asılı olduğu panoyu düşürdüm. Bütün anahtarlar karıştı. Şimdi hangi anahtar hangi odaya ait bulamıyoruz. Ancak, paniğe gerek yok. Odanızın anahtarı düzgün çokgen şeklindeydi. Bütün anahtarlar burada doğru anahtarın hangisi olduğunu kendiniz bulmalısınız der ve rolden çıkar.

Öğretmen; çocuklar anahtarı bulmak için öncelikle düzgün çokgen ne demek onu bulmalıyız. Bu konuda fikri olan var mı? diyerek tartışmayı başlatır. Tartışmanın sonunda öğrencilerden **kenar uzunlukları ve açıları eşit olan çokgenlere düzgün çokgen denildiğini** söylemeleri beklenir. Ardından öğrenciler 1,2,3,4,5 diyerek 5 gruba ayrılırlar. Öğretmen fon kartonundan yapılmış 15 çokgeni gruplara üçer üçer paylaştırır. Ayrıca her gruba tablo, kalem, cetvel ve açıölçer vererek her gruptan verdiği çokgenlerin kenar uzunluklarını ve açılarını ölçerek verilen tabloya yazmalarını ister. Her çokgen için ayrı tablo doldurulur. Her grup 3'er tane tablo doldurur.

Anahtarın numarası:	
Kenar Özellikleri	Açı Özellikleri
1. kenarının uzunluğu:	1. açısının ölçüsü:
2. kenarının uzunluğu:	2. açısının ölçüsü:
3. kenarının uzunluğu:	3. açısının ölçüsü:
4. kenarının uzunluğu:	4. açısının ölçüsü:
5. kenarının uzunluğu:	5. açısının ölçüsü:

6. kenarının uzunluğu:	6. açısının ölçüsü:
7. kenarının uzunluğu	7. açısının ölçüsü:
8. kenarının uzunluğu:	8. açısının ölçüsü:

Öğrencilerden tablolarını doldurduktan sonra hangi anahtarların düzgün çokgen biçiminde olduklarını belirlemeleri istenir.
Öğretmen, "Çocuklar az önce otel görevlisi odanın anahtarıyla ilgili bir bilgi daha gönderdi. Anahtar dar açılı değil ve bir kenar uzunluğu 5 cm' den büyük olan bir çokgenmiş." Diyerek çalışmalarını tekrar gözden geçirmelerini ve doğru anahtarı bulmalarını ister. Gruplardan birer sözcü seçilerek her grubun yaptıkları çalışmayı anlatmaları ve odanın anahtarının onlarda olup olmadığına ilişkin bilgi vermeleri istenir. Odanın anahtarı bulunur. Öğrencilere verilen çokgenler içerisinde eşkenar dörtgen ve dikdörtgen de bulunmaktadır. Gruplar sunumlarını yaparlarken bu dörtgenlere özellikle dikkat çekilir ve bir çokgenin düzgün çokgen olabilmesi için sadece açı ölçülerinin aynı olması yeterli midir? (Dikdörtgendeki gibi) Diye sorulur. Tartışmadan sonra dikdörtgenin düzgün bir çokgen olamayacağını söylemeleri beklenir. Ardından bir çokgenin düzgün çokgen olabilmesi için sadece kenar uzunluklarının aynı olması yeterli midir? (Eşkenar dörtgendeki gibi) Diye sorulur. Tartışmanın ardından eşkenar dörtgenin düzgün bir çokgen olamayacağını söylemeleri beklenir.

Bir çokgenin düzgün olabilmesi için hem tüm açılarının aynı, hem de tüm kenarlarının birbirine eşit olması gerektiği tekrar vurgulanır.

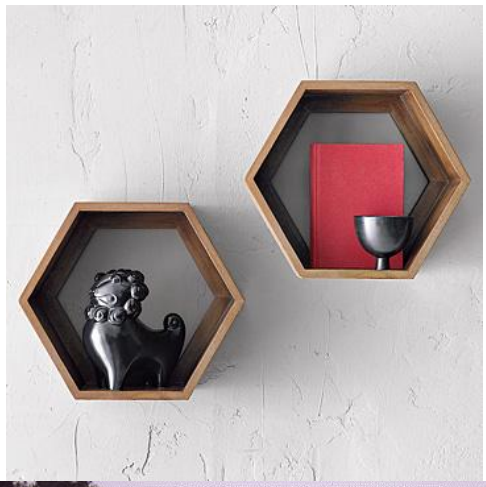
Sonuç Etkinlikleri:

Öğretmen tahtaya iki tane farklı renkte fon kartonu asar. Birinde "Düzgün Çokgenler Oteli Anahtar Panosu", diğerinde "Düzgün Olmayan Çokgenler Oteli Anahtar Panosu" yazılıdır. Öğretmen her öğrenciye fon kartonundan yapılmış üzerinde açı ölçüleri ve kenar uzunlukları yazılı olan birer çokgen dağıtır. Ardından elinizde bu otellerden birine ait anahtarlar var. Sizden istediğim elinizdeki anahtarın hangi otele ait olduğunu düşünüyorsanız onu tahtadaki uygun panoya asmanız der. Öğrenciler asma

işlemini tamamladıktan sonra öğretmen bazı öğrencilere söz vererek seçimini neye dikkat ederek yaptıklarını sorar. Ardından bir çokgenin düzgün olabilmesi için hem bütün kenarlarının aynı uzunlukta hem de bütün açılarının aynı ölçüde olması gerektiği vurgulanır. Ders tamamlanır.

Ders planı-2

Tahtaya asılan günlük hayattan ve Çanakkale'den çokgen örnekleri




12
BOCCIA


RENGARENK BİR GÖKYÜZÜ
Beşiktaş Belediyesi
II. UÇURTMA
ŞENLİĞİ
26 Mayıs 2007
10:00 - 18:00
Çilekli Spor Tesisleri
Lions 118-T'ye katkılarından dolayı teşekkür ederiz.
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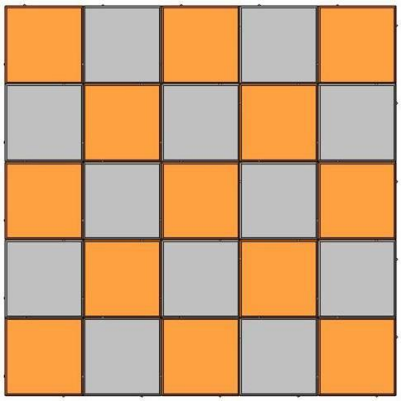
ÇANAKKALE



Ders Planı 3

Süre: 4 ders saati

Kazanımlar:
1.Eşlik ve benzerlik arasındaki ilişkiyi açıklar.
2.Eş ve benzer çokgenlerin kenar ve açı özelliklerini belirler.
3.Çokgenler ile çokgensel bölgelerin eş ve benzerlerini kullanarak örüntüler oluşturur.
Kullanılan drama teknikleri: Öğretmenin role girmesi, uzman yaklaşımı, rol oynama, rol içinde yazma
Araç-gereç: Kartondan yapılmış her birinden 2 adet büyük, 2 adet küçük boy eşkenar üçgen, dörtgen, paralelkenar, dikdörtgen, kare, beşgen, düzgün beşgen, düzgün altıgen, kartondan yapılmış aynı boyutlarda iki üçgen, dörtgen, beşgen, altıgen, izometrik kağıtlar, cetvel, açı ölçer, renkli kalemler, boyalar, makas, renkli kartonlar

I. Oturum (2 ders saati)

Giriş Etkinlikleri:

Öğretmen her öğrenciye çokgenler dağıtır. Çokgenlerin sayısı aşağıdaki gibidir:
2 adet büyük, 2 adet küçük eşkenar üçgen (büyük üçgenler ve küçük üçgenler birbirleriyle aynı boyutlarda)
2 adet büyük, 2 adet küçük dörtgen
2 adet büyük, 2 adet küçük paralelkenar
2 adet büyük, 2 adet küçük dikdörtgen
2 adet büyük, 2 adet küçük kare
2 adet büyük, 2 adet küçük beşgen (eş büyük çokgenler ve
2 adet büyük, 2 adet küçük düzgün beşgen eş küçük çokgenler)
2 adet büyük, 2 adet küçük düzgün altıgen

Öğretmen öğrencilerden çember olmalarını ve ellerindeki çokgeni herkesin görebileceği şekilde tutmalarını ve diğerlerinin elindeki çokgenleri incelemelerini ister. Ardından müzik açılarak öğrencilerden müzik eşliğinde dans etmelerini ve müzik durduğunda ellerindeki çokgenin birebir aynısı kimdeyse onu bulup eşleşmeleri ve kenara geçmeleri istenir.

Oyun farklı şekilde tekrar oynanır. Bu sefer müzik durduğunda büyük çokgenlerin kendilerinin küçükleriyle eşleşmeleri istenir. Örneğin büyük kare, küçük kare ile.

Oyun son kez 4 lü eşleşme şeklinde oynanır. Aynı çokgenlerin tamamı bir araya gelirler (2 büyük paralelkenar, 2 küçük paralelkenar).

Geliştirme Etkinlikleri:

Öğretmen öğrencileri üçgen, dörtgen, beşgen ve altıgen diyerek 4 gruba ayırır. Ardından öğrencilere çember olmalarını söyler. Öğretmen role girerek 'Arkadaşlar sizi çok önemli bir konuyu görüşmek üzere burada topladım. biliyorsunuz biz uzun zamandır Türkiye'nin en kaliteli fayanslarını üreten bir fabrikayız. Yakında fabrikanın sahibi bir heyetle çalışmalarımızı denetlemeye gelecek. Fabrikanın sahibi üretilen fayanslar arasında milim fark olmasına tahammül edemez. Benim şefiniz olarak sizden istediğim üretilen fayanslarla ilgili gerekli hesaplamaları yapmanız ve bu hesapları size vereceğim tabloya not etmeniz ve incelediğiniz fayanslarla ilgili bir rapor hazırlamanız. O gelmeden tüm raporlar hazır olmalı." der ve her gruba ismine göre aynı boyutlarda iki çokgen (Üçgen grubuna üçgen gibi), doldurmaları için birer tablo, açıölçer, cetvel ve kalem verir. Tablo aşağıdaki gibidir:

Fayansın kenar özellikleri	**2. Fayansın kenar özellikleri**
1.Kenarının uzunluğu:	1.Kenarının uzunluğu:
2.Kenarının uzunluğu:	2.Kenarının uzunluğu:
3.Kenarının uzunluğu:	3.Kenarının uzunluğu:
4.Kenarının uzunluğu:	4.Kenarının uzunluğu:
5.Kenarının uzunluğu:	5.Kenarının uzunluğu:
6.Kenarının uzunluğu:	6.Kenarının uzunluğu:
1. Fayansın açı özellikleri	**2. Fayansın açı özellikleri**
1. açının ölçüsü:	1. açının ölçüsü:
2. açının ölçüsü:	2. açının ölçüsü:
3. açının ölçüsü:	3. açının ölçüsü:
4. açının ölçüsü:	4. açının ölçüsü:
5. açının ölçüsü:	5. açının ölçüsü:
6. açının ölçüsü:	6. açının ölçüsü:

Öğretmen grupların yanına giderek rolden çıkmadan soruları olup olmadığı sorar. Gruplardan fabrikanın sahibine sunulmak üzere buldukları verilere dayanarak fayansların birebir aynı olduklarını ispatlayan bir rapor hazırlamaları istenir.

Raporlar hazırlandıktan sonra öğretmen aynı rolde, her gruptan birer temsilcinin hazırlanan raporu diğerleriyle paylaşmalarını ister. Raporlar sırayla okunur.

Öğretmen bu verilerle patronun ikna edilip edilmeyeceğini sorar. Öğrencilerden fayansların (çokgenlerin) bütün açılarının ve kenar uzunluklarının birbirine eşit olduğundan aralarında hiçbir fark olmadığını söylemeleri beklenir.

Öğretmen artık patronu gönül rahatlığıyla karşılayabiliriz der ve gruplara teşekkür eder.

"Öğretmen kenar uzunlukları ve açıları aynı olan çokgenlere eş çokgenler denildiğini vurgular ve tahtaya eş çokgenlerin "≅" sembolüyle gösterildiğini yazar."

Sonuç Etkinlikleri:

Öğretmen tahtaya üzerinde farklı renklerle boyanmış eş ve benzer çokgenlerin olduğu kareli bir kâğıt yapıştırır ve öğrencilerden "eşlik" sembolünü kullanarak eş çokgenleri yazmaları istenir. Öğrencilere yanıtlarının nedeni sorulur ve eş çokgenlerin özellikleri vurgulatılır.

II. Oturum (2 ders saati)

Giriş Etkinlikleri:

Öğrenciler eş ve benzer denerek iki gruba ayrılırlar. Öğretmen sıranın üzerine fon kartonundan yapılmış çok sayıda çokgen koyar. Her çokgen çeşidinden dört tane vardır: iki adet büyük, iki adet küçük. İki grup karşılıklı olarak grubun üyeleri birbirinin sırtını görecek şekilde öğretmenin önünde tek sıra halinde dizilirler. Öğretmen her iki sıranın önündeki öğrencilere sırayla çokgenlerle ilgili bazı sorular sorar. (Bir soru eş grubuna bir soru benzer grubuna). Öğretmen soruyu doğru yanıtlayan öğrencilerden eş grubundakilerden gösterdiği çokgenin aynısını, benzer grubundakilerden ise aynı çokgenin farklı boyutlarda olanını bulmalarını ve sıranın arkasına geçmelerini ister. Öğrenciler buldukları çokgenler için 10' ar puan alırlar. Sorulan soruyu bilemeyen öğrenci sıranın arkasına geçer. Sorunun yanıtı tüm gruptan alınır ancak grup puan alamaz. Sorular bittiğinde en çok puanı olan grup oyunu kazanır.

Sorulan sorular boşluk doldurma, doğru-yanlış tipi sorulardır:

1. Üç köşesi olan çokgene ..... denir.
2. Dört kenarı olan çokgene ..... denir.
3. Kenar uzunlukları ve açıları birbirine eşit çokgene ..... çokgen denir.
4. Üç veya daha fazla doğrunun kesişmesiyle oluşan kapalı şekillere ..... denir.

5. Dikdörtgen düzgün bir çokgendir.(D-Y)
6. ..... üçgen düzgün bir çokgendir.
7. ..... düzgün dörtgendir.
8. İki çokgenin kenar uzunlukları ve açılarının ölçüleri birbirine eşit ise bu çokgenler ..... dır/dir.
9. Bütün kapalı şekiller çokgendir (D-Y).
10. Bir şeklin çokgen olabilmesi için en az ..... kenara ihtiyaç vardır.
11. Beş kenarlı bütün çokgenler düzgün çokgendir (D-Y).
12. Bir çokgenin kenar sayısı köşe sayısına eşittir (D-Y).
13. Bir çokgenin 6 kenarı varsa ..... tane açısı vardır.
14. Eş çokgenler arasında fark yoktur (D-Y).
15. Köşeleri olan bütün geometrik şekiller çokgendir (D-Y).
16. Kapalı olmayan hiçbir geometrik şekil çokgen değildir (D-Y).
17. Çeşitkenar üçgen düzgün çokgen değildir(D-Y).
18. Bir açısının ölçüsü 90° olan üçgen düzgün çokgen değildir(D-Y).
19. İkizkenar üçgen düzgün bir çokgendir(D-Y).
20. Bir açısı geniş açı olan üçgen düzgün çokgen değildir(D-Y).
21. Paralelkenar düzgün çokgen değildir(D-Y).
22. Çokgen çizebilmek için en az 2 doğrunun kesişmesi yeterlidir(D-Y).

Öğretmen özellikle doğru-yanlış tipi sorularda verilen yanıtların nedenini sorar, yanıtı yanlış olan soruların doğruları vurgulanır.

Geliştirme Etkinlikleri:

Öğretmen öğrencileri eşkenar üçgen, kare, dikdörtgen ve düzgün altıgen olmak üzere dört gruba ayırır. Ardından role girerek öğrencilere "Çokgenlerden mükemmel örüntüler" konulu resim yarışmasına hepiniz hoş geldiniz. Bu yarışma matematiğin sanatla ilişkisini ortaya koyduğu için çok önemli. Ancak yarışmamızın bazı kuralları var. İlk kuralımız: yapacağınız örüntüde yalnızca bir çokgen çeşidi kullanabilirsiniz.

Kural iki: Örüntüde kullanacağınız çokgenin farklı büyüklüklerini kullanmak zorundasınız.

Kural üç: Yapacağınız örüntüyü size verilen süre içinde ve size verilen malzemelerle tamamlamak zorundasınız.

Kural dört: Örüntüler tamamlandıktan sonra, onlara isim verilip sergi odasında sergilenecek ve her gruptan bir temsilci yapılan örüntüyü tanıtacaktır.

Kural beş: Örüntüler gezildikten sonra her gruptan birer öğrenci seçilerek jüri grubu oluşturulacak ve jüri en mükemmel örüntüyü seçecek ve seçme gerekçesini açıklayacaktır.

Öğretmen bu kuralların yazılı olarak gruplara dağıtılacağını söyler. Her grubun kendileri için ayrılan bölüme geçmelerini ister. Her grubun oturacağı yer belirlenmiş ve masalarda izometrik kağıtlar, cetvel, açı ölçer, renkli kalemler, boyalar, makas, renkli kartonlar bulunmaktadır. Öğrencilere örüntülerini oluşturmak için 20 dakika verilir. Öğretmen grupları gezerek, soruları olup olmadığını sorar.

20 dakikanın sonunda yapılan örüntüler sınıfın farklı duvarlarına asılır. Sırayla tüm sınıfça örüntüler gezilir. Temsilciler örüntüleri tanıtırlar. Ardından jüri üyeleri seçilerek en mükemmel örüntü seçilir. Seçim yapılırken kurallara uyulup uyulmadığına ve estetik özelliklere bakılır.

Seçilen örüntüdeki çokgenler incelenir. Öğretmen örüntüde kullanılan çokgenin farklı büyüklükte olan iki tanesini seçer ve bunların arasında ne fark olduğunu sorar. Öğrencilerden kenar uzunluklarının farklı olduğunu söylemeleri beklenir. Öğretmen "sizce açılarının ölçüleri birbirinden farklı mıdır?" diye sorar öğrenciler tahmin yürütürler.

Öğretmen aynı grupların yerlerine giderek onlara vereceği farklı büyüklükte iki çokgeni alıp kenar uzunluklarını ve açılarını ölçmelerini ister.

Hesaplamalar yapıldıktan sonra öğretmen açılarının arasında fark olup olmadığını sorar. Öğrencilerden açılarının aynı olduklarını söylemeleri beklenir.

Ardından, kenar uzunlukları ve açıları aynı olan çokgenlere eş çokgenler denildiğini ve eş çokgenlerin "$\cong$" sembolüyle gösterildiği hatırlatılır. Açıları aynı, kenar uzunlukları orantılı olan çokgenlere benzer çokgenler denildiği vurgulanır ve benzer çokgenlerin "$\approx$" sembolüyle gösterildiğini tahtaya yazar.

Öğretmen eş çokgenlerin aynı zamanda benzer olup olmadığı sorar. Öğrencilerin fikirleri alındıktan sonra eş çokgenlerin aynı zamanda benzer çokgenler oldukları fakat benzer çokgenlerin aynı zamanda eş olamayacakları vurgulanır.

Sonuç Etkinlikleri:

Öğretmen tahtaya üzerinde farklı renklerle boyanmış eş ve benzer çokgenlerin olduğu kareli bir kâğıt yapıştırır ve öğrencilerden "eşlik ya da benzerlik" sembollerini kullanarak eş ve benzer çokgenleri yazmaları istenir.

Her öğrenciye verdiği yanıtın nedeni sorulur. Neden eş ya da benzer olduklarını düşünüyorsun? gibi. Eşlik ve benzerlik arasındaki fark tekrar vurgulanır. Öğrencilere soruları olup olmadığı sorulur, sorular (varsa) cevaplandıktan sonra atölye tamamlanır.

Ders Planı 4

Süre: 2 ders saati

Kazanımlar:

1. Üçgenleri açılarına ve kenarlarına göre sınıflandırır.

Kullanılan drama teknikleri: Mektuplar, öğretmenin role girmesi, rol oynama, uzman yaklaşımı

Araç-gereç: 5 m uzunluğunda lastik ip, izometrik kağıt, cetvel, makas, fon kartonu, açı ölçer, kalem

Giriş Etkinlikleri:

Öğretmen tüm gruba 5 m uzunluğunda bir lastik verir. Öğrencilerden bu lastiği kullanarak bir üçgen oluşturmaları istenir. Öğretmen sırayla aşağıdaki yönergeleri vererek öğrencilerden farklı üçgenler oluşturmaları istenir:

-şimdi üç açısı da dar olan bir üçgen oluşturalım. "Dar açı neydi?"

- bir açısı dik açı olan bir üçgen oluşturalım. "Dik açı neydi?"

-bir açısı geniş açı olan bir üçgen oluşturalım. "Geniş açı neydi?"

- tüm kenar uzunlukları aynı olan bir üçgen oluşturalım.
- İki kenar uzunluğu aynı olan bir üçgen oluşturalım.
- Bütün kenar uzunlukları birbirinden farklı olan bir üçgen oluşturalım.

Geliştirme Etkinlikleri:

Öğretmen role girerek öğrencilere değerli mimarlar odası üyeleri, bu sabah Kanada'daki mimar arkadaşımdan bir mektup aldım. Bu mektubu sizlere okumak istiyorum der. Mektup şöyledir:

Sevgili Arkadaşım,

Biliyorsun bir yıldır burada mimar olarak çalışmaktayım. Şimdiye kadar yaptığım evler herkes tarafından beğenildi. Ancak iki hafta önce aldığım iş biraz canımı sıkıyor. Müşterim her şeyiyle onun istediği gibi bir ev yapmamı istiyor. Ancak evin çatısı konusunda kararsızım. Müşterim üçgen biçiminde bir çatı istiyor. Ona gösterdiğim çatı örneklerinin hiç birini beğenmedi. Senden ricam ekibinle birlikte bana aşağıda belirttiğim özelliklere göre çatı örnekleri hazırlamanız. Bana bu konuda yardımcı olursanız çok sevinirim.

Üçgen çatı çeşitleri:

1. *Üç açısı da dar olan ve üç kenar uzunluğu birbirine eşit*
2. *Üç açısı da dar olan, iki kenar uzunluğu birbirine eşit*
3. *Üç açısı da dar olan, bütün kenar uzunlukları birbirinden farklı*
4. *Bir açısı dik olan, iki kenar uzunluğu birbirine eşit*
5. *Bir açısı dik olan, bütün kenar uzunlukları birbirinden farklı*
6. *Bir açısı geniş olan, iki kenar uzunluğu birbirine eşit*
7. *Bir açısı geniş olan, bütün kenar uzunlukları birbirinden farklı*

Şimdiden Teşekkürler,
Sevgilerimle, Özgür

Öğretmen mektubu okuduktan sonra gruplara arkadaşıma yardım etmeliyiz der. Öğrencilere bence bu işi gruplara ayrılarak yapalım der ve sınıfı dar, dik, geniş diyerek üç gruba ayırır. Dar grubundan ilk üç örneği, dik grubundan 4. ve 5. yi, geniş grubundan son iki örneği hazırlamalarını ister. Ardından öğretmen Dar, dik, geniş gruplarını yerlerine alır. Onlara kullanmaları için izometrik kağıt, cetvel, makas, fon kartonu, açı ölçer, kalem verir.

Gruplar üçgenlerini hazırladıktan sonra öğretmen hazırladığınız çatı örneklerine kenar ve açı özelliklerini dikkate alarak uygun birer isim verin ve onları renkli kağıtlardan oluşturarak evlerin üzerlerinde nasıl duracağını örnekleyin der. Önce "dar" grubu dinlenir. Öğrencilerden dar açılı eşkenar, ikizkenar, çeşitkenar üçgenleri söylemeleri beklenir. Öğretmen eşkenar üçgenin bir açısının ölçüsünün kaç derece olduğunu sorar. Dik grubundan ikizkenar dik üçgen ve çeşitkenar dik üçgen isimlerini vermeleri beklenir. Geniş grubundan geniş açılı ikizkenar üçgen, geniş açılı çeşitkenar üçgen demeleri beklenir. Öğretmen dik ya da geniş açılı eşkenar üçgen oluşturulup oluşturulamayacağını sorar. Öğrencilerden hayır yanıtı beklenir. Eşkenar üçgenin tüm iç açılarının birbirine eşit ve 60° olduğu tekrar vurgulanır.

Sonuç Etkinlikleri:

Öğretmen öğrencilerden verdiği bilgilerle üçgenleri sınıflandırmalarını ister. Sorular şöyledir:

1. Kenar uzunlukları 4cm, 6cm, 4cm olan ABC üçgeni
2. Kenar uzunlukları 22cm, 60cm, 70cm olan DEF üçgeni
3. Kenar uzunlukları 5cm, 5cm, 5cm olan KLM üçgeni
4. Açı ölçüleri 36°, 44°, 100° olan MNO üçgeni
5. Açı ölçüleri 30°, 60°, 90° olan MNP üçgeni
6. Açı ölçüleri 56°, 48°, 76° olan MRO üçgeni

7. Açı ölçüleri 45°, 45°, 90° olan PRS üçgeni
8. Açı ölçüleri 60°, 60°, 60° olan MNO üçgeni
9. Açı ölçüleri 40°, 40°, 100° olan SRO üçgeni
10. Bir eşkenar üçgen aynı zamanda ikizkenar üçgen olur mu? Neden?
11. Bir çeşitkenar üçgen aynı zamanda dik açılı üçgen olabilir mi?
12. Üçgenleri kenar uzunluklarına göre sınıfladığımızda kaç çeşit üçgen oluşur? Açıklayınız.
13. Üçgenleri açı ölçülerine göre sınıfladığımızda kaç çeşit üçgen oluşur? Açıklayınız.

Öğretmen öğrencilerden soruları defterlerine yazmalarını ve yanıtlamalarını ister. Yanıtlar öğrencilere tek tek söz verilerek alınır ve tüm sınıfça tekrar edilir.

Ders Planı 5

Süre: 1 ders saati

Kazanım: Kare ve dikdörtgenin açıları, kenarları ve köşegenleri arasındaki ilişkileri belirler.

Kullanılan drama teknikleri: Rol oynama, öğretmenin role girmesi, rol içinde yazma, toplantı düzenleme.

Araç-gereç: Farklı boyutlarda kartondan yapılmış 8 adet kare, 8 adet dikdörtgen, cetvel, renkli kalemler, tablo.

Giriş Etkinlikleri:

Öğretmen öğrencilerden sınıfta bulunan eşyalardan yüzeyi dikdörtgen biçiminde olan bir tanesini tutmalarını, ardından yüzeyi kare olan bir tanesini tutmalarını ister. O yüzeyin neden dikdörtgen ya da kare şeklinde olduğunu düşündüğünü açıklaması istenir.

Geliştirme Etkinlikleri:

Öğretmen öğrencilere sevgili arkadaşlarım az önce gazetede ülkemizin geleceğini ilgilendiren çok önemli bir haber okudum. Bu haberi sizlerle paylaşmak istiyorum der. Haberi okur:

Sınır komşumuz Dikdörtgenler Ülkesi'nin Cumhur Başkanı, Dikdörtgenler Ülkesi'nin sahip olduğu bütün fiziksel özellikleriyle Kareler Ülkesinden üstün olduğunu bu konuda yapılacak bütün kıyaslamalarda Dikdörtgenler Ülkesi'nin Kareler Ülkesi'ne açık ara fark atacağını bildirdi.

Öğretmen, arkadaşlar bu haber Kareler Ülkesi'nin bir vatandaşı olarak beni çok rahatsız etti. Siz de benimle aynı fikirdeyseniz bu açıklamanın doğruluğunu araştıralım diyorum. Ben sizlere hem kendi ülkemizin hem de Dikdörtgenler Ülkesinin farklı oranlarda küçültülmüş haritalarını ve bu konuyu araştırmamız için gerekli bütün malzemeleri hazırladım. Öncelikle gruplara ayrılalım der. Öğrencileri 1,2,3,4 diyerek dört gruba ayırır. Her

gruba farklı büyüklükte 2 tane kare 2 tane dikdörtgen, açıölçer, cetvel, renkli kalemler ve doldurmaları için aşağıdaki tabloyu verir.

Dikdörtgenler Ülkesi	**Kareler Ülkesi**
Kenar Özellikleri	
1.kenarın uzunluğu=	1.kenarın uzunluğu=
2.kenarın uzunluğu=	2.kenarın uzunluğu=
3.kenarın uzunluğu=	3.kenarın uzunluğu=
4.kenarın uzunluğu=	4.kenarın uzunluğu=
Kenar uzunluklarını incelediğiniz ülkeleri karşılaştırarak kenar uzunlukları hakkında ne söyleyebilirsiniz?	
Açı Özellikleri	
1. açısının ölçüsü=	1. açısının ölçüsü=
2. açısının ölçüsü=	2. açısının ölçüsü=
3. açısının ölçüsü=	3. açısının ölçüsü=
4. açısının ölçüsü=	4. açısının ölçüsü=
Açı ölçülerini incelediğiniz ülkeleri karşılaştırarak açı ölçüleri hakkında ne söyleyebilirsiniz?	
Köşegen özellikleri	
1. köşegenin uzunluğu=	1. köşegenin uzunluğu=
2.köşegenin uzunluğu=	2. köşegenin uzunluğu=

Köşegen uzunluklarını incelediğiniz ülkeleri karşılaştırarak köşegen uzunlukları hakkında ne söyleyebilirsiniz?
Aşağıdaki soruları cevaplayınız.
Dikdörtgenler ülkesinin köşegenlerinin kesiştiği nokta bütün köşelere eşit uzaklıkta mı? Ölçerek cevabınızı yazın.
Kareler ülkesinin köşegenlerinin kesiştiği nokta bütün köşelere eşit uzaklıkta mı? Ölçerek cevabınızı yazın.
Dikdörtgenler ülkesinin köşegenleri birbirlerini dik olarak keserler mi? Ölçerek cevabınızı yazın.
Kareler ülkesinin köşegenleri birbirlerini dik olarak keserler mi? Ölçerek cevabınızı yazın.

Yaptığınız incelemeler sonucunda sizce hangi ülke diğer ülkenin sahip olduğu bütün özellikleri içerir? Cevabınızı açıklayarak yazın.

Öğretmen, yaptıkları ölçümler sonucunda Dikdörtgenler Ülkesi'nin Cumhur Başkanı'nın açıklamalarının doğruluğuyla ile ilgili bir karara varmalarını ve bu kararlarını nedenleriyle birlikte resmi bir dille yazmalarını ister. Ardından her gruptan birer temsilci belirlemelerini ister. Birazdan çalışmanızın sonuçlarını öğrenmek üzere basın üyeleri burada olacaklar der. Grubun temsilcileri tahtaya çıkarılır. Vardıkları kararı basın üyeleriyle paylaşmaları istenir. Geriye kalan grup üyeleri öğretmen tarafından toplanarak onlara basın üyeleri oldukları söylenir ve temsilcilere bu araştırma ile ilgili sorular sormaları istenir.
Basın toplantısı düzenlenir. Temsilciler kararlarını açıklarlar. Basın üyeleri temsilcilere sorular sorarlar. Öğretmen açık olmayan yerlerde bir basın mensubu gibi davranarak aydınlatıcı sorular sorar ve Kareler Ülkesinin Dikdörtgenler Ülkesinin sahip olduğu bütün özelliklere sahip olduğu belirlenir. Öğretmen Kareler Ülkesinin Dikdörtgenler Ülkesinde olmayan özelliklere sahip olup olmadığını sorar. Öğrencilerden karenin bütün kenar uzunluklarının birbirine eşit olduğunu söylemeleri beklenir.

Öğretmen bu sonuçlara dayanarak sizce bir kare aynı zamanda bir dikdörtgen midir? Diye sorar. Öğrencilerden yorumlarını ister.

Sonuç Etkinlikleri:

Öğretmen öğrencilerden aşağıdaki özellikleri defterlerine yazmalarını ister. Öğrencilerden bu özellikler sadece dikdörtgene ait ise dikdörtgen, sadece kareye ait ise kare yazmalarını, hem kareye hem dikdörtgene ait ise kare ve dikdörtgen yazmaları istenir. Özellikler şöyledir:

1. Bütün kenarları birbirine eşittir. (K)
2. Komşu kenarları birbirine diktir. (K-D)

3. Köşegen uzunlukları birbirine eşittir. (K-D)
4. Köşegenler birbirini ortalar. (K-D)
5. Karşılıklı kenarları aynı uzunlukta ve birbirine paraleldir. (K-D)
6. İki kısa, iki uzun kenarı vardır. (D)
7. Köşegenleri birbirini dik keserek ortalar. (K)

Tüm öğrenciler cevapladıktan sonra öğretmen öğrencilere söz vererek doğru cevapların tüm sınıfça paylaşılmasını ister.

Ders Planı 6

Süre: 2 ders saati

Kazanımlar:

1. Çokgenlerin çevre uzunluklarını strateji kullanarak tahmin eder.
2. Çokgenlerin kenar uzunlukları ile çevre uzunluğu arasındaki ilişkiyi açıklar.

Kullanılan drama teknikleri: Uzman yaklaşımı, öğretmenin role girmesi,

Araç-gereç: Kartondan yapılmış eşkenar üçgen, kare, düzgün altıgen, düzgün sekizgen, kalem, kağıt, düzgün olmayan çokgen şekiller.

Giriş Etkinlikleri:

Öğretmen yere tebeşirle bir kare çizer ve öğrencilerden karenin kenarlarına yerleşmeleri istenir. Bir gönüllü ebe olur. Öğretmen ebeden karenin etrafında dolaşmasını ve öğrencilerden birinin sırtına dokunmasını ister. Sırtına dokunulan öğrenci ebenin tersi yönünde koşmaya başlar. Ebe ile seçilen öğrenci karşılaştıklarında durup, birbirlerinin elini sıkıp, kareye ait bir özellik söyleyip, koşmaya devam ederler boş kalan yere önce ulaşan yeri kapar, diğeri ebe olur.

Oyun beşgen ve altıgen olunarak tekrar oynanır. Bu sefer karşılaştıklarında beşgenin ve altıgenin bir özelliği söylenir.

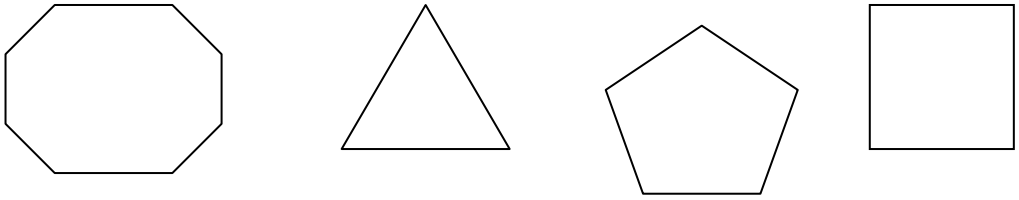
Geliştirme Etkinlikleri:

Aşağıdaki çokgen resimleri tahtaya yapıştırılır. Öğrenciler eşkenar üçgen, kare, düzgün beşgen, düzgün sekizgen denerek 4 gruba ayrılırlar. Öğretmen Belediye Başkanı rolüne girerek,

"Arkadaşlar, belediyemiz burada gördüğünüz bölgeleri korumak için çevrelerine dikenli tel çekmek istiyor. Ancak belediyenin kısıtlı imkanları olması nedeniyle öncelikle en az tel kullanarak çevrilebilecek bölgeden

başlanacaktır. Bölgelere ait gerekli bilgiler şöyledir: Bu bölgeler düzgün çokgen biçiminde olup, her bölgenin bir kenar uzunluğu 50 m dir.

Sizden belediyede çalışan işçiler olarak grubunuza ait bölgenin belediyenin imkanları dahilinde kaçıncı sırada dikenli telle çevrilmesi gerektiğini tahmin etmenizi istiyorum" der. Aşağıdaki çokgenleri tahtaya asar.

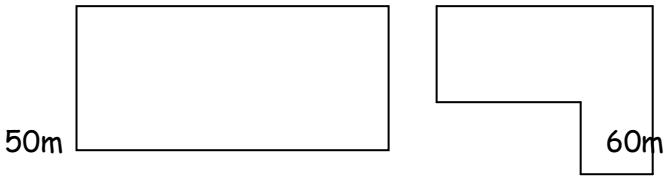


Tüm gruplara düşünmeleri için biraz süre verilir ve ardından karışık olarak gruplara söz verilir. Tüm gruplar konuştuktan sonra doğru sıralama tekrar alınır. Aynı gruplarla devam edilerek tüm bu bölgeleri telle çevirmek için toplam kaç m tel kullanılacağını tahmin etmeleri istenir.

Öğrencilere düşünmeleri için kısa bir süre verilir (hesap yapamayacak kadar) ardından gruplardan birer sözcü seçilerek tahminleri ve tahminlerini yaparken nasıl strateji izlediklerini söylemeleri istenir.

Ardından öğrencilere kağıt kalem verilerek her bölge için kaç m tel kullanılması gerektiğini ve tüm bölgeler için toplam kaç metre tele ihtiyaçları olduğunu hesaplamaları istenir. Hesaplanan değerlerle tahminler karşılaştırılır. Hesaplamayı nasıl yaptıkları sorulur. En yakın tahmin yürüten grup alkışlanır. Düzgün çokgenlerin çevre uzunluklarının kenar sayısı x çokgenin bir kenar uzunluğu olduğu vurgulanır.

Öğretmen role girerek tüm gruplara belediyeden telle çevrilmesi gereken yeni bölgeler olduğunun haberi geldi der. Tüm gruplara aşağıdaki bölgelerin çizili olduğu kağıtlar verilir.



Öğrencilere verilen bilgilerle bölgeyi çevirecek telin uzunluğunun hesaplanıp hesaplanmayacağını sorulur. Cevaplarını açıklamaları istenir.

Öğrencilerden hesap yapılamayacağını söylemeleri beklenir. Öğrencilerden düzgün olmayan çokgenlerin kenar uzunlukları birbirine eşit olmadığından bu çokgenlerin çevre uzunluklarının hesaplanabilmesi için tüm kenar uzunluklarının verilmesi gerektiğini söylemeleri beklenir.

Ardından tahtaya verilen çokgenlerin diğer kenar uzunlukları da yazılarak hesap yapmaları istenir.

Sonuç Etkinlikleri:

Öğrencilere aşağıdaki sorular verilir ve cevaplamaları istenir. Soruların cevapları sınıfta tartışılır.

1) Bir düzgün çokgenin kenarı ile çevresi arasıdaki ilişkiyi açıklayınız.
2) Bir düzgün beşgenin bir kenarının uzunluğu 35 cm ise çevresinin uzunluğunu bulunuz.
3) Bir düzgün altıgenin çevresinin uzunluğu 120 cm ise bir kenarının uzunluğu kaç cm dir?
4) Bir dikdörtgenin kısa kenarının uzunluğu 10 cm, uzun kenarını uzunluğu 15 cm ise bu dikdörtgenin çevresi kaç cm dir?

Ders Planı 7

Süre: 1 ders saati

Kazanım: Çokgenlerin çevre uzunlukları ile ilgili problemleri çözer ve kurar.

Kullanılan drama teknikleri: Uzman yaklaşımı, rol oynama.

Araç-gereç: Fon kartonundan yapılmış çokgenler, cetvel, kalem, zarf

Giriş Etkinlikleri:

Öğrencilerden,

1. Parmaklarıyla duvara bir kenarının uzunluğu 10 cm olan bir eşkenar üçgen çizmeleri istenir. Bu eşkenar üçgenin çevresinin uzunluğu kaç cm dir?
2. Dirsekleriyle duvara bir kenarının uzunluğu 8 cm olan bir kare çizmeleri istenir. Bu karenin çevresinin uzunluğu kaç cm dir?
3. Ayaklarıyla yere bir kenarının uzunluğu 7 cm olan bir düzgün beşgen çizmeleri istenir. Bu düzgün beşgenin çevresinin uzunluğu kaç cm dir?

Ara değerlendirme:

Öğrencilere buldukları çevre uzunlukları ve bu uzunlukları nasıl hesapladıkları sorulur.

Geliştirme Etkinlikleri:

Öğretmen grubu üçgen, dörtgen, beşgen, altıgen diyerek 4 gruba ayırır. Her gruba ismine göre fon kartonundan yapılmış çokgenler, cetvel, kalem verir ve tüm gruplara;"Değerli mimarlarımız sizlere ilçemizdeki bazı arsaların krokilerini dağıttım. Bu arsalarla ilgili bazı problemlerimiz var. Bu problemler sizlere dağıtacağım zarflarda yazılı. Sizden istediğim her grubun kendi içinde bu problemleri çözmesi ve çözümleri verilen kağıttaki çözüm için ayrılan bölüme yazması."Her gruba içinde aşağıdaki sorular yazılı olan zarflar dağıtılır:

1. Elinizdeki arsanın krokisinin çevre uzunluğunu hesaplayınız.
2. Elinizdeki arsanın krokisi gerçeğinin $\frac{1}{100}$ oranında küçültülmüş hali ise arsanın çevre uzunluğunu hesaplayın.
3. Arsa % 40 küçültülmüş olsaydı çevre uzunluğunu hesaplayın.

Gruplara yeterli süre verilir. Gruplardan birer sözcü seçilerek çözümlerini paylaşmaları istenir. Çözüm yolları tartışılır. Yanlışlar anında düzeltilir.
Aynı gruplarla devam edilerek şimdiye kadar yapılanlar göz önüne alınarak çokgenlerin çevre uzunlukları ile ilgili farklı bir problem kurmaları istenir. Yeterli sürenin ardından kurulan problemler yüksek sesle okunur. Uygun olup olmadığı tartışılır.

Sonuç Etkinlikleri:

Her öğrenciden defterine çokgenlerin çevre uzunluklarıyla ilgili bir problem yazıp çözmeleri istenir. Öğrencilere tek tek söz verilerek yazdıkları problemler yüksek sesle okunur. Öğrencilerden okunan problemi çözmeleri istenir.

Ders Planı 8

Süre: 2 ders saati

Kazanımlar:

1. Dikdörtgensel ve karesel bölgelerin alan bağıntılarını oluşturur.
2. Üçgensel bölgelerin alan bağıntılarını oluşturur.

Kullanılan drama teknikleri: Uzman yaklaşımı, öğretmenin role girmesi, rol oynama

Araç-gereç: Tatil sitesi planları, 25x25 lik karelerden oluşan tablo.

Giriş Etkinlikleri:

Öğrenciler sınıfta serbest olarak yürürler. Öğretmen öğrencilerden kare dediğinde sınıfta kare şeklinde olan bir nesneye dokunmalarını ve alanını tahmin etmelerini ister. Aynı oyun dikdörtgen ve üçgen denerek oynanır.

Ara Değerlendirme:

Öğrencileri sınıfta bulunan hangi eşyaların şekillerinin kareye, dikdörtgene ya da üçgene benzedikleri sorulur. Bu şekillerin alanlarını nasıl tahmin ettikleri sorulur. Birkaç kişiden tahminleri alınır.

Geliştirme Etkinlikleri:

Öğretmen role girerek öğrencilere daha önce benden istediğiniz tatil sitesi projesi için dört farklı plan hazırladım. Sizlerden burada yaşayacak kişiler olarak bu planlar hakkındaki fikirlerinizi öğrenmek istiyorum. Bu tatil sitesinde olmasını istediğiniz neler var diye sormadan önce tatil sitesinde yer alacak aktivitelerden bahsetmek istiyorum der. Çocuk parkı, yüzme havuzu, market, spor salonundan bahseder. Ardından öğrencilere, sizin fikirleriniz bizim için çok önemli bu aktivitelerin dışında sitede nelerin yer almasını istersiniz? diye sorar. Öğrencilerden fikirleri alınır ve not edilir. Bu fikirlerin de değerlendirileceğini söyler ve ardından öğrencileri dört gruba ayırarak hazırladığı planları her gruba dağıtır.

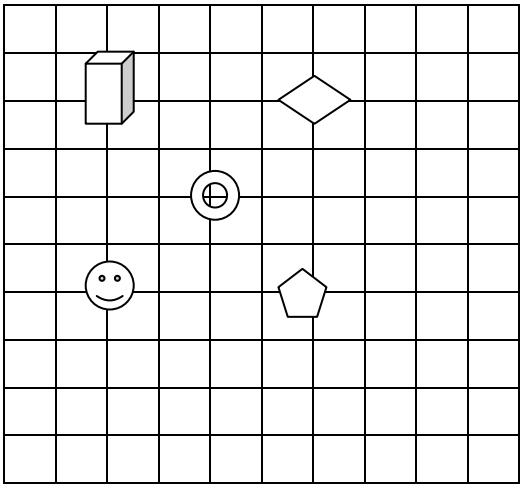
Öğrencilere, planları incelemeye başlamadan önce sizlere küçük bir teknik bilgi vermek istiyorum der. İyi planlanmış bir tatil sitesinde,

1. Tatil sitesindeki apartman, çocuk parkı, market ve spor salonu arasında kalan bölgenin alanı en büyük,
2. Tatil sitesindeki apartman, market ve yüzme havuzu arasında kalan bölgenin alanı en küçük olmalı.

Bu nedenle lütfen en uygun planı seçerken bu teknik şartlara uygun olup olmadığını kontrol edin. Bu şartlar sağlanmadan bir tatil sitesi yapılamaz der.

Planlar şöyledir:

1.



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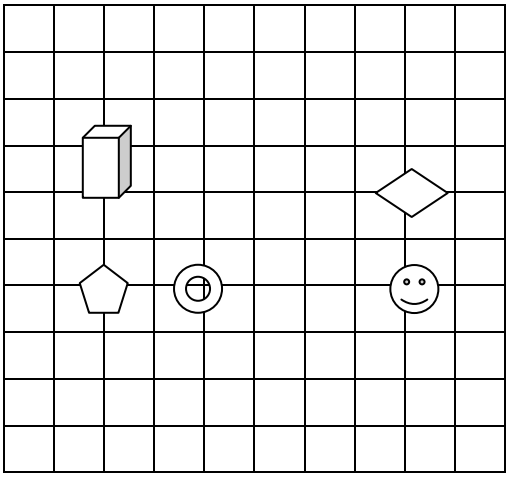

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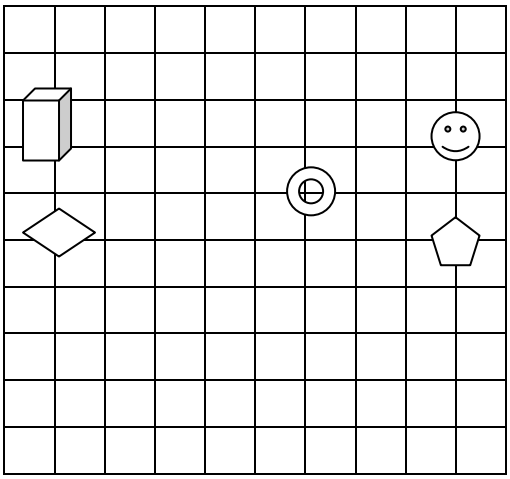

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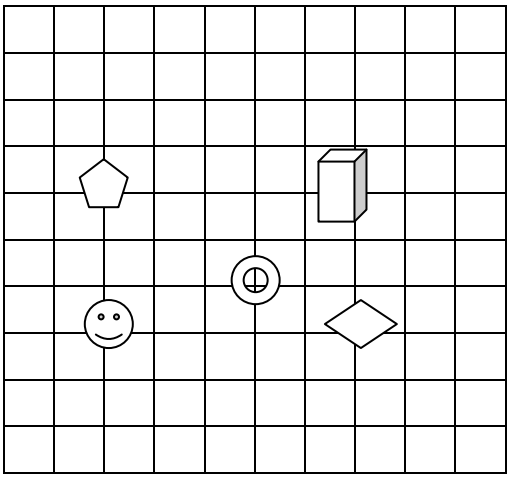


 Apartman  çocuk parkı  yüzme havuzu  market  spor salonu

Öğrencilere hesap yapmaları için yeterli süre verilir. Gruplardan birer sözcü seçilerek hangi planın en uygun olduğunu söylemeleri ve neden onu seçtiklerini açıklamaları istenir. Alan hesaplamaları incelendikten sonra kareleri saymanın dışında kenar uzunluklarının yardımıyla alan bağıntıları oluşturulup oluşturulamayacağı sorulur. Öğrencilerden formülleri hatırlamaları beklenir.
Ardından üçgen, kare ve dikdörtgenin alan formülleri hatırlanır ve öğrencilerden bu formülleri defterlerine yazmaları istenir.

Sonuç Etkinlikleri:

Aynı gruplarla devam edilerek, öğrencilere üzerinde 25x25 lik kareler çizili olan kağıtlar dağıtılır. Onlardan inceledikleri planı da göz önünde bulundurarak, bu planlardan farklı bir tatil sitesi planı hazırlamaları istenir. Onlara göre bir tatil sitesi planında olması gereken aktiviteleri düşünmelerini ve bu binalar arasındaki alanlardan birinin üçgen, birinin kare, birinin dikdörtgen şeklinde olmasını sağlamaları ve bu alanları alan formüllerini kullanarak hesaplamaları istenir. (her karenin bir kenarı 1 birim olarak kabul edilir)

Gruplar planlarını tahtaya yapıştırır. Diğer gruplara planlarındaki alanlarla ilgili soru sorarlar. Öğrencilerden cevaplamaları istenir. Yanıtlar tahtada çözülür.

Ders Planı 9

Süre: 1 ders saati

Kazanımlar:

1. Dikdörtgensel, karesel ve üçgensel bölgelerin alanları ile ilgili problemleri çözer ve kurar.

Kullanılan drama teknikleri: Uzman yaklaşımı, rol oynama.

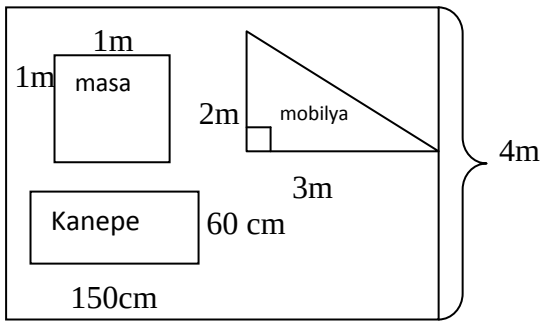
Araç-gereç: İki adet oturma planı

Giriş Etkinlikleri:

Öğrenciler serbest halde yürürler. Öğretmen öğrencilerden yürürken sınıftaki tüm alanı kullanmalarını ister. Sınıfın alanı kaç metrekare olabilir? Tahmin edin. der. Yürürken sıralara dokunmalarını ister. Sıraların alanları kaç metrekare olabilir? Sınıf tahtasının alanı kaç metrekare olabilir?

Geliştirme Etkinlikleri:

Öğretmen tahtaya bir odanın oturma planını yapıştırır. Öğrencilere tahtadaki oturma planına göre size dağıttığım soruları cevaplayın der. Oturma planı ve sorular şöyledir:

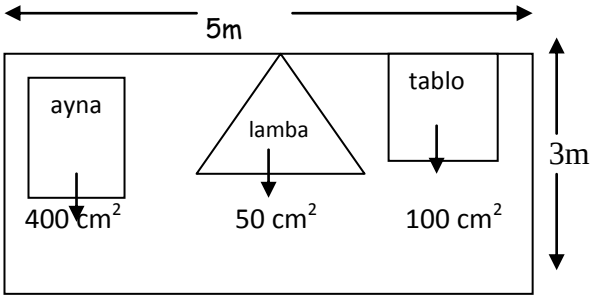


Sorular:

1. Bu odanın alanı kaç metrekaredir?
2. Mobilyanın alanı kaç metrekaredir?
3. Kanepenin alanı kaç metrekaredir?

4. Masanın alanı kaç santimetrekaredir?
5. Odadaki boş alan kaç santimetrekaredir?

Öğrencilere soruları cevaplamaları için yeterli süre verilir. Her sorunun cevabı öğrencilerden alınır. Nasıl hesapladıkları sorulur.
Öğretmen tahtaya başka bir odanın oturma planını yapıştırır.



Öğrenciler ikili eş olurlar. Biri A, biri B olur. A'lara evinizin oturma odasını yeniden dekore ettirmek istiyorsunuz. Bu konuda yardım istediğiniz iç mimar tahtada asılı olan planı hazırladı. Fakat bu planla ilgili bazı sorularınız var. İkna olabilmek için bu oturma planındaki verilere uygun olarak bir problem kurmalarını ve B'lerden bu problemi çözmeleri istenir. Bazı gruplara söz verilerek yazdıkları problemi okumaları istenir. Hep birlikte sorunun cevabı aranır. Cevap verildikten sonra başka bir soru okunur. Daha sonra A'lar ve B'ler yer değiştirirler.

Sonuç Etkinlikleri:

Öğrencilere yanıtlamaları için aşağıdaki sorular sorulur:

1. Uzun kenar uzunluğu 15 m, kısa kenar uzunluğu 12m olan bir salonun alanı kaç metrekaredir?

3. Bu salona yerleştirilecek üçgen biçimindeki sehpanın taban uzunluğu 40 cm

alanı ise 2 metrekare ise bu sehpanın yüksekliği kaç cm dir?

4. Konu ile ilgili çözümü aşağıdaki gibi olan bir problem yazınız.

Çözüm: $3m^2 = 30000\ cm^2$

$30000cm^2 : 150cm = 200cm$