

THE EFFECT OF CREATIVE DRAMA BASED INSTRUCTION ON SEVENTH
GRADE STUDENTS' MATHEMATICS ACHIEVEMENT IN PROBABILITY
CONCEPT AND THEIR ATTITUDES TOWARD MATHEMATICS

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AYŞE DAMLA GEÇİM

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Approval of the Graduate School of Social Sciences

Prof. Dr. Meliha ALTUNIŐIK

Director

I certify that the thesis satisfies all the requirements as a thesis for the degree of Master of Science.

Prof. Dr. Jale AKIROĐLU

Head of Department

This is to certify that we have read this thesis and that in our opinion it is fully adequate, in scope and quality, as a thesis for the degree of Master of Science.

Assoc. Prof. Dr. Mine IŐIKSAL BOSTAN

Supervisor

Examining Committee Members

Assoc. Prof. Dr. Yezdan BOZ (METU, SSME) _____

Assoc. Prof. Dr. Mine IŐIKSAL BOSTAN (METU, ELE) _____

Assist. Prof. Dr. Didem AKYÜZ (METU, ELE) _____

I hereby declare that all the information in this document has been obtained and presented in accordance with the 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 - Surname: Ayşe Damla GEÇİM

Signature:

ABSTRACT

THE EFFECT OF CREATIVE DRAMA BASED INSTRUCTION ON SEVENTH GRADE STUDENTS' MATHEMATICS ACHIEVEMENT IN PROBABILITY CONCEPT AND THEIR ATTITUDES TOWARD MATHEMATICS

Geçim, Ayşe Damla

M.S., Department of Elementary Education

Supervisor: Assoc. Prof. Dr. Mine IŞIKSAL BOSTAN

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The aim of the study is to investigate the effect of creative drama- based instruction on 7th grade students' achievement in probability concept and their attitude toward mathematics. Another purpose of the study is to investigate the gender differences regarding mathematics achievement and attitude. The study was conducted with two 7th grade classes from a public school in the 2010-2011 academic year, lasting 17 lesson hours (six weeks). Twenty-two of the participants received Creative Drama Based Instruction (CDBI), and twenty-one received Regular Instruction (RI).

Experimental design was used in which two different learning environments; creative drama based instruction and regular instruction was compared. In order to measure students' mathematics achievement Probability Achievement Test (PAT) was used. The participants were given Mathematics Attitude Scale (MAS), in order to quantify the levels of attitude towards mathematics. These instruments were

implemented before and after the treatment as pre-test and post-test. Independent samples t-test was performed on gain scores of PAT and MAS. Moreover, two way ANOVA was performed to examine the data.

Two way ANOVA results yielded that there was a statistically significant difference between the mean scores of Experimental Group and Control Group in terms of achievement in favor of Experimental Group. Moreover, female students had significantly higher mathematics achievement scores than males. The results of mathematics attitude scale showed that the seventh grade students' attitudes towards mathematics were not significantly different with respect to teaching method. Also, it could be stated that gender difference regarding of mean attitude scores was not statistically significant.

Keywords: Probability, creative drama based instruction, regular instruction, mathematics achievement and attitude toward mathematics.

ÖZ

YARATICI DRAMA TEMELLİ ÖĞRETİMİN YEDİNCİ SINIF ÖĞRENCİLERİNİN OLASILIK KONUSUNDAKİ BAŞARILARINA VE MATEMATİĞE YÖNELİK TUTUMLARINA ETKİSİ

Geçim, Ayşe Damla

Yüksek Lisans, İlköğretim Fen ve Matematik Alanları Eğitimi Bölümü

Tez Yöneticisi: Doç. Dr. Mine IŞIKSAL BOSTAN

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Bu çalışmanın amacı yaratıcı drama temelli öğretimin, yedinci sınıf öğrencilerinin olasılık konusundaki başarılarına ve matematiğe yönelik tutumlarına etkisini araştırmaktır. Bu çalışmanın bir diğer amacı ise öğrencilerin matematik başarı ve tutumlarında cinsiyet farklılığını incelemektir. Çalışma bir devlet okulunda bulunan iki 7.sınıf üzerinde 2010–2011 öğretim yılında gerçekleştirilmiş, 17 ders saati (6 hafta) sürmüştür. Çalışmada 22 öğrenci Yaratıcı Drama Öğretimi (YDTO), 21 öğrenci ise Geleneksel Öğretim (GO) almışlardır.

Bu deneysel planda yaratıcı drama öğretimi ve geleneksel öğretim iki farklı öğrenim ortamında karşılaştırılmıştır. Öğrencilerin matematik başarılarını ölçmek için Olasılık Başarı Testi kullanılmıştır. Katılımcıların matematik dersine karşı tutumlarını belirlemek için Matematik Tutum Anketi uygulanmıştır. Bu test yaratıcı drama metotlarının uygulanmasından önce ve sonra ön-test ve son-test olarak uygulanmıştır. Olasılık Başarı Testi (OBT) ve Matematiğe Yönelik Tutum anketi (MTA) puanları üzerinde bağımsız örneklem t testi uygulanmıştır. Buna ek olarak verilerin analizi için iki yönlü varyans analizleri gerçekleştirilmiştir.

İki yönlü varyans analiz sonuçlarına göre, deney grubu ile kontrol grubu arasında oluşan anlamlı fark deney grubu lehinedir. Buna ek olarak kız öğrencilerin matematik başarı puanları anlamlı dercede erkek öğrencilerden daha yüksek çıkmıştır. Öğretim yöntemi bazında matematik tutum ölçeği sonuçlarına bakıldığında yedinci sınıf öğrencilerinin matematiğe karşı tutumlarında anlamlı bir fark görülmemiştir. Matematik tutum ölçeğine sonuçlarına dayanarak cinsiyet farkına bakıldığında anlamlı bir fark yoktur.

Anahtar Kelimeler: Olasılık, Yaratıcı Drama Temelli Öğretim, Geleneksel Öğretim, Matematik Başarısı, Matematiğe Yönelik Tutum

To My Mother, Father and Sister
Who have always shown their love and trust in me

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LIST OF ABBREVIATIONS

ABBREVIATIONS

ANOVA: Analysis of Variance

CDIB: Creative Drama Based Instruction

EG: Experimental Group

RI: Regular Instruction

CG: Control Group

df: Degree of freedom

f: Frequency

t: T value

PAT: Probability Achievement Test

MAS: Mathematics Attitude Scale

M: Mean

MoNE: Minister of National Education

NCTM: National Council of Teachers of Mathematics

N: Sample size

p: Significance level

SD: Standard deviation

CHAPTER 1

INTRODUCTION

Mathematics is the language that we use to explain many of our deepest thoughts and secrets about the world. The mathematical applications can be used as a way to get inside this dark world (Baykul, 1997). There are many areas in life where mathematics can be instrumental. Examples of mathematics can be seen in use daily with aspects of engineering, finance industry and other customer facing jobs. It plays a significant role in the lives of individuals and the world of society as a whole (McLeod, 1992).

As mathematics is so important, it needs to be augmented in education to equip students with skills necessary to achieve higher academic performance. The National Council of Teachers of Mathematics (NCTM, 2000) reinforced the importance of mathematics in Principles and Standards for School Mathematics (2000). Haladyna, Shaughnessy and Shaughnessy (1983) stated that there is a concern about poor academic performance in mathematics. The statistics about the percentage of students with poor performance in mathematics heightened this concern (Ma & Kishor, 1997; McLeod, 1992). NCTM identified that mathematics curriculum has particular impact on students' poor academic performance in mathematics and the council stated that mathematics curriculum should be improved and it should encourage students to realize the value of mathematics (NCTM, 2000). NCTM also mentioned the influence of mathematical teaching methods and their applications.

The discussions on mathematics curriculum, teaching methods and their application had an influence on Turkey's education system as well. The emphasis on the importance of mathematical teaching methods caused a new reform on Turkey's

mathematics program developed in 2004 especially in elementary mathematics program. The revised elementary mathematics program emphasizes students' individual differences by taking multiple learning styles into account and encourages them to be more active in the learning process (Ministry of National Education [MoNE], 2005, 2006). The reason for focusing on multiple learning styles is to motivate students and give them an opportunity for problem solving in a more creative way (Akkuş & Özdemir, 2006). It was also mentioned in the new elementary mathematics program that the student-centered instruction and increasing learner willingness are of great significance. In the program, as a way to promote student-centered instruction and to increase learner willingness, a method is emphasized by Ministry of National Education [MoNE]: *creative drama* (2005, 2006).

Creative drama is one of the teaching methods based on learning by doing, and it provides awareness, gives confidence and increases empathy (San, 1998). In comparison to the other methods, creative drama gives more opportunities to students to apply what they learn in real life (Duatepe, 2004). It improves attitudes by attracting students' attention with an exciting, motivating, and interesting learning environment that includes dramatic play, story enactment, imagination journeys, music, and dance (Üstündağ, 2003). According to San (1998), creative drama enables students to visualize a subject, a word, a concept or an idea by improvisation and role playing techniques with the help of their own experiences in playing processes. There is a need for mathematics learners to learn mathematics with the touch of real life concepts and creativity (Saab, 1987). From this perspective, it is believed that this study would give valuable information about the effects of creative drama-based instruction in mathematics education.

Even though creative drama is not a well known teaching method in mathematics, related literature shows that mathematics teaching based on the creative drama method has a positive effect on the mathematics achievement of elementary students. Some research studies are available on creative drama-based instructions related to geometry and the other visual concepts in mathematics. In fact, this might

be caused by the convenience of using creative drama on visual concepts (Debreli, 2011). However, none of these studies were about probability concepts. In comparison to other topics of mathematics, probability is one of the subjects which give more opportunities to students to apply their real life experiences to mathematical situations. Moreover, students have some difficulties in learning probability concepts which are generally based on interpreting the problems (Alkan, Boyacıoğlu, Erduran, 1996; Bulut, 1994; Bulut, Ekici and İşeri, 1999). Students are mostly not aware of the relationship between probability and real life situations. Therefore, applying creative drama-based instruction could help students realize the importance of using probability in real life situations. In addition, creative drama in mathematics can be an important approach to construct a deep understanding of probability concept by letting students discuss their reasoning (Şengül & Ekinözü, 2004), which is one of the objectives in curriculum.

Mathematics achievement is of great importance in the literature. On the other hand, attitude towards mathematics is also a prominent variable (Haladyna, Shaughnessy, & Shaughnessy, 1983). Literature review on attitude towards mathematics shows that it is one of number of factors that was significantly related to success in mathematics. Mathematics is usually not a favored lesson for the students. Because of students prejudice on mathematics, it is not easy to make them enjoy the mathematics. By using creative drama as a method of teaching mathematics, it is possible to increase the students' interest and make the mathematics an enjoyable lesson (Ruffell, Mason, & Allen, 1998). In other words, creative drama-based instruction could improve attitudes by motivating students and getting their attention towards mathematics (Üstündağ, 2003). Thus, the effect of creative drama-based instruction on attitude towards mathematics is another concern of the present study.

1.1 Purpose of the Study

The main purpose of this study is to investigate the effect of creative drama-based instruction on 7th grade students' achievement in probability concepts and attitude toward mathematics. Another purpose of the study is to investigate the gender differences regarding mathematics achievement and attitude.

1.2 Research Questions and Hypothesis

The following research questions are going to be investigated in this study and hypothesis are formulated as follows:

RQ1. Is there a significant mean difference in seventh grade students' mathematics achievement in probability regarding gender and teaching method?

Sub-Question 1: Is there a significant influence of gender-teaching method interaction on seventh grade students' mathematics achievement in probability?

H_0 : There is no significant influence of gender-teaching method interaction on seventh grade students' mathematics achievement in probability.

Sub-Question 2: Is there a significant mean difference in male and female seventh grade students' mathematics achievement in probability?

H_0 : There is no significant mean difference in male and female seventh grade students' mathematics achievement in probability.

Sub-Question 3: Is there a significant mean difference in seventh grade students' mathematics achievement in probability, who are involved in creative drama-based instruction and regular instruction?

H_0 : There is no significant mean difference in seventh grade students' mathematics achievement in probability, who are involved in creative drama-based instruction and regular instruction.

RQ2. Is there a significant mean difference in seventh grade students' mathematics attitude regarding gender and teaching method?

Sub-Question 1: Is there a significant influence of gender-teaching method interaction on seventh grade students' mathematics attitude?

H₀: There is no significant influence of gender-teaching method interaction on seventh grade students' mathematics attitude.

Sub-Question 2: Is there a significant mean difference in male and female seventh grade students' mathematics attitude?

H₀: There is no significant mean difference in male and female seventh grade students' mathematics attitude.

Sub-Question 3: Is there a significant mean difference in seventh grade students' mathematics attitude, who are involved in creative drama-based instruction and regular instruction?

H₀: There is no significant mean difference in seventh grade students' mathematics attitude who are involved in creative drama-based instruction and regular instruction.

1.3 Definitions of Important Terms

Research questions and hypothesis were presented in the previous section. In order to clarify those research questions and hypothesis, operational and constitutive definitions of important terms of this study are stated below.

Creative drama refers to “an improvisational, nonexhibitional, process-centered form of drama in which participants are guided by a leader to imagine, enact and reflect upon human experiences” (O’Neill, 1995, p.24).

Creative drama-based instruction refers to “an experimental approach that involves the interaction of mind, sensory and daily life experiences and evaluation” (Adıgüzel, 2007, p.16). In this study, creative drama-based instruction refers to the experimental approach conducted to teach probability concepts given in 7th grade curriculum. Each instruction consists of three stages as Warm-up, Improvisation and Evaluation-Discussion.

Regular instruction refers to the use of standard applications and methods and tools in mathematics classes. In this study, regular instruction refers to the classroom routines where teacher use textbook to guide curriculum and ask questions about probability concepts.

Attitude towards Mathematics refers to “liking or disliking of mathematics in mathematical activities and what students feel about these” (McLeod, 1992, p.210). In this study, attitude towards mathematics was measured by the mean scores obtained from the Mathematics Attitude Scale developed by Aşkar (1986).

Mathematics Achievement refers to the mean of mathematics scores obtained from the Probability Achievement Test developed by the researcher.

1.4 Significance of the Study

Most of the researchers indicated that the teaching method which is used while teaching mathematics has a significant effect on learning mathematics (Threadgill, 1979; Yoon, 1993). Thus, improving students' mathematical understanding skills, developing interactive teaching methods, preparing a learning environment based on social interactions and giving students opportunities for practice are important (Kauchak & Eggen, 2003). In this respect, it seems necessary to implement instructional strategies that let students be more active.

There is a dominant belief that mathematics learning can occur in an individual process, in which every student finds their solutions and studies on the topic individually (Chaviaris, 2006). On the other hand, the new education system in Turkey supports the social interactions in the classroom and encourages teachers to direct students for group working (MoNE, 2005, 2006). This study could offer an answer for appropriateness of group working by using creative drama-based instruction in mathematics.

Creative drama-based instruction is based on student centered approach. Thus, this study could also offer an alternative method and its appropriateness that is linked to the constructivism. Based on active participation, creative drama-based instruction provides students a chance not only to share what they learn, but also opportunities to realize their ability to think, create, and imagine about their past experiences (Adiguzel, 2006). Additionally, creative drama-based instruction has some benefits on students' awareness of their self and the others, and developing their communication and social skills. Literature supports the effect of creative drama-based instruction in social skills and offers teachers a method to develop students' social skills (Başkaya, 2000). Therefore, it is believed that this study offers creative drama-based instruction to develop students' social skills in learning process.

Probability is a part of mathematics curriculum for primary and middle school classes in many countries as in Turkey. The usefulness of probability for daily life and its role in other disciplines have been repeatedly highlighted over the past 20 years (Vere-Jones, 1995). Although it is essentially useful in daily life, probability is one of the most difficult but also challenging subjects in school mathematics. Students have lower grades in 'Probability' than the other subjects of mathematics (Bulut, 1994). In order to enhance students' success some methods like computer based instruction was suggested. However, literature review showed that the methods on teaching probability with different methods are limited (Alkan, Boyacıoğlu, Erduran, 1996; Bulut, 1994; Bulut, Ekici and İşeri, 1999). Therefore, this study offers creative drama as an alternative method on teaching probability with the help of social interactions that can be very helpful in engaging student in learning process actively.

Based on its association with mathematics achievement, attitude became an important issue in mathematics learning. Attitude is often measured in educational research since positive attitude is desirable. Although research studies related to creative drama and mathematics are scarce (Kariuki & Humphrey, 2006), most of

them emphasize the positive effect of creative drama in mathematics attitude in general. Therefore, it is believed that this study will contribute to the literature related to the effect of creative drama-based instruction on students' achievement in probability concepts and attitude towards mathematics. Moreover, it is believed that this study will be instrumental for teachers and educators to use creative drama in mathematics classes through the offered lesson plans.

1.5 Assumptions and Limitations of the Study

For the current study, it was assumed that the subjects responded to the items of the tests honestly and students impartially reflected their opinions. Furthermore, it was assumed that all tests were administered under the same standard conditions and the subjects were able to understand the test items correctly.

In this study, convenient sampling is used. Data were collected from the elementary school in Gazi district, Ankara. Due to convenient sampling, the generalization of the results of the study would be limited.

Moreover, the researcher implemented the creative drama-based instruction to experimental group and regular mathematics teacher implemented the regular instruction to control group. The presence of the researcher instead of the class teacher may have influenced students' mood and attitude.

CHAPTER 2

LITERATURE REVIEW

The main purpose of this study is to investigate the effect of creative drama-based instruction on 7th grade students' mathematics achievement related to probability and their attitude toward mathematics. Another purpose of the study is to investigate the gender differences regarding mathematics achievement and attitude toward mathematics. The review of literature on creative drama will be presented under two sections: phases of creative drama-based instructions and creative drama techniques. Also, related literature about creative drama in education, research studies on creative drama-based instruction and in mathematics education will be stated. Lastly, literature related to teaching and learning probability, research studies related to attitudes towards mathematics and gender differences in mathematics achievement and attitude will be mentioned

2.1 Creative Drama

Creative drama defines as “an improvisational, nonexhibitional, process-centered form of drama in which participants are guided by a leader to imagine, enact and reflect upon human experiences” (O’Neill, 1995, p.24). Creative drama can also be described as a process inspired from human experiences (Heing, 1988) and as an activity that can be used to improve personal development because when people are posed with some dramatic moments in real life, they should find a way to solve the problem. Posing a dramatic moment and trying to solve it makes people force themselves to be more creative and active. The purpose of creative drama is to foster personality growth and enable learning of the participants rather than to train actors for the theatre performance. State differently, creative drama does not have a target of artistic aspect. However, the process of creative drama sustains

artistic value (Levent, 1999). Besides, as cited by Kelner (1993), drama-based instruction does not need theatrical skill. The ‘art’ part of drama is not necessary and is not the goal of the aim of creative drama-based instruction.

Contrary to common belief, creative drama is not an audience-centered art like theatre. Some of the techniques can be used in both creative drama and theatre. However one of the most important difference between theatre and creative drama is that, creative drama focuses on the process of dramatic moments and the process, not an audience (Heinig, 1988). Another difference between drama and theatre is that the theatre covers artistic aspects and due to that aspect it has written text and all process is dependent on these texts. On the other hand the process in creative drama is spontaneous and momentary performed. In other words, the aim of creative drama activities is not the performance because it is not audience-centered (Kelner, 1993). In addition, the success of the activity is not measured by someone who is authorized, but by participants who is active in the process (Adıgüzel, 2010).

By using the body language, creative drama has an important function at dramatizing the situations and getting participant’s interest. In creative drama process, a drama leader and a group of participants become together and carry out a study in a place. In drama-based learning environment creative drama leader guides the process and frequently take roles just as the other participants (Adıgüzel, 2010).

2.1.1 Phases of Creative Drama-Based Instruction

Creative drama-based instruction consists of three parts: introduction, development, and evaluation (Heining, 1988 cited in Duatepe, 2004). These parts were redefined by Adıgüzel (2010) with the help of creative drama-based experiences as Warm-up, Improvisation and Evaluation-Discussion. In the warm-up part, there are activities in which the participants try to adapt to new social conditions with the guidance of a group leader. These activities include games that refer to free activities and the development of such activities which are based on certain rules

(Adıgüzel, 2007). Improvisation part requires abandoning a defined subject or topic or moves to a targeted point in graded steps. In this process, main activities of the creative drama-based instruction, namely role playing and improvisation are used according to objectives. Dramatic moments are necessary in dramatic structure. Dramatic moments which refer to a tension between opposing forces are the main elements of creative drama-based instruction (Adıgüzel, 2006; Andersen, 2000). In improvisation part, nobody knows how the process will end. While conducting improvisation part there should be a struggle or tension in the dramatic moment process (Andersen, 2000).

Lastly, the evaluation-discussion part refers to creating a discussion after each phase or some phases, receiving some feedback and getting answers from the participants to such questions as “What have you experienced?” and “How did you feel?” The evaluation phase is important to see whether the objectives were achieved or not during the learning process (Adıgüzel, 2010).

2.1.2 Creative Drama Techniques

There are many techniques which can be employed in creative drama. Improvisation and role playing are the basic and the most important techniques which should take place in creative drama-based instruction (Heining, 1988 cited in Duatepe, 2004)

Improvisation is a technique in which students pretend as if they are someone/something else and/or something is happening. Improvisation is an essential technique to use in the classroom as it prompts the learners to be active and creative participants under tension in different situations, thereby, reducing their self consciousness (Heining, 1988 cited in Duatepe, 2004). At the beginning students could be shy to participate in the activities, but after a few sessions with the aid of the group leader, they will become more enthusiastic and there will be an improvement in participation and their confidence level (Andersen, 2000).

Improvisation provides learners with opportunities not only to increase their mathematics achievement, but also to improve their confidence which will ultimately lead to the development of positive concepts (Duartepe, 2004).

Role play is another technique to explore the issues involved in complex social situations (Blatner, 2002). Role play affords participants to build on their prior experiences and to translate their roles into characters in the role play design. In this way, according to Wrentschur and Altman (2002), the participants are able to adopt roles that are new to them, and to try what it feels like to be on the other side even if they don't feel or think like the other side. To imagine oneself in another's position is an essential element in creative drama.

There are also other techniques that can be used in the process according to the objectives of the lesson. Some of these techniques are Still Image, Teacher in Role, Letters, Space Between, Conscience Alley, Split Screen, Gossip Circle, Forum Theatre, Moment of Photo, Moment of Truth, Flash Back, Inner Voice, Small Group Improvisation, Dramatization, Private Property, Writing in Role, Role cards, Hot Sitting, Interviews and Interrogations, Pantomime, Telephone Conversations, Holding a Meeting and Whole Group Improvisation (Boal, 2010; Ozturk, 2007; Somer, 1994). Techniques used in the creative drama-based lesson plans of this study were Dramatization, Still Image, Teacher in Role, Moment of Photo, Writing in Role, Role Cards, and Whole Group Improvisation. Basic characteristics of these techniques are given below.

Dramatization is representation of ideas or be a particular way of case study, given that dramatization of a problem for students is equivalent to presenting them a human relations case. From an educational point of view, dramatization can be defined as a method to develop skills through the performance of activities in situations that simulate real life. It is possible to dramatize a job interview, a moment of a birth, a product sale or an exhibition (Adıgüzel, 2006).

Still Image technique is used for the group to emphasize a moment or an idea for which students construct an image using their body language (Swartz, 2002). These images may be in the form of a photograph or a sculpture. This method can be used in every phase of creative drama-based instruction. Another technique that can be also used in every phase is Teacher in Role technique. Teacher takes on the role(s) of character(s) within a drama. This technique encourages the students to become engaged in the activities of the drama. If the teacher is actively engaged in her/his role, it makes it easier for the students to motivate (Swartz, 2002). Teacher can organize the scenario or direct the dramatic moments by being a member of the group and this organization helps concentrate on their own roles. This method is especially used during the improvisation phase.

Moment of Photo technique is sequences of still images that can describe important moments within a drama, piece of literature, an event in history and so forth (Öztürk, 2007). This method is mostly used in improvisation and evaluation phase (Öztürk, 2007). Writing in Role is another technique of creative drama-based instruction that represents activities such as writing a letter, diary or report in role (Adıguzel, 2010) Role Cards technique includes information about some characters that have conversation about an event or situation. This event or situation mostly presents a dramatic moment which starts with or ends with tension (Neelands, 1991). The students are expected to think on how that conversation can continue and start improvisation. This technique is also used in improvisation phase. Whole Group Improvisation is another technique in which groups of four or five people work to create interesting scenarios, and they improvise the characters they created (Neelands, 1991).

Techniques that explained in this section were based on the objectives of the lessons used during the treatment. On the other hand, Gossip Circle, Forum Theatre, Moment of Truth, Flash Back, Inner Voice, Small Group Improvisation, Private Property, Role cards, Hot Sitting, Interviews and Interrogations, Pantomime, Telephone Conversations, Holding a Meeting are some of the techniques that can be

used according to the specified objectives of the related lesson (Boal, 2010; Ozturk, 2007; Somer, 1994).

2.2 Creative Drama in Education

Creative drama-based instruction is an educational method which focuses on the process of learning instead of learning outcomes (San, 1998). As to creative drama in education, it has dramatic moments in which teachers expect an achievement from students to solve a problem (Andersen, 2000). Creative drama in education is mostly used in kindergartens and primary schools but the positive impact of creative drama is realized by educational researchers and creative drama methods are started to be used in elementary and secondary schools as well (Bailin, 1998). It is mainly based on students' prior experiences, and it involves social skills and communication. It provides an environment in which students can communicate with the help of their experiences and build the interpretations about a particular subject. Using personal experiences and communicating with each other make students understand and be aware of each other. This method lets students put themselves into others' shoes (Simon, 1995), and they are encouraged to communicate and interact with each other (Simon, 1995).

There is a mission in creative drama that creates a tension and students are expected to resolve this tension in given time. The pressure after this tension that expected to resolve creates an environment which forces students to be more creative (Booth, 1985). This learning environment includes problems that need to be solved without any fear of punishment.

Critical challenges in creative drama which make students create encourage students' personal development (Bailin, 1998). Furthermore, creative drama-based instruction has a positive effect on students' attitude and achievement toward related lessons by getting students' attention with an interesting and enjoyable learning environment and encouraging them to learn (Baker, 1996, McCaslin, 2006;

Üstündağ, 2003). For these reasons, creative drama became an alternative method of teaching which is highlighted especially in the new elementary programs in Turkey (Ministry of National Education [MNE], 2005, 2006).

As to teacher roles in creative drama-based instruction, teachers are not the ones who teach a subject to the students but are leaders who communicate with the students and give instructions (Andersen, 2000). Teachers can sometimes be one of the group member in the process at teacher in role technique and give immediate feedback if it is necessary. Observing and communicating are the main roles of teachers in creative drama-based instruction (Heing, 1988). In addition, creative drama-based instruction creates an environment in which students can comprehend and personalize another person's thinking and feelings by taking role in the process (Karaçil, 2009). Furthermore, students can have a opportunity of taking risk without limiting themselves in their learning by means of their prior experiences (Farris & Parke, 1993). Creative drama-based learning environment provides students focused learning process rather than teacher directed environment.

2.3 Research Studies on Creative Drama-Based Instruction

Most of the research on creative drama emphasizes the effect of drama on communication and socialization skills. To reveal the effects on communication, Flennoy (1992) conducted a study on the effect of drama on communication skills with the first grade students. He used an experimental design and found a significant effect of drama-based instruction on communication skills.

To investigate the effects of creative drama on socialization skills, on the other hand, Porteous (2003) conducted a study on self awareness perceived by people aged between 16 and 21. She concluded that drama had a very remarkable role on students' personal development and mentioned that creative drama was very helpful to understand their self. Correspondingly, Akin (1993) studied the effects of drama on third graders' socialization. She used an experimental design and she found an

increase on the socialization level of the experimental group thanks to creative drama. Yassa (1999) studied the effect of drama in social interactions of high school students. The findings of the study revealed that drama-based instruction also improved self confidence. These studies have proved creative drama's substantial role on socialization.

There are also other studies focusing on the attitude towards creative drama-based instruction. For instance, Okvuran (1993) conducted a study to investigate the attitudes of individuals who trained on creative drama. In this research study, creative drama attitude scale was used. Sample of the research was consisted of 240 adults who had taken creative drama education. The results of the study showed that training time on drama education increased positive attitudes toward creative drama.

Another positive aspect of creative drama is that it can be used in different disciplines. For instance, Selvi and Öztürk (2000) studied the effects of creative drama-based instruction on fifth grade attitudes toward science. The results indicated that the students' achievement in science improved by the help of creative drama-based instruction. The results of the experimental group were significantly better in achievement test compared to the regular instruction. In another study, Koç (1999) studied with fourth grade students to discover the effect of creative drama on social sciences achievement. According to the findings, a significant change was found between the means of achievement scores of drama-based instruction compared to the regular instruction.

Drama-based instruction also has a very clear and actual effect on language learning. Gönen and Dalkılıç (1998) studied the drama-based instruction with the students of five-seven years old. They used experimental design and found a significant effect on treatment group about the effect of drama-based instruction in children's language learning. Additionally De La Cruz (1995) investigated the effects of drama in language learning of students with learning disabilities. He used an experimental design and found that the experimental group enjoyed the experience of

learning with drama, additionally they improved in communication. Previous researches revealed that creative drama-based instruction has positive effect on learning foreign language. For instance, Ay (1997) studied on drama-based instruction and its effectiveness on learning foreign language. In this study, she discussed how drama-based lesson plans can be apply in teaching foreign language effectively and suggested to use lesson plans in language learning. In another study, Aynal (1989) compared the drama-based instruction with lecturing on third grade students' learning on English vocabulary. He revealed that drama-based instruction has a significant positive effect on students' achievement.

In the literature, there are studies related to the effect of techniques that can be used in creative drama. For instance a study conducted to investigate an effect of dramatization method on social studies lessons, it is mentioned that dramatization is an effective technique in social studies (Sever, Yalçinkaya, Mazman, 2009). The researchers suggested using dramatization more active in social studies and other disciplines in dramatization.

Apart from the effect of creative drama and its relationship with other disciplines, creative drama-based instruction is also effective on mathematics. Studies related to creative drama in mathematics is the main concern of this study and the research studies on this concern will be mentioned in the next section.

2.4 Research Studies on Creative Drama in Mathematics Education

There are very few studies focused on the use of creative drama-based instruction on mathematics education. A lack of researchers who were qualified both mathematics education and creative drama-based instruction may be a reason for this. Saab (1987) compared the effects of drama-based mathematics instruction with the effects of textbook-oriented mathematics education. There were 87 sixth graders in his study in which the control group received a textbook-oriented mathematic

education. Saab (1987) described a pre-test-post-test experimental design and found a significant increase on post-test in the experimental group which received drama-based mathematics instruction.

In another research, Omniewski (1999) conducted a study to emphasize the effectiveness of arts infusion approach integrated with creative drama-based learning on mathematics achievement of students at seven grades compared to traditional textbook approach. They used randomized pretest-posttest control group design and found no significant difference between the scores of the groups.

By using creative drama method while teaching mathematics, it is possible to take the student's attention. Özsoy (2003) tried to destroy prejudice of learning mathematics by using different teaching methods and make the mathematics an enjoyable lecture. The aim of her study is to investigate the effect of creative drama method on teaching of right prisms to 8th grade students. Results revealed that experimental group that received creative drama method in terms of learning right prisms got significantly better scores on achievement tests related to the topic taught. There is also another study by Günhan and Özen (2010) that has an aim of determining the students' views as to the fact that drama method be used in teaching geometry and also to establish their viewpoints concerning this method and its effect on their self-efficacy towards geometry on 20 sixth grade students. It was found that there was no meaningful difference in favor of using drama method in mathematics teaching. On the other hand it was seen from the investigation that the students said that the creative method was entertaining and useful.

As geometry is a visual field of study, creative drama can be used while teaching geometry. Duatepe (2004) studied the effects of drama-based instruction on geometry learning. She examined the effects of creative drama methods on seventh grade students' geometry achievement. The sample was 102 seventh grade students in a public primary school. To gather data she used five instruments; two achievement tests (one on angles and polygons, and the other on circle and cylinder),

van Hiele Geometric thinking level test, mathematics attitude scale, and geometry attitude scale. She used an experimental design and found a significant effect of drama-based instruction on experimental groups' geometry achievement, retention of achievement, van Hiele geometry thinking levels and attitude towards mathematics and geometry.

In a more recent research, Debreli (2011) studied the effects of creative drama-based instruction on seventh grade students' achievement in ratio and proportion concepts and their attitudes towards mathematics. She used an experimental design and found a statistically significant mean difference between the students who received creative drama-based instruction and regular instruction in terms of achievement in ratio and proportion concepts and in terms of scores of attitudes toward mathematics, in favor of creative drama-based instruction.

The use of creative drama while teaching the subject of probability is not a prevalent method. In other words, there is very limited literature on creative drama related to probability. In Turkey, Şengül and Ekinözü (2004) conducted a study on the investigation of using dramatization technique to teach "Permutation and Probability" taking students' achievements and memory levels into consideration. They studied with 8th grade students and only focused on dramatization technique (Şengül & Ekinözü, 2004). They used randomized pretest-posttest control group design and didn't find statistically significant mean difference between the students received dramatization technique and regular teaching in terms of learning mathematics and attitude toward mathematics.

To sum up, in spite of the benefits of creative drama-based instruction in the mathematics, number of studies conducted with mathematical topics was very scarce both in Turkey and abroad.

2.5 Teaching and Learning Probability

Learning probability is very important and useful both inside and outside the school. Probability gives an opportunity to students to combine theory with practice. If educators take full advantage of this opportunity, probability can be students' favorite topic in mathematics. But related literature shows that it is not even among the top ten favorite topics of students in mathematics (NCTM, 2000) due to the challenges in its teaching and learning.

According to Bulut (1994), one of the challenges is the negative attitudes of teachers, which affect the learning of the subject 'probability'. Although probability includes daily life experiences and concrete examples, it is difficult to understand because students are mostly forced to memorize the formulas, not to understand the logical reasons. Students do not understand the questions clearly and they have negative attitude toward probability, but in fact, probability can be learned by an average person without encountering a lot of complicated formulas (Bulut, 1994). There are some formulas which can be applied while solving a probability question, but logical thinking might be more useful and permanent. Thus, learning probability can actually be fun (Fouch, 1975).

As stated by Fischbein and Gazit (1984), one major characteristics of the subject 'probability' is 'intuition'. Intuition in probability means making predictions to answer probability questions. People usually make predictions on probability examples in daily life and students also do this. Teachers should encourage their students when they have probabilistic intuition. Even if they make wrong intuitions, they can learn where their mistakes. Apart from Fischbein and Gazit (1984), Carpenter and his colleagues (1981) also say that students have intuitions on probability but they have difficulty in interpreting probability even after instruction, which constitutes another challenge for both students and teachers (Carpenter, Corbitt, Kepner, Lindquist, Reys, 1981).

Despite the challenges, there are different methods that can be used while teaching probability as suggested by several studies. For instance, Gürbüz (2006) conducted a study on teaching probability with the help of concept maps. He emphasized how a concept map can be prepared and how effective it is to use concept maps in probability learning. He found significant effects of using concept map in probability learning. Another study shaped by Memnun (2008) investigated the teaching Permutation and Probability topics by active learning and its effect on students' success at the application phase in the eighth grade (Memnun, 2008). She used experimental design and found significant effects on treatment group about the effect of active learning on students' success at the application phase in the eighth grade.

In the study of Bulut (1994), the effects of cooperative learning method, computer based instruction and regular teaching method on 43 eighth grade students' probability achievement and attitudes toward probability were investigated. Results of the study indicated that there was a significant mean difference between groups who received instruction through cooperative learning method and regular instruction with respect to probability achievement test scores in favor of cooperative learning group. However, there was no statistical significant difference between the computer based instruction group and regular teaching method and also no statistical significant difference between other pairs of groups with respect probability achievement test scores.

In this section some research studies which examined the different instructional methods on probability concept were explained. Most of the research studies stated that different instructional methods (concept maps, cooperative learning method, active learning, and computer based instruction) had a significant effective on students' probability achievement. The present study also gives importance to instruction of probability and suggests creative drama method as an alternative way of teaching.

2.6 Research Studies related to Attitudes towards Mathematics

According to the simple definition of attitude, it is clear what “a ‘positive’ or a ‘negative’ attitude is: a ‘positive’ attitude is a positive emotional aptitude toward the subject; a ‘negative’ attitude is a negative emotional aptitude toward the subject” (McLeod, 1992, p.210). According to Ma and Kishor (1997), attitude toward mathematics is related to liking, enjoying or disliking mathematics, tendency to engage in or avoid mathematical activity, feeling adequate or bad at mathematics.

There has been an attention towards the research studies analyzing the critical role of factors within the fields of education and educational psychology (McLeod, 1992; Pintrich, 2000). Educational psychologists have been concerned with understanding the nature of relationship between personal development and academic performance (Karaçil, 2009). Attitude towards mathematics is one of the important factors that are significantly related to achievement in mathematics. There is strong and consistent evidence that attitude towards mathematics and mathematical achievement is unavoidably linked. That is, the more positive attitude a student holds towards executing mathematical tasks, the better achievement they have (Haladyna, Shaughnessy, & Shaughnessy, 1983). However, it still cannot be said that positive attitude always causes high achievement in mathematics. The researchers who claimed that there was a significant relationship between attitude towards mathematics and achievement in mathematics believed that attitudes had a crucial role in both teaching and learning of mathematics. For instance in a study of Fennema and Sherman (1977) with secondary school students, it was found that those who viewed mathematics as more useful generally received higher grades in mathematics tests. As can be seen from the related literature, the researchers have not reached an agreement on the relationship between mathematics achievement and attitudes towards mathematics.

The studies related to attitude towards mathematics in Turkey have mainly focused on either relationship with mathematics achievements, gender differences on mathematics attitude or the influence of socioeconomic status etc. For instance, Yıldız and Turanlı (2010) investigated 700 private high school student and graduates' attitudes towards mathematics. Results revealed that general attitude of students towards mathematics were not negative. Moreover, students with positive attitude towards mathematics were relatively successful and more likely to prefer professions related to mathematics.

In this section, researches related to attitude towards mathematics and studies that try to investigate relationship between mathematics achievement and mathematics attitude were mentioned. It is stated that attitudes play an important role in learning mathematics.

2.7 Gender Differences in Mathematics Achievement and Attitude towards Mathematics

Another aim of this study was to investigate the differences between female and male students with regard to mathematics achievement and attitude towards mathematics. The importance of gender in learning mathematics is emphasized by many researchers as it is essential differences between males and females has been a major concern in many literatures (Fennema, 1974; Hyde, 2006; Isiksal & Çakiroğlu, 2008). Gender differences are marked in success patterns in mathematics. For this reason researchers have motivation in searching these differences.

Research findings on gender difference in mathematics achievement at the elementary yielded that there is no significant relationship between gender and mathematical ability (Cahan & Ganor, 1995; Fennema, 1974). On the other hand at secondary level, some studies have shown a significant gender difference favoring males (Cooper & Robinson, 1989). For example, Alkhateeb (2001) investigated differences in mathematics achievements of last grades in an elementary school with

respect to gender. Achievement test results were compared and no significant difference was detected between males and females mathematics achievement.

The difference between male and female students on problem solving skills was also one of the important research topics for researchers. The research of Hyde, Fennema, Ryan, Frost and Hopp (1990) indicates that while solving problems in mathematics female students are more competitive than male students and they are more interested in mathematics than male students do. It is also mentioned that teachers have difficulty in helping male students. The research of Hyde and his colleagues (1990) showed that there is a relationship between male students' failure and teachers' attitude while helping male students with mathematics achievement (Hyde et al., 1990).

There are many research studies indicating that females are more responsible on subjects that need retrieval from long-term memory (Halpern, Benbow, Geary, Gur, Hyde, & Gernsbacher, 2007) and as might be predicted, because of this advantage, girls outperformed in arithmetic in the early elementary school grades when "mathematics" include computation (Willingham & Cole, 1997). In another study mathematical ability tests show advantages for girls in the primary school when mathematics consists of computational knowledge and speed. After the early primary years, male students perform better on such topics as geometry which is taught in the higher secondary school grades (Hyde, Fennema, & Lamon, 1990). In addition, meta-analysis of Mullis, Martin, Fierros, Goldberg and Stemler (2000) found that males perform better than females on word problems in the high school, and college. For instance, according to Gallagher and De Lisi (1994), female students were more likely to solve conventional problems correctly using algorithmic strategies than male students.

As seen above, several studies have investigated the gender differences on attitude but there is still no consistent findings on the differences of attitudes towards mathematics and achievement in mathematics with respect to gender due to lack of

theoretical framework (Fennema & Sherman, 1977). In a meta-analysis of studies on gender comparisons of mathematics attitudes and affect, Hyde et al (1990) found that female students' negative attitudes are more than male students. However, there were some studies reporting weak influence of gender on attitude towards mathematics (Ma & Kishor, 1997). For instance, in their meta-analysis of Ma and Kishor (1997) reflected that gender was not a statistically significant difference on the relationship between attitudes toward mathematics and achievement in mathematics.

As can be seen for the literature, there were lots of studies conducted to investigate the influence of gender on mathematics achievement. However, the findings are inconsistent. Therefore, the influence of gender regard to mathematics achievement and attitude is a concern of this study.

2.8 Summary

Review of literature demonstrates that probability is a critical topic for mathematics curriculum. That is this topic is a step for being successful in mathematics (NCTM, 2000; Van de Walle, 2004). Probability gives opportunity to students to combine theory with practice. However, as stated at the beginning of the chapter, there is limited literature on the teaching and learning of probability. Moreover, there is a limited number of teaching methods in the literature that could be used while teaching and learning probability.

The current study puts forward that as a new instructional method, creative drama could be used in mathematics education (Debreli, 2011; Günhan and Özen, 2010; Omniewski, 1999 ; Özsoy, 2003 Saab, 1987; Omniewski, 1999 ; Özsoy, 2003; Sozer, 2006) and specifically while teaching probability (Şengül and Ekinözü, 2004). Although there are few studies about the use of creative drama in mathematics education in abroad (Saab, 1987; Omniewski, 1999), the studies done so far show that teaching mathematics based on creative drama activities has a positive effect on the mathematics achievement of elementary students and on their attitude toward

mathematics. Thus, the present study was aim to investigate the effect of creative drama-based instruction on seventh grade students' achievement in probability concepts and on their attitudes toward mathematics in Turkey. As can be seen from literature some researchers believed that students who had positive feelings towards mathematics were tend to learn mathematics and spent more time and energy in doing mathematics (Fennema and Sherman, 1977) It is highlighted in this study that attitudes play an important role in learning mathematics.

Moreover, most of the studies revealed that male students held more positive views about mathematics than females and males mostly perceived themselves as being more accurate at mathematics than the girls (Mullis, Martin, Fierros, Goldberg and Stemler; 2000). There exist very few studies on gender differences in creative drama-based instruction both in Turkey and abroad (Önder, 2006). Therefore, the present study has an aim of investigating the gender differences in creative drama-based instruction.

CHAPTER 3

METHODOLOGY

The purpose of this study is to investigate the effect of creative drama-based instruction on 7th grade students' mathematics achievement in probability concepts and attitude towards mathematics. Another purpose of the study is to investigate the gender differences regarding mathematics achievement and attitude. The aim of this chapter is to provide information about the research design, population and sample, data collection instruments, reliability and validity of the study, data collection procedure, analysis of data and lastly, the internal and external validity issues.

3.1 Design of the Study

The Static-Group Pretest-Posttest design was employed in this experimental research study since the study do not include the use of random assignment of participants. There were two already existing groups in the study, namely, experimental and control group.

Table 3.1 The Static-Group Pretest-Posttest design

Group	Pretest	Treatment	Posttest
Experimental Group	Pretest of PAT Pretest of MAS	Creative Drama Method	Posttest of PAT Posttest of MAS
Control Group	Pretest of PAT Pretest of MAS	Regular Instruction	Posttest of PAT Posttest of MAS

The data collection instruments as given in Table 3.1 are: PAT-Probability Achievement Test (PAT) and MAS-Mathematics Attitude Scale (MAS). PAT and MAS were administered before treatment to determine the achievement levels in proportional reasoning of both groups at the beginning.

Both PAT and MAS were re-administered after treatment to examine the difference in seventh grade students' mathematics achievement and attitude toward mathematics in probability concepts. Creative drama-based instruction for experimental group and regular instruction for control group lasted for 6 weeks and 4 class hours per week.

Descriptive statistics of PAT and MAS scores with respect to gender and teaching method was conducted. In order to test the research hypothesis, t-test and two-way ANOVA procedures were performed. Table 3.2 summarizes the design of the study:

Table 3.2 Design of the Study

1. Research Design	The Static-Group Pretest-Posttest design
2. Sampling	Convenient sampling
3. Instrument	Probability Achievement Test(PAT) Mathematics Attitudes Scale (MAS)
4. Data Analysis Procedure	Descriptive Statistics , Two-way ANOVA and t-test

3.2 Population and Sample of Study

There are 335 public schools in Ankara (MoNE, 2010) and all 7th grade public school students in Ankara were identified as the target population. The accessible population to which the results of the study will be generalized is all

seven grade public school students in Gazi district, Ankara. The sample is chosen from the accessible population with convenience sampling. In other words, sample of the study is 7th grade public school students in Gazi district, Ankara. This school was selected because of the fact that it is accessible and transportation is convenient. In this school, the students were randomly assigned to classes at the beginning of the semester by school administrators. So, the classes were assumed to be heterogeneous. Table 3.3 shows the descriptive statistics of the students who participated in the study.

Table 3.3 Frequency of participants in experimental and control group regarding gender and group distributions of the sample

	Female	Male	Total
Experimental Group	10	11	21(48.8%)
Control group	11	11	22(51.2%)
Total	21(48.8%)	22(51.2%)	43(100%)

As it can be seen in Table 3.3, 21 (48.8 %) students were in the experimental group and 22 (51.2 %) were in the control group. Moreover, in terms of gender, 21 (48.8 %) female and 22 (51.2 %) male students participated in this study. In other words, the number of female and male students and the number of participants in the control and the experimental group was almost equal.

3.3 Data Collection Instruments

In order to collect data, Probability Achievement Test (PAT) and Mathematics Attitude Scale (MAS) were used. The details regarding PAT and MAS are given below.

3.3.1 Probability Achievement Test (PAT)

Probability Achievement Test (PAT) was prepared to measure students' mathematics achievement regarding probability concepts. This test which is applied to the students before and after the treatment as pretest and posttest was developed by the researcher. There were 9 open ended questions in PAT and to evaluate students' responses to each question in PAT, six-point rubric was used. Thus, the minimum and maximum possible scores from the test are 0 and 54 points, respectively. The 2th and 8th questions in PAT have 2 sub items and the 1th, 5th, 7th, 9th questions have 3 sub items. All the questions were developed based on the objectives related to permutation and probability in the 7th grade mathematics curriculum of Ministry of National Education. Table of specifications for PAT, which is presented in Table 3.4, was prepared including the objectives. All the items in the test were given in Appendix A.

Table 3.4 Table of specification of PAT

Objectives	Find factorial of natural numbers	Explain the concept of permutation and calculate permutation	Determine the terms joint and discrete events experiment and sample space	Determine joint and discrete events	Calculate the probability of joint and discrete events	Calculate the probability of one case by using geometry.
Content						
Factorial	Q1	Q2,Q3,Q4				
Permutation	Q2,Q3, Q4	Q2,Q3,Q4				
Discrete and joint cases in Probability			Q5,Q6	Q5,Q6	Q7,Q8	
Relationship between probability and geometry						Q9

3.3.1.1

3.3.1.2 Pilot Study of PAT

One of the purposes of conducting the pilot study was to verify the clarity of questions and determine the validity and reliability of the test and revise test questions according to students' responses. A pilot study for this instrument was applied to 52 seventh grade students chosen from a different public school located in Gazi district, Ankara. There were 10 questions in the pilot study. The time given to complete the initial version of PAT was 30 minutes. However, this time limit was not enough for students to complete the test. The students needed 10 more minutes, so in

the main study, 40 minutes were given to the students. Besides, some questions were changed according to students' responses. For instance, in the 1st question, students were asked to answer the question based on factorial. There was no instruction at the beginning of the question that it should be solved using factorial. After the pilot study, "Solve this question by using factorial" instruction was added. Also, the picture which was at the end of the question was deleted because it was confusing. In the third question, students were asked to find the probability of sitting on 5 empty chairs after the music stopped. The rules were not explained to the students during the pilot study, and it was observed that the students had difficulty playing the game. Therefore, in the main study, the game was explained in the question based on students' feedback in the pilot study. Moreover, in the 9th question, the students were asked to find the probability of the plane landing on one of the squares which had different colors such as red and orange. Yet, after the pilot study the question was changed and the ratio of landing on red and orange spaces was asked.

3.3.1.3 Reliability and Validity of PAT

It is important to use valid instruments because by using valid instruments, the researcher can reach valid conclusions and inferences (Fraenkel & Wallen, 2006). The content related validity of the instrument was established by three mathematics educators by using the table of specification.

Additionally, the reliability estimate scores on pre and post implementation of PAT were found with Kuder-Richardson 21 as 0.87 and 0.98, respectively. Fraenkel and Wallen (2006) explained that reliability values which are above .70 can be accepted as relatively high in social sciences. Thus, it can be said that PAT is a reliable instrument (Appendix B).

3.3.2 Mathematics Attitude Scale (MAS)

Mathematics attitude can be defined as liking mathematics, enjoying studying mathematics or confidence in ability to use mathematics. In this study, attitudes toward mathematics were measured by a 20-item Likert questionnaire developed by Aşkar (1986).

Table 3.5 Sample Items from MAS

Dimension	Sample Item
Level of attitudes towards mathematics	I get bored in mathematics courses.
	I get very nervous while solving mathematics questions.

Each of the items uses a 5-point scale (strongly agree=5, slightly agree=4, slightly disagree=3, disagree=2, strongly disagree=1). The scores were added across items to form a possible total score ranging from 31(low attitude) to 95 (high attitude) in MAS results. The MAS had three dimensions. 1st, 3th, 4th, 8th, 11th, 14th, 17th, 18th items were about enjoyment of mathematics (EMAT), 7th, 9th, 10th, 13th, 19th, 20th items were about instrumental motivation of learning mathematics (IMMAT) and 2th, 5th, 6th, 9th, 12th, 15th, 16th items were about mathematics anxiety (AMAT). Also, the alpha reliability coefficient of the MAS with 13 items was reported as 0.88. All the items in the scale were given in Appendix C.

3.4 Data Collection Procedure

As stated earlier, in accordance with the purposes of the current study, PAT and MAS were administered to 43 seventh grade students from an elementary school in Gazi district. The questionnaires were administered at the beginning of spring semester of 2010-2011 academic years.

First of all, official permission was taken from Middle East Technical University Human Subjects Ethics Committee, the school administration and the national education authority of Ankara. Permissions were given in Appendix E. After all the official approvals were obtained, the researcher made interview with the head of the school where the research was conducted for administration of instruments. The researcher also made interview with the mathematics teacher to determine the lesson hours and the dates of the data collection and implementation of creative drama-based instruction

Table 3.6 Data Collection Procedure

Week	Date	Content of the implementation
1st	18 February	Pretests of PAT and MAS
2nd	21-25 February	Factorial and permutation
3rd	28 February- 4 March	Probability of joint and discrete cases
4th-5th	7-18 March	Analyzing Probability cases by using geometry
6th	22 March	Posttests of PAT and MAS

PAT and MAS were implemented before and after the application of creative drama-based instruction to the experimental and control group. The time schedule for data collection procedure was planned with the consultant of the researcher, school administrators and mathematics teacher as presented. The details of data collection is given in Table 3.6, Students were given 40 minutes for PAT and 10 minutes for MAS. Implementation of creative drama-based instruction continued for six weeks with four class hours each week. Lessons in CG were also observed by the researcher.

3.5 Treatment

While the experimental group learned permutation and probability topics with creative drama-based instruction, the control group learned these topics with regular instruction. The comparison of treatments in terms of classroom arrangement, instructor and student role, instruments, and interaction between students is given below.

Table 3.7 The Comparison of the Learning Environments

Category	Experimental Group	Control Group
Classroom Arrangement	Creative drama study conditions which provide more empty space	Regular classroom arrangement
Instructor Role	Researcher selected tasks related to objectives. Different creative drama techniques were used to achieve the objectives of the lesson.	Lesson process was based on selected topics related to the objectives. Teacher was responsible to give mathematical information about factorial, permutation and probability subjects to the students.
Students Role	Students experience and live ideas embellished with the subject in role playing.	Students take notes from the blackboard, and solve the questions that the teacher asks them.
Instruments	Instruments were implemented and collected by the researcher.	Instruments were constructed and collected by the researcher.
Interaction Between Students	Mostly group work	Individual work

3.5.1

3.5.2 Treatment in the Experimental Group

The experimental group (EG) explored permutation and probability topics of seventh grade curriculum by creative drama instruction. Experimental group was taught by the researcher. Treatment took eighteen class hours and it was completed in six weeks. All lessons of EG were applied on the ground floor of the school which is designed for social activities. This place was suitable for creative drama study conditions and provided more empty space for students to move around easily. Creative drama instruction consisted of three stages in each lesson as explained in literature chapter; (i) warm-up activities, (ii) improvisation, and (iii) evaluation-discussion. Table 3.8 presents a sample lesson plan used in EG. One class hour was 40 minutes.

Table 3.8 A general lesson plan for Experimental Group

Lesson Plan	Student Activity	Teacher Activity
(i) Warm-up activities: 20 minutes	Introduces with Creative drama-based instruction	Gives students directions about the games and activities.
	Gets used to the subject of the lesson.	Guides students when necessary
	Gets ready to be involved in improvisation process	
(ii) Improvisation: 40 minutes	Be aware of the main concept of the lesson	The researcher participates in the activities by taking some roles
	Improvises and role playing.	Gives some directions to the students
		Encourages students to communicate and share their feelings and ideas
(iii) Evaluation-discussion: 20 minutes	Reviews what they have learned either by answering or solving the questions	Emphasizes the main points of the lesson
	Takes notes or writes poems, letters about what they feel gets opportunity to share their feelings, and ideas.	

The warm-up activities aimed to give students some hidden clues about the rest of the lesson. These activities help students adapt to the process and get ready to be involved in make believe plays. Through warm-up activities students also have fun and get relaxed.

In the improvisation period, students generally work in groups of 4 to 6. They sometimes work individually or as a whole class. Students are introduced with the make believe plays, which requires them to pretend as someone else. Make-believe play forms, dramatic moments and role playing lead the process of this part of creative drama-based instruction of the lesson. Students are asked to complete the statement related to their real life experiences. In evaluation-discussion stage, the students are asked to state what they have learned and what they have felt during the implementation of creative drama-based instruction. A sample lesson plan is explained below.

3.5.2.1 A Sample Lesson Plan

The aim of the lesson was to make students calculate the probability of joint and discrete events. Game of “Drop the Handkerchief” was played as the first warm-up activity. In this game, students were asked to form a circle. One volunteer was selected and asked to put the handkerchief behind one of the students in the circle and try not to show it to that student. The researcher asked how many blonde students were in the classroom and asked students the probability of putting the handkerchief behind the blonde students. Variables such as being blonde or being tall were selected by the researcher and this game was repeated several times. Once the game finished, the students were congratulated. The aim of this game was realizing the term ‘proportion’ which was going to help students to calculate ‘probability’ problems.

In the second warm up activity, students formed as two lines. The first line involved female students, while the second line involved male students. One volunteer was chosen from each line and these volunteers stand in front of the blackboard and turned their back to the students standing at the lines. Students at the lines tried to reach the blackboard where two volunteers stood. Volunteers suddenly turned around and caught the students who were moving towards the blackboard. The researcher asked students about the probability of catching male or

female students. The second game of the warm-up activities has the same purpose of the first game which was realizing the term ‘proportion’.

In the improvisation part, students were asked to write a sentence which included the term ‘probability’ considering the daily situations. The researcher collects all the sentences that the students generated and pasted them to the wall. Students were then asked to talk about these situations and prepared an improvisation about these situations related to probability. Six groups were formed by the researcher and each group chose one situation. In our study, the improvisations were about buying a lottery and a conversation between son and dad. Each group was asked to write a scenario about these situations and to make improvisation with these scenarios. For instance, in the current study, son’s task was to persuade his dad to buy a lottery ticket and the role of the dad was to refuse to buy the ticket and explain his son the probability of winning a lottery. This improvisation was aimed to make students illustrate probability cases and associate the mathematics term ‘probability’ with probability applications in real life situations.

In evaluation-discussion part, the students were asked to pose a probability problem. They showed their problems and their solutions. Discussion was carried out about critical points of the problems and type of these probability situations. This evaluation-discussion part was aimed to understand what students learned and feel about the process. All lesson plans were given in Appendix D.

3.5.3 Treatment in the Control Group

As the students in the experimental group explored probability by creative drama instructions, the teachers in the control group followed a traditional approach for six weeks by adhering to the curriculum to teach probability and permutation. In the control group, the researcher made observations. Typically, the teacher taught probability and permutation by making an explanation, giving the strategy and solving a sample problem. The class listened to the teacher and took notes (copying

the explanations and the problems with the solutions) as the teacher solved the problem.

The content of the lesson plans in the control group was the same as the content of the lesson plans in the experimental group. In other words, only the method of applying these lesson plans was different. The method in the control group can be characterized by its emphasis on procedural skills. Throughout the lesson, the teacher asked the students to help her to solve the problems and do the exercises which are based on factorial, permutation and probability. The students were also asked to control their answers and to generate solutions for their mistakes. The teacher called on the students to the blackboard to practice several exercises. The students in the control group were responsible for listening to the teacher, taking notes from the blackboard, and finding an answer to the questions that the teacher asked them.

3.6 Analyses of Data

The data were analyzed using both descriptive and inferential statistics. In terms of descriptive statistics, mean, standard deviation, skewness and kurtosis values of pretest and posttest of PAT and MAS were calculated. Two-way ANOVAs were performed to investigate the difference between attitude towards mathematics and mathematics achievement of seventh grade students in terms of gender and teaching method. To illustrate and compare the pretest mean scores of PAT and MAS, t-test was used. Moreover, Eta Square was calculated to find out the effect size that shows the practical significance of the study (Pallant, 2007). All statistical analysis was carried out by using SPSS 15.

3.7 Internal and External Validity of Study

In the last part of the methodology chapter, internal validity threats and external validity of the study were discussed in detail.

3.7.1 Internal Validity of Study

Internal validity is the extent to which detected differences on the dependent variable is associated with the independent variable and not some uncontrolled variables (Fraenkel & Wallen, 2006). This study is the static-group pretest-posttest experimental design, and thus it had some possible threats. These possible internal threats were subject characteristics, location, history, maturation, mortality, instrument decay, data collector bias, testing, and regression and Hawthorne effect (Fraenkel & Wallen, 2006).

In this study students were not randomly assigned to the experimental and control group which can cause the “subject characteristics” threat to the study. To eliminate this threat, pretest of achievement and attitude test was implemented. The results of these tests which were taken from both experimental and control group were compared. These results showed that there was not a significant difference between control and experimental group before the treatment. In addition, subjects were at the same age and all students were living in the same district and subjects’ socio-economic backgrounds were almost the same. Therefore, the subject characteristics threat was controlled. Location threat was reduced no outside events were notified that could influence the students’ responses. Therefore, location threat was reduced.

History threat may occur if something unexpected happens during the study process (Fraenkel & Wallen, 2006). There were not any unusual events during the study and the researcher was alert for potential influences that may occur. Maturation was not an issue because all the subjects were at the same age and duration of the study was limited to six weeks. In addition, mortality could not be a threat to the study since there were no missing data in all pretests and posttests.

To handle instrument decay threat to internal validity, detailed rubric was prepared by the researcher to score students pretest and posttest results. While the researcher was scoring the items, two elementary mathematics teachers also scored the photocopied answers of the items at the same time.

In order to control the data collector bias, the data collector was the researcher who made so much effort to behave in a standard way during the application. In addition, there was no treatment in the application that encourages the interaction and communication between the participants and the data collector. In addition, there was a six- week break between pre-test and post-test. This time interval was long enough to prevent students from memorizing the questions and remembering the results. Therefore, testing threat was reduced as well.

Students may perform different because of the revision of the treatment rather than the nature of the treatment. This has been referred to as the Hawthorne effect (Fraenkel & Wallen, 2006). As to the Hawthorne effect in the current study, the researcher frequently announced to students that the new teaching method is just a regular part of the instruction. In addition, the researcher avoided telling students that an experiment was being conducted.

3.7.2 External Validity of Study

External validity refers to “the extent to which the results of a study can be generalized from a sample to a population” (Fraenkel & Wallen, 2006, p.111). In this study, all 7th grade public school students in Ankara were identified as the target population. The population to which the results of the study will be generalized is all 7th grade public school students in Gazi district, Ankara. The selected sample size did not provide population generalizability to intended population due to convenient sampling method. However, the results of this study can be generalized in some clearly defined conditions that have similar conditions with the school where the data were collected. This supplies the ecological generalizability.

CHAPTER 4

RESULTS

The main purpose of this study is to investigate the effect of creative drama-based instruction on 7th grade students' mathematics achievement related to probability and their attitude toward mathematics. Another purpose of the study is to investigate the gender differences regarding mathematics achievement and attitude toward mathematics. The results of descriptive and inferential statistics regarding pretest and posttest of Probability Achievement Test (PAT) and Mathematics Attitude Scale (MAS) are presented in this chapter.

4.1 Descriptive Statistics

In this section, descriptive statistics on pretest and posttest scores of PAT and MAS are given. At the beginning of the treatment, Probability Achievement Test (PAT) was administered to determine the achievement levels of students both in control and experimental groups. The experimental group had a total mean score of 2.24 (SD= 3.58), and control group had a mean score of 2.23 (SD=3.35). Based on this result it was assumed that two groups were equivalent at the beginning of the study in terms of mathematics achievement. Mean and standard deviation of pretest PAT scores with respect to gender and teaching method are given in Table 4.1.

Table 4.1 Mean and Standard Deviation for Pretest Scores of PAT

Gender	Treatment groups	Mean	Std. Deviation	N
Male	Experimental	1.18	2.99	11
	Control	.82	1.83	11
	Total	1.00	2.43	22
Female	Experimental	3.40	3.95	10
	Control	3.64	3.98	11
	Total	3.52	3.87	21
Total	Experimental	2.24	3.58	21
	Control	2.23	3.35	22
	Total	2.23	3.42	43

Table 4.1 shows that 7th grade elementary male students had a mean score of 1.00(SD =2.43), and female students had a mean score of 3.52 (SD=3.87) on the pretest of PAT. To state differently, female students had higher mathematics achievement scores when compared to male students before the intervention. The mean scores and standard deviation for posttest of PAT with respect to gender and teaching method are given in Table 4.2.

Table 4.2 Descriptive Statistics for Posttest Scores of PAT

Gender	Teaching method	Mean	Std. Deviation	N
Male	Experimental	25.91	9.94	11
	Control	15.45	9.81	11
	Total	20.68	11.02	22
Female	Experimental	32.00	8.98	10
	Control	25.36	10.36	11
	Total	28.52	10.07	21
Total	Experimental	28.81	9.77	21
	Control	20.41	11.07	22
	Total	24.51	11.17	43

After the intervention, difference in PAT scores of control and experimental groups occurred. Experimental group had a total mean score of 28.81 (SD= 9.77), and the control group had a mean score of 20.41 (SD=11.07). These results yield that the experimental group had higher scores than the control group in the post test.

To conclude Table 4.2 also shows that male students had a mean score of 20.68 (SD =11.02) and female students had a mean score of 28.81 (SD=10.07) on the posttest of PAT. In other words, similar to the pretest scores, female students had higher scores on the posttest of PAT. Moreover, While pretest of PAT mean scores of CG, which was 2.23 (SD= 3.3), increased to 20.41 (SD= 11.07) in posttest of PAT, pretest of PAT mean scores of EG, which was 2.24 (SD= 3.58), increased to 28.81 (SD= 9.77) in posttest of PAT. In addition to the achievement score, descriptive statistics concerning the mean scores and the standard deviation for pretest of mathematics attitude scale with respect to gender and teaching method are given in Table 4.3.

Table 4.3 Descriptive Statistics for Pretest Scores of MAS

Gender	Teaching method	Mean	Std. Deviation	N
Male	Experimental	59.18	6.161	11
	Control	55.27	3.580	11
	Total	57.23	5.309	22
Female	Experimental	57.00	10.48	10
	Control	54.91	10.24	11
	Total	55.90	10.15	21
Total	Experimental	58.14	8.34	21
	Control	55.09	7.49	22
	Total	56.58	7.97	43

Table reveals that the experimental group had higher scores than the control group. The experimental group had a total mean score of 58.14 (SD= 8.34), and the control group had a mean score of 55.09 (SD=7.48).

As can be seen in Table 4.3, the 7th grade elementary male students had a mean score of 57.23 (SD =5.30), and female students had a mean score of 55.90 (SD=10.15) on the pretest of MAS. State differently, the results demonstrated that female students had lower scores on the pretest of MAS. The mean scores and standard deviation for posttest of MAS with respect to gender and teaching method are given in Table 4.4.

Table 4.4 Descriptive Statistics for Posttest Scores of MAS

Gender	Teaching method	Mean	Std. Deviation	N
Male	Experimental	65.36	19.69	11
	Control	65.27	16.50	11
	Total	65.31	17.73	22
Female	Experimental	68.40	21.95	10
	Control	70.72	13.75	11
	Total	69.61	17.69	21
Total	Experimental	66.80	20.32	21
	Control	68.00	15.08	22
	Total	67.41	17.63	43

Table 4.4 indicates that the experimental group had a total mean score of 66.80 (SD= 20.32), and the control group had a mean score of 68.00 (SD=15.08). That is, the experimental group had lower scores than the control group regarding mean scores of mathematics attitude.

The gender variable was also inspected. It was seen that females outperformed males in mathematics attitude scores for both teaching methods. Male students had a mean score of 65.31 (SD =17.73), and female students had a mean score of 69.61(SD=17.69) on the posttest of MAS.

To sum up, while pretest of MAS mean scores of CG, which was 55.09 (SD= 7.49), increased to 68.00 (SD= 15.08) in posttest of MAS, pretest of MAS mean scores of EG, which was 58.14 (SD= 8.34), increased to 66.80 (SD= 20.32) in posttest of MAS.

4.2 Inferential Statistics

In the previous section, descriptive statistics regarding Probability achievement test (PAT) and Mathematics Attitude Scale (MAS) were indicated. In this section, inferential statistics will be given.

T-test was used to compare the pretest mean scores of PAT and MAS, T-test results show us whether there is a statistically significant difference in the mean scores for the control and experimental groups regarding achievement and attitude. In other words, this test was mainly used to see if both the control and experimental groups had the same level of mathematics achievement and attitude toward mathematics before the treatment. In order to examine the difference in mathematics achievement and attitude toward mathematics scores of PAT and MAS in terms of gender and teaching method, two-way ANOVAs were performed.

4.2.1 Pretest Analysis Regarding Achievement Scores with Respect to Teaching Method

In order to reveal the difference between the control and the experimental group regarding students' achievement, a preliminary analysis was conducted before t-test was performed.

4.2.1.1 Assumptions of T-test Results for Pretest of Probability Achievement Test

The assumptions of independent-samples t-test are level of measurement, independence of observations, normality and homogeneity of variance. In this study, it was assumed that the observation of the data is independent. In other words, it was considered that student's responses are not influenced from each other. Additionally, achievement and attitude are the dependent variables which are continuous variables;

hence, it was assumed that the level of measurement assumption was assured. To evaluate the normality assumption, skewness and kurtosis values were checked.

Table 4.5 Skewness and Kurtosis Values for Probability Achievement Test Scores

	Skewness	Kurtosis
Experimental Group	.501	.972
Control Group	.491	.953

Table 4.5 shows that skewness and kurtosis values ranged between .491 and .972, which means that normality assumption was not violated for achievement scores of the pretest (Kunnan, 1998).

Table 4.6 Levene's Test Results for Probability Achievement Test Scores

	F	df1	df2	sig
PAT (pretest)	2.028	3	39	.126

Lastly, as it was displayed in Table 4.6, homogeneity of variance assumption was assured since the significance value in the Levene test was greater than .05, [F (3, 39) = 2.028, p= .126]. That is, the variance within each population was equally distributed. After the assumptions were met, t-test analysis was conducted to check the significance of the difference.

4.2.1.2 T-test Results for Pretest of Probability Achievement Test

In order to investigate the difference among pretest mean scores of probability achievement of students before the treatment, t-test was performed. Table 4.7 presented the results of the t-test.

Table 4.7 Pretest of Probability Achievement Test

Group	N	Gain scores	SD	<u>Levene's</u>				
				Test F	sig.	t	df	p
Experimental Group	21	2.24	3.57	2.028	.126	0.10	41	.992
Control	22	2.23	3.35					

As can be seen in Table 4.7, pretest scores of probability achievement was not statistically significant [$t(41) = .010$ $p = .992$]. It can be concluded that there is not a significant difference between the control and the experimental group regarding student's pretest scores of PAT before the treatment.

4.2.2 Difference in Probability Achievement Scores with Respect to Gender and Teaching Method

To investigate the effect of creative drama method and the gender differences on 7th grade students' mathematics achievement, two-way ANOVA was used. Before conducting analysis, preliminary analyses were performed to test for the assumption of ANOVA.

4.2.2.1 Assumptions of Two-Way ANOVA for Probability Achievement Test

Level of measurement, independence of observations, normality and homogeneity of variance are the assumptions that need to be verified before applying two-way ANOVA (Pallant, 2007). In the present study, independence of observations assumption was assumed to have been met. Achievement is the

dependent variable, which is the continuous variable; hence it was assumed that the level of measurement assumption was assured.

Table 4.8 Tests of Normality

	Skewness	Kurtosis
Males (Experimental)	.110	-.125
Females(Experimental)	-.227	-.512
Males (Control)	.591	-.152
Females (Control)	-.078	-1.159

For normality assumption, skewness and kurtosis values were examined. These scores on PAT were in an acceptable range (for skewness .591 - .227, and for kurtosis -.125 – 1.159) for a normal distribution (Kunnan 1998).

The histograms with normal curves also provided further evidence of the normality of PAT scores for males and females in the control and experimental groups.

After checking the normality assumption, the results of Homogeneity of Variance test were checked, which are summarized below.

Table 4.9 Levene’s Test of Equality of Error Variances

	F	df1	df2	Sig
PAT(posttest)	.188	3	39	.904

As it was displayed, homogeneity of variance assumption was assured since the significance value was greater than .05, [F (3, 39) = .188, p= .904]. That is, the variance within each population was equally distributed. Thus, assumptions of two

way ANOVA were checked, and no violation of assumptions was found. After conducting a preliminary analysis, a two-way ANOVA was conducted.

4.2.2.2 Two-Way ANOVA Results of Probability Achievement Test

To see the effect of creative drama method and investigate the gender difference two-way ANOVA was conducted. The results and interpretation of the data are given in Table 4.10.

Table 4.10 Probability Achievement Test scores with respect to Gender and Teaching method

	Type III sum of squares	df	Mean Squares	F	sig.	Partial Eta Squared
Gender	686.829	1	686.829	7.143	.011	.155
Teaching method	783.681	1	783.681	8.150	.007	.173
Gender- Teaching method	39.113	1	39.113	.407	.527	.010

As can be seen in Table 4.10, the interaction effect of gender and teaching method with respect to mean of probability achievement scores was not statistically significant [$F(1,39) = .407, p = .527$]. In particular, this indicated that females' mean of scores on PAT was higher than that of males regardless of the method implemented. Since there was not a significant interaction effect of gender and teaching method on the probability achievement, whether there was a main effect of gender and teaching method needed to be explored.

The results demonstrated that gender difference with respect to mean of probability achievement scores was statistically significant [$F(1, 39) = 7.143, p = .011$]. These results yield that females scored significantly higher than males. The effect size for gender (Partial eta square) was calculated as .155. According to Cohen's (1998) the effect size of gender for the present study was relatively large.

The results revealed that there was a statistically significant difference between the mean scores of EG that received creative drama-based instruction (CDBI) and CG that received regular instruction (RI) in terms of achievement in probability concepts in favor of EG, [$F(1, 39) = 8.15, p = .007$]. The effect size for teaching method (Partial eta square) was calculated as .173. According to Cohen's (1998) the effect size of teaching method for the present study was relatively large. These results represent that the creative drama method, which had been applied to the experimental group, had increased the scores.

4.2.3 Pretest Analysis Regarding Attitude Scores with Respect to Teaching Method

This section discusses the results of the preliminary analysis conducted before the t-test was performed to reveal the difference between the control and experimental groups regarding student's attitude.

4.2.3.1 Assumptions of T-test Results for Pretest of Mathematics Attitude Test

Such assumptions as the level of measurement, independence of observations, normality and homogeneity of variance should be met before conducting t-test (Pallant, 2007). In this study, the independence of observations assumption was assumed to be met. Similar to the achievement, attitude is the dependent variable which is the continuous variable; hence, it was assumed that the level of measurement assumption was assured.

Table 4.11 Tests of Normality

	Skewness	Kurtosis
Experimental Group	.554	1.89
Control Group	-1.08	1.91

Table 4.11 represents that skewness and kurtosis values ranged between -1.08 and 1.9,1 which confirms that there was no violation of normality assumption for the attitude scores of the pretest (Kunnan, 1998).

Table 4.12 Levene's Test of Equality of Error Variances

	F	df1	df2	sig
MAS(pretest)	2.38	3	39	.084

As mentioned earlier, homogeneity of variance assumption was assured since the significance value was greater than .05, [F (3, 39) =2.38, p= .084]. That is, the variance within each population was equally distributed. To sum up, the assumptions of two-way ANOVA were satisfied for investigating the difference in mean attitude scores with respect to gender and teaching method.

4.2.3.2 T-test Results of the attitude Towards Mathematics

In order to investigate the difference for mean scores of probability attitude of students before the treatment, t-test was performed. Table 4.13 presents the results of the t-test.

Table 4.13 Mathematics Attitude Test

Group	N	Gain scores	SD	Levene's				
				Test F	sig.	t	df	p
Experimental	21	58.14	8.34	2.379		1.26	41	.214
Control	22	55.09	7.48	.084				

Table 4.10 shows that probability attitude scores were not statistically significant, [$t(41) = 1.26$ $p = .214$]. This suggests that there is not a significant difference between control and experimental group on MAS before the treatment.

4.2.4 Difference in Mathematics Attitude Scores with Respect to Gender and Teaching method

The second aim of this study is to investigate the effect of creative drama method and to investigate the gender differences on 7th grade students' attitude towards mathematics.. For this aim two way ANOVA was run. In addition, preliminary analyses were performed to test for the assumption of two-way ANOVA.

4.2.4.1 Assumptions of Two-Way ANOVA for Mathematics Attitude Scale

As stated above, Pallant (2007) mentioned three main assumptions to be assured before conducting two-way ANOVA: level of measurement, independence of observations, normality and homogeneity of variance. Independence of observations assumption was assumed to be assured in this study. As in the achievement test which was stated above, the dependent variable is the continuous variable; hence, it was assumed that the level of measurement assumption was assured.

Table 4.14 Tests of Normality

	Skewness	Kurtosis
Males (Experimental)	-.713	-.253
Females(Experimental)	-.229	-1.108
Males (Control)	-.079	-.763
Females (Control)	-.239	-.354

It was suggested that skewness and kurtosis values between -1 and +1 were required, but values between -2 and + 2 were acceptable for normal distribution as well (Pallant, 2007). Table 4.14 represents that skewness and kurtosis values ranged between -1.108 and - . 079, which satisfies that there was no violation of normality assumption for attitude scores.

Table 4.15 Levene’s Test of Equality of Error Variances

	F	df1	df2	Sig
MAS(posttest)	1.652	3	39	.193

It was displayed that homogeneity of variance assumption was assured, [F (3, 39) = 1.652, p= .193]. That is, the variance within each population was equally distributed. After testing the assumptions, analysis of two-way ANOVA is conducted, and results are given below.

4.2.4.2 Two-Way ANOVA Results of Mathematics Attitude

In order to investigate the difference in attitude scores of students with respect to gender or teaching method, two-way ANOVA was performed at .05 significance level. Table 4.16 presented the results of the two-way ANOVA.

Table 4. 16 Mathematics Attitude Scale with respect to Gender and Teaching method

	Type III sum of squares	Df	Mean Squares	F	sig.	Partial Eta Squared
Gender	193.427	1	1	.588	.448	.015
Teaching method	13.418	1	96.585	0.41	.841	.001
Gender- Teaching method	15.689	1	8.869	.048	.828	.001

As it is also seen in Table 4.16, the interaction effect of gender and teaching method with respect to mean of mathematics attitude scale was not statistically significant, $[F (1,39) = .048, p= .828]$. It could be stated that regardless of the teaching method, males' mean attitude score was lower than that of females'. Based on the results presented above, there is not a significant difference between male and female students $[F (1, 39) = .588, p= .448]$. As it is also represented in the Table 4.16, there is not a statistically significant effect of teaching method $[F (1, 39) = .041, p= .841]$. In other words, there was no statistically significant difference between the mean scores of EG that received creative drama-based instruction (CDBI) and CG that received regular instruction (RI).

CHAPTER 5

DISCUSSION, IMPLICATIONS AND RECOMMENDATION

The main purpose of this study is to investigate the effect of creative drama method on 7th grade students' mathematics achievement related to probability concept and mathematics attitude. The other purpose of the study is to investigate the gender differences regarding mathematics achievement and attitude.

In this chapter findings will be discussed in line with the previous research studies. This chapter mainly consists of three sections. First section presents the discussion of the results for the influence of creative drama-based instruction and second section presents the discussion of the findings for gender difference. Implications and recommendations for further studies are given in the third section.

5.1 The Effect of Creative Drama-Based Instruction on Achievement in Probability Concept and Attitudes toward Mathematics

Mathematics teaching methods and their applications had a considerable role on education system. The emphasis on the importance of alternative mathematical teaching methods in elementary mathematics program had a place in Turkey's mathematics program developed in 2004 (Ministry of National Education [MoNE], 2005, 2006). The revised elementary mathematics program emphasizes students' individual differences and encourages students to be more active in the classroom. Regular teaching methods do not provide an active learning environment for students, and does not emphasize individual differences (Doğan, 2006). Therefore to promote student-centered instruction and to increase learner willingness, alternative methods are emphasized in the program. Creative drama is one of the teaching methods that put an emphasis on students' individual differences.

In this study, creative drama-based instruction which is based on student-centered approach was used to teach probability concept. Results of the study revealed that there was a statistically significant effect of creative drama-based instruction on mathematics achievement related to probability concept. The results are also practically significant with a large effect size. In the literature, there are a number of studies which provide evidence to show the positive impact of creative drama-based instruction on mathematics achievement (Debreli, 2011; Saab, 1987). The findings of current study supports the statement of Debreli (2011), she stated that when students experience creative drama-based environment, it can have a positive impact on student mathematics achievement. This finding also supports the statement of Saab (1987) who described a pre-test-post-test experimental design and found a significant increase on post-test in the experimental group which received drama-based mathematics instruction.

Several reasons may account for the positive effects of drama-based instruction on achievement. This difference might be explained by the exciting and interesting learning environment that was created during creative drama-based instruction. This reason can be implied that creative drama-based instruction is an exciting way of learning mathematics which made students find mathematics more enjoyable and students' mathematics achievement has been effected positively. Moreover, students did not use classical methods to learn concepts in mathematics; they learned them by creative drama based instruction which was new for them. This new method could draw their attention and affect their mathematics achievement positively.

Second reason might be students' active participation during creative drama based learning process. Creative drama activities provide actively involvement that let students searching for explanations of process (Saab, 1987). By the help of this instruction, students' active participation may avoid memorization in probability learning, and understands concepts meaningfully. In other words, they have a chance to learn the concepts while they were actively involved in the process. Thus,

students' active participation during the creative drama based instruction might enhance their learning process that leads higher scores in the achievement test. Additionally, many research studies in the literature have emphasized the importance and the necessity of students' active involvement in the task (Brown & Campione, 1986). Also, with the constructivist perspective, students' interaction with the material and his/her friends are undeniable facts for effective instruction. Thus, active involvement of students in present study might have increased students' mathematics achievement. Active participation in a classroom environment is comprised of communication, interaction and social skills. Students are encouraged to communicate and interact with each other during creative drama-based learning and this encouragement influence their personal development (Simon, 1995). Using personal experiences and communicating with each other make students understand and be aware of each other (Farris & Parke, 1993). As an advantage of communication, students became consciously aware of what they were studying on during the treatment in this study. The findings of the study indicated that the advantage of communication and active participation in mathematics classes brings success. Moreover, creative drama activities involve social skills that students influence their learning in a positive way in a non-threatening and authentic environment. The social interaction between the students might provide a comfortable learning environment supported by their point of view.

Creative drama based instruction let students observe relationships with cooperative group working and social interaction, extend and revise their ideas in real-life context (Farris & Parke, 1993). In addition creative drama-based learning environment gives chance to students to apply what they learn in real life (Duartepe, 2004). This environment can also be described as a process inspired from human experiences. Furthermore, students in this environment can have an opportunity of taking risk without limitation by means of their past experiences (Farris & Parke, 1993). Inspiring from their past experience might have been another reason for those students who were applied creative drama based instruction got higher grades.

The results of mathematics attitude scale showed that the seventh grade students' attitudes towards mathematics were not significantly different with respect to teaching method. One possible reason for the low scores of experimental group might due to the fact that attitudes are relatively stable and the duration of the study might not have been enough to change students' attitudes toward mathematics.

5.2 Findings for the Gender Difference

The importance of differences between males and females in learning mathematics has been concerned in related literatures (Fennema, 1974; Hyde, 2005; Isiksal & Çakiroğlu, 2008). One of the aims of this study was to investigate the difference between seventh grade male and female students' mathematics achievement. The results yielded that gender difference with respect to the mean of probability achievement scores was statistically significant favoring females.

Research findings on gender difference in mathematics achievement at the elementary level yielded that there is no significant relationship between gender and mathematics achievement (Cahan & Ganor, 1995; Fennema, 1984) or significant gender difference favoring males at secondary level (Cooper & Robinson, 1989). Opposite of those research studies females outperformed males with respect to mathematics achievement scores in this study. These differences might result from genetics or socio-cultural difference (Hyde, 2004). In the literature, it was claimed that the left hemisphere of a person realizes for logical thinking in numerical operations while right hemisphere is specialized in social tasks and artistic efforts (Capparo, 2001). Males are more likely to use their left hemisphere than females (Kimura & Hampson, 1994) and hence they become more advantageous in mathematics achievement (Capparo, 2001). That is, in the literature, right hemisphere is specialized in social tasks, artistic efforts and body image (Capparo, 2001). In particular, females are more likely to use their right hemisphere (Kimura & Hampson, 1994) and hence they become more advantageous over males in social tasks (Capparo, 2001). Based on the literatures, creative drama based activities

encourages students social interactions and thus females may be more advantageous in those social tasks. Therefore, it is possible to find out significant difference in females' and males' mathematics performances in the favor of females.

Another aim of the study was to investigate the difference between seventh grade males and females in terms of their attitude towards mathematics. The results revealed that although females score higher, gender differences regarding attitude was not significant. The reasons could be such as similar job expectations of both gender, being supported as much as male students, there occurred no gender difference between male and female students' mathematics attitude. In other words, female students can also express themselves in the learning process and take part actively in the lessons as much as male students. The communication among the students and the learning environment might affect females' and males' attitudes in the same way and this might be the reason why there is no gender difference.

In the literature several studies are inconsistent with the present study's result. For instance, Savaş and Duru (2005) mentioned that females' attitudes towards mathematics in elementary level were higher than that of males and girls' career interests related to mathematics had significantly more than boys. In this study no gender difference has been found. There might be difference but because of their grade level this difference is not obvious and it may come out in later years. As a result, it is believed that the findings of the present study could present some clues about the influence of gender on mathematics achievement and attitude.

5.3 Implications and Recommendations for Future Researches

This study mainly focused on the effects of creative drama-based instruction compared to regular instruction on seventh grade students' achievement in probability concept and their attitude toward mathematics. In addition, it focused on investigating the gender differences regarding mathematics achievement and attitude. Based on the findings, this study has some implications for mathematics teachers,

mathematics educators, and curriculum developers. As mentioned before, creative drama-based instruction was included in the revised elementary mathematics program. Results show that creative drama-based lessons should be developed in other topics of mathematics. In other words this study was limited to probability topic and further research studies may examine the effect of the creative drama-based instruction on different topics of mathematics like trigonometry, fractals, 3D objects. Therefore, different lesson plans with related topics could be developed by mathematics educators who are qualified with creative drama-based instruction to investigate the effect of creative drama on mathematics

Mathematics teachers and mathematics teacher educator could be informed about creative drama-based instruction. In other words, seminars related with using creative drama in mathematics lessons should be planned for mathematics teachers and mathematics teacher educators. In addition, in order to make mathematics teachers more sufficient in this context, courses related with creative drama in mathematics for preservice teachers should be offered or these topics should be mentioned in mathematics education courses. Moreover, in order to use creative drama-based instruction in the mathematics classroom, teachers should be given a chance to improve their understanding of drama-based instruction and develop their confidence to be able to implement creative drama-based lesson. State differently, Ministry of National Education could provide in-service training for teachers. Therefore, elective courses in the universities about creative drama could be increased.

The curriculum developers could organize textbooks in a way that they include creative drama-based activities for students. That is, curriculum developers could add activities and topics to the curriculum and textbooks highlighting the importance of creative drama-based instruction in mathematics courses.

Finally, based on the findings, some recommendations for further research studies can be proposed. The design of this study was the static-group pretest-posttest

design. This means that in this study two already existing, or intact groups were used, one of them was experimental group and the other one was control group (Fraenkel & Wallen, 2006). Similar research study might be replicated with participants who assigned randomly to the group.

The design of the study included some limitations for generalizability. For instance the sampling method was convenience sampling which means that the researcher collects data from the individuals who are available (Fraenkel & Wallen, 2006). In order to make generalization of the findings to the population, further research including the randomly selected sample from the elementary schools in Turkey could be conducted.

The sample consisted of 7th grade elementary students in a public school. Thus, a study might be implemented at different grades and the impact of creative drama-based instruction on different grades might be investigated. Moreover, this study was delimited to probability topic and further research studies may examine the effect of the creative drama-based instruction on students' mathematics achievement and attitudes on different topics of mathematics. In addition a replication of the present study might be conducted both public and private schools to see the effect of school type.

There were two different instructors while conducting this research study. One was the classroom teacher and the other was the researcher. To determine whether creative drama-based instructions has an effect on students' achievement regardless of the implementer, or in other words, to reduce implementation threat, Further study could be performed after educating classroom teachers about creative drama-based instruction. Finally, from the treatment it can be claimed that creative drama-based instruction could make a substantial differences in the ways that students understand probability concept.

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APPENDICES

APPENDIX A

PROBABILITY ACHIEVEMENT TEST

Olasılık Başarı Testi

Adı Soyadı:

Bu test öğrencilerin faktöriyel, permütasyon ve olasılık konularındaki başarıları hakkında bilgi edinmek için hazırlanmıştır.9 sorudan oluşmaktadır. Bazı sorular bir ya da birkaç alt soru içermektedir. Bazıları ise açıklama yapmanızı istemektedir. Sorulardaki alt sorulara verilecek cevaplara ve yapacağınız açıklamalara karşılık gelen puan değerleri bulunmaktadır.

Katkılarınız için teşekkür ederim.

I. Kişisel bilgiler

1) Cinsiyetiniz: () E () K

2) Sınıfınız:

Sorular

- 1) Okul yönetimi hafta sonu için bir gezi düzenleyecektir. Huzurevine yapılacak bu gezide gönüllü olarak seçilen 6 öğrenci bakıma ihtiyaç duyan yaşlılara kitap okuyacaktır. Huzur evine gelindiğinde müdür 6 öğrenci arasından seçim yapar ve kitap okuyacağı kişiye yönlendirir.
- A) Birinci öğrenciyi yönlendirdikten sonra geriye kalan öğrencilerden kaç farklı seçim yapılır?
- B) Müdür bu 6 öğrenciyi 6 yaşlıya kaç farklı şekilde yönlendirebilir?
- C) Huzurevine giden bu 6 öğrenci kitap okudukları yaşlılarla fotoğraf çekilecektir. Toplu fotoğraf çekiminde 6 yaşlı ve 6 öğrenci yan yana bir sıra halinde durmak koşuluyla kaç farklı şekilde fotoğraf çektirebilir?(Cevabınızı açık bir şekilde yazınız.)



2) Öğretmeniniz sizden yılsonu gösterileri için bir tiyatro düzenlemenizi istedi. Sana sınıftan 11 kişiyi seçmen gerektiğini söyledi.

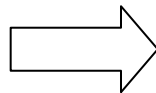
A)Bu seçimi kaç farklı biçimde yapabilirsin?

B) Sınıftan 4 kişi mazeret belirtip tiyatroya katılamayacağını baştan söyledi. Geri kalan öğrencilerden bu seçimi kaç farklı şekilde yapabilirsin?

(Cevaplarınızı açık bir şekilde yazınız)

3) Sınıftan 5 arkadaş sandalye kapmaca oynayacaksınız. (Beş kişi dört sandalye etrafında müzik eşliğinde dans eder. Müzik durduğunda beş kişinin dördü sandalyeye oturur biri zamanında oturamaz ve oyundan elenir.) 4 sandalyeyi yan yana koyup dans etmeye başladınız. Müzik durduğunda sandalyeye oturanların sıralaması kaç farklı şekilde olur. (Açıklayıcı bir şekilde gösteriniz.)

4) Aşağıdaki resimde de gördüğünüz gibi gökkuşağının 7 rengi vardır. Bu renk sıralaması resimde gördüğünüz sıralama dahil kaç farklı şekilde sıralanabilirdi?



1.sıralama
KIRMIZI
TURUNCU
SARI
YEŞİL
MAVİ
LACİVERT
MOR

- 5) Aşağıda verilen örnek durumlardaki boş bırakılan yerlere aklınıza gelen örnek uzay, deney ve olayı yazınız.

Örn: Deney: Zar atılması

Örnek uzay: Zarın üstünde yazan [1,2,3,4,5,6]sayılar

Olay: Zarın üst yüzeyine tek sayı gelmesi

Deney: Yön Bulma

Örnek Uzay:

Olay: Kuzeye veya güneye gitme

Deney: Resim yapma

Örnek Uzay: Gökkuşağının renkleri

Olay:.....

Deney:.....

Örnek Uzay: Okuldaki tüm dersler

Olay: Matematik, Fen Bilgisi, Tarih

- 6) Matematikte olasılık konusunda işlediğimiz ‘ayrık olay’ ve ‘ayrık olmayan olay’ hakkında günlük hayattan birer örnek veriniz.

- 7) Köyün birinde yaşayan 14 kız varmış. Bunların 5'i sarışın, 4'ü sarışın mavi gözlü, 4'ü kahverengi gözlüdür. Verilen bilgilere göre aşağıdaki tabloyu doldurunuz.

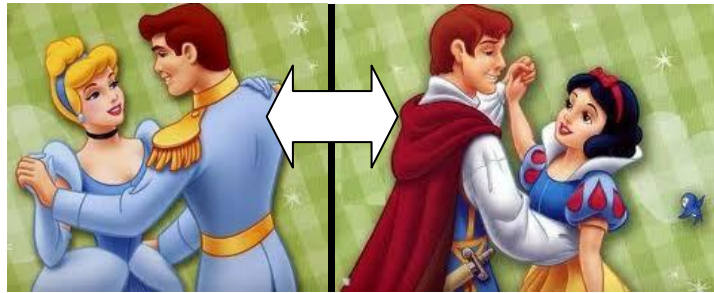
	Mavi gözlü	Kahverengi gözlü
Sarışın		
Esmer		

Bir prens bu köyden geçerken bir kızı beğenir. Prensın seçtiği kızın;

a)Mavi gözlü olma olasılığı nedir?

b)Esmer ve kahverengi gözlü olma olasılığı nedir?

c) Sarışın veya mavi gözlü olma olasılığı nedir?



8)

Şöför

Muavin

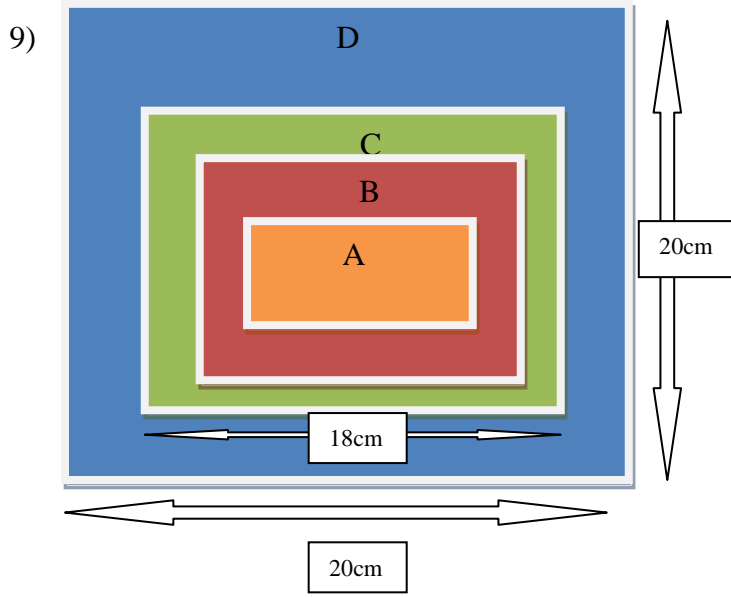
1	2
5	6
9	10
13	14
17	18
21	22
25	26

3	4
7	8
11	12
15	16
19	20
23	24
27	28

Ceren sabah servise binecektir. Servisteki oturma planı yanda verilmiştir. Buna göre;

a)Cerenin cam kenarında veya çift numaralı koltuklarda oturma olasılığı nedir?

b)Koridor tarafında veya tek numaralı koltukta oturma olasılığı nedir?



Yanda kenar uzunlukları 2cm kısaltılarak iç içe çizilmiş karelerden oluşan platform, 19 Mayıs Gençlik ve Spor bayramı için gösteri yapan uçaklar için hazırlanmıştır. Uçakların platforma inerken karışıklık yaşanmaması için renk renk ayrılan bölgeye;

a) İlk inen uçağın 'B' yazan kırmızı bölgeye inme olasılığı nedir?

b) İkinci inen uçağın 'C' yazan mavi bölgeye inme olasılığı nedir?

c) Mavi bölgeye inme olasılığı turuncu bölgeye inme olasılığından yüzde kaç fazladır?

APPENDIX B

The reliability estimate scores on pre and post implementation of PAT were found with Kuder-Richardson 21

$$\text{KR21 (reliability coefficient)} = \frac{K}{K-1} \left(1 - \frac{M(K-M)}{K(SD^2)} \right)$$

'K' is the number of the items on the test, 'M' is the mean and 'SD' is the standart deviation (Fraenkel and Wallen 2006). The reliability coefficient would be calculated as shown below:

$$\text{Reliability of pre PAT} = \frac{20}{19} \left(1 - \frac{2.23(20-2.23)}{20(3.42^2)} \right) = 0,87$$

$$\text{Reliability of post PAT} = \frac{20}{19} \left(1 - \frac{24.51(24.51-20)}{20(11.173^2)} \right) = 0,98$$

APPENDIX C

HISTOGRAMS

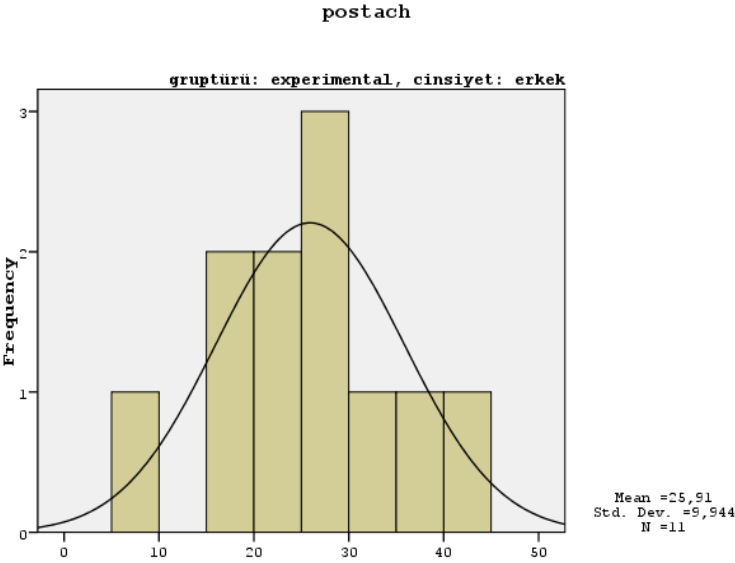


Figure 1 Histogram of mean achievement scores for male students in the experimental group

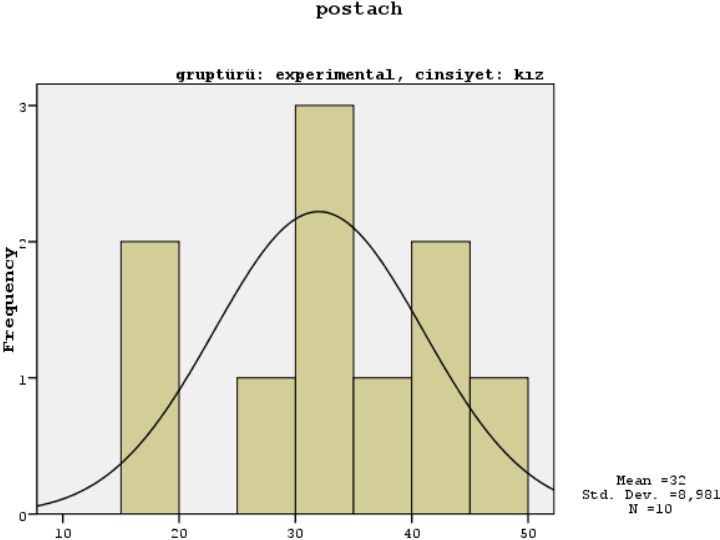


Figure 2 Histogram of mean achievement scores for female students in the experimental group

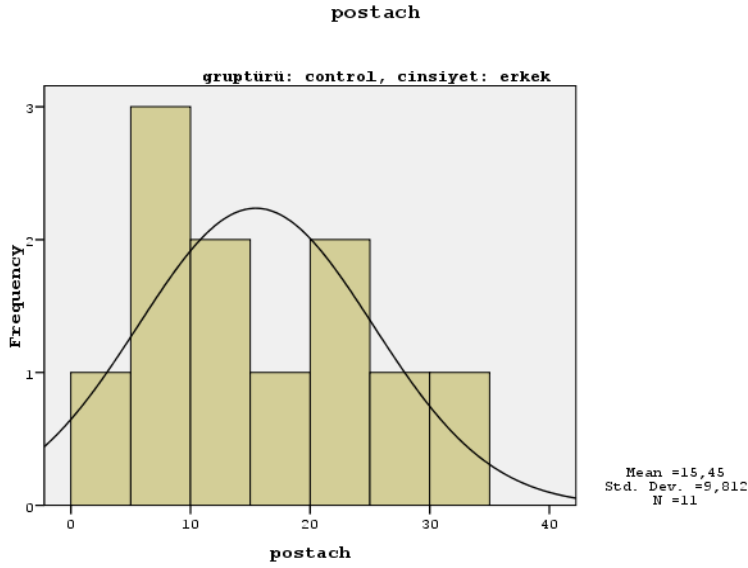


Figure 3 Histogram of mean achievement scores for male students in the control group

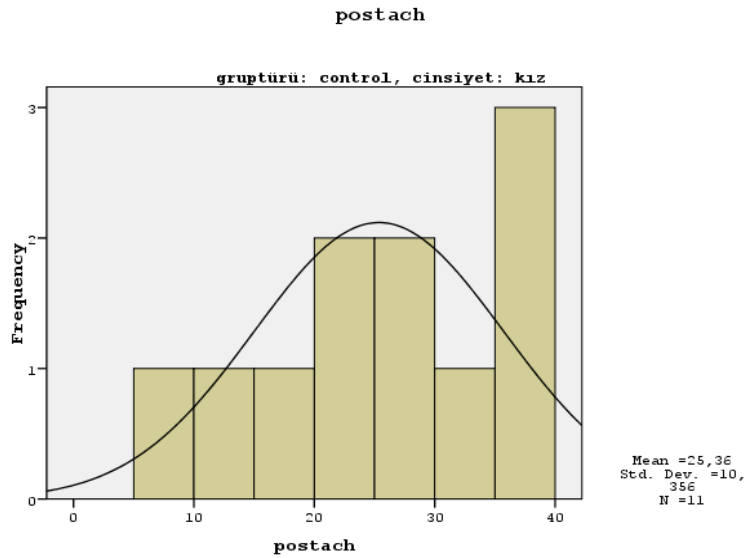


Figure 4 Histogram of mean achievement scores for female students in the control group

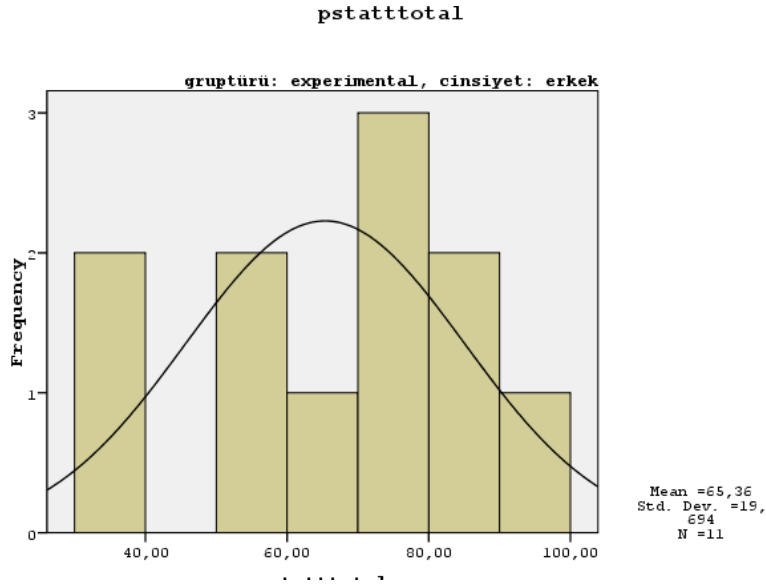


Figure 5 Histogram of mean attitude scores for male students in experimental group

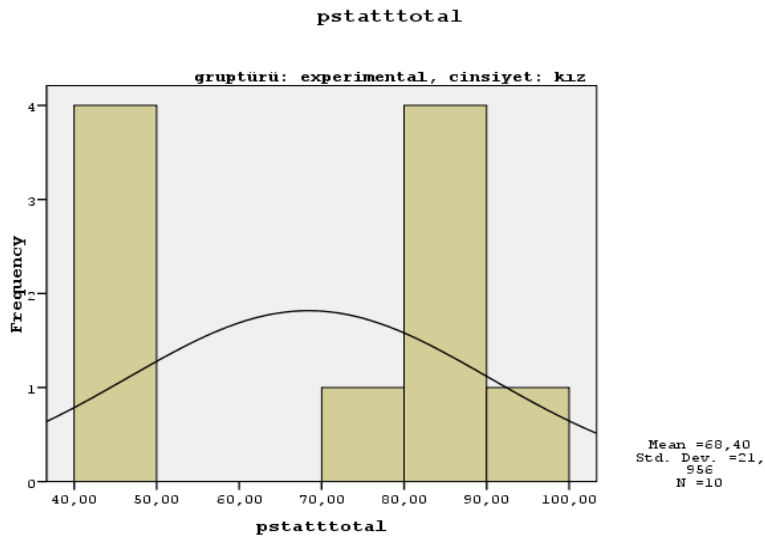


Figure 6 Histogram of mean attitude scores for female students in experimental group

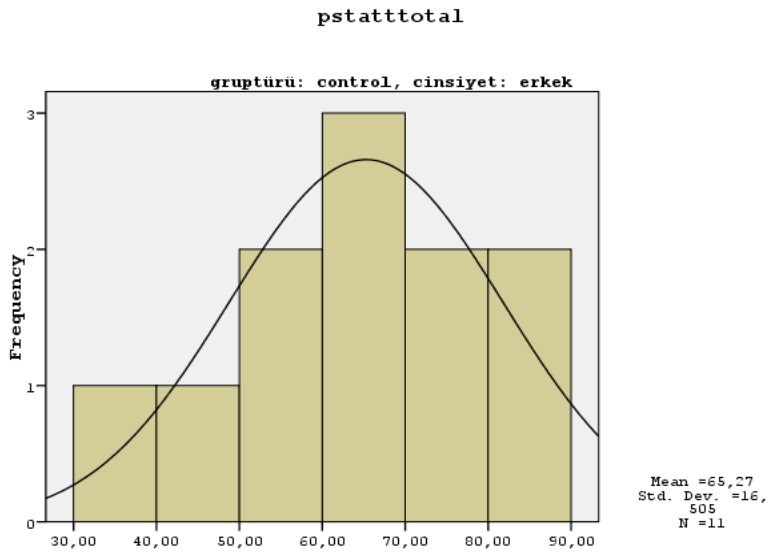


Figure 7 Histogram of mean attitude scores for male students in control group

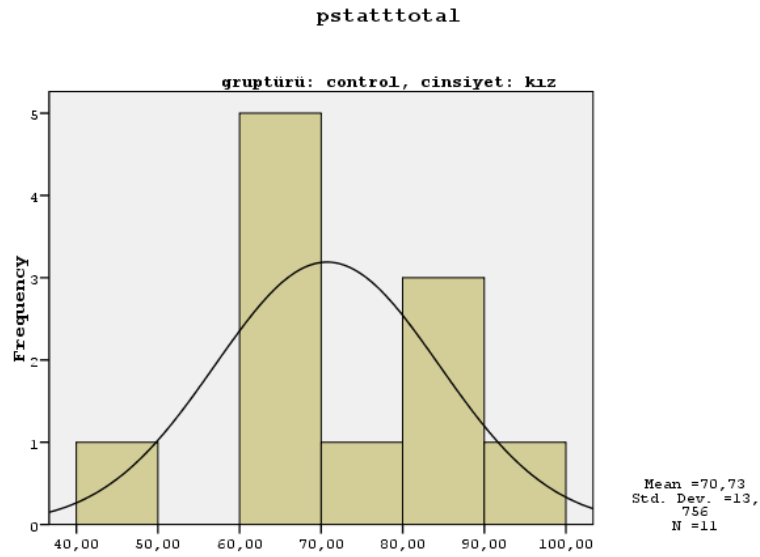


Figure 8 Histogram of mean attitude scores for female students in control group

APPENDIX D

MATHEMATICS ATTITUDES SCALE - MAS

Matematik Tutum Ölçeği

Bu anket, öğrencilerin matematik dersine ilişkin tutumlarını belirlemeyi amaçlamaktadır. Ankette her biri bir cümlelik 20 madde bulunmaktadır. Aşağıdaki seçenekler bütün maddeler için ortaktır. Her maddenin sizi ne kadar doğru tanımladığını bu seçeneklere göre belirtiniz. Kendinize uygun olduğunu düşündüğünüz seçeneği (X) işareti ile işaretleyiniz ve lütfen her bir maddeyi cevaplamaya özen gösteriniz.

(1) Kesinlikle Katılmıyorum (2) Katılmıyorum (3) Kararsızım (4) Katılıyorum
(5) Kesinlikle Katılıyorum

	Kesinlikle Katılmıyorum	Katılmıyorum (2)	Kararsızım (3)	Katılıyorum (4)	Kesinlikle Katılıyorum
1) Matematik sevdiğim bir derstir.	(1)	(2)	(3)	(4)	(5)
2) Matematik dersine girerken büyük sıkıntı duyarım.	(1)	(2)	(3)	(4)	(5)
3) Matematik dersi olmasa öğrencilik hayatı daha zevkli olur.	(1)	(2)	(3)	(4)	(5)
4) Arkadaşlarımla matematik tartışmaktan zevk alırım.	(1)	(2)	(3)	(4)	(5)
5) Matematiğe ayrılan ders saatlerinin fazla olmasını dilerim.	(1)	(2)	(3)	(4)	(5)
6) Matematik dersi çalışırken canım sıkılır.	(1)	(2)	(3)	(4)	(5)
7) Matematik dersi benim için angaryadır.	(1)	(2)	(3)	(4)	(5)
8) Matematikten hoşlanırım.	(1)	(2)	(3)	(4)	(5)

9) Matematik dersinde zaman geçmez.	(1)	(2)	(3)	(4)	(5)
10) Matematik dersi sınavından çekinirim.	(1)	(2)	(3)	(4)	(5)
11) Matematik benim için ilgi çekicidir.	(1)	(2)	(3)	(4)	(5)
12) Matematik bütün dersler içinde en korktuğum derstir.	(1)	(2)	(3)	(4)	(5)
13) Yıllarca matematik okusam bıkmam.	(1)	(2)	(3)	(4)	(5)
14) Diğer derslere göre matematiği daha çok severek çalışırım.	(1)	(2)	(3)	(4)	(5)
15) Matematik beni huzursuz eder.	(1)	(2)	(3)	(4)	(5)
16) Matematik beni ürkütür.	(1)	(2)	(3)	(4)	(5)
17) Matematik dersi eğlenceli bir derstir.	(1)	(2)	(3)	(4)	(5)
18) Matematik dersinde neşe duyarım.	(1)	(2)	(3)	(4)	(5)
19) Derslerin içinde en sevimsizi matematiktir.	(1)	(2)	(3)	(4)	(5)
20) Çalışma zamanımın çoğunu matematiğe ayırmak isterim.	(1)	(2)	(3)	(4)	(5)

APPENDIX E
LESSON PLANS
DERS PLANLARI

Lider Adayı: Damla Geçim

Tarih: 14.02.2011

Yer: Emniyetçiler İlköğretim Okulu

Grup: Emniyetçiler İlköğretim Okulu 7.sınıf öğrencileri

Konu: Olasılık

Süre: 12 ders saati

Yöntem Teknik: Doğaçlama, Rol oynama

Kazanımlar:

Alan Bilgisi:

- 1) Doğal sayıların faktöriyelerini bulur.
- 2) Permütasyon kavramını açıklar ve hesaplar.
- 3) Ayrık ve ayrık olmayan olayın deneyini, örnek uzayını ve olayını belirler.
- 4) Ayrık ve ayrık olmayan olayı açıklar.
- 5) Ayrık ve ayrık olmayan olayların olasılıklarını hesaplar.
- 6) Geometri bilgilerini kullanarak bir olayın olma olasılığını hesaplar.

Psikomotor Alan:

Kazanımlar

- 1: Sözel yönergelere uygun olarak ısınma hareketleri yapar.
- 2: Sözel yönergelere uygun olarak yürür.
- 3: Sözel yönergelere uygun olarak koşar.

Sosyal Duygusal Alan:

Kazanımlar

- 1: Duygularını müzik, dans vb. yollarla ifade eder..
- 2:Gerektiğinde lideri izler.
- 3: Estetik bedensel hareketlerle yürür/ dans eder.
- 4:Grup etkinliğine kendiliğinden katılır.
- 5: Etkinliklerin süresine ilişkin yönergelere uyar.
- 6: Grup etkinliklerinin kurallarına uyar.

Ders Planı 1

Bilişsel Kazanım 1: Doğal sayıların faktöriyelerini bulur.

ISINMA – HAZIRLIK

Etkinlik 1: Lider tarafından Sınıfa sayma sayılarının sırasıyla sayılacağı ve herkesin bir sayı söyleceği yönergesi verilir. Sayılar sayılırken bir sayı aynı anda iki kişi tarafından söylenirse başa döneceği belirtilir.

Etkinlik 2: Sınıf ayağa kalkar. Lider katılımcılardan bir tanesine diğerlerine farketmeden göz kırpağını , göz kırptığı kişinin ilk ebe olacağını söyler. Müzik eşliğinde ilk önce ilk seçilen ebe dans figürleri yapar. Ebenin kim olduğu başlarda anlaşılmaz anlaşılana kadar ebe figürleri yapmaya devam eder, anlaşıldıktan sonra ebe oyundan çıkar başkası ebe seçilir.

Ara değerlendirme:

Öğrencilere ebeyi ilk seçerken kaç kişiyi seçebileceği, liderin kaç öğrenci arasından ebeyi seçme şansı olduğu sorulur. Her ebe seçildiğinde ve elendiğinde geriye kalan ebe sayısı tartışılır.

Etkinlik 3: Çember olunur. Sırayla 1’den 5’e kadar sayılır. Bu sayıların her biri kendi içlerinde grup oluşturur. Bu beş gruba kendi ritimlerini bulmaları söylenir. Gruplar sınıfın köşelerine dağılır. İlk önce bütün gruplar bir arada ritimlerini uygular. Daha sonra liderin yönergeleriyle, her grup sıra sıra susar. Etkinliğin sonunda ilk önce kaç farklı ritmin bir arada söylendiği daha sonra kaç ritim kaldığı tartışılır.

Etkinlik 4: Çember olunur. Herkes sıra sıra sayma sayılarını söyler. Herkes söylediği sayıyı unutmamak koşuluyla liderin yönergesini dinler. Lider ‘5 çarpı 2’ dediğinde 5 ve 2 numaralı söyleyen öğrenciler ortaya gelir. Bu sayılar ortaya geldiğinde ‘5’ ile ‘2’ nin çarpımı olan ‘10’ da ortaya gelmelidir.

CANLANDIRMA

Etkinlik 1: Emniyetçiler İlköğretim okulunda bir suç işlenmiştir. Lider suçlunun sınıftan biri olduğunu ve bütün sınıfın bu suçluyu bulmak için çalışması gerektiğini söyler. Suçlu daha önceden sınıftan belirlenmiş bir kişidir. Suçlu (hırsız kim? oyunundaki gibi) sırayla diğer öğrencileri yaptığı bir hareket doğrultusunda eler. Her elemenden sonra grupta kaç kişi kaldığı. Suçlunun kaç kişiyi daha elemesi gerektiği söylenir.

Etkinlik 2:

Öğretmen oynanacak doğaçlama için sınıfta ön bilgi verir. Matematik sınavından birkaç dakika öncesidir. İki arkadaş sınıfın dışında konuşurlar. (Sınıftan doğaçlama için istekli 2 kişinin ortaya gelmesi istenir.) Birinci gencin amacı: Bu sınav için hiç çalışmamıştır. Soruların yanıtını kendisine göstermesi için arkadaşını ikna etmeye çalışır.

İkinci gencin amacı: Sınıfta örnek bir öğrencidir. Sınav sırasında yanıtları arkadaşına göstermeyi hayal bile etmemesini söyler. Oynayacak öğrencilere amaç açıklandıktan sonra kısa bir süre düşünmeleri için zaman tanınır. 3-5 dakika gibi bir zaman beklenebilir. Öğrenciler kendi kafalarında yorumladıkları rolleri canlandırmaya başlarlar.

Sınıftaki öğrenciler ikişer kişilik gruplara ayrılır. Herkes bu doğaçlama etkinliğini kendi aralarında dener. Daha sonra ikna olmayan öğrenciler sırasıyla seçilir. Seçilen her öğrenciden sonra ‘seni ikna etmek isteyen kaç kişi var?’ diye sorulur.

DEĞERLENDİRME

Her bir oyun hatırlatılır. Hangi oyunlarda neler yaptığımız konuşulur. Boşluklar verilen kartpostalların doldurulması istenir.

Bu etkinlikte..... öğrendim.

Bu etkinlikte en çok 'yı sevdim.

Bu etkinlikte..... 'yı iyi yaptım.

Bu etkinlikte da zorlandım.

Bir sonraki etkinlikte 'yı daha farklı yapacağım.

DERS PLANI 2

Kazanım 2: Permütasyon kavramını açıklar ve hesaplar.

ISINMA – HAZIRLIK

Etkinlik 1: ‘El el üstünde kimin eli var?’ oyunu oynatılır. Daha sonra tahtaya 3 kişi çıkarılır. Bir tanesi ebe olur, diğer ikisi elini ebenin sırtına koyar. Ebe en üstteki elin kimin eli olduğunu tahmin etmeye çalışır. Oyuncu sayısı azaltıp arttırılarak kaç farklı tahmin yapılacağı tartışılır.

Etkinlik 2: Sınıf 4 gruba ayrılır. Her gruba kâğıt bebekler ve onlara uyacak farklı kıyafetler verilir. Bu kıyafetleri kaç farklı şekilde giydirileceği tartışılır.

Etkinlik 3: Çember olmayarak ‘meyve sepeti’ oyunu oynatılır.3 çeşit meyve ismi üzerinden gruplaşan öğrenciler. Kendi meyve adları söylenince kendi içlerinde yer değiştirir.

Etkinlik 4: Gökkuşuğu renkleri tahtaya yazılır. Her öğrenciye gökkuşuğunu oluşturan renklerde kalemler dağıtılır. Kendi belirledikleri sıraya göre gökkuşuğunu oluşturmaları istenir. Daha sonra kâğıtlar toplanır. Oluşturulan sıralamalar öğrenciler tarafından ayrıştırılır. Kaç farklı sıralama olduğu tartışılır.

Etkinlik 5: Müzik eşliğinde sandalye kapmaca oynanır. Sınıftan 5 gönüllü seçilir. Tahtaya ilk önce 4 sandalye daha sonra 3 sandalye konur. Ve her durumda kaç farklı sıralamanın olacağı sınıfla tartışılır.

Ara Değerlendirme: Permütasyon kavramı verilir. Etkinliklerle ilişkisi tartışılır.

CANLANDIRMA

Etkinlik 1: Tahta ikiye bölünür bir tarafına sinema türleri(korku, romantik, komedi, dram), bir tarafına da konser türleri(rock, türkü, pop) yazılır. Sınıf 4 gruba ayrılır. Her grup sinema ve konser türlerinden birer tane seçer ve ardı ardına olacak şekilde fotoğraf anı olarak sınıfta sunarlar. Her bir fotoğraf karesi tahtaya yazılır. Kaç farklı fotoğraf karesi olduğunu bulması için öğrencilere zaman verilir.

Etkinlik 2: ‘6 şapka’ yöntemi kullanılarak, 6 tane gönüllüye verilen şapkaların görevlerine göre okulda üniforma giyilmesi konusu tartışılır. Şapkalar değiştikçe fikirler değişir. Her öğrencinin savunduğu fikirler tek tek sorulur. Ve böylece kaç fikir oluştuğu tartışılır.

DEĞERLENDİRME

Verilen tablonun boşluklarının doldurulması istenir.

Bu etkinlikte..... öğrendim.
Bu etkinlikte en çok’yı sevdim.
Bu etkinlikte..... ’yı iyi yaptım.
Bu etkinlikteda zorlandım.
Bir sonraki etkinlikte.....’yı daha farklı yapacağım.

DERS PLANI 3

Kazanım 3: Ayrık ve ayırık olmayan olayın deneyini, örnek uzayını ve olayını belirler.

ISINMA – HAZIRLIK

Etkinlik 1: Sınıf ikişerli gruplara ayrılır. Her grup kendi içinde ‘A’ ve ‘B’ olur. A’lar B’lerin sırtlarına 1-10 arası bir sayı yazar. B’ler sayıyı doğru tahmin ederse bu sefer yer değiştirilir ve B’ler A’ların sırtına bir sayı yazar. Bu oyun bir süre oynatıldıktan sonra A’lar lider tarafından kenara çekilir ve B’lerin sırtlarına sadece tek sayıları yazmaları söylenir. B’ler A’ların hangi kurala göre bu sayıları yazdıklarını bulmak için arada toplanıp kuralı tahmin etmeye çalışır. B’ler sırtlarına yazılan sayıları söyleyerek kuralı bulur. Daha sonra bu oyun asal sayılar, çift sayılar olarak tekrar oynatılır.

Etkinlik 2: Çember oluşturulur. Sınıf sayısına göre 1’den başlayarak 30’a kadar saymaları istenir. Her 1’e döndüğünde örnek uzay denir. İkinci tekrarlanışta, biraz önceki söylenen sayılar sayılarını unutmamak koşuluyla bir kuralla beraber sayılar söylenir. Ve kural uygulanır. Örneğin tek sayılar ‘olay’ denir. ‘deney’ sayıların sayılması. Bütün sayılar ise ‘örnek uzay’ dır. Bu kavramlar birkaç defa tekrarlanır.

Etkinlik 3: Öğrencilerin sırtlarına bazı deney, örnek uzay ve olay örnekleri yazılır. Ve bu örneklerin kendi içinde gruplaşmaları istenir. Herkes birbirine sırtında yazanı sorar ve örneğin kendisi deney ise kendi konusu ile ilgili örnek uzayı ve olayı bulur. Doğru üçleme bulunduğu diğer grupların da kendi grubunu bulması beklenir.

Örn: ‘zar atma, {1,2,3,4,5,6}, {1,3,5}’ , ‘yön bulma, {kuzey, güney, doğu, batı}, {kuzey}’ ...

CANLANDIRMA

Etkinlik 1: İki arkadaş sinema girişinde bekliyor. Sinemanın başlamasına on dakika kaldı ama biletleri alan 3. arkadaş ortada yok. Sinemanın başlamasına bekleyen iki arkadaştan bir tanesi sinemaya girmeyi çok istiyor ve 3.kişiye kızgın. Diğeri ise sinemaya gitmeyi istemiyor eve gidip ödev yapmanın daha iyi olacağı düşüncesinde. Lider bu hikâyeye sonlar arandığını söyler. Sınıf 3 er kişilik gruplara ayrılır ve başka sonlar oluşturarak bu hikâyeyi canlandırırlar.

Etkinlik 2: Bir kırlangıç, bir adama aşık olur. Ve adamın penceresinin önüne konup ona ‘Ben seni çok seviyorum, lütfen pencereyi açıp beni içeri al da birlikte yaşayalım’ der. Adam ‘Olmaz alamam... ’ Sen bir kuşsun ve bir kuş bir adama âşık olamaz! ‘ diye yanıt verir.

Kırlangıç bir süre sonra tekrar gelir ve ‘Lütfen pencereyi açıp beni içeri al birlikte yaşarız. Hem ben sana dost ve arkadaş olurum canın da sıkılmaz birlikte yaşar gideriz’... Der.

Adam onu yine geri çevirir. Zaman geçer, sonbahar gelir. Kırlangıç üçüncü ve son kez pencerenin önüne konup adama tekrar şöyle der: ‘Lütfen beni içeri al... Artık soğuklar da başladı, dışarıda kalamam biliyorsun ben sıcak havalarda yaşayabilirim yalnızca... Beni içeri almazsan sıcak ülkelere gitmek zorunda kalırım.’

Lider öğrencilerden bu hikâyeye bir son düşünmelerini ister. İkişer kişilik doğaçlamalar halinde öğrencilerden hikâyedeki kuş ve adam olmaları istenir.

Ara Değerlendirme: Bu hikâyeden yola çıkarak bu hikâyenin deney, örnek uzay ve olayı belirlenir. Her grup kendi sonuna göre deney, örnek uzay ve olayı belirler.

DEĞERLENDİRME

Çember olunur. Canlandırma aşamasında anlatılan hikâyenin sonu öğrencilere okunur. Bu hikâye ile ve etkinlik ile ilgili akıllarına gelen bir kelimeyi sıra sıra söylemeleri istenir.

DERS PLANI 4

Kazanım 4: Ayrık ve ayrık olmayan olayı açıklar.

ISINMA – HAZIRLIK

Etkinlik 1: Öğrenciler 2’şerli gruplar oluşturur. Omuzlarına kâğıt konur. Ve kâğıdı düşürmeden yürümeleri istenir.(yapışkan kâğıt)

Etkinlik 2: ‘Ayrık olay’ kelimesinin onlara ne ifade ettiği sorulur. Ayrık olay diyince akıllarına gelen ilk örneği ile ‘ve’ ve ‘veya’ bağlaçları kullanarak iki cümle yazmaları ve yazdıkları kâğıtları duvara yapıştırmaları istenir. (Etkinlik sonunda tekrar incelemek üzere)

Etkinlik 3: Öğrenciler çember olur. Bazı özellikler söylenir ve o özelliklere sahip öğrencilerin bir adım öne çıkmaları istenir. ‘kravatlılar ve gözlüklüler’, ‘kızlar veya gözlüklüler’, ‘kızlar ve erkekler’, ‘kızlar veya erkekler’ gibi... ‘ve’ ile ‘veya’ arasındaki fark sorulur. ‘Ve’ diyince kimlerin öne çıktığı ‘veya’ diyince kimlerin öne çıktığı sorulur.

CANLANDIRMA

Etkinlik 1: Doğaçlama: Bir tarih öğretmeni ve öğrenci, öğretmenin odasında, öğrencinin ödevi hakkında konuşuyor.

Öğretmenin amacı: Elinde çok kaliteli ödevin bu öğrenci tarafından yapılmadığına inanıyor. Öğrencinin bunu açıklaması için onu ikna etmeye çalışıyor. Öğrencinin amacı : Bu ödev üzerine çok çalışmış. Öğretmenini bu ödevi kendisinin yaptığına ve çok uğraştığına inandırmak istiyor.

İkişer kişilik gruplar liderin yönergesine göre doğaçlamalarını gösterir. Her doğaçlamanın sonunda verilen ödevin özellikleri sorulur. Tahtaya ‘ve’ li ‘veya’lı cümleler yazılır.

Etkinlik 2:

Emlakçıya gelen müşteri bir evin fiyatını sorar. Beğendiği ev 50 milyardır.

Emlakçının amacı;evi en az 45 milyara satmaktır ve evin iyi özelliklerini söyler.

Müşterinin amacı; Evi en çok 40 milyara almaktır ve evin kötü özelliklerini söyler.

Doğaçlamanın sonunda İyi özellik ve kötü özellikler ile ilgili ‘ve’ ve ‘veya’lı cümleler tahtaya yazılır. ‘Ve’ diyince bunun neleri kapsadığı ‘veya’ diyince neleri kapsadığı konuşulur.

DEĞERLENDİRME

Lider öğrencilere ayırık ve ayırık olmayan olaylar ile ilgili günlük hayat örnekleri verir.. Öğrenciler hangi örneğin ayırık hangi örneğin ayırık olmadığını bulur. Sınıf beş kişilik gruplara ayrılır. Her grup içinde ‘ve’ ,‘veya’ yazan slogan bulur ve arkadaşlarına sunar.

DERS PLANI 5

Kazanım 5: Ayrık ve ayrık olmayan olayların olasılığını hesaplar.

ISINMA – HAZIRLIK

Etkinlik 1: ‘Yağ satarım, Bal satarım’. Ebe mendili bir öğrencinin arkasına bırakır. Sonra ebeyi yakalamaya çalışır.

Etkinlik 2: Herkes salona dağılır. ‘Tek tek ama hep beraber çalışacağız. Yaptığımız işe konsantre olun ve birbirinize yardım edin. Hep birlikte anlamlı sesler çıkaracağız’ denir. Lider ‘Durun!’ diye bağırdığında ya da el çırdığında tüm seslerin anında kesilmesi gerektiği söylenir. ‘herkes susturma sesi çıkarsın, Şşş, Şimdi fısıldama... Tıslama, Mırıldanma, Mızırdanma, İnleme, Yakarma, Söylenme, Homurdanma, Kükreme, Bağırma, Durun!’ ‘Diyerek yönergeler verilir.

Son çıkardığımız sestten başlayarak (sondan başlayarak), başa doğru gideceğiz. Bağırma, Kükreme, Homurdanma, Söylenme, Yakarma, İnleme, Mızırdanma, Mırıldanma, Tıslama... Fısıldama, Susma, Durun!

Etkinlik 2: ‘En-de-tura’. Tahtanın önünde bir kız ve bir erkek arkası dönük bir şekilde durur. Erkek öğrencinin arkasında kızlar, kız öğrencinin arkasında ise erkekler beklemektedir. Kızlar erkek ebeye doğru yaklaşır. Erkek ebe arkasını döndüğünde hareket halinde birini görürse o kişiyi elemiş olur. Elenen kişi kız ebe önüne geçer. Elenen öğrenciler. Her elenenden sonra eleme oranını söyler. ‘1 de 10’, ‘2 de 10’ gibi...

Ara değerlendirme: Yağ satarım bal satarım da kaç kız arasından ebeyi seçtiği ve bunun olasılık teoremi ile ilişkisi tartışılır.

CANLANDIRMA

Etkinlik 1: Herkes olasılık kelimesini kullandığı bir cümle yazar ve bu kâğıtlar sınıfın ortasında toplanır. 4'er kişilik gruplar oluşturulur ve her grup yere konan kâğıtlardan 3 tanesini alıp belirli bir kurgu içinde canlandırır.

Etkinlik 2: Baba erkek çocuğunun odasında şans oyunu kuponu bulur.

Erkek çocuk: Sınıftan bir arkadaşıyla şans oyunu oynamış, arkadaşına bir miktar para çıkmasına rağmen kendine çıkmamış. Tekrar oynarsa para çıkacağına babasını inandırmak için babasının yanına gider.

Baba: Çocuğunu daha öncede bu oyunlarla oynarken yakalamış ve kızmıştı. Üstüne üstlük bugün arabasını çarpmış.

Etkinlik 3: Belirlenen grupların her birine belirli olaylar verilir.Örneğin,bir restaurantta 35 masa içinden cam kenarında olanlar 20,yüksek ayaklılar 15 gibi..bu masaların içinden cam kenarı ve mavi renkli olanlara oturma ihtimalinizi hesaplayıp. Her grup garsona neden bu masayı tercih ettiklerini anlatır. Garsonu ikna etme gibi...

DEĞERLENDİRME

Lider Akdeniz folklorunun neslinin tükenmesi ile ilgili bir eylem düzenleyeceklerini söyler ve her gruba belirli renklerde kalemler ve renkli kâğıtlar dağıtır. Gruplar afişleri bitirdikten sonra her afiş ile ilgili sorular sorma. 'Başlığı kaç farklı renkte kalemle boyayabilirdin?' gibi...

Bu etkinlikteöğrendim.

Bu etkinlikte en çok 'yı sevdim.

Bu etkinlikte 'yı iyi yaptım.

Bu etkinlikte da zorlandım.

Bir sonraki etkinlikte 'yı daha farklı yapacağım.

DERS PLANI 6

Kazanım 6: Geometri bilgilerini kullanarak bir olayın olma olasılığını hesaplar.

ISINMA – HAZIRLIK

Etkinlik 1: Bahçeye belirli büyüklükte bir kare ve kareyi belirli büyüklüklerde bölecek başka kareler çizilir. Öğrencilerin alan bilgilerinden yararlanarak her karenin alanını bulmaları söylenir. Ellerindeki parçayı nereye atmak istedikleri sorulur. Daha sonra bütün öğrenciler sırayla ellerindeki parçayı karenin içine atar. Atmak istedikleri parçaya gelme olasılığı hesaplanır. Büyük kareye gelme olasılığının neden fazla olduğu tartışılır.

Etkinlik 2: (Ana yol-Tali yol)

Ara değerlendirme: Etkinliklerden yararlanılarak öğrencilerle olasılık üzerinde konuşma

Etkinlik 3: Dikdörtgen prizmanın üstüne bazı görevler yazılır. Daha sonra bu görevlerin yapılması istenir.(şarkı söyleme, taklit yapma, dans). Hangi görevlerin gelme olasılığının daha fazla olduğu tartışılır.

Etkinlik 4:Çocuklar 5'er kişilik gruplara ayrılır. Her bir grup için bir gazete sayfası yere serilir. Müzik eşliğinde gazetenin etrafında dans ederler. Müzik bittiğinde 5 kişi gazetenin üzerine çıkar. Ayağı gazetenin dışında kalan oyundan çıkacağından gazeteyi paylaşmaları önemlidir. Gazeteler ikiye katlanır. Oyun aynı şekilde devam eder. Oyun, gazete üzerinde birer oyuncu kalıncaya kadar devam eder. Gazete üzerinde kalan oyuncuya gazetenin kaç kez katlanmış olabileceği sorulur.

Etkinlik 5: Lider sınıfın ortasına bir havuz çizdiğini söyler Bu havuzun içinde herkes ayakta duracaktır. Seçilen iki ebe havuzun içindekileri dışarı çıkarmaya çalışır. Havuzun içindekiler havuzun dışına çekilmemek için, ebeler ise onları dışarı çekmek için uğraşır.

CANLANDIRMA

Etkinlik1:Dramatik anlar verilip içindeki olasılık öğeleri tartışılır. Örn: odanız küçük, oturma odasıyla odanızı değiştirdiğinizde daha geniş ve rahat bir odada kalacaksınız. Babayı ikna etme. Geniş odada kalmanın olumlu yönlerinden bahsetme.

Etkinlik 2: İzciler kamp kuracaktır.

1.izci: Çadırların çevreye dağılması gerektiğini düşünür.

2.izci: Çadırların yan yana ve küçük bir alana dağılması gerektiğini böylece dışarıdan gelecek tehlikeye karşı daha korunaklı olunacaktır.

DEĞERLENDİRME

Yapılan çalışmalar ile ilgili öğrencilere sorular sorulur. Etkinliklerle ilgili ne düşündükleri sorulur.

APPENDIX F

PERMISSIONS



1956

Orta Doğu Teknik Üniversitesi
Middle East Technical University
Fen Bilimleri Enstitüsü
Graduate School of
Natural and Applied Sciences

06531 Ankara, Türkiye
Phone: +90 (312) 2102292
Fax: +90 (312) 2107959
www.fbe.metu.edu.tr

Sayı: B.30.2.ODT.0.AH.00.00/126/29 - 208

22 Şubat 2011

Gönderilen: Yrd. Doç. Dr. Mine İşıksal

İlköğretim Bölümü

Gönderen : Prof. Dr. Canan Özgen

IAK Başkan Yardımcısı

İlgi : Etik Onayı

"İlköğretim 7. Sınıf Öğrencilerinin Matematik Başarı ve Matematik Tutumlarına, Olasılık Konusu Üzerinden Yaratıcı Drama Metodunun Etkisi" isimli araştırmanız "İnsan Araştırmaları Komitesi" tarafından uygun görülerek gerekli onay verilmiştir.

Bilgilerinize saygılarımla sunarım.

Etik Komite Onayı

Uygundur

22/02/2011

Prof.Dr. Canan ÖZGEN
Uygulamalı Etik Araştırma Merkezi
(UEAM) Başkanı
ODTÜ 06531 ANKARA

T.C.
ANKARA VALİLİĞİ
Milli Eğitim Müdürlüğü

BÖLÜM : İstatistik Bölümü
SAYI : B.08.4.MEM.0.06.22.00-60599/ 32685
KONU : Araştırma İzni
A. Damla GEÇİM

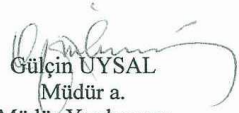
22/04/2011

ORTA DOĞU TEKNİK ÜNİVERSİTESİNE
(Öğrenci İşleri Daire Başkanlığı)

İlgi : a) MEB Bağlı Okul ve Kurumlarda Yapılacak Araştırma ve Araştırma Desteğine
Yönelik İzin ve Uygulama Yönergesi.
b) Üniversiteniz Öğrenci İşleri Daire Başkanlığının 23/03/2011 tarih ve 2004 sayılı yazısı.

Üniversiteniz İlköğretim Fen ve Matematik Eğitimi Anabilim Dalı yüksek lisans öğrencisi A. Damla GEÇİM'in "**İlköğretim 2. Kademesinde, 7. Sınıf Matematik Dersi Permütasyon ve Olasılık Konusunun Yaratıcı Drama Yöntemiyle Öğretiminin Matematik Başarılarına Etkisi**" konulu tezi ile ilgili çalışma yapma isteği Müdürlüğümüzce uygun görülmüş ve araştırmanın yapılacağı İlçe Milli Eğitim Müdürlüğüne bilgi verilmiştir.

Mühürlü anketler (8 sayfadan oluşan) ekte gönderilmiş olup, uygulama yapılacak sayıda çoğaltılması ve çalışmanın bitiminde iki örneğinin (CD/disket) Müdürlüğümüz İstatistik Bölümüne gönderilmesini rica ederim.


Gülçin UYSAL
Müdür a.
Müdür Yardımcısı

EKLER :
Anket (8 sayfa)

22/04/2011 Memur :E. ÇİNER
21/04/2011 Şef :N. ÇELENK

İl Milli Eğitim Müdürlüğü-Beşevler
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Tel : 223 75 22
Fax: 223 75 22

APPENDIX G



TEZ FOTOKOPİ İZİN FORMU

ENSTİTÜ

- Fen Bilimleri Enstitüsü
- Sosyal Bilimler Enstitüsü
- Uygulamalı Matematik Enstitüsü
- Enformatik Enstitüsü
- Deniz Bilimleri Enstitüsü

YAZARIN

Soyadı :

Adı :

Bölümü :

TEZİN ADI (İngilizce) :

.....

.....

.....

.....

TEZİN TÜRÜ : Yüksek Lisans Doktora

1. Tezimin tamamı dünya çapında erişime açılсын ve kaynak gösterilmek şartıyla tezimin bir kısmı veya tamamının fotokopisi alınsın.
2. Tezimin tamamı yalnızca Orta Doğu Teknik Üniversitesi kullanıcılarının erişimine açılсын. (Bu seçenikle tezinizin fotokopisi ya da elektronik kopyası Kütüphane aracılığı ile ODTÜ dışına dağıtılmayacaktır.)
3. Tezim bir (1) yıl süreyle erişime kapalı olsun. (Bu seçenikle tezinizin fotokopisi ya da elektronik kopyası Kütüphane aracılığı ile ODTÜ dışına dağıtılmayacaktır.)

Yazarın imzası Tarih