SIXTH GRADE STUDENTS' PERCEPTIONS OF AND ENGAGEMENT IN ETHNOMATHEMATICAL TASKS IN THE AREA MEASUREMENT CONCEPT

A THESIS SUBMITTED TO
THE GRADUATE SCHOOL OF SOCIAL SCIENCES
OF
MIDDLE EAST TECHNICAL UNIVERSITY

BY

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IN PARTIAL FULFILLMENT OF THE REQUIREMENTS
FOR
THE DEGREE OF MASTER OF SCIENCE IN
THE DEPARTMENT OF ELEMENTARY SCIENCE AND MATHEMATICS EDUCATION

SEPTEMBER 2013

Approval of the Graduate School of Social Sciences

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ABSTRACT

SIXTH GRADE STUDENTS' PERCEPTIONS OF AND ENGAGEMENT IN ETHNOMATHEMATICAL TASKS IN THE AREA MEASUREMENT CONCEPT

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September 2013, 180 pages

The purpose of this study is to investigate the sixth grade students' perceptions of and engagement in ethnomathematical tasks in area measurement concept. The study aims to explore how do students perceive and engage with the area measurement instruction enriched with ethnomathematics.

Data was collected from twelve 6^{th} grade students in a public school located in rural İzmir. The design of the research was basic qualitative research design which the researcher was also the teacher at the same time. The area measurement topic with its supplementary topics such as length measurement and land measurement were covered with the ethnomathematics based tasks developed by the researcher. Classroom observations, field notes, video recordings, students' task sheets, students' activity assessment forms were used to evaluate the students' perceptions of and engagement with instruction. The data was described in detail and analyzed to identify the students performances during the activities enriched with ethnomathematics.

The findings of the study revealed that an instruction enriched with ethnomathematics result in an increase in students' motivation, interest, and self confidence; comfort and enjoyment in mathematics classes; a peaceful and sharing classroom environment; progress in problem solving skills through culturally relevant activities about their daily practices in a familiar context and promotion of their own culture and other cultures in mathematics classroom. The study also indicates that the most recognizable positive changes in means of above-mentioned performances were observed in middle and lower middle achievers, while low and high achievers maintained their existing status.

Keywords: Ethnomathematics, culturally relevant mathematics education, area measurement

ÖZ

6. SINIF ÖĞRENCİLERİNİN ETNOMATEMATİK ETKİNLİKLERİYLE OLAN ETKİLEŞİMLERİ VE BU ETKİNLİKLERİ ALGILAYIŞLARI

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Eylül 2013, 180 sayfa

Bu çalışmanın amacı etnomatematik ile zenginleştirilmiş bir matematik öğretiminin, 6.sınıf öğrencilerinin alan ölçme konusunu nasıl algıladıkları ve ilişkilendirdiklerini belirlemektir.

Çalışmanın katılımcılarını İzmir ilinin kırsal bölgesinde yer alan bir devlet okulunun on iki 6.sınıf öğrencisi oluşturmaktadır. Çalışmada Temel Nitel Araştırma tasarımı kullanılmıştır. Araştırmacı aynı zamanda uygulamanın yapıldığı sınıfın matematik öğretmendir. Araştırmacı tarafından geliştirilmiş olan alan ölçme ile birlikte uzunluk ve arazi ölçme gibi tamamlayıcı konuları içeren etkinlikler öğrencilere uygulanmıştır. Bu yöntemle öğretimin öğrencilerin alan ölçme konusunu nasıl algıladıkları ve ilişkilendirdiklerini belirlemek için sınıf içi gözlem, gözlem notları, video kayıtları, öğrenci etkinlik değerlendirme formları ve öğrenci çalışma kağıtları kullanılmıştır. Toplanan veriler, öğrencilerin etnomatematikle zenginleştirilmiş etkinlikler boyunca performanslarını tespit etmek amacıyla analiz edilmiş ve detaylıca aktarılmıştır.

Çalışmanın bulguları, öğrencilerin kültürleriyle ve günlük pratikleriyle ilişkili etkinliklerin sunulması ile işlenen derslerin, öğrencilerde motivasyon, ilgi ve özgüven artışı, rahat ve keyifli matematik dersi, barışçıl ve paylaşımcı sınıf ortamı, ve problem çözme becerisinde gelişme gibi sonuçlar ortaya koymuştur. Çalışma aynı zamanda bu anlamda en farkedilir performans değişimlerinin orta ve orta-alt başarı seviyesine sahip öğrencilerde gözlenirken, düşük ve yüksek başarılı öğrencilerin var olan durumlarını koruduklarını göstermiştir.

Anahtar Kelimeler: Etnomatematik, kültür ile ilişkili matematik eğitimi, alan ölçme

To the dignity of educationally deprived children

ACKNOWLEDGEMENTS

Firstly of all, I would like to express my deepest gratitude to my supervisor Assoc. Prof. Dr. Erdinç ÇAKIROĞLU for his guidance, advices, encouragements and insights throughout this research. I am grateful to him especially for supporting my desire to study on present topic and make me feel his trust. I also would like to thank Assoc. Prof. Dr. Cennet ENGİN DEMİR for her guidance and help especially at the beginning of the formation of this study.

I thank my father Ahmet AKTUNA, who is the primary reason of the position where I stand in this life, for his belief in my success and endless support. Thanks my dear mother Gülfer AKTUNA for providing the best working environment during the most stressful period of my work and my sister İlke AKTUNA for her friendship and patience.

I felt the necessary power to complete my thesis in a December night of Bornova thanks to my friend Onur SÖNMEZ. You were effective more than you imagine in formation of this study. Many deep thanks you for sharing my excitement to my field of study, widening my point of view, motivating, guiding and encouraging me for further ways.

I am also thankful to my dear friends whose existence is a real chance for me; Damla GEÇİM who never hesitated to guide me about academic stuff during this hard process and considerably eased my way in every step of it; Nihal ŞAH who opened her home to me, gave me real comfort and her warm friendship and whom I darken her door whenever I was in trouble; Merve ERDOĞAN and Sait Eren ERENER who cared me physically and morally during the most hard passing times of this process, just as they always do whenever I need; Burçin BAL who put her precise English into this work with an ultimate attention even though she was pretty much busy; and Burcu BİLGİÇ who made little Uras' coming into the world possible and coloured our lives.

In addition to this, special thanks go to my school manager Öznur YILMAZ for her understanding, permanent support and being an elder sister to me; my

colleague Ali Rıza TUNÇEL for his invaluable contributions to this study and his sensitivity; and my students, thank you for being so sincere and warmhearted.

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LIST OF ABBREVIATIONS

NCTM	National Council of Teachers of Mathematics
MNE	Ministry of National Education
OECD	Organisation for Economic Co-operation and Development
PISA	Programme for International Student Assessment

CHAPTER 1

INTRODUCTION

Mathematics education is generally labeled as a *culture-free* field which only contains numerical calculations, application of equations, transmission of technical knowledge, etc. Although mathematics education, like mathematics itself, is perceived as *culture-free*; it actually incorporates many social, cultural and economic dimensions. Such dimensions have substantial role on mathematical perception and thinking (Bishop, 1988; D'Ambrosio, 1985; Frankenstein, 2005; Gutstein, Lipman, Hernandez, & de los Reyes, 1997).

Moreover, considering mathematics as the most value-free school subject and ignoring that mathematics is a human product and reflects cultural knowledge as much as other fields is also surprisingly quite common not only in the society, but also in mathematics classrooms. Teachers and students also mostly are not aware of the connection between mathematics and culture because of the absence of culture in content and instruction in these traditional classrooms (D'Ambrosio, 2001; Bishop, 2002).

However, in contrast to the common misconception which advocates that mathematics has no need to be linked to culture to be taught effectively; there is an emerging area of study called ethnomathematics which considers socio cultural aspects of mathematics classroom and accepts cultural background of students as a resource to be linked into mathematics activities (Fasheh, 1997a).

In industrialized societies a considerable difference in achievement could easily be observed between the students come from lower socioeconomic class and disadvantaged ethnic origin and the students come from middle class and dominant ethnic origin. It has been argued that this achievement difference is quite obvious because the social and cultural needs of disadvantaged students are not fulfilled, they cannot adapt to educational processes sufficiently, because of their backgrounds and also their disadvantaged situation is reproduced by various factors in classroom

(power relations, teacher attitude, curriculum, etc.); so the achievement gap between those students always continues to exist (Oakes, 1990; Secada, 1992; Tate, 1997). By this way, the significance of social, cultural and economic factors on education comes into the picture right in the point when we realize the reasons of why some students are successful while the others are not.

In such a system the ethnic minority and working-class students tend to be left behind in the academic journey (Civil, 2002). Some solutions need to be proposed in order to eliminate those inequality problems and have fairer educational processes. In contrast to common idea, mathematics education field deserves much more attention about inequality issues because of its gatekeeper role in society. Mathematics serves as a "critical filter" in society, with its potential to reward successful students with high occupational status and pay (Campbell, 1991). In other words, students have to achieve mathematics to gain places in further academic studies, high prestige and well-paid positions (Meaney, 2002). Mathematics not only serves as a ladder of economic mobility, it is also essential for making informed consumers and voter choices. Moreover, mathematical literacy is a key in the fight for racial equality (Moses, 1994).

However, unfortunately, there exist inequality problems to reach mathematics in reality. For instance, mathematics holds its own situation as the mostly failed discipline in elementary and secondary schools in Turkey (Tıraş, 1999). Turkey is also at the top among OECD countries on interscholastic disparity in mathematics in PISA 2003 (EARGED, 2005). To sum up, not to let kids give up on mathematics, and in turn give up on society, as well as to live in a fairer society with our awareness, we need to give the full treatment to mathematics education and its social dimensions. As mentioned above, the discipline of mathematics plays a complex role in societies - a role which is rarely under scrutiny in education systems anywhere (FitzSimons, 2002). Therefore, this study started to be shaped with an attempt to investigate social issues in mathematics education and stresses to provide useful suggestions to eliminate negative effects of them. In this point of view ethnomathematics could be proposed as a method to eliminate the inequality in reaching and achieving mathematics because it suggests more meaningful mathematical understanding and it brings achievement with the contribution of students' own background, culture and roots in mathematics classroom.

1.1 Purpose of the Study

The purpose of this study is to investigate the sixth grade students' perceptions of and engagement in ethnomathematical tasks in area measurement concept.

1.2 Research Question of the Study

How do students perceive and engage with the area measurement tasks enriched with ethnomathematics?

1.3 Significance of the Study

With an ethnomathematics program,students develop abilities such as creating hypotheses, contacting mathematics with biology, chemistry, physics, geography, history, and language, working in groups, sharing experiences, learning how to appreciate both criticism and alternate opinions, respecting the ideas of others from them, interacting with others,sharing global and interactive visions necessary to develop successful mathematical content. Briefly, the major objective of ethnomathematics as a program is to raise student self-confidence, to enhance creativity, and to promote cultural dignity (cited in Orey & Rosa, 2006).

Overall, when ethnomathematical approaches are applied, the school mathematics is getting more relevant and meaningful for students and it also promotes the overall quality of education (Adam, 2004). The students feel more comfortable and confident about discussing mathematical concepts and gain a better appreciation of mathematics when they are taught with a cultural perspective (Schultes & Shannon, 1997).

In this respect, this study will try to offer ethnomathematics to the students as a critical instructional strategy that lets them to be more active, confident and successful in mathematics. In this way, the students who are culturally particular are expected to receive a meaningful and comprehensible mathematical understanding to gain those skills.

Particularly in diverse societies, we can see that the culture experienced by learners in their homes is rarely the same as that represented by the school curriculum (Bishop, 1994). This reveals that, for many children around the world, the mathematical experiences in school are not culturally consonant with their home experience (Bishop, 2002). This mismatch is one of the contributing factors to the low achievement of students who come from subcultures in mathematics (Lubienski, 2001). In Turkey, as a country which has cultural diversity in terms of social class, geography, ethnicity, language, religion, etc.; we cannot ignore the problems of the students who are exposed to a curriculum not respecting those cultural factors.

However, even if many countries in the world have put ethnomathematics on their agenda in order to make culturally disadvantaged students' position better and taking cultural background of the students as a source for mathematics activities (Keitel, Damerow, Bishop & Gerdes, 1989), those social issues about mathematics education haven't been widely discussed in Turkey yet. There are several studies that investigate cultural issues in mathematics education in many countries, especially in USA, which has a multicultural society with many conflicts in it. However, in Turkey which also has a multicultural society, these issues do not attract sufficient attention in educational field, in especially mathematics education. Although almost a quarter of the population of 8 to 15 year-old children belong to ethnic minority groups and there exist remarkable differences in educational outcomes across ethnic groups (include ethnic Kurds, Arabs, and Caucasians along with ethnic Turks) (Kırdar, 2009), there is almost no study that examines cultural and ethnic disparities in educational outcomes in Turkey. With this point of view, this study might offer good practices for our country, in order to let children win in mathematics by feeding their needs with culturally relevant methods. In such kind of absence of studies, any research, methods and task integration about ethnomathematics seem to be valuable as a starting point. This study also aims to develop a specific example for the application of ethnomathematics concepts with students come from sub-populations. Therefore, this study may not only provides practical task plan examples for teachers who want to integrate their lessons with ethnomathematics, but also may pave the way for other studies and widen this research area for more practices in future.

Ethnomathematical program also constitutes a consonance with today's mathematics educational trends and curriculum which generally aim to introduce pupils to mathematical problem solving, communication, reasoning, and connections

(NCTM, 2000). Ethnomathematics is also one of the teaching approaches that respects students' individual differences and encourages them to be more active in the learning process. For this reason, it is quite coherent with the new Turkish mathematics curriculum that supports the constructivist and student centered approach into the classrooms (MNE, 2005). Alternative mathematical teaching methods are also welcomed especially in elementary mathematics curriculum(MNE, 2005, 2006).The revised elementary mathematics curriculum emphasizes students' individual differences and encourages students to be more active in the classroom. Therefore, in means of those educational principles, ethnomathematics curriculum may fulfill the principles of the program such as promoting student-centered instruction, increasing learner willingness, etc.

Ethnomathematics might actually go a step further than today's mathematics education programs by also considering connecting learners' everyday discourses with the unfamiliar discourse of academic mathematics not to let the disadvantaged students lag behind because of the mentioned cultural disparities (Benn, 1997). Because, although modern educational approaches continuously state that current curricula are based on the real world experiences, the challenging point is whose or which cultures'experiences are reflected in curriculum. Thus, this study may contribute the current mathematics education program's goals, also may widen it by considering cultural differences in mathematics classroom.

Not only instructional dimensions, but also social dimensions of ethnomathematics are also presenting quite critical and convincing evidences to accept mathematics as a tool for a better and equal world; instead of something strange, serious, far away and not even belong to us. In today's societies which include economic, social and cultural diversitiesand even in classrooms as micro societies; hate speech and ignorance of the others could be observed easily. However, ethnomathematics discourages any marginalization by promoting different cultures in classrooms and plays a critical role for a more equal, peaceable and respectful society. Especially when it is applied in such kind of contexts, besides learning to value the mathematics, students also realize that all cultures are valuable. It is known that when students taught with multicultural mathematics activities, they develop a greater respect to those different from them (D'ambrosio, 2001). Therefore, as well as academic ones, this study also might be a good attempt for social aspects of mathematics classroom too.

1.4 Definitions of Terms

The term *ethnomathematics* had been defined by many researchers, educators and mathematicians and it all interpreted differently in practical meaning. Ethnomathematics was first used in the late 1960s by a Brazilian educator and mathematician, Ubiratan D'Ambrosio to describe the mathematical practices of identifiable cultural groups. After him, some interpreted it as the study of mathematics in different cultures, others as a way of making mathematics more relevant to different cultural or ethnic groups, or as a way of understanding the differences between cultures.

Ethnomathematics means "the math practiced among cultural groups such as national-tribal societies, labor groups, children of a certain age bracket, professional classes and so on" (D'Ambrosio, 1985, p.45). In this study, ethnomathematics refers to describing mathematical practices of identifiable cultural groups, the mathematics of their cultural practices and the relationship between mathematics and their culture (Presmeg, 1996a).

The prefix *ethno* refers to identifiable cultural groups, such as national-tribal societies, labor groups, children of a certain age bracket, professional classes, etc. and includes their ideologies, language, daily practices, and their specific ways of reasoning and inferring. It is sometimes used specifically for small-scale indigenous societies, but in its broadest sense the *ethno*prefix can refer to any group - national societies, labor communities, religious traditions, professional classes, and so on (D'Ambrosio, 1985). Mainly, the term *ethno*describes "ingredients that make up the identity of a group: language, codes, values, beliefs, community, class, food and dress, habits, and physical traits" (D'Ambrosio, 2001, p. 308).

*Mathema*means to explain, understand and manage reality specifically by ciphering, counting, measuring, classifying, ordering, inferring and modeling patterns arising in the environment (D'Ambrosio, 1991) and *'tics'* defined as methods, modes, styles, and techniques (D'Ambrosio, 1999).

*An instruction integrated with ethnomathematics*refers to students' introduction to the mathematical operations developed in familiar cultural contexts as

a way of expanding their perspective of math and deepening their understanding of the cultural influence on how we perceive and use math (Bishop, 2002). In this study, ethnomathematics-based instruction refers to teachers' building activities from a particular group of students' culture and daily informal mathematics practices; employing them formeaningful mathematical understandings and developing their mathematics perspective.

1.5 My Motivation for the Study

Basically, my interest in cultural issues and various cultures has motivated me to carry out this study. Focusing on a field of study unrelated to culture would make me unhappy because I believe that culture is the reflection of our products as human beings and the way we express ourselves in emotional and spiritual sense. Thus, serving in an area that I would not able to process my soul and emotions would not be acceptable for me. However, doing a culture-related work in mathematics is regarded as arduous and weird in today's values and perceptions. Even if mathematics emerged from the needs of people is an area which was completely intertwined with life, it is still regarded as an area which is not possible to be rendered down to daily life practices despite the recent teaching methods. Against the notion considering mathematics' as a culture-free subject, I felt the need to do my study with the aim of demonstrating the social aspects of this area, primarily for myself.

I love being in the field and working together with people both mentally and phsycally. However, according to the prevailing opinion, mathematics is not a course that can be combined with cultural issues and this was affecting my motivation negatively at the beginning of study. Before doing my research, I used to wish that I were a teacher of a subject from the field of social sciences instead of mathematics so that I could influence my students' lives directly. Nevertheless, after starting to work as a teacher, I realized teaching profession on its own is already a field that nested with students, including a lot of mutual interactions and emotions, and I liked it. On top of it, I have been more satisfied since I observed student's high energy and excitement in the courses that I prepared with the thoughts of endearing the feared

and hated math classes to my students and letting them to realize math is more than just memorizing equations and calculations.

However, in other schools where I worked, I experienced how difficult and laborious teaching the existing mathematics curriculum to the students who have different ethnic origins and who speak different languages was. It was impossible to associate their daily life practices with the cases presented in the curriculum. While working with those students who were completely away from the mathematics language used in classes and the values in textbooks appealing to a different (dominant) socio-economic and ethnic class, I noticed that mathematics education is also influenced by social variables as well as other subjects. With the desire of stated reasons, I started to read, and then I noticed that culturally relevant mathematics is such a large research area that there have been many studies on it. After some more reading, I came across a research field called ethnomathematics which is a great workspace for a teacher like me who is sensitive to culture of various people and who believes in the necessity of cultural diversity and accepts this as a resource rather than a conflict.

After I learned that ethnomathematics is an area applicable not only to ethnic identities but also all particular cultural groups, I decided to conduct this study with the students that I teach. They are members of a community who make a living from olive farming and some of my students still actively work in the olive groves. I believed that they were even better than me in some practical mathematical applications due to their daily practices brought from their ancestors. However, they were not aware of this and didn't define them all as mathematical. At that point, I presupposed that a mathematics teaching method nourished with theirown culture and practices could contribute their learning.

Another reason attached me to this study was that ethnomathematics is an area looking for solutions to inequality of opportunity in education. As it offers a teaching relevant to practices of some particular cultural groups instead of a main curriculum appealing to only middle class. Consequently, the success of the students who has difficulty in establishing the connection with the existing curriculum because of their unrepresented culture and background is expected to increase. Namely, ethnomathematics method can also let those students who mostly come from a lower class break their educationally deprived situation in order not to leave

them behind. Even if it seems like a utopia in existing social system, it still worthes giving a try for a better world.

CHAPTER 2

LITERATURE REVIEW

In this chapter the related literature is reviewed. This chapter is divided into two main parts. In the first part the theoretical framework is elaborated and in the second part related research studies are reviewed.

2.1 Theoretical Framework

In this section, the concepts of culturally relevant subject and culturally relevant mathematics are presented and Western mathematics versus Non-Western mathematics is discussed. Subsequently ethnomathematics is introduced and its relationship with human rights, the critics related it and the situation in Turkey context are stated.

2.1.1 Culturally Relevant Subject

Educational difficulties are connected to the disparity between the values of the dominant culture and the values of minority groups within the culture (Kneller, 1971). Disadvantaged minority groups live mostly outside of the dominant culture and, by race, religion, sex, or other characteristics find themselves handicapped in an educational system controlled by the values of the dominant culture. The dominance of a certain culture in an educational system makes it difficult to heal the educational disadvantages of non-dominant groups, and contributes to social division, inequality, economic disparity and human alienation (Sahin & Gulmez, 2000).

Moreover, the students those have diverse cultural values and norms different from dominant culture become disadvantageous when they were exposed to a standardized pedagogy which is developed for dominant class (McLaren, 1989).

Thus, to inhibit this reproduction process and provide more appropriate and effective learning for all students, the connections between students' everyday experiences and their own knowledge are required to be established.

Many young people come to school from homes that have particular cultural, linguistic and symbolic capital that isn't represented in formal education and those ones inevitably experience a dissonance between formal education and out of formal education (Gea, 1992). However, if we could establish culturally relevant educational programs for others, we may achieve to provide an educational environment without negative effects of this dissonance. Because, we know that when the students understand conceptions from their own point of view and with their own words, they feel that they have ownership in the subject and their motivation to learn increases (Greene, 2000). It only could be guaranteed by multicultural approaches in education.

Actually, all curriculum and instructions are culturally relevant but the important thing is, whose cultural background and practices is mentioned on it. In minority context, it usually refers to dominant culture (Lipka et al., 2005). However, multicultural education has a basis that doesn't eliminate any culture, ethnicity, gender, socio-economic status and promotes the rights of all people to let the learners to understand diverse issues and problems existing in society (D'Ambrosio, 1995).

2.1.2 Culturally Relevant Mathematics

The cultural dissonance and its natural outcome the existing failure in education are mentioned in general; but this situation is usually reproduced by different sub-variables in micro-educational environments such as classrooms. Even if this issue seems to refer only social subjects such as history, language, etc., it actually might occur in all sub layers of education in an apparent or hidden way. Thus, mathematics classroom is also one of those sub layers. However common idea might mislead us about mathematics is a culture-free subject that only consists of numbers, formulas that are same in every culture. That's why mostly we couldn't be able to catch the point that it is a subject which could be affected by social issues. Actually, in every mathematics classroom, there exist an intersection between culture which forms students' background and mathematics that surrounds this environment.

However, there are differences between what is valued in these cultures and when this difference widened; the existing intersection resembles a clash rather than a successful symbiosis. Thus, such a clash excludes many culturally diverse studentsfrom a successful education unless they become assimilated (Wooltorton, 1997).

Besides those arguments which support the cultural dimensions of mathematics education, there also exist some views which go one step further by saying cultural deficiencies in mathematics education might be more critical than other subjects because of its gate keeper role in society, in means of students' further academic studies and future occupational status (Campbell, 1991; Meaney, 2002). D'Ambrosio (2001) captures the problem of *children of color* in USA context and states that they do not derive the same level of mathematics as much as their European American peers in the classrooms of USA. Also, they mostly do not achieve to get in higher level mathematics courses and professions requiring significant mathematical competence and drop out from the mathematical field without realizing the huge mathematical heritage that they bring historical and culturally.

Besides equality issues in mathematics education, one other problem that moots culturally relevant mathematics curriculum isthe necessity of diverse learning methods for diverse cultures and societies. For a general example, the work in the 1970s in Papua New Guinea by Lancy (1983), suggested that children from some cultural groups did not pass through Piaget's stages in the same way as children from Western cultures did. This study shows up wrongfulness of generalizing and same implementations for all in education. Another study reveals the importance of culturally relevant mathematics education reported that Aboriginal children living in both urban and rural settings had much less number knowledge than their non-Aboriginal counterparts but outperformed them in understanding of directions. For such children, culturally relevant programs are a requirement and it may be more sensible to start a mathematics curriculum based upon the directional understandings that they have and build understandings of number into these (Kearins, 1991).

When students are unable to crack the code of classroom mathematics and teaching practices, they come to see themselves as failed learners and so develop particular dispositions towards mathematics and have minimal expectations of their achievement potential (Niesche & Zevenbergen, 2008). Though it still sounds

ridiculous for many people, putting the math in its cultural context helps teaching the mathematics and makes it more meaningful to students, since it has a human context (Philipp, 1996).

However, it is still needed to be explored how the mathematics curriculum can be made more culturally responsive, in order to encourage more meaningful and effective learning, more equal participation at the higher levels particularly (Bishop, 2002). With the help of multicultural educational policies, culturally responsive teaching may be integrated with mathematics education, but with the condition of moving beyond the superficial, ostensible and trivial attempts and cursory examples of their culture like food, festivals, and holidays (Irvine & Armento, 2001).In other words, applying ethnomathematics program in classrooms will help the students to enrich their construction of mathematical ideas when it is presented by investigating and exploring the mathematics in their cultural products and practices, instead of adding the trivial and formalistic elements connected to a specific culture in the tasks (Powell & Frankenstein, 1997).

2.1.3 Western / Non-Western Mathematics

In the sixteenth and seventeenth centuries, after the scientific revolution that occurred in Europe, mathematics is categorized in Western society and used to be linked to analytical activities as objectivity and factuality (Rowlands & Carson, 2002; Bishop, 2002). The priority of Western mathematics and number systems had universal dominance after this scientific revolution which made Europe as cultural and scholarly center of the world. In the following centuries, non-Western approaches to mathematics were regarded as inferior (Malaty 1998). It is assumed that the immigrants should reject their native mathematical practices and learn Western mathematics instead when they get into Western culture, mostly in a harsh educational environment that require assimilation (Weiger, 2000).

As all mentioned before, mathematics is an important subject for students in regard to many aspects. However, mathematics and the way that it is taught is degraded to Western, generally middle-class values and beliefs (Meaney, 2002). Values like rationalism, objectivity, control, mystery, etc. are assigned as the main values of Western mathematics (Bishop, 1988b). Those values which conquered and

dominated the entire world with Western civilization affect our beliefs and values too (D'Ambrosio, 1985). However the reality is that even if the most worldwide mathematics known and used today developed in the Western World, it occurred with the contribution of diverse civilizations throughout human history (Bishop, 1988b). While teaching Eurocentric mathematics in almost entire world with an appreciation to ancient Greeks, we are missing to count that the legendary founders of Greek mathematics such as Pythagoras and Thales traveled and studied in India and northern Africa, where they acquired much of their mathematical knowledge (D'Ambrosio, 2001). Thus, children do not know about mathematical inventions and applications of such ancient non-European people as the Egyptians, the Babylonians, the Maya, and the Incas because they are not taught with a mathematics which is contributed by members of different cultures whom were all intelligent, resourceful and creative too (D'Ambrosio, 2001). Even if the surveys of history of mathematics have always included the contributions of non-Western cultures, such as those of the Egyptians and Mayans, the main achievements were typically treated as milestones on the pathway of the development of Western mathematics (Zaslavsky, 2002). Moreover, these topics are rarely, if ever, available to students studying mathematics at any level (Powell, 2002).

While determining the deficiencies in application of mathematics, for sure, we should clarify that the aim of ethnomathematics is not to underrate the role of Western contributions to mathematics, but to present the role of other cultures' inputs to mathematics in an unbiased, unprejudiced, and objective manner (İzmirli, 2011). Anyway, this historic trespass about some other cultures' mathematical contributions is being solved with investigations, books and papers detailing the history of the mathematical developments of non European civilizations, such as Japanese, Iraqi, Egyptian, Islamic, Hebrew, and Incan (İzmirli, 2011).

The report of Australian Academy of Science (Australian Academy of Science, 2003) indicates that there had been many cultures which created significant mathematical systems. However, some people unfortunately find those ancient mathematics systems irrelevant today. Yet, according to the researchers of this report, many non-Western mathematics systems remain still alive, such as some Mayans are still using traditional calendars for religious purposes and to help determine the agricultural cycle. Besides there still exist some practiced systems other than Western ones, the important point is about being aware of the Western

mathematics does not and cannot meet the needs of all people around the World and is not always easily understood by outsiders of mainstream cultures. For example, Australian educators have noted that Western mathematics often has little meaning in remote Aboriginal communities and therefore it is difficult to communicatefor years. Approaches that take into account the cultural context and the mathematical systems in use within the community are likely to be much more effective. In other words, even if the relationship between the length of the hypotenuse and lengths of the sides of a right triangle is an eternal truth, it doesn't mean that any other culture needs to share it. Teaching the same mathematical values in all around the world explains that most of mathematics education depends on the assumptions of Western cultures. Eventually, the mathematics learning process for those with other culture and practices is getting alienated and harder (Ascher, 1991).

The researchers that have begun adopting a more culturally sensitive approach to the study of the history and development of mathematics attempt to avoid this assumption of Western cultures (Bishop, 2002). However, reaching a real mathematics which is constructed with each culture's own roots and background is not always quite easy. Besides demographical inequalities discussed above, the other important factor that reproduces some students' disadvantaged position is promotion of Western mathematics –instead of their own- in schools all around the world. It has been thought that low mathematics attainment and achievement especially in the third world countries could be due to the lack of cultural consistence in the curriculum (Bakalevu, 1998).

However, as Hatfield, Edwards, Bitter and Morrow (2000) state we have to recognize that mathematics has been present in every culture since societies started to record their histories and the effects of mathematics on any culture and its people are not identical. Many studies, generally the ones related with ethnomathematics suggest that if mathematics which is produced by each culture is well adapted to mathematical tasks, it brings more meaningful and useful mathematical knowledge for those particular cultural groups.

Although it is accepted that we do not have to teach mathematics in a way that is relevant to Western values, it is still hard to breaking down this rigid structure and building up culturally relevant mathematics teaching. Such as Seagrim and Lendon (cited in Lancy, 1983, p.54) suggested that "the closer the home environment approaches the Western model, the more closely does performance approach the

Western standard". In other words, in order to succeed in mathematics, children need a home background similar to the ones Western children have. At that point, this situation calls this critic question to the mind; why we wouldn't give a try to reverse? In other words, if we would present children a mathematics which intersects with their own culture and background, then they would succeed in it more.

2.1.4 Ethnomathematics

Bishop (1988a) distinguished the difference between mathematics with a capital *M* and a small *m*. M is the mathematics accepted as a scientific and institutional discipline which is applied by mathematicians and highly specialized engineering or physics students, especially in universities. However, m is determined as any procedures that a person uses in his/her daily life, such as counting and measuring. From this distinction, François and Pinxten (2007) question that "should we accept the idea that the mathematician's *M* ought to be learned by everyone, or should we develop the *m* in the subjects' culture through our mathematics classes?" (p. 214).

Ethnomathematics, which is one of the naturalistic theories about mathematical knowledge, is formed as an alternative to absolutist views such as formalism, logicism, and constructivism (Ernest, 1991). Ethnomathematics and other proponents of the naturalistic approach advocate that mathematical knowledge (including insights and intuitions of *M*) has cultural and contextual roots by nature (Pinxten, 1992). In this study, the naturalistic perspective of mathematics is accepted.

An important benefit that is associated with ethnomathematics in the literature is its emphasis on the significance of using math as a part of everyday life (Bishop's "m"). This can be particularly useful for cultural minority students who may have difficulty distinguishing the usefulness and relevance of formal, Western mathematics to their lives. By employing culturally-significant examples and contexts from their everyday life, the disconnection that students perceive as separating real life from the academic world can be minimized (Greene, 2000). It is asserted that ethnomathematics may be an effective tool for bridging everyday mathematics and academic mathematics, as well as helping students from culturally

marginalized groups to become more successful in Western mathematics (Civil, 2002).

As all cultures in the world develop activities in particular ways, they also need specific exercises to learn, to refer their mathematical skills (Presmeg, 1998). If we accept that individuals and cultures play an active role in learning and producing mathematics, then we normally have to reject the teaching approaches that consider mathematics as a deductively discovered, pre-existing body of knowledge. Thus, mathematics demands a multicultural approach which improves students' awareness, cultural self-respect and cohesive view of cultures by exposing them to the mathematics of different cultures (İzmirli, 2011).

At the present time, there is no universally accepted operational definition of what constitutes ethnomathematics and its instructional elements. Furthermore, a lack of quantitative data on the subject makes a credible limitation for material improvements in ethnomathematics (Ethnomathematics: Historical Overview, Critical Analysis, Implications and Applications, nd). However, there exist many different definitions and interpretations of the term ethnomathematics. İzmirli (2011) gathered the commonalities in all these different definitions and characterized ethnomathematics as an approach that considers the objectives such as;

> *Mathematics is a cultural product and non-literate, traditional cultures and social groups also have a mathematics; Mathematicians have to establish a dialogue between the mathematics of different cultures, especially between those that have been systematically excluded from the mainstream history of mathematics, and formal, academic mathematics, and thus restore cultural dignity to groups that have been traditionally marginalized and excluded; all quantitative and qualitative practices, such as counting, weighing and measuring, comparing, sorting and classifying, which have been accumulated through generations in diverse cultures, should be encompassed as legitimate ways of doing mathematics; people produce mathematical knowledge to humanize themselves.along with music, arts, literature, and sciences is a distinct product of human societies and as any other such cultural phenomenon, is vital to our being human; the history and the philosophy of mathematics constitute essential components of ethnomathematics. (p. 34)*

2.1.5 Mathematics as a Human Right

Besides teaching and learning processes, ethnomathematics is also proposed as a tool for a better world. Basically because of the idea of respect to the others, equality in classroom and social practices that ethnomathematics defend, students gain a manner considering human rights and equality in social life. D'Ambrosio thinks that teaching and learning mathematics is a practice with an obvious political

ground because it is a lever for the development of the individual, national and global well-being (cited in François, 2010). He also continues with the political proposition as registered in the OECD/PISA report (which is the basis for the PISA-2003 continuation enquiry) that mathematics education should be accessible to all pupils, not only to the privileged few.

Also throughout ethnomathematics, students gain an unconscious awareness to own and use their education as part of their citizenship with the social practices of the classroom by getting used to what counts as being mathematical (Lerman, 2001). In OECD report at 2004, it is stated that;

> *Mathematical literacy is an individual's capacity to identify and understand the role that mathematics plays in the world, to make well-founded judgments and to use and engage with mathematics in ways that meet the needs of that individual's life as a constructive, concerned and reflective citizen.(p.37)*

Besides learning to value the mathematics, ethnomathematics also provide social acquisitions such as students develop a greater respect to those different from them, when they taught with multicultural mathematics activities (D'Ambrosio, 2001).

That is to say, the ethnomathematics program promotes the rights of all people, no matter their sexual orientation, gender, ethnicity, race, and socio-economic status and lets the students to understand the issues of all members of our increasingly globalized society and appreciate the achievements of their own and other cultures (cited in Orey & Rosa, 2006).At the same time, perhaps the most powerful claim for the new discipline has been made by D'Ambrosio himself (cited in Australian Academy of Science, 2003):

> *Mathematics is absolutely integrated with Western civilization, which conquered and dominated the entire world. The only possibility of building up a planetary civilization depends on restoring the dignity of the losers and, together, winners and losers, moving into the new. [Ethnomathematics, then, is] a step towards peace.*

2.1.6 Critics of Ethnomathematics

As always there exist controversial between the idea of mathematics is culture-free (the Realist-Platonist school) or culture-laden (Social Constructivists); the main question discussed is actually about whether ethnomathematics is a part of

mathematics or not (İzmirli, 2011). Some educators claim that teaching mathematics with ethnomathematical approach reduces it to a social studies subject that teach students little about 'real' mathematics. Some others simply ridicule the whole notion. According to one disparaging journalist, "Unless you wish to balance your checkbook the ancient Navajo way, it's probably safe to ignore the whole thing" (Australian Academy of Science, 2003)

In Rowlands and Carson's (2002) review of ethnomathematics, they criticized it from another point of view that is career opportunities. They claim that ethnomathematicalinstruction reduces the importance of formal, Western mathematical concepts and skills and eventually cause students unfit for many rewarding career paths. They think that if we enforce ethnomathematics, mathematics as an academic discipline will become accessible only to the most privileged ones in society and the rest learn multicultural arithmetic within problem solving as a life skill. In the same study, the researchers agree with the relevance of using culturally familiar contexts and examples to teach formal mathematics. They also admit that it is quite beneficial for especially minority students. Their proposal makes sense when a mathematics curriculum which students are evaluated with standardized tests is considered. However, in order to deal with that the cultural contexts might be used to allow students to gain access and acquaintance with formal, Western mathematics, rather than replacing them altogether.

A common imprecise approach used by Western industrial countries about ethnomathematics is regarding it as teaching mathematics used by indigenous people as a "folkloristic" introduction to "real" mathematics. However, as also stated before, ethnomathematics is a discipline which proposes to moving beyond the superficial, ostensible and trivial attempts and cursory examples of particular cultures' like food, festivals, and holidays (Irvine & Armento, 2001). Also Powell and Frankenstein (1997) reject this approach and recommend that ethnomathematics is studied as a means to reveal the vital role that mathematics has played throughout the development of human civilization.

2.1.7 Ethnomathematics in Turkey Context

Especially in diverse countries like Brasil (D'Ambrosio, 1985), USA (Wilson & Mosquera, 1991), Mozambique (Gerdes, 1998), etc., there is a growing awareness about mathematics is a cultural product and it is effectively dependent on students' social class, race, ethnicity, language background, gender and other demographic characteristics. (Secada, 1992). The increasing mobility of the world's population has forced the development and implementation of effective cross-cultural instructional methods to be a priority (Bishop, 2002). Those countries started to derive benefits of this situation and try to use the ethnicity of students as a resource in meaningful learning of school mathematics, instead of reading it negatively (Presmeg, 1998). While the dominant culture of the teacher was the only culture valued in the classroom before, now the culture of students is seen as a powerful tool for a better understanding of school mathematics (Nieto, 1996).

In every society, there are some minority groups, which differ from the dominant culture in some aspects of social life, such as religion, language, being isolated in the country, low economic status, ethnicity, gender, or in being physically, mentally or psychologically handicapped (Sahin & Gulmez, 2000). Yet, schools can potentially support the existence and acceptance of bicultural identities in the majority population. The culture of subgroups should be understood and respected to make education appropriate for their children (Wyman, 1993). As Wyman (1993) points out,one's education is guided by one's culture, and all aspects of education are cultural.

In Turkey context, education is uniform for all grades in all schools and in all regions of country with a nationwide curriculum which was prepared by Ministry of National Education. The transmission and advancement of the dominant Turkish culture is an integral part of this education. The presence of any sub-societies and subcultures, their historical existence, their languages, values, norms, and ways of life are ignored in the formal school system (Sahin & Gulmez, 2000). It is a dilemma that there isn't enough study on culturally relevant mathematics in Turkey, as also a multicultural society.

2.1.8 Why Measurement Subject?

Bishop (1991) asserts that mathematics occurs across cultures in six aspects of human activity. Those categories in which mathematical activity occurs are counting, measuring, locating, designing, playing, and explaining. The measuring category is identified as;

> *Measuring is the third 'universal' and significant activity for the development of mathematical ideas, and is concerned with comparing, with ordering, and with quantifying qualities which are of value and importance. All cultures recognize the importance of certain things but once again, all cultures do not value the same things to the same extent. Much depends on the local environment and the needs which it provokes. (p. 34)*

These six categories underlines that mathematics influences peoples' lives, including, most importantly to educators and children's lives. If teachers want their students to derive personal relevance from learning mathematics in school, they should capitalize on these six areas which will promote students' every day experiences and connect them to the mathematics lessons. Therefore, measurement as one of the main activities of human seems to be a good start to develop and apply culturally relevant mathematics activities in an elementary classroom.

Measurement has a special place in every mathematics curriculum because it takes place in mathematics as one of the subjects that is quite necessary in daily life and quite connected with other areas such as geometry, statistics, etc. Also, having measurement skills, using appropriate units and tools let students to quantify and understand the world better (Tan-Sisman & Aksu, 2011).

Measurement is also a mathematical activity which all cultures have to be involved in (Bishop, 1988a), but in different ways, methods and approaches. However, the different cultural practices between home and school mathematics mostly cause conflicts for students. In Bishop's (1978) study, the Papua New Guinean interviewee revealed his conflict on finding area in different sociocultural mathematical contexts by saying that "At home I add, at school I multiply". Bishop (1978) explains the importance of taking into account the effect of cultural values on measurement concepts with the example of some villagers who measure the size of a garden by the numbers of paces across and down the garden, even if Westerners think that is a semi-perimeter. However, in school, the same student will calculate area as a product of the length and breadth that clearly shows children from different

background may have different varying area perspectives. Likewise, in Owens and Kaleva's (2007) study in Australia, students were intuitively thinking of area in terms of length but not as a product of two sides as presented in school mathematics nor as a semi-perimeter but as a way of counting fixed areas known from their context.

As all cultures are connected with measuring in some way, the important part is these alternative cultural approaches could assist us to fulfill students' development more. This kind of studies that develop activities linked to diverse cultures will enable us to notice the cultural artifacts that represent measurement of length or related concepts such as area. That kind of informal measurement systems might also help us to recognize how intuitive understandings of measuring can be transformed into structural understandings. We only need to consider key concepts of measurement such as; the units used, these units' way of repetition and the need to compare quantities using identical units to be able to transform (Outhred & McPhail, 2000). In order to connect home discourse into classroom activity on measurement, it must be understood well that how every society compares and measures systematically and so why people measure. It actually requires special skills of mathematics educators and first language speakers to discover the existing measurement systems and converting it into the classroom activity (Bishop, 1988a).

Besides all, measurement is a subject that quite difficult to students around the world (Zacharos, 2006). Area and perimeter concepts are frequently confused by students, repeated units and structure are poorly grasped and proportional reasoning is often not achieved by students despite its fundamental position in mathematics. Generally, the students have difficulty on recognizing the structure of measurement systems. The difficulty of teach and students' failure on estimation in measurement is also another issue needs to be solved(cited in Kaleva, Matang & Owens, 2008).

Likewise in world, the researches on students' understanding of measurement in Turkey reveal serious difficulties varying from incorrect alignment with a ruler to confusion of perimeter with area (Tan-Sisman & Aksu, 2011). In their study, Tan-Sisman & Aksu (2009) founded that most of the seventh grade students not only confuse the concept of perimeter with the concept of area but also confuse the formula for perimeter with area. They also revealed that many students have difficulties in units of length and area measurement.

Lastly, after realizing that measurement is a quite difficult but critical subject in both international and national contexts, I offer to use ethnomathematical

approach on measurement unit because according to literature, it is known that the traditional communities are quite strong on measurement skills, so I want take its advantage as a source in mathematics classrooms.

2.2 Review of Related Literature

The relatively new discipline ethnomathematics had been started to be discussed in the 1970s and sufficient research activity had been completed to form a substantial body of literature and source for possible instructional application, in last 15 years (Knijnik, 2002a). At this time, there is no universally accepted operational definition of what constitutes ethnomathematics and its instructional elements; and a lack of quantitative data on this subject makes a credible determination of the ability to encourage material improvements in the current mathematics achievement gap(Ethnomathematics: Historical Overview, Critical Analysis, Implications and Applications, nd).

Demmert and Towner (2003) reviewed more than 8000 studies about culturally based education and found only a few studies that used quasi experimental design, get statistically significant results, and involved core academic content. According to Western scholar opinion, empirical data and mathematical calculations are superior and more reliable than those produced through qualitative analysis. This assumption is based on the broader idea that numbers and mathematical functions are purely objective, and as a result, are immune to the influence of subjectivity (Arismendi-Pardi, 1999). However, both qualitative and quantitative studies are appreciated regarding on their contribution to the field by considering that the association of mathematics with objectivity and factuality has lasted only since the scientific revolution that took hold in Europe over the course of the sixteenth and seventeenth centuries (Rowlands and Carson, 2002). In this section, I will state some existing quantitative researches and try to feed them with qualitative ones. Here are some of those studies that used experimental methods.

2.2.1 Empirical Studies about the Instruction Integrated with Ethnomathematics

There exist many scientific arguments for ethnomathematics which show a direct correlation between culture and students' academic success in mathematics. One of them is Arishmendi-Pardi's (2001) empirical study which is conducted in Orange Coast College (OCC), Florida, USA between two groups whom are taken Intermediate Algebra, with and without ethnomathematical pedagogy. The results of this study clearly reveal the positive effect of ethnomathematical pedagogy on mathematics achievement. In this quasi-experimental research, students whom are taught with ethnomathematical pedagogy performed better than those whom are taught without ethnomathematical pedagogy.

Magallanes (2003) applied a quasi-experimental research in his thesis for National University with two groups of math students at Torch Middle School in California. He aimed to find a significant difference between the test scores of the students whom are taught coordinate planes with ethnomathematics software and those taught with traditional teaching methods only. Finally, it is found that the students that taught with ethnomathematics software outscored the others. The results show that a teaching technique riveted with ethnomathematics is an effective tool in order to increase students' academic achievement in mathematics.

Another experimental research (Kurumeh, Onah & Mohammed, 2012) which points out ethnomathematics as a very significant strategy for increased meaningful understanding of concepts, higher retention and more recall of concepts in mathematics is conducted in Obi and Oju education areas of zone C in Benue state of Nigeria with 248 Junior Secondary three students.In the end of this experiment, the treatment group who had been taught with an ethnomathematical approach had higher retention rate in statistics than the control group who had been taught with conventional method. Throughout this study, it is proved that ethnomathematics teaching approach is more effective in facilitating and improving students' retention in statistics than the conventional approach.

Besides positive results, there are some studies concluded without significant effect. In their study which aims to develop an instruction integrated with ethnomathematics and evaluate its effects on students' mathematics achievement and

attitudes toward mathematics, Kara and Togrol (2010) provide many purposeful implications about designing and applying an instruction related with ethnomathematics by expressing their experiment, which applied to 7th graders during 6 hours of instruction, on transformational, reflectional and rotational symmetry, patterns and ornaments based on the mathematics used in Topkapi Palace. However, after statistical testing, they couldn't gain a significant difference between the achievement levels of control and treatment group. This result which contradicts with related literature is questioned in terms of the time/length of the treatment or about the differentiation of the treatments by the researchers. Beside achievement, the effects of instructions with ethnomathematics on students' attitudes towards mathematics are supported by findings of the same study with positive statistical results of treatment group.

2.2.2 Ethnographic Field Studies about the Instruction Integrated with Ethnomathematics

There also exist some studies that conduct field research especially among specific cultural groups such as tribal communities, in order to provide practical resources for ethnomathematics area. Even if those researches mostly applicable to only specific environments, they usually provide a course of action for others who would like to develop tasks for some particular groups. In one of those studies called "Ethnomathematics in practice", François and Pinxten (2007) offer some suggestions about the practical use of ethnomathematics in the classroom. They undertook a field research among the Navajo Indians (in the U.S.) and applied the *hooghan* (traditional housing) project, which refers to Navajo geometry teaching, with the children who are visiting hooghan, living in a hooghan or receiving explicit explanations about it any time. In the classroom, children are asked to build a hooghan which is a cosmological scale model of the world and illustrates the Navajo concepts for above-below, proportions, wind directions, room to move, etc. During this team work, they mentally explored all aspects of the hooghan, like notions of orientation and proportion, a scale model is built and graphic presentations of the hooghan are made. In these lessons, Navajo language is used and autochthonous concepts are respected and developed further. After this study, researchers find beneficial for children to

start with daily surroundings, then visualizing the features in it and finalizing with graphical representations to gain the insight needed to grasp the implicit view of mathematics. Besides all, the article provides a detailed instruction task of hooghan project for future practical usage.

Another culturally based mathematics curriculum is implemented to indigenous Yup'ik students by two different trainee teacher -one a cultural insider and the other new to Alaska- in Lipka, et al.(2005)'s experimental study. In order to construct a culturally based mathematics curriculum for elementary students, the researchers carried out a collaborated study with Yup'ik elders, teachers, schools, and communities and after implementation, they tried to analyze remarkable outcomes about students' math performance and the changes in teachers' relationship with the content, culture, community and students. In those case studies, students tried to make a fish rack –a structure used to dry salmon. Throughout this activity which connects everyday knowledge to school based knowledge, the students stimulated this structure whose four corners form a rectangle and gained a deeper and further explorations of mathematics more challenging than in math textbooks knowledge. As an example of both quantitative and qualitative research designs, the results of the study strongly reveal that this culturally relevant curriculum applied to Alaska Native students has been statistically and practically significant in improving their academic mathematics performance. According to the results, cultural topics of modules provided real and positive connections for students and also altered the social organization and communication in the classroom.

A study that commented by D'Ambrosio (2002) as an excellent example of the connection between ethnomathematics and modeling, was containing useful and practical indications also for the topic and application process of our study, especially by the ways of how to make mathematical modeling related with ethnomathematics. In this study, a group of Brazilian teachers worked on the cultivation of wines brought to Southern Brazil by Italian immigrants in the early twentieth century because they thought that their problem has to be related with the culture of the people in this region. After some ethnographical and historical research on their topic and interviewing wine producers, a wine producer who builds his own barrels drew their eye because he was finding the volume of barrel perfectly with a process very different from academic mathematics. This practice presents a good example for ethnomathematics because the producer's techniques were learned from

his father and transmitted to the family members of his family through generations by his ancestors long before arriving in Brazil.

There also exist some studies that offer ethnomathematical activities to be implemented in classrooms. One of them is a study of Powell and Temple (2001) which suggest a board game called Oware - originally coming from Africa - to support African students' mathematics in school. They especially used this game because children have a common biological root in Africa and cognitively fulfilled when they work with different cultural elements of mathematics. They taught the 6-12 years old children to play the Abapa version of Oware in New York. Throughout this game, the players recognize interesting and important numerical patterns which introduce the idea of a one dimensional cellular automaton and triangular numbers. Besides that, students interacts with aspects of the culture in which it originated when they play a game such as Oware and the teachers may benefit from many important mathematical and cultural values by using it in classroom.

2.2.3 Development and Application of Ethnomathematical Tasks on Measurement

Through an ethnomathematical approach, students gain meaningful mathematics experiences and appreciate to see the link between their daily experiences and school mathematics. Especially in such an important topic as measurement that appears in all grades of mathematics curriculum, using ethnomathematical approaches become more vital and applicable in school mathematics to let students internalize related concepts. Besides some studies that provide data about the effects of ethnomathematical approaches on students' achievement and attitude, there also exist a number of researches on development and application processes of an ethnomathematical task. In this part,the related researches on measurement unit will be stated and also try to place some studies give information about instructional process.

In Adam's (2004) study, an ethnomathematical unit of measurement (area, perimeter, volume) was designed and applied to 5^{th} grade students in two primary schools in the Maldives. Teachers and students were able to identify the activities and experiences about measurement systems in Maldivian culture and link them to

the 5th grade measurement syllabus. And eventually, after collecting data from teacher workshops, questionnaires, classroom observations, interviews, teacher resources, and a research journal, he found that the ethnomathematical approach was appreciated and understood by teachers and students. Despite the very traditional education of the Maldives, students gained motivation and interest, saw that mathematics at work in society, connected school mathematics to real world activities and actively understood that mathematics as something that humans develop in response to particular situations. In this ethnographic study, an ethnomathematical measurement unit designed and taught over three weeks replacing the standard unit in the curriculum. Some of the activities designed by researchers and teachers took place during the unit were; visiting different sites such as carpentry, boat building sheds, and markets, to explore mathematical aspects of these activities, doing activities in the classroom using cultural objects related to measurement, doing activities in the classroom that were outside students' experiences or culture, doing activities in the classroom to learn about and learn to use conventional mathematical systems, notations, and techniques by discussing the need for accuracy and examining real world instances where mathematical accuracy and formulae are needed; and those activities were inspired the development process of our activities used in this study. Besides that, the parameters determined for observations were; "the use of context during the lesson; the teacher helping and encouraging students to talk about mathematics in the classroom; the teacher and students' use of their own ethnomathematical experiences; and the teacher and students linking ethnomathematics to school mathematics". From observations and data analysis, it is proved that implementing an ethnomathematical curriculum unit was appreciated, in accordance with teachers and students' views.

For further ideas how to connect ethnomathematics to school mathematics, Masingila's (1993) study could be followed which aims to suggest ideas on deriving mathematical ideas from an out of school practice within culture, incorporating it with school curriculum and introducing it to the students. The researcher purposely chose to make a research on measurement because of the existing density of work on arithmetic and geometry concepts in the research area that seeks ethnomathematical practices within cultures. In order to realize the mathematical concepts and processes involved in estimating and installing floor coverings, the researcher spent a summer with a group of carpet layers. At the same time, she analyzed the measurement

chapters of 6^{th}, 7^{th} and 8^{th} grade mathematics textbooks to connect ethnomathematics of carpet layers with school learning. Four mathematical concepts used by carpet layer are observed by the researcher; measurement, computational algorithms, geometry and ratio and proportion. Yet, the most widely-used concept by the estimators and installers was measurement such as finding the perimeter of a region, finding the area of a region, drawing and cutting 45^o angles, and drawing and cutting 90^o angles, estimating, visualizing spatial arrangements, knowing what to measure, and using non-standard methods of measuring, etc. Based on the observations and investigations, this study reveals three key ideas to connect in-school and out-of-school mathematics that teachers should build upon the mathematical knowledge that students' bring to school from their out-of-school situations;introduce mathematical ideas through situations that engage students in problem solving; and establish master - apprentice relationships with their students to guide students in doing mathematics and help initiate them into the mathematics community.As it could be seen, according to the study, the biggest responsibility is given to teachers on connecting students' everyday experiences and mathematical knowledge by making connections between these two worlds in a manner that will help formalize the students' informal mathematical knowledge and learning mathematics in a more meaningful, relevant way.

Kaleva, Matang and Owens, whom are members of the Glen Lean Ethnomathematics Centre (GLEC) at University of Goroka, wish to collate and analyze the information on cultural measurement systems of the different language groups of Papua New Guinea (PNG). In PNG where colonial education systems marginalized the knowledge, culture and values of these societies, those mathematics education lecturers are collaborated and conducted a case study as a framework for understanding mathematics of learners in transition from home cultures to classroom mathematics. By determining out of school knowledge of measurement in these indigenous communities, they aim to establish new tasks for more socially and culturally responsive measurement education applicable in PNG and worldwide.

In order to adapt it into math education, they asked local people about the ways of comparing and measuring in their village or language group. As example, they stated some activities that may include comparing and measuring such as comparing land, garden, or house areas; collecting, preparing and using traditional

materials; plant growth, feasts; wind strength, heat, speed; making houses, clothes, bilas, carvings, bags, canoes, drums, sacred objects, musical instruments, medicine or food; travel distance. They also wanted to discover how this cultural group compare or measure, or carefully show others how to do things and explain and their expression was basically "In your village, you may have other measurement activities".

In PNG project, they followed some stages. Firstly they identified the different types of cognitive and physical strategies used by a culturally diverse sample of Indigenous Papua New Guinean societies in various cultural activities that involve comparing and measuring length (including distance), area, mass, and volume and associated concepts such as ratio within cultural contexts. Then, they collected data from as many different languages as possible to confirm the appropriateness of analysis of the systems and strategies and to establish a database of length, area, volume and mass measurements. After enough field research, they relatedthe findings to current Western understanding of how children develop fundamental concepts of measurement and undertook an evaluation of teaching using this new knowledge to improve students' learning in elementary school.

After all, linguistically modified surveys, observations and interviews with mature-aged students and villagers are used as valuable sources to provide example lesson plans for elementary measurement unit in this project. Data have indicated that estimation is commonly used for comparing lengths and areas in different PNG cultural groups. However, it is also clear that informal units are used extensively with varying degrees of emphasis on accuracy using these measures. Making gardens and drains were the main areas for discussion, especially in the highlands. Food gathering and preparation is also an area where measurement takes place.

The informal cultural approach to measurement allows students to grasp more easily the meaning of measurement and how units are structured (Owens & Kaleva, 2007). Thus, it is wise for a teacher to use the cultural or out-of-school experiences of students for measuring rather than textbook suggestions which may have been written in a different context emphasizing calculations and giving small visuals of shapes. It is surely beyond doubt that experiencing large areas to measure from out-of school contexts were not comparable to small diagrams drawn on the board or in textbooks. With this research that uncovers the potential wealth of indigenous

knowledge to be practiced in mathematical activities, it is also become clear that the measurement systems have their own specific non-western methods, purposes, and indeed strengths in introducing students to the idea of measurement.

CHAPTER 3

METHODOLOGY

The aim of this chapter is to provide information about the design and participants, data collection instruments, data collection procedure, analysis of data, trustworthiness and limitations of the study.

3.1 Inquiry approach of the Study

The main purpose of this study is to investigate the students' perceptions of and engagement in ethnomathematical tasks about area measurement concept.This study has a momentary meaning for a particular situation because it requires to be implemented in a particular cultural group. Because of that, actions and cases in this study require to be evaluated in the environment which they belong. In other words, students' behaviors and reactions, social movements and interrelationships were tried to be understood; and they were examined while students were continuing their daily practices in their natural habitat. Stressing to explain the certain facts and cases in certain terms and conditions dependent on reality, culture, people, time and place with detailed investigations required to adapt qualitative research approach for this study in order to fulfill those steps and purposes stated above (Uçak, 2000). More specifically, this study could be categorized as a basic interpretive study which can be used when an instructor is interested in how students make meaning of a situation or phenomenon (Merriam, 2002). In basic qualitative study, the data is being collected from interviews, observations, or document analysis (e.g., students' written work) and analysis is of patterns or common themes and the outcome is a rich descriptive account that makes reference to the literature that helped frame the study (Merriam, 2002).

3.2 Participants of the Study

The study was conducted in a public school in a village of Kemalpaşa, İzmir. The participants were consisted of twelve sixth graders, four girls and eight boys, who were living in the village, where economy was mostly based on olive farming. They were also the only 6th graders in school. This study group was chosen by convenience because of the fact that the researcher served as a mathematics teacher in this school and their particular culture was suitable for applying an ethnomathematical method.

Since there is only one group of 6th graders in this school, as the only teacher and the researcher of the study I was not able to divide the classroom as control and experiment groups. Besides, the area measurement topic, which I integrated with ethnomathematics, is one of the main topics in current mathematic curriculum. Therefore as the teacher who is responsible to ensure their learning all, I also needed to consider ethical issues. In other words, if I believe that this kind of instruction improves my students' learning, then I should provide it to all of them. Also due to ethical issues, the participant students' names were replaced with their pseudonyms.

According to their previous examination results and performances in the classroom, and the opinion of their primary teacher, the class was heterogeneous in terms of mathematics achievement. There existed low and high achievers together in the classroom. The participants will also be introduced one by one in terms of their existing academic, social and special situation to be helpful while comparing with their situation after implementation.

Yakup, whose self confidence in mathematics is considerably high, is one of the most successful students in class. He is very responsible about academic duties. His academic level is generally high. He has concrete targets, he is willing to work for them and his family is a real supporter of his achievement. He is quite comfortable and participating in mathematics classes due to his academic success and positive attitude towards mathematics.

İsmail was one of the successful students of classroom. Even if he doesn't study and practice his academic duties regularly, he achieves well in mathematics due to his critical thinking skills and background. His social skills and self confidence is quite high in general. He also knows that he is able to achieve in

mathematics and likes it. He behaves very confident in mathematics classes and participates pretty much in activities.

Rüya is one of the top level achievers in classroom. Even if she has some other responsibilities except school, she still very positive and responsible towards academic issues. She is very active in mathematics classes and usually differs from others with her special mathematical contributions. She is quite self confident and relaxed in mathematics classes.

Ferhat is the most responsible and hardworking students in the classroom. He is very successful in mathematics as long as he studies hard. However he is socially inadequate in general. He doesn't take the floor frequently due to his shyness. Even if he is a really good achiever in mathematics, he is not quite active in mathematics classes.

Emre is a student who has hyperactivity and concentration disorder. He also had a serious surgery so his family behaves him very careing. Therefore, his behaviours sometimes are not so appropriate but he has a good relationship with classroom and teachers in advance. He is quite capable of mathematics but doesn't fulfill academic responsibilities. In anyway he can be defined as a well achiever and confident student in mathematics classes.

Yağmur is a middle achiever student who actually could be handled academically. However she doesn't have a motivation to be successful in general. She is experiencing learned helplessness in mathematics and she accepted that her mathematics is weak, probably due to her previous academic experiences. Her mathematical background is complete. She is socially active in classroom but sometimes getting nervous in mathematics classes.

Yasin is not a successful student but he is willing to be. He is usally eager to take part in mathematics classes but cannot contribute voluntarily because of his fear of failure. He also has deficiencies in multiplication facts and basic calculations and could be defined as a shy student in classroom in regular mathematics classes. He is responsible to do his academic duties but mostly not that much able to achieve.

Ali, who is a striving but shy student, is not active in mathematics classes. Even if he has a motivation to do so, normally he couldn't starts to begin speaking in classroom easily. He has some mathematical deficiencies which create this situation. He is not really responsible about fulfilling his academic duties but open to be motivated to do so.

Mehmet is not an academically successful student. He experiences difficulties in mathematics quite often. He has deep mathematical gap in his previous academic journey. His motivation to achieve in mathematics is not high. He usually doesn't take floor, he is quiet and shy in mathematics classes.

Osman is a student who has very limited mathematical literacy and knowledge. He requires extra time to grasp and understand academic material than the others. He might need to receive a special education because of that but not recognized yet. He is quite relaxed and happy in mathematics classes. He is active to take the floor in mathematics classes but not able to provide related answers.

Feride is a student who receives special education due to her mental disorder. An individual mathematics program is being provided for them. Due to this reason, the data gained from her hadn't been included tho the results.

Yeşim is a student who receives special education due to her mental disorder. An individual mathematics program is being provided for them. Due to this reason, the data gained from her hadn't been included tho the results.

3.3 Data Collection Instruments

In order to collect data, different types of instruments such as video recordings, observations, field notes, students' task sheets and students' activity assessment forms were administered during, and after the instruction.

3.3.1 Video Recordings

Except the activities that held outside, all classes were recorded minute by minute with a high quality mobile phone in capturing image and sound which was placed at a fixed position in classroom. Those video recordings let the observations to be concrete and eased to evaluate students' performances during the classes by revealing their movements, gestures, behaviors, attendance, etc. Those recordings were benefited while developing observations and field notes especially, stating appropriate quotations during evaluating the results, in other words not to miss any kind of valuable data for the study.

3.3.2 Observations and Field Notes

During each class, students were observed by the researcher while conducting area measurement activities enriched with ethnomathematics. After each class, field notes were created for describing the classroom environment and atmosphere, students' actions, the questions asked, and the interactions occurred in the context of teaching. The researcher observed each class as a participant observer. By taking the advantage of being a participant observer, short notes were taken during the instructions about observations and those short reminder notes were developed and detailed quite after this instruction to be evaluated as the main data later. The actions not related with current concept such as daily issues about classroom, discussions after a class interruption by hall monitor, etc. were not recorded in note sheets.

3.3.3 Students' Task Sheets

In all of the activities, task sheets in related topics were delivered to students. Those task sheets (Appendix A), which include introductory information, main activity, related intensifier exercises, and developed problems, aimed to let the students not to spend too much time for writing and to follow ethnomathematical activities. Until students complete the task sheets, they revealed their mistakes, different strategies and failures on paper. In order to keep those data on the students' task sheet, they were asked not to delete anything. At the end of the implementation, all task sheets were taken back from the students to be used as data for this study. The sections, such as activity steps applied by students, different strategies, incorrect strategies, etc. that taken from task sheets were used to feed the collected data whenever necessary.

3.3.4 Students' Activity Assessment Forms

In order to evaluate students' views and ideas, and verify the data derived from observations, the activity assessment forms were delivered to students after the implementation. Those forms which aimed to collect students' written comments and

evaluations about activities were including questions such as which activity was your favorite one?, which activity you did not like?, do you like this method of learning mathematics and do you prefer to continue learning other topics of mathematics with this kind of activities?, etc. The meaningful statements that could be considered as data were selected from those forms and they used to strengthening the existing data especially about how students perceive the activities enriched with ethnomathematics.

3.4 Data Collection Procedure

First of all, the required official permissions were taken from Middle East Technical University Human Subjects Ethics Committee, the National Education Authority of Kemalpaşa / İzmir and the school administration (Appendix B). After all the official approvals were obtained, students were given a two hour long pre-course about length measurement topics to remedy their prerequisite knowledge due to the determined deficiency from previous year. Before the implementation of instructional tasks, students were asked to write some paragraphs on olive (as much as they want-due to their relationship degree on topic). In order to check their familiarity and interest on olive topic as a main part of their culture, they were allowed to write anything (case, memory, knowledge, etc.) related to olive. Also, a PowerPoint presentation about olive was presented to the students by the researcher. The aim of this audiovisual, non-mathematical presentation was taking students' attention for upcoming project, giving some main information, stating stories, myths, and art pieces about the topic of olive –that was related with their culture. Then, the area measurement topic was instructed with ethnomathematical tasks developed by the researcher (Appendix A). The data collectors and implementations were implemented in spring semester of 2012-2013 academic year.

Even if the length of instruction exceeded the determined time for area measurement in the annual plan, it should be considered that the process did not only covered the 6th grade mathematics curriculum's related goals and activities, but also included required prerequisite knowledge, strengthening exercises, practical daily field applications and general narrative activities in a detailed way with a holistic perspective. Also, the time stated in annual plan was not enough in order to construct

effective area measurement abilities but the researcher made a great effort to spent minimum time to enable it.

During the implementation, the process was video recorded in classroom to provide data to analyze students' performances. Detailed field notes were taken by the researcher. During the activities, the researcher recorded some students' strategies, difficulties, common mistakes, and common misconceptions. Those observation notes and student sheets were kept to be used in data analysis. After the implementation, students were asked to write reflective paragraphs to express their feelings and ideas about the activities, instruction process, how they perceived the activities and evaluate the effectiveness of the activities for their learning, whether they enjoyed the lessons or not, which one was their favorite activity, etc.

Table 3.1 Data Collection Procedure

Date	**Content of the implementation**
15, 16 April	Presentation and reflective paragraphs
22, 23, 29 April	Estimating the area of plane regions by using strategy (Activity 1)
30 April;6, 7 May	Explaining area measurement units and converting each other (Activity 2)
13, 14, 20 May	Explaining land measurement units and converting each other (Activity 3)
21 May	Solving and building problems about the area of plane regions (Activity 4)
27 May	Solving and building problems about the area of plane regions (Activity 5)
28 May	Solving and building problems about the area of plane regions (Activity 6)
3 June	Solving and building problems about the area of plane regions (Activity 7)
4 June	Activity assessment forms

3.5 Data Analysis

Field notes, video recordings, students' task sheets and the students' activity assessment forms were analyzed to identify the students performances during the activities enriched with ethnomathematics.

The analysis of gathered data started with data reduction stage which is proposed by Miles and Huberman (1984) as the first stage of qualitative data analysis. In this stage, the raw data gathered from especially the decrypted video recordings and field notes were subjected to sorting, summarizing and converting transactions. During this process, which part of data will be left out of research, which part of data will be used and how to classify data set were decided according to the purpose of the study. Secondly, the remaining data after data reduction process were intertwined in order to provide specific results. Through this process, the data set without sense were tried to be made more understandable by complete and comprehensive description of the studied cases and context (Dey, 1993). The last stage of the data analysis process was achieving and confirming results as Miles and Huberman (1984) suggested. The data collected at every stage of the research process from the beginning was tried to be understood what it means. The reality that stays uncertainly in the data set was tried to be discovered and mined to face the day through this stage. Indeed, from the data gathered, it was tried to reach a conclusion with an inductive approach.

However, reaching a specific conclusion only based on a data set raises the question of the validity of that information. At this point, the researcher must test the validity of new knowledge that was produced. In order to ensure this, some quotations and dialogs were transferred, other findings of study gathered from other instruments were stated and already existing research findings from literature were cited whenever necessary (Miles & Huberman, 1984). The valid results were attempted to be achieved at the end of this process.

Adhering to stated qualitative data analysis steps, descriptive analysis method was adopted in this study among others. Descriptive analysis is a method which contains summarizing and interpreting the data gathered by various data collection techniques. In this analysis method, the researcher may often give direct quotations in order to reflect the views of observed or interviewed individuals. The main

purpose of this data analysis method is presenting the findings to the reader in a summarized and interpreted manner. (Yıldırım & Şimşek, 2003). Therefore, during the data analysis process of this study, the data was read and edited on the basis of previously created frame, and brought together in a logical manner. Then, the edited data was described by referring to direct quotations where necessary. At the end of this process, the defined findings were announced, associated and interpreted; and the cause and effect relations between the findings were explained in detail in order to strengthening the interpretations (Yıldırım ve Şimşek, 2003).

3.6 The Related Literature about Ethnomathematics-based Activity Development

Before the task development and their integration with ethnomathematics process, the most important part among all gathered resources that guided the researcher by during this process was the related literature that proposes methodological recommendations about how cultural practices (particularly measurement practices) might be associated with classroom learning at schools. After reviewing and internalizing the related literature, it was quite easier for me to identify how to integrate their cultural practices about olive to mathematics classroom. The previous studies and proposed theoretical ideas that assisted me during task development process are mainly stated below.

During this process, I followed the approaches and aims that proposed by Adam (2004) for an ethnomathematical curriculum. I focused on her principles such as using ethnomathematics as an educational tool to help students to understand what mathematics is about, make mathematics part of students' own knowledge and making it more interesting with ethnomathematical examples. Using ethnomathematics to teach about particular groups of people, enhancing feeling of cultural worth and unity - often used to try to help students from minority groups in a society and showing how the same mathematical idea is present in many contexts were some other ways for an ethnomathematical approach and this study wascohesivethose principles to be able to develop real ethnomathematical tasks.

Presmeg (1998) also advises that while designing culturally relevant courses in mathematics, it is better to derive benefit from a theoretical framework grounded

in ethnomathematics. In his study about designing a course for prospective and practicing mathematics teachers, he puts to work some basic principles in order to create successful ethnomathematical activities from students' authentic cultural elements, such as; considering that each student has a unique sociocultural history and ethnicity, and this ethnicity is a mathematical resource, students can use their ethnicity in developing mathematical activities for sharing with peers.

Besides those principles required to be followed for this study, the other research project of Presmeg (1996a) that aims to practice those principles in a high school mathematics class reveals many useful implications and set a guide for this study, especially while constructing an ethnomathematical instruction to implement in an elementary mathematics class. That's why I would like to state this study in a detailed way. This project is constituted from interviews with students of Algebra II class in a local high school and a lesson taught by the researchers.

In order to investigate authentic student activities of participating students who comes from different ethnic backgrounds, the researchers interviewed students about their "Histories (that is, their cultural heritages), their Hobbies, their Hopes (career aspirations), and their Homelands – the four Hs" (Presmeg, 1998, p. 322). The students also asked about the nature of mathematics, the regular activities of their parents include mathematics or not, their success and attitude toward mathematics, relationship between mathematics and other subjects in school. Besides them, the following questions are asked in the final interview; "What is mathematics?, Has your view of mathematics changed as a result of participating in this project? If so, in what way? and Are you seeing mathematical elements in your other activities or other subjects?" (Presmeg, 1998, p. 322).

After those interviews, mathematics is mostly tied with cultural and home activities (such as racing around barrels on horse, international coin collecting, American football, basketball, volleyball, and cheerleading, carpentry and house painting, etc.) by students –although they even didn't define them as mathematical. Even if those daily activities seem like not worth to consider, they provide a good resource and constitute a potential for developing mathematical activities related with culture. In this study, those kinds of daily activities are tried to be caught in order to use in mathematical tasks.

Presmeg's study led our study as previously determining the daily practices, hobbies, home experiences, unique activities that refer the students' own cultures to

be worked with, then picking the ones that related with mathematics and developing them to be used in mathematical tasks in class. Following those steps was quite beneficial for me, because directly applying an ordinary or literature-based activity in a classroom may works, but may not be efficient or suitable for the culture of the particular population worked on it. This idea can be supported with a quotation from Presmeg's (1998) study; "the rich patterns (e.g., hairpin, candle, cloverleaf) involved in racing around barrels on horseback are important for students in Keri's class, because they are part of Keri's culture; but they may not have meaning for students in other classes who do not know Keri" (p.325). Each community and its culture is unique, so a mathematical task has to be developed and applied to a classroom by regarding their own cultural elements and practices as I tried to do. Thus, in the case of all of the students are not highly related in olive topic in their own daily life, they at least will be familiar due to their peers and community who are actually related.

Besides the principles needed to be considered about the situation and culture of our students, the ethnomathematical activities developed by the teacher should also care, respect and promote other cultures by "building tolerance of other cultures, eliminating racism, teaching the content of different cultures; and teaching students to view the world from differing cultural frames of reference" (Spring, 1996, p. 164). I also tried to respect those principles of ethnomathematics and put it into practices especially with the activities of "Ancient measurement systems & measurement units in Ottoman Empire", "The universal symbol of peace- dove & olive branch", "Olive and culture; thousand years old mystical motif- the tree of life" by considering other cultures and giving information about their cultural practices.

In Presmeg's (1998) study about a graduate course entitled Ethnomathematics, some possible examples of activities which include those discussed multicultural goals and constitute examples for our study are presented to the course students as;"songs from various countries: music has shape which can be represented mathematically, as can also its pattern and rhythm (KwaZulu, USA, Germany, etc.); mathematical elements in Japanese origami; number systems: words and symbols (quipu of the Incas); tracing graphs in the sand (Bushoong & Tshokwe in Africa, Malekula in Vanuatu, South Pacific); the logic of kin relations (Warlpiri in Australia); chance and strategy in games and puzzles (Native American, Maori); the organization and modeling of space (Navajo, Inuit, Caroline Islands); symmetric

strip decorations (Inca, Maori); geometrical designs on Ndebele houses (South Africa); Scandinavian Yule baskets; mandalas of the East; informal mathematics of young candy sellers (Brazil); traditional American quilting patterns" (p. 331).

One of the major requirements of Presmeg's course for students was developing mathematical ideas from their own culture and cultural history. The students who have doubts and fears about developing a task at first amazed the instructor by using variety of cultural elements to constructing mathematical ideas. Some of the topics chosen by participants to investigate were also impressive examples for task development process of this study and they were as follows; "Sports such as baseball (USA) and golf (Scotland); American marching bands;mathematical elements of the I Ching (China);national flag (Jamaica, South Korea);music, e.g., Gospel music, Italian music, Irish music;counting in American sign language;games around the world, e.g., bridge, mancala;stick charts used in Pacific traditional navigation (p. 332).

This part of study shows us that teacher who would like to apply that kind of ethnomathematical tasks in class may produce some activities depending on his/her students' own experiences by implicitly or explicitly deriving ideas from them. Because, as Presmeg (1998) states "What is noteworthy is not the topics themselves, but that each topic was part of the cultural experience of the student who chose it, and hence intensely meaningful to that student" (p. 332). By thinking like this, it can be concluded that each topic is suitable in ethnomathematics curriculum to be integrated in mathematical activities, as long as it is derived from students' experiences, so it is meaningful for them. I also tried to decide the most suitable possible activities with this point of view during the task construction.

By being aware of the difference in different cultures' mathematical thinking ways, practices and methods, I tried to look over and analyze the proper activities from my students' cultural backgrounds, then find the activities that are appropriate to be integrated into the class, and create a rich and inspiring environment to help them use their potentials. Therefore, the developed tasks and activities are assumed to be based in ethnomathematics because they tried to demonstrate how mathematics is related to the local culture, history, and environment (D'Ambrosio, 2001).

3.7 Development of Ethnomathematics-based Activities and Implications for Teachers

This part of the study holds the key for ethnomathematics research field. The lack of practical data on the subject make this process quite challenging for the researchers who would like to study on it and the teachers who would like to apply this method in their classes. For this reason, development of specific frameworks for the application of ethnomathematics concepts for different student sub-populations is highly recommended to be supported (Ethnomathematics: Historical Overview, Critical Analysis, Implications and Applications, nd).That's why; the preparation process of the instruction tasks will be presented in detail to be a guide for future studies and implications.

The mentioned lesson plans were prepared for 6th grade students who were culturally related with olive, olive farming, olive oil, olive tree, etc. due to their daily practices for living. In other words, the tasks were adapted to the culture of students whom were culturally particular in a village 35 km far away from central İzmir; and focused on area measurement conceptfrom several aspects.

Before integrating the mathematics classes with students' cultural contexts, I needed to be familiar with their culture, have information about the focus theme olive and its importance in their culture and daily life in order to be able to create culturally relevant mathematical tasks. For this reason I followed the way of PNG measurement project by the members of Glen Lean Ethnomathematics Center (GLEC) at University of Goroka (Kaleva, Matang & Owens, 2008). In that project with the aim of collating and analyzing the cultural measurement systems of different PNG language groups, they first made in-depth interviews with staff, students and villagers which provided rich information to be used as example in the lesson plans for bridging classes. With the methodological guide of this study, I conducted unstructured interviews with elder students who were familiar with both Western and traditional measurement ways/systems. Besides,with the help of the tips from those students, I also needed to gather some other information from more expert resources. Therefore, I made several interviews with a villager who serves as a primary teacher in school at the same time. Studying with him was quite advantageous, because he was a teacher and familiar with Western approaches to measurement. At the same

time, he was a villager who used to live in this village in his entire life, has olive farms and makes olive products, can communicate with other villagers, observe and use measurement activities and may interpret their relationship with mathematics.

During this ethnomathematical approach, he also led me to communicate with elder villagers to interview and gain more information from them to be used during the tasks. The interview questions were constructed by being inspired from the survey used in PNG project and my own ideas by considering the cultural issues related with mathematics. Those interviews' content was including questions about olive and measurement from many several aspects. I prepared some questions such as; Is measuring necessary for olive farmers? In which means? With which methods do you compare different olive farms?Do you have some special measuring methods used in this village? Have you ever used some special measuring units, maybe before The Republic of Turkey? Can you tell your most unforgettable memory about olive? What are the cultural artifacts produced by the people of this village?, etc. , but some spontaneous contributions and questions were welcomed during the interviews. Those interviews are video recorded and inspired me about the task development process and also some related parts are used in some of the tasks as a part of activity.

The discussions, brainstorming and field researches with the villager-teacher provided rich ideas about the future tasks to be developed. His ideas, as a person who has mathematical literacy and cultural background at the same time, let me to improve them and use for integration process.

Before the integration process, the related literature was reviewed. Especially the studies consisting of practical application were analyzed in detail. The possible future topics about measurement to integrate in mathematical task were noted to be improved. This review not only provided creative, inspiring and suitable ideas about the future tasks, but also guided me about task development process. Besides,different 6th grade Teacher Guide Books and the objectives of 6thgrade mathematics curriculum of National Education of Turkey led task development process in selecting possible topics to be integrated and adapting the existing examples and problems into our context.

In addition to them, one of the effective resources for task development was the general research about our main topic olive in internet and written materials. The review about olive in mythology, history and religion, how to

design an olive garden, technical information and statistics about olive and olive products, and many related topics provided me inspiration about topic selection to integrate into ethnomathematics. The forums which olive farmers discuss about their practices, the websites about sections related with olive from mythology and religion, and about different kinds of art which are fed from olive and the valuable and unique book called *Zeytini Kuşlar Diker*, written by Ayşe Aktül-Schafer (2011)also providedvisual materials and data to use in ourtasks.

Finally after the tasks were developed, they were reviewed by two mathematics teachers with master degree for they whether measure what they were supposed to measure, are those activities were suitable to fulfill the required objectives of area measurement unit, were the expressions and directions clear, were those activities suitable for the students' achievement level and background, are those exercises stated after the main activities strengthening the main topic, etc. According to the reviews from stated point of views, the tasks were reconsidered and updated to be used in classroom.

3.8 The Process of Instruction

The area measurement concept is tried to be applied with an ethnomathematical approach during this study. The activities were intended to associate students' daily life practices –about olive and area measurement- and local culture with mathematics; activate their existing prior knowledge and link it to the future ones; letthem to learn/remember the history, cases, stories, myths, words, etc. about olive in their own or other cultures and construct mathematical understanding easily with self-confidence by feeling the ownership of information, realize that mathematics is meaningful because it is involved in their own culture and daily practices; and also get familiar to other cultures and their mathematical practices by respecting and promoting them in general (D'Ambrosio, 2001). In Table 3.2, activities and corresponding objectives are presented.

Table 3.2 Activities Used in Instruction and Corresponding Objectives

Activities	Objectives	Duration
Activity 1: Uncle Halil says that…	Estimate area of plane regions by using strategy	6 class hours
Activity 2: While planting olives	Explain area measurement units and convert each other	6 class hours
Activity 3: Ancient measurement systems & measurement units in Ottoman Empire	Explain area measurement units and convert each other	6 class hours
Activity 4: Rating the remaining area of olive-tree	Solve and build problems about the area of plane regions	2 class hours
Activity 5: The area of the land of Nomads	Solve and build problems about the area of plane regions	2 class hours
Activity 6: Olive and culture; thousand years old mystical motif- the tree of life	Solve and build problems about the area of plane regions	2 class hours
Activity 7: The universal symbol of peace- dove & olive branch	Solve and build problems about the area of plane regions	2 class hour

The lesson plans are generally formatted with four parts:

- **Goal of lesson plan:** In this part, students are presented with the aim of the tasks and learned what they are going to learn in this activity.
- **Introduction:** The aim of this part is to warming up the students for the related tasks. Interview videos; sections about their close environment; discussions or brainstorming about their daily life and experiences; their cultural practices such as history, poetry, folksongs, handcrafts; international ethical values, etc. are used in order to prepare students for following task.
- **The tasks:** This is the main part of the activity. With the help of the introduction part, the students who are supposed to be highly involved in the topic are asked to complete this task to develop the expected mathematical skill.

- **Conclusion:** In this part, some examples and exercises are presented students to practice and harden their learning.

3.8.1 The Content of the Activities

Before the mathematical activities, students are asked to write reflective paragraphs about their experiences, memories, stories and knowledge about olive and olive farming. They were left totally free to write anything they wanted to share in order to assess their readiness and excitement about olive topic. After the paragraphs, a presentation about olive and olive farming was conducted as an introductory activity. This presentation including pictures, videos and interviews about "olive" did not include any mathematical information and linkage because the aim of the presentation was only capturing students' attention, increase their motivation about the topic, letting them to feel exited about an upcoming mathematical topic that was quite related to their culture. Olive from many different aspects were stated in the presentation such as; etymology, history, geography and economy of olive, its existence and importance in various cultures, its particular growing areas, olive oils' spectacular benefits for human beings, the art stuff just like poetries about olive, the stories about olive in mythology and scriptures, Turkey's position in production and consumption and the interview videos with the villagers, etc.

Activity 1 called *Uncle Halil says that…*was developed to estimate area of plane regions by using strategy. In order to follow this goal, the activity was composed of four parts mainly; measuring with non-standard units, measuring with standard units, indirect measurement and solving problems about the areas of plane regions. Before the task starts,Uncle Halil waspresented to students with his story about olives and his visual images. As a warming up activity, it was intended to take students attention to the topic with a person who was used to be an olive farmer and known by all of the students as a nice and venerable man in the village. According to the story of the task, the students were asked some questions related with olive grove area measuring strategies about the mentioned four steps of the activity and they were tried to be reached to the main sense of the objectives. While proposing and applying some strategies that they already know or developing new ones; if they fail, need help or want to check their practices, the videos of Uncle Halil (the wise man

about olive in the village) which were recorded during the interviews in the task development process were presented to students. It was aimed by this activity that students had a chance to compare and discuss their activities with the guide of an elder knowledgeable person that they already know and respect his knowledge very much. Even if they are not able to propose appropriate strategies, they will be exposed to a familiar and meaningful discourse by Uncle Halil. In another scenario, when their strategies are the correct ones, they will realize that it matches with Uncle Halils' and they appreciate their existing mathematical knowledge. In order to fulfill those goals, the mentioned four objectives are tried to be met by mainly following activities; comparing the sizes of different olive groves, estimating their area with non-standard units, calculating their area with standard units, measuring area with indirect methods such as scale and solving problems about related activities.

Activity 2 called *While planting olives*was developed to explain area measurement units and converting them each other.As a warming-up activity, technical informationnourished with visuals about olive planting was read and discussed. The main activity for converting area units started with putting a carton which is representing the 1 m^2 size of hole representing the area needed to plant olive. Depending on the information read before, we had to convert our area which is 1 square meter into dm^2 or cm^2 to be able to know how much fertilizer and water we will put. With this activity, students were aimed to realize the relationship between area measurement units by converting 1 meter long sides of the square into dm and cm, and then reaching the area in different units after multiplying the length of its sides. Discovering the numeric relation between area measurement units such as 1 m^2 is 100 dm^2 and 10000 cm^2 was planned to be concluded by a generalization about converting area measurement units each other to be also used in other situations. In order to strengthening this acquisition, exercises and problems about converting were presented. Then, land measurement units were started to be discussed with the olive point of view. Exercises about converting land measurement units and area measurement units were solved, and problem situations about olive farming were followed those exercises as the final activity.

Activity 3 called *Ancient measurement systems &measurement units in Ottoman Empire* could be linked to the "explain area measurement units and convert each other" goal of 6^{th} grade mathematics curriculum. However, it is an activity serves for out of curricular mathematics that aims remembering the old

cultural mathematical practices which have still been in use, which couldn't be separated although their genuine cultures have been changed by the effect of modernity and time and basing the mathematical gain on this channel. As a matter of fact, instead of making the numerical relation between the units' steps and memorizing the system, doing conversion exercises on different measurement systems' units (the ones which were being used in their own geography before decades) thought to be a great mathematical gain to let them to construct the relationship in any system and discover its parts as a whole. In order to achieve these goals, many different ancient cultures' measurement system and practices were investigated, discussed and compared. Then passes to the Ottoman Empire Measurement System that their older generations were used to use and they still use in some degree. An old land title in Ottoman language and units, as some of their families still have, was presented in Latin characters and the area described in there was tried to be converted to current measurement units. After students got familiar to the relationship between those old units, then converting area measurement exercises were applied. Those exercises were followed with problem situations related with Ottoman context.

Activity 4 called *Rating the remaining area of olive-tree* was developed for the objective of solving and building problems about the area of plane regions. In the 6^{th} grade mathematics textbooks, one of the stated problems was related about finding the remaining area from a bigger area. In order to achieve the same goal, this activity related with intra agriculture in olive farming found suitable to integrate. After introductory statements about intra agriculture, students were presented a map of olive grove and the planted olives were signed on it. The types of olives and the area they need to grow were given. The problem was about finding the remaining area from the olives to farming other plants. They were supposed to find the whole area multiplying the two sides leading from the outline in the activity and then how much area all the olives use needed to be calculated considering the area each olive cover. As the last step subtraction was made to find the region remaining. After students got the point with this main activity, some other problems related with the same goal were presented as strengthening activities.

Activity 5 called *The area of the land of Nomads*was developed to solve and build problems about the area of plane regions. This activity was also referring one of the main problems stated in 6^{th} grade text book which aims to finding the area of

an object which they don't know how to calculate its area by dividing it into small parts and adding the areas of these parts together. In order to fulfill this goal a problem situation is presented to the students about the bird's eye view of the village. First of all, some information about the roots of the village and villagers were presented and discussed and then Google maps photos of the village minimized by scale was stated. The students were expected to find the area of village's area by dividing this improper shape into the small parts that they already know how to calculate its area to find the total area of it. After dividing, they needed to estimate the real area by considering the scale. After students got the point with this main activity, some other problems related with the same goal were presented as strengthening activities.

Activity 6 called *Olive and culture; thousand years old mystical motif- the tree of life*is developed to solve and build problems about the area of plane regions. The goal of this activity was the change which will occur on their areas when the length of the sides of polygons were increased and decreased. As the warming up about different types of art on olive and especially handicrafts motives were read and discussed. One of the motives representing the tree of life; olive that also used to be used in Anatolia since many years was presented to students on a squared paper. The aim was to finding the relation between the length of sides and area through the question of what kind of a change occurs if all the side lengths are doubled. In order to achieve this goal, students calculated the motive's current area, then doubled the sides of it and calculated the area again. When they compared the previous and following areas, they wanted to reach the idea of the area will increase 4 times, while the sides increased 2 times.

Activity 7 called *The universal symbol of peace- dove & olive branch* was developed to solve and build problems about the area of plane regions. It was the last activity as a follow-up of previous activity. It was also related with the change which will occur in their areas when the side lengths of polygons were increased and decreased. But, this time the aim was not just doubling the side lengths or making them half, was to make the change which would occur be discovered when it increased or decreased in different ratios. In order to achieve this goal, the task started with a warming up activity by discussing peace issue and olive. Then a dove with olive branch figure on squared paper was presented the students to discover the new figure's area when its sides were tripled for painting it on school wall. The

activity was developed by considering and emphasizing the international social and cultural, universal values at the same time compatible with our olive project.

3.9 Trustworthiness

The term of "trustworthiness" is proposed for substituting reliability and validity in qualitative studies and four main criteria is presented to achieve this concept; credibility (in preference to internal validity), transferability (in preference to external validity/generalisability), dependability (in preference to reliability), confirmability (in preference to objectivity) (Guba, 1981). Those four criteriawere consideredin this study to fulfill trustworthiness will be presented in this part.

Credibility substitutes internal validity in quantitative studiesand mainly refers to describing phenomenon/events as they actually occurred (Shenton, 2004). In order to ensure credibility, the basic principles that determined by Shenton (2004) were tried to be guaranteed. First of all, the reasons for applying a qualitative research and first person inquiry method, and why these methods are appropriate for the aim of this study were discussed in methodology part in detail to establish the adoption of research methods. The researcher was already familiar with the culture of participating students and environment; and a relationship based on trust was already constructed during previous semester between the students and researcher because she was also the teacher of them. In order to ensure honesty in participants, the students haven't been asked to participate or refuse to participate because this study was conducted as a part of their regular educational program. Thus, they are accepted as willing to taking part and offering data freely during the instruction. Besides that, due to the principles of applied instructional method the researcher always aimed to promote freedom in classroom. Therefore, the classroom environment was quite suitable for participants to contribute ideas and talk about their experiences. Another principle to promote credibility was thick description of the phenomenon and it is provided by detailed descriptions of students'characteristics and contributions individually, instruction process and environment especially in result chapter in order to convey the actual situation that have been investigated and the context surrounds them. As another tactic to increase credibility, the findings of the study were tried to be related with the other previous studies in discussion chapter to indicate in which

degree the results of this study are congruent with existing body of knowledge. Finally, supporting the gathered data by triangulation was another method considered to ensure credibility. With different types of documents such as video records, field notes, observations, task sheets andstudents' activity assessment forms, the data was tried to be guaranteed to explain the performances and attitudes of students truly.

Transferability substitutes external validity in quantitative studies and mainly provided by describing the context of the fieldwork in detail so that the findings of the study become comparable for similar situations and transferable for similar settings (Shenton, 2004). Even if this study deals with a particular situation and particular group, its findings might be extended to other similar situations, settings and individuals with replication. For example, the activities might be applied to a group of students who lives in a village and whose culture is quite related with olive farming. Then, similar results are expected to be found when the same study is applied in other similar villages whose culture is related with same or similar contexts. Therefore, in order to ensure transferability, some contextual information should be kept clear in order to let the others to decide the findings are transferable for similar settings or not. To address those issues, the context of fieldwork is explained in detail especially in result and discussion chapters of this study. The culture and environment of participating students were discussed, their quantity and characteristics were stated, task instruction methods and procedure was explained, data collection instruments and methods were given, number and length of the data collection periods were stated to fulfill the transferability of this study.

Another criterion for constructing trustworthiness in qualitative studies was dependability which is equivalent with reliability concept in quantitative studies. In order to ensure dependability, necessary efforts should be spent on describing the research process so that other researchers have chance to replicate the research (Shenton, 2004).Because of this study was prepared to be a guide for future studies due to the lack of research about ethnomathematics field, from activity development to the instruction all steps of the process were tried to be stated as clear as possible. Thus, if another researcher follows all steps described in previous chapters, he or she might obtain the same results because all needed documentation, literature support and research on field were stated in detail to let him/her to replicate the study. Besides the process within the study, detailed description about the research design and its implementation, and detailed documentation of the procedures followed in

data collecting and data analyzing were also presented in previous parts of this chapter.

Confirmability as the last criteria for the trustworthiness, it refers to objectivity and means to ensure that the findings of the study were drawn from the data of the study, instead of researchers' own ideas (Shenton, 2004). In order to reduce the effect of researcher bias, triangulation was applied by gathering data from multiple resources such as video records, field notes, observations, task sheets andstudents' activity assessment formsin this study. Besides triangulation, the researcher bias was stated in the following limitation part to contribute the confirmability of this study as Miles and Huberman (1994) suggested.

3.10 Limitations of the Study

One of the limitations of the current study was about participants. The participants of the study weren't selected randomly because it was the only 6^{th} grade class in the school. However, this 6th grade class could be accepted as heterogeneously formed because it is the only one classroom consisted of the same aged group of students in whole village. Also, there existed low achievers and high achievers together in the classroom. Also, limited quantity of participants might constitude a limitation but it tried to be prevented by considering trustworthiness.

During the data collection and implementation of the activities, the researcher bias might be considered as a limitation for this study. Due to the nature of qualitative research which is dependent on the researcher in both collecting and interpreting data, I made observations and took some notes for the interpretation, but I tried not to include my own opinions into these notes. Even if the design of the research was first person inquiry and this kind of research is open to be subjective, I paid attention to this point and tried to be as objective as possible while taking notes and interpreting outcomes. However, my perspective about education and ideas about mathematics teaching might have been reluctantly and unavoidably effected the process of this study while designing this study, observing classrooms, taking field notes, analyzing and interpreting the findings.Therefore, in order to better understand the process and results of the study, it will be beneficial in any caseto determine those ideas and perspectives.

I believe that there isn't any student who is not capable of being successful when his/her needs are fulfilled in educational system, except special conditions. However, there are determined roles and positions which are produced by educational processes and this cycle only lets some middle class privileged groups to be successful for gaining high and well paid positions in future and save the existing social levels. Especially in mathematics education there is a belief which advocates that only some intelligent minority is enabled to achieve in mathematics. This belief is becoming real when it is supported with the idea of mathematics is a quite difficult subject that consist of a body of determined numeric calculations which is identical in all cultures and environments. Besides that, this idea also serves for reproduction of this privileged group who achieve in mathematics. I think, all students from different culture and backgrounds should be provided relevant instructions even in mathematics and the curriculum should be revised by considering different student needs and values, in order to break this chain. Therefore I started this study with the motivation of providing relevant mathematical experiences to the relatively disadvantaged villager children to contribute their existing situation. Thus, in a study which is structured on a group of people's welfare, distorting the data and findings would be pointless and insincere because manipulated results might cause negative effects to their situation. With this point of view, I was aware of recording all kinds of data and interpret them with an objective eye is quite important due to ethical and reliability issues.

In addition to that, the purpose of this study was not to determine the positive or negative effect of an instruction enriched with ethnomathematics to the students' achievements but to determine the contribution of this special method on classroom environment and students' performances. Thus, the data derived from students hadn't been reported according to their achievement but according to their occurrence. Also, according to results of the study, only a few students' performances were increased, instead of all of them. Besides them, some detected negative sides of the method were also stated clearly for better future studies. In other words, the whole process was tried to be applied and stated in an unbiased and objective way as it happens by considering all positive and negative results are valuable and scientific.

CHAPTER 4

RESULTS

The data that collected from video recordings, observations, field notes, students' task sheets and students' activity assessment forms are presented in this chapter. In the first part, students' performances on the activities are explained in detail, and in the second part students' views and feelings about the activities are presented.

4.1 Students' Performances on the Activities

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As stated in the research questions, this study aims to explore the sixth grade students' perceptions of and engagement in ethnomathematical tasks in area measurement concept. I plan to achieve this aim byassessing the nature of students' performances in tasks with the help of the observations, student task sheets, video recordings, field notes and students' activity assessment forms.

During ethnomathematics-based area measurement instructions, a project based approach was applied. The process did not only cover the 6th grade mathematics curriculum's related goals and activities, but also included required prerequisite knowledge, strengthening exercises, practical daily field applications and general linguistics information in a detailed way with a holistic perspective. For this reason, ethnomathematical activities may not have been used in exactly all of the courses, but the covered topic in general could be identified as enriched with an ethnomathematical approach.

The situation of two students who needed special education programs found necessary to be discussed in here. Those students who have reading, learning and understanding difficulties didn't give meaningful data during the activities in terms of our study's goals. They also couldn't be able to understand the questions in the assessment form completely because empty or irrelevant replies were observed in

their papers. It was not an unexpected result when they were exposed to a program prepared by considering the majority of classroom, instead of a special one for them. Even if it is not quite appropriate ethically, the deficiencies in developing special education programs and worries about completing the instructions on time prevented us to develop and apply special tasks for them. However, especially the daily cultural issues discussed in classroom took their attention so they always felt happy and included during the activities.

4.1.1 Presentation and Reflective Paragraphs:

During the presentation activity, students were observed while often interrupting the presentation and being willing to share their experiences about related topics. For instance;Yağmur said that "teacher, have you seen the olive trees in the lowland? They are the oldest and biggest one in these villages" when she saw that it is emphasized in presentation that olives can live long years and reach till 15 m length. Students were also quite familiar with the concept of human health and consuming olive, so they wanted to share their experiences about they already know and take advantage of it when we were talking about the benefits of olive oil's spectacular benefits for health. İsmail said that; "all of the meals are being cooked with olive oil in our house. One day my mother put flower oil to the rice but my father threw all of it to the trash". Emre also added that; "When I was young, I didn't like olive oil. I immediately could recognize olive oil in the meals and never eat them. One day my mother started to mix olive and flower olive in the meals, and every day she put more olive one. One day after I finished my meal, she laughed. I asked why you are laughing. She said the meal that you just ate was cooked with completely olive oil but you didn't recognize. Then I started to eat olive oil". When İsmail saw the picture of children who put bread to the olive oil, he couldn't help himself and added; "I love olive, ok! But picking olives is a torture. However, after it is picked and oil comes what a beautiful moment to eat that oil!". When the picture about olive *pür*s (olive remaining after olive oil) came out, Yakup said that; "teacher, we are using those pürs as barricade and throwing cones as bombs, it is so fun".

The most exiting parts of the presentation for the students were the poetries about olive written by some other students, the stories about olive in mythology and scriptures, and the interview videos with the villagers. They got emotional while one

of the students was reading the poetry about olive was seen from their quiet and a kind of sad looking and Rüya's and Mehmet's expression that "teacher, it is so good, thanks to who wrote it", "why don't we write a poetry about olive too?". Also when they saw Uncle Halil on the screen, they became exited and shouted all together by revealing how they are surprised. They described him to a few ones who know him but not sure about details.

Even if some parts of the presentation was quite familiar for them, some statements about olive such as olive has a very important role in many different cultures and history, it is grown only in some particular geographies and their locations in world map, Turkey's position in production and consumption, etc. was quite new for them because they revealed their interest to them by saying;"I didn't know before olive is a that much important tree" (Yasin), "Where is Spain in the map if they produce the most quantity of olive?" (Yakup), "Qoran also speaks about olive like other scripts?, I am going to ask my father" (Ali), "Teacher, I am sure nobody knows about the benefits of olive oil, that's why Turkey consumes so less than others" (İsmail), "Olive doesn't worth to grow anymore, doesn't make money, the farmers sold groves out and migrate, so it is normal to decrease in production of Turkey" (Eren).

Before the presentation activity, students were asked to write reflective paragraphs about olive and olive farming in order to collect some hints about their motivation. Some expressions from those paragraphs also found valuable such as Osman's ones: "we have olive groves that left from my grand grandmother. One day we went to grove to pick olives but we realized that somebody cut one of the olive trees. My father bet that guy over there and we got the woods anyway. Yet, my father was very sad because it was the tree which gives maximum olive. We planted a new olive tree instead of it and it started to give more than the other one. One day we picked 35 bag olives from that grove which was 10 dönüm and we had too much oil too". Osman's expressions revealed some important hints for the future expectations of the study because Osmanas a student, who has very limited mathematical literacy and knowledge, started to unconsciously use mathematical expressions and started to make connections between the area (dönüm) and quantity (olive). It was his regular daily life issue and he wasn't actually aware thathe was using mathematics which he was not good at in school. In other words, this activity revealed that the students who are not actually good at in school mathematics might be directed with appropriate

activities to discover the real mathematics that they already use. With this point of view, ethnomathematical approach used in this study may provide all kinds of students not related with their academic background to achieve in mathematics.

Ali expressed his connection with olive as saying that “there are many olive trees in our village that you can see while passing by car. Because we don’t have olive groves I don’t know so much things about olive, know just how to pick it but in any way I love olive”. This expression was also one of the important ones for the study because it reveals that there exist somestudents who are not that into olive stuff. Yet, they still appreciated the present activity according to the observations and it probably was one of the reasons that explain the high involvement in activity.

According to the stated expressions and contributions of students during the presentation and paragraph writing, students seemed very motivated and excited to speak about their existing experiences, they were comfortable about revealing their thoughts and feelings, and open to got new perspectives about olive and olive farming. Therefore, their explained behaviors could be interpreted as; the existence of olive and olive farming in students’ lives and culture, and implementation of an activity related with those topics let them to get into this activity easily and become highly motivated to fully attend in activities as a whole classroom.

4.1.2 Activity 1: Uncle Halil Says That …

Before the task starts, Uncle Halil was presented to students with his story about olives and his visual images as the warming up activity. When students sawUncle Halil in the task sheet, they were very bewildered and surprised, and revealed their excitement by laughing and saying that “Is that Uncle Halil?”, “What is he doing in here?”, “Teacher, how do you know him?”, “Did you take those pictures of him?”, “I just saw him yesterday”, etc. They also approved with words that he is the wise man in the village about olive and olive farming;“He has many olive groves teacher”, “he never worked in other jobs like factories, he earned all his many from olive for years, he knows a lot about olive”, “he just sold some of those groves over there, he plans to become a politics man in city!”. Uncle Halil was assuring that he will support the students with his deep experience during they are trying to create strategies for the problem situations. According to their expressions

derived from observations, the warming up activity about a real person from their daily lives and olive groves as a part of their way of livingseemed to achieve the goal of taking their attention to the task.

The activity is started in olive groves in the field with discussing some starting questions such as; “why do we need to measure area?”, “Is area measurement necessary for olive farming?”, etc. in order to let students examine related goals and develop strategies for the objective of comparing and estimating area. Actually, during this part of activity, students answered the questions quite easily, while I was planning to get the answers after some directions. Some of the answers spontaneously given by students were as following; “We have to measure the area to determine how many olive trees we will plant in a grove and how long space we will leave between them. If we buy saplings without measuring the area, then they go down the drain and we’ll make loss.”(İsmail). “We use area measurement when we need to determine how much land we will plough” (Rüya). “When the olive grove will be divided up among brothers, we need to measure the total area. Just in last days my uncles shared my grandfather’s grove, they measured the area and cut it in half” (Mehmet).

Those sentences came up from the students includes quite rich findings because for example Mehmet was talking about his real experience which is coincidently happened in near future in his own family. The described situation which was quite related to our area measurement topic was practiced by himself and he personally witnessed the area measurement and dividing process of the grove. Also İsmail’s answer was quite impressing because it was just like the product of a professional point of view. According to his answer, it is obvious that he knows how the trees should be placed in a grove, the distances between themand it is possible to calculate how many trees we need to buy by considering the distances among the trees and the area of the grove. Those expertise measuring and olive farming knowledge seemed to be the result of not only his mathematical knowledge but also his existing real life experiences.

There weren’t many more words to be added after the students’ responses. As a part of the activity,the points that Uncle Halil was mentioned for the questions were almost the same ones with students’. They were not quite impressed with his responses and they were acting like they are discussing a topic that they even do not need to talk about because of their familiarity on these daily activities.

After the discussions about measurement concept, students asked to estimate which one of the rectangular shaped olive gardens is bigger than the other. İsmail, Yakup, Rüya whose self confidence in mathematics were considerably high, dispersed around the land and decided the correct one by applying their experiences and instinct. Yasin's movements were notable. He, who used to be usually eager to take part in mathematics classes but cannot contribute voluntarily because of his fear of failure, also had deficiencies in multiplication facts and basic calculations and could be defined as a shy student in classroom in regular mathematics classes,was walking around and trying to make a decision in a curious and independent way without any directions. He was trying to deduce and compare the areas by pointing at the trees in the boundaries. After applying his strategy by speaking with himself, then he decided that the groves have same area. It seemed to be a valuable step and might be interpreted as his awakening in mathematics class when it is compared with previous ones. At the end, all of the students concluded their results and Uncle Halil relaxed them by saying that it is normal not to get the right answer in first glance. It is possible to compare and make correct estimations about different areas by just looking but it requires strong experiences. Then he directed them that they need to apply some concrete strategies to be surer.

In the second part of the activity which aims to measuring with non-standard units, students tried to prove which grove is bigger than the other by developing strategies without any instrument. All the students agreed on the fact that pacing must be done without spending time and many of them already started pacing familiarly without waiting direction and instruction. When it is asked what should be cared while pacing, the response of opening the pace in an equal way was given without delay. While six students were doing pacing, they touched on the fact that pacing by different people wouldn't be suitable and the width and length of two gardens must be measured by the same person. Those kinds of details about measurement came up from the students spontaneously, because they seemed to be familiar those practices before.

At the beginning of the pre-course which was made for completing pre-requisite information on measurement subject, the whole class failed to find the area of a regular rectangular region. They were not actually practically internalized the logic of finding the area. After some reminders, some students like Rüya, İsmail, Yakup, Ferhat, Eren, Yağmur remembered and started easily applying it. Yet,

relatively lower achieving students Yasin, Ali, Mehmet, Osman couldn't get the logic in this short class.However, interestingly, the whole class which hesitate over finding the area of the rectangular region started the operation stating that they would multiply the width with length they paced for finding the area of the field without any direction. Almost all class replied as "we'll multiply" and Mehmet and Yasin was one of those leaders. This might be the reflection of their already existing mathematical experiences in a familiar context, while it was harder for them to concretize to the sense of area.

After applying this strategy, they were more certain about the bigger olive garden. Also, they made a joke and started laughing by saying "how are we going to call the unit of the area now; as pacesquare?" Students reveal two important findings with this expression. Firstly, they totally seemed to have fun and enjoying the activity as much as making jokes and their energetic movements observed during the activity supported that idea. Their being so happy could be explain by implementation of a culturally relevant task. The comfort and joy of familiarity to the tasks so achievement might had been let them to feel like that. It also could be the result of just being in outside and receiving a different instruction. Secondly, they were thinking in detail by considering the unit of the area which is a quite important element of measurement concept.

When the students were asked about other possible strategies to predict areas, they came up with impressiveexamples from their own experiences. İsmail said one of the expected answers"by looking at the areas among the trees''. He meant that predicting the distance between two trees is easier than a whole grove, so we can calculate the width and length of the grove and multiply. Besides İsmail's strategy, a similar one which wasconsidering the area among the 4 trees as 1 unit square in dotted paper, the method of predicting the whole area was going to be used as a main exercise after this activity.They continued to make pretty successful associations. Rüya said that olive sackings –the coverings put on the ground while olive picking to save the dropped olives- could be used and Mehmetadded"we can predict that the area is covered by how many tractors while we are driving tractor". Both strategies were quite related about estimating an area by using other little areas strategy and they were presented related exercises about this strategy later.

When passed to the solution of the exercises involved, the activities regarding the area of which fields placed on the unit squares was big were done easily by all

the students. However in the questions related to the measurement of the area of olive grove which was placed on the dotted paper brought about the problem case, Mehmet, Yasin, Ali and Osman needed support on the matter of starting the solution of the problem focusing, even if the problem cases are related with olive groves. Those students who are academically lower had difficulty even in concentrating on the long problem cases but they were still working on their task sheets to complete. The others solved the problem immediately. However, by small directions and corrections everybody reached the right answer. Although culturally relevant exercises were provided for the students, it was observed that some of them were not able to achieve it. A sudden change was not expected especially in the first activity but whole class's completing exercises by reaching the objectives was actually unique for this group of students.

In another part of the activity, the areas of various olive groves given on dotted paper were going to be predicted taking the area of one unit square as a reference given in the figure. The areas of the regions formed of exact unit squares were made easily. In the exercises including the areas of half squares divided into two equal parts, that the two parts will be 1 unit square was explained by students and it was continued to be solved voluntarily. The students developed kinds of strategies. İsmail gave numbers to unit squares, was counting giving the same number to the two half units.Yasinlinked the half unit squares with one line and counted them as one square without any direction and reached the right result at all of them.In some exercises, there were some students who divided the given regions into parts in an unsuitable way to 1 unit square shown as reference. It was asserted that this situation wouldn't be useful in prediction because it is not compatible with the region given to us. Especially the exercise given in the figure couldn't be done by most of the students even when that it must be divided into the parts resembling to the area which we took reference was said. Upon this matter, after stated that they must find the areas of the parts remaining drawing by 1 unit square, all of them reached the right results. At the end of the lesson, the students who completed the involved exercise already started solving the other exercises. That they liked the subject and were successful at it was clear. There were no students who didn't join the activities and didn't try to solve the exercises on task sheet. (Except two students who require special education-and they also were doing some scratch). While the questions related to the methods of comparison and measurements of the areas of the

olive grove were being discussed, almost all students wanted to take the floor voluntarily. To sum up, during the exercises part, some of the questions were solved by all students, while some of them were not. While academically better students like Rüya, Yasin, Ferhat completed most of the exercises with little trouble, some of them like Yasin, Ali, Mehmet, Osman needed direction. The little directions were actually enough for them because all they were really motivated to complete this task. Even after little hints, they were getting excited to improving in exercise. Because they started the task with a topic which they feel that they really know and after that they were exposed to exercises which they might relate with real life and still find interesting. In other words, instead of correctly completing the activities, the students' excited and motivated behaviors compared to their previous situation and being decisive to complete the activities are observed and recorded as an important finding.

To the question of how we will decide definitely which olive grove is bigger, the students responded like 'by measuring by meter' easily by the effect of previous discussions. They showed their interest commenting like "what did Uncle Halil say?" by referring the sessions Uncle Halil's responses are provided.Mehmet said that they measured his uncle's field by rope. In the class we had decided that we can use a long rope like a huge ruler to be able to measure the width and length of the field, using it as a big tool of measurement dividing it in meters and marking, by question and answer method. But, Mehmet emphasized that they used another method while measuring by rope during his own experiences. After taking the rope to the field and marking it as in the way it will cover the width and length, he warned us measuring the rope marked taking the meter will give faultless result. Maybe, the method which is used in reality and which is more practical was that. Especially during the first parts of activities which we discuss measurement concepts and practices, Mehmet was observed to provide outstanding examples and contributions. As a student who is academically almost lowest one, his proposing much more flourishing examples than the others gave an expectation about the future results of our method. Even if he wasn't that active in exercises parts, he was quite good at developing strategies to the problem situations about measurement. By correcting our faults and proposing the ones he used to apply to measure the gardenshe was sharing and applying his own experiences but they were spontaneously turning into mathematical contribution.He

also seemed to be relaxed and happy to be in there with his recently started cool, wise and confident behaviors.

They understood standard measurement units and the meaning of standard word comfortably. Metric System was talked about; its upper and lower units were touched on. When what the lower and upper units will be useful for and if they didn't exist what will happen were asked, all of the students were raising hands. When Yasin took the floor, that he raised hand without designing what to tell was obvious. After some fuddle, he mentioned that we couldn't measure the small things, for example; we needed a small unit like centimeter to measure the side of his watch. The notable changes in Yasin's comfortable and confident behaviors compared to his previous performance will be discussed together in detail in another paragraph. Likewise Yasin, Ali said that we need bigger units to measure the olive gardens. How it will be to measure the fields we went before with meter and the fault types which can occur were discussed. Ali who used to be striving but shy student contributed more by saying that it must be measured with kilometer, because large fields would be measured by big units. We asked Uncle Halil as we didn't have a measurement tool with kilometer.

Students were given the plan of field with 1/2500 scale in which the fields we went for comparing were in. The aim of this activity was to remember the concept of scale and make them the simple operations do before starting exercises about area measurement with a scale. It drew their attention pretty much. They were asked to write the names of those on the places they know. They placed like school, factory, and asphalt easily. It was obvious that they knew better than me, none of them needed help. The length which is 2500 unit in real was told to be 1 unit on the map over the scale of 1/2500. So, if the length of one side of the first field is approximately 1 cm on the map, how much it is in real was asked. A few simple examples were done on this.Yakup, Rüya, Ferhat, İsmail started to get bored while the others trying to get the strategy.Because while finding the area of the fields minimized with scale which requires advanced capability they would need these basic information.

By the first example, when I asked students to find how many centimeters one side of the field in real which is 6 centimeter is on map, almost all of them found the right real length including the students who had difficulty in the previous lesson. I was surprised. I predict they found multiplying with 1000 thinking that the area

which is 6 cm on map with 1/1000 scale is normally larger. When I asked the students who found the length of one side how they will find the area of it, Ali said we multiply two sides and they applied.The other questions continued as we didn't have any difficulty. There were points Yasin, Mehmet and Osman had difficulty but they corrected understanding by small clues.

İsmail, Rüya, Yakup, Ferhat solved the worksheets I gave before thinking them as easy although I told them we would do together at school. Even if they understood the subject of scale in the previous lesson, it was normal for them to connect it with the area subject. That's why, all of them made mistakes. They didn't follow the steps we discussed carefully by the courage and comfort of being successful. They started to repeat when they realized that the results were wrong. When these students didn't yet reach the right answer, Yağmur wanted me to check her paper. Until that time I hadn't given a clue about the fact that they must find the real area by 1 unit square but I saw Yağmur reached the result writing 25 instead of 5(the area of 1 unit square)by unit squares she counted. She was so happy. She used assertions like "Gosh, I solved in right way for the first time". In the previous lesson Yağmur who couldn't solve the questions of simple scale I asked through ordinary questions solved this question requiring high level capability here. By intensifying scale concept with activities on olive groves might have been let her to internalize the concept hiddenly. Also her reaction to her being correct reveals that it is not a quite usual moment for her to feel the confidence of achieving. Thanks to this activity, she had the joy of being successful in mathematics and its reflections are observed easily from her movements in class.

As one of the joyful moments, Ali was murmuring a song while trying to solve the question.This behavior which hasn't been observed before is accepted as a positive change in performance because it probably was revealing that he was having fun when he was fully concentrated on his job, enjoying that he is able to achieve or trusting his understanding of related topic. Also, he was supposed to be relaxed, comfortable and sure to conclude the task with success while working on it during this activity.

4.1.3 Activity 2: While Planting Olives

Before starting converting area unit's activity, converting length units is taught to the students during 1 hour because of their observed lack of prerequisite knowledge. During this lesson the length measurement units which can be necessary for converting the area measurement units as prerequisite information was introduced by direct method, conversion exercises were done. Successful students understood easily, but, although the medium levels understand the matter that they could reach the right result in application took time.

The warming-up activity, technical information about olive planting was read, discussed. The students talked about their own experiences. They told planting in square type as explained in task sheets would not be good; they did in the round way contrary to the one mentioned on the paper. They also contradicted the stated water and fertilizer quantities during the discussions by saying that they usually decide how much water and fertilizer needed to be put by just looking at it and it usually like until the hole is completely full with water.On the contrary previous activity, students did not appreciate the information stated in task sheet. The exact quantities given in the sheet sounded like useless and trivial to them. When I couldn't get expected supporting reaction from them, I asked "How do you plant olive trees?".Yasin replied in an alienated manner; "this is not the way to do that, we don't need that" and others approved. According to their reactions, it might be proposed that this activity failed to be accordant with students' real life experiences. However, from the other side, it also helped to arisingin students' existing knowledge about how to plant olive tree, but in a different way. After those negative reactions, the task might be criticized by not being developed by being fed from students' practices about olive planting but from technical information gathered from various websites about olive farming. The assumption that if the information is related with olive, then it will definitely touch my students' culture didn't work. Because this group was a particular one even in olive farmer communities, so I should have considered that they might have particular practices while developing this activity. As also proposed by principles of ethnomathematics, not olive farming but the way students currently perceive and practice olive farming is their actual culture.

The area conversion activity in the field passed doubtfully. The students found this task hard. They were watching surprisingly despite the directions on the

sides. Yakup, Rüya and İsmail reached the right answer after the direction made taking the lead from the relation between meter and decimeter. Successful students also had difficulty in this task. Rüya started to get bored while trying to make others understand to be able to achieve the aim of the activity. While thinking that the activity is simple, it continued on the experiences related to the olive cultivation and they would understand it easily, to have such kind of a reaction caused me to stress and not to be able to know what to do. As also discussed similarly in previous paragraph, with this main activity for area units converting, a normally basic regular practice about olive farming for the students was unfortunately turned to a complicated mass of knowledge. That's why, even well achievers couldn't manage to achieve and internalize the aim. From the other side, if we accept that the task successfully integrated with ethnomathematics, and the activity about olive planting even its practices were different was connecting the students whom are olive farmers,the reason of failure might be linked to difficulty of the task.The activity was requiring converting length measurement units and linking it with area measurement. If we consider that the students wasn't taught length measurement topic in a regular unit, they just received a 1 hour long pre-course about length measurement. They actually couldn't be expected to internalize length measurement units and converting them each other after 1 hour long pre-course. Thus, it makes sense that this activity which requires this skills was perceived as hard by students.

The students' performances were better in exercises about converting area measurement units, after the main activity in the garden finished and we passed to the class. Ali and Yasin became self-confident. When I asked who wanted to do the conversion exercise, although there weren't many who raised hand Yasin raised his hand without thinking. They understood how they will do the exercises easily and went on without almost fault. I think that the subject was understood. Ali was happy and wanted to do the exercises insistently without spoiling the order of the lesson. After completing exercises, he was enthusiastic about passing the problems related with this subject immediately.

When the problem-solving steps were applied, almost every student in the class was volunteered for explaining the problem case in the part of comprehension of the question. The students had already been knowing problem solving steps. After reading and understanding the problems related to the olive, when passed to the solution part Ali was singing standing half. He was comfortable and happy, didn't

care about the environment and I am sure he was still interested in the question. Yasin exceeded himself, he was wandering around in the class self-confidently, discussing the questions with other students and comparing. He also was interfering in the points which he didn't understand without spending time and didn't hesitate to interrupt asking "Teacher, by what it is shown?". As also seen from Ali and Yasin's reaction, it is observed during the instruction that students were more enthusiastic when they were presented problem situations instead of regular exercises such as converting. Even if in generally students were not quite good at following problem solving steps appropriately and reaching the result, the narrative expressions about olive must have been taking their attention. Thus, after little guide not about solving but about steps, then they continued in a motivated way and were probably feeling the victory of theirimprovement. And eventually they got back their motivated, positive and energetic behaviors with those problems related with area measurement and olive or olive oil quantities.

They asked me whether I would distribute new task sheet or not when the problems were finished. They were so enthusiastic for the distribution of the new. When the olive questions became the subject, most wanted to speak and talk about their experiences, the memories were started to be sharedwhen the occasion presents itself. Rüya told she broke the olive branch, Emre told he loved egg with olive oil, Osman told that a half sack olive was taken from one tree, İsmail talked about black olive and how it is made. Yakup and İsmail were talking on 25 km² statement in a problem. While the question including 25 km^2 statement was being read, they tried to understand the size of the field thinking and calculating. They were talking like "from here to İğdecik is 4 km, where and which land did those men buy?". Probably with the help of familiar olive context, they started to visualize measurement concept by exemplifying with real life distances. It could be proposed that if area measurement concept is presented to those children with regular methods or special teaching methods but with meaninglesssubjects and example, then this need for visualizing probably wouldn't be appeared.

While wandering around the desks to check the students' answers on paper, when I passed to the side Ali, Mehmet, Yasin, Yakup and İsmail sit, I confirmed those students' answers before that İsmailunderlined his and his friends' success by saying "Teacher, when you come here you always say yes, yes, great!" and they

laughed at each other and reveal their boast. They, mostly Ali, Yasin, Mehmet whom were not that active before in class, seemed to be having fun because of achieving.

When we started to talk about land measurement units, and how land was used in daily life was asked Ferhat responded like "vineyard, garden, olive", Rüya: "when I ask my grandmother, she says that grandfather goes to the land" and Yakup: "I haven't heard the word of land as we go to the land, they generally say we go to the *ova* (lowland)".When that they use units like Are, decare, hectare or not in daily life was asked, Yasin: "for example; they say that this olive is 15 dönüm", Yakup: "e.g. they will sell field, they say if 1 dönüm costs that, how much the whole of it is sold", Yağmur: "we bought the place of Ali Rıza, it is 10 dönüm my father says like that.", Osman: "my father plants tree, and he says 'I planted for 4-5 dönüm". Meanwhile, Mehmet says: "Teacher, there is also *karık* (furrow)." When I asked: 'what is furrow? ', they react humiliating me: 'Don't you know furrow?'. They explain: Mehmet says: 'length', Yağmur says: 'there are long rods which are laid to fields, for example; they plant by intervals of 5 meters. They realized that all the time dönüm was used, are, decare and hectare weren't used much. Mehmet said 'they only know dönüm and always use it'. Normally, children who aren't initiative in mathematics, Yağmur, Yasin and Mehmetseemed to feel the ownership of knowledge and share without thinking, hesitating, with self-confidence.And providing a traditional measurement instrument and its appreciation by teacher and others increased their prestige just like a successful one. Also especially the students who were not good at in school math such as Yasin, Ali and Mehmet were behaving like having an occasion to contributing and attending in mathematics class. They also revealed their familiarity on olive topic more than the well achievers bybeing well ahead with their original contributions and examples. Those activities' serving for low achievers' and their stated active participation could be linked to subjecting and promoting village life and culture in mathematics classroom, instead ofmiddle class values. Because the successful students of regular, middle class values relevant curriculum could be assumed to come from the culture close to those middle class values (Meaney, 2002). Therefore, in out context, the students who are not dealing with village stuff too much, not let to be busy about real life villager practices for being good at school and have a home culture similar to middle class are becoming more successful with this type of curriculum. Yet, the others whom are coming

purely from low class villager culture may be well ahead with these culturally relevant mathematics activities.

While converting the field measurement units among themselves, they mostly didn't have difficulty.When how many square meter is 1 hm^2 was asked all raise hands immediately. Osman says: "Two steps were passed, a zero and a zero more, 10000. Among them there was decare." He gives the right answer. The exercise that Osman solved was not so important one in general but when Osman's previous performance is considered his correct answer to this question is becoming quite meaningful. Because Osman who has psychological and family damages, big problems in understanding and huge deficiencies in academic background answered an exercise without any guidance probably with the motivation of activity focused, energetic classroom atmosphere. When the first conversion exercises were done, Ali who realized his fault saying "I thought we must divide" understood the exercises in time. He also was totally focused on the activities, realized his fault and corrected. He wasn't shy anymore likewise in previous classes, he also was very relaxed as much as speaking about his faults too. Yasin, Yağmur and Ozi tried to go to the board. When they understood the subject or not was asked, Yağmur said: "It's so easy" with dancing.Her behavior was the glory of achieving in mathematics. Before the instruction, Yağmur was usually relaxed and socially active but she was not really tied with up mathematical concepts and thinking so she can not be identified as an academically successful student in general. Even if she wasn't extra active during the activities, she outscored in especially last activities. As also stated in previous observations, she was being the first who got the correct answers in some of the activities that makes her surprised about her performance which never occurred before as I remember. It is obvious that, these activities started to become a presentation of her daily practices in classroom environment instead of complicated ordinary mathematical exercises.

When all three exercises Ali did in his sheet was said to be wrong, Ali mentioned his surprise like "wasn't it? Mine is wrong, impossible."According to his words and movements, Ali was not a stranger in mathematics classroom any more. The topics that are discussed were not odd; they at least were meaning to him something. And he was good at it finally.

Rüya who said that the exercises I didn't do were right as well and was excited to go to the board stood up and started to wander among the desks, she was

checking her friends' answers.Rüya revealed her feelings about how the exercises are easy for her with words but didn't get bored probably because of hardworking, sharing and free atmosphere in classroom, found herself a job and started to help the others by herself.On their desks students were studying, looking at the steps on the blackboard and they were discussing with each other. There was a sharing, excited and productive class atmosphere, entertainment, jokes, shouting with one voice etc.

Yasin wanted to go to the board for a partly difficult conversion exercise which has adding operation and converting, and the example of which wasn't shown before. His self-confident was perfect but I hesitated about whether he could do or not. I decided to make him find the answer by helping. Yasin: "I will try, we will add daa to a (he converted the different units into decare individually). We will go from hectare to decare, one 0, 20 (Yağmur: Don't you add them?) (The right answer without help)." When I said that he did so beautifully that I could cry, he said he would cry too. Finally after some more exercises, Yasin comes near me while giving the homework in, opens the involved pages and helps me. Normally it is a behavior that he doesn't do. Yasin showed quite active and spontaneous performance during the instructions. He stared to be able to complete some problem situations until the end. He also started to raise his hand often and even without designing thoughts in his mind, in other words he actually left his fears, he was confident about his answers, and he was relaxed. His comfortable behaviors and quick responses without any hesitation may reveal his low anxiety level during the activities. Another considerable behavior change was his walking around in classroom, comparing and discussing the problems with other students during the activities and asking for help comfortably from teacher. While doing them, he also was very focused on his tasks, following and recording the required steps in his task sheets. Yasin's active performance and confident behaviors during the activities was not even similar his previous performance in classroom. It also was visibly changing in a positive way day by day. Moreover, Yasin, who even started to complete hard problem situations by himself until the end, stated that he was also shocked by his own success.

4.1.4 Activity 3: Ancient Measurement Systems & Measurement Units in Ottoman Empire

When students were intrigued by new task sheet about different measurement systems of different antique cultures, they were surprised to see the samples of old land titles on which Ottoman Turkish is written among the pages. The alphabet used in the samples of these land titles seemed familiar to the students due to the religious education they had. Yağmur said: "I know Arabic a bit, but I couldn't read this. (This is not Arabic, it is Ottoman Turkish), anyway, but it is similar."İsmail asks his friends signing the letters of Arabic alphabet by his hand: "what was that? Aleph - The first letter of Arabic alphabet- was like that, but what was this letter?". These kinds of comments gave the message we can draw the attention of the students to the topic with their cultural familiarity.

As the ancient measurement units different cultures used are concerned, they made jokes using the images related to the ancient civilizations they had in their minds. Ali; "Hammurabi hehee", Yağmur; "teacher I know that woman (pharaoh), saw in the cartoon", Osman; "teacher how they paint their eyes, I love that". Yakup asked if I liked the numbers Roman used and we will make operations or not. He stated his interest in mathematical practice of different cultures asking these. When we started to learn about other cultures' measuring practices, Yasin asserted that he finds this practice different and interesting saying "Egyptians measure by their hands and arms." When especially the values of the units stated by parts of our body while discussing ancient measurement units, students imitated spontaneously and confirmed the correctness. For example; 7 hands were equal to 1 cubit. Children tried to confirm starting measuring the part from elbow to fingertip without giving any direction. The classroom seemed to be happy and motivated to being presented this task with items related with both their own culture and other cultures. They revealed their excitement about discussing other cultures' practices with their words stated above.

For passing from length measurement units to area measurement units that other ancient cultures used to use, when it was asked about whether we can find the area of the square one side of which is 1 cubit or not, Yasinsuggested cubit square saying "we multiply two sides like square". As also observed from students' behaviors, they started to use appropriate units, associate perimeter with area, and

discuss it upon other cultures' mathematical practices. Therefore, other cultures' mathematical practices turn took pretty much attention and it turned to mathematical learnings.

This activity was interesting for the students because they asserted that they learned different measurement systems'existence, since they haven't heard before and have always used metric system they mentioned that they haven't thought of existence of such different systems. By Yasin's advanced level question, "Can they belong to their own measurement units related to their cultures?" there has been a spontaneous discussion about the relation between culture and mathematics. They said yes for the question "Does the metric system we use belong to our culture?", because the system we used was that. İsmail said: "everybody knows his/her own culture. Maybe they haven't heard meter or decimeter we use if we go to India". Yakup told that it wasn't our culture opening the historical dimension into discussion. For example; he says: "we sell and buy things from Europe and vice versa, we say 5 hand span and they say centimeter. We use theirs in case there will be no confusion". There became discussions on why there isn't only one measurement system in the world, and on different measurement systems used nowadays.With the help of this activity, it was observed that students' awareness and sophistication increased, they started to discuss about mathematical practice inherently,and gained the idea of mathematics is inside of life and culture, and they are very integrated because mathematics also changes when culture is changed. Therefore it might be assumed that with this activity about measurement methods of different cultures, students' point of view about measurement topic had changed and became meaningful so it resulted in more motivation and success.

In the entrance of the other lesson Ali wants to start impatiently. He announcedthat he checked out task sheets at home and used statements like there are a lot of measurement units, they use different units in some places and he told he wants to start immediately. Ali and most of the students were still motivated but some of them especially Emre and Yağmur looked bored a bit when the sources were started to be read. This situation can be explained by the fact that Yağmur who is the organizer of the cleaning class project which they conduct since the morning got bored because it wasn't allowed while they were thinking about conducting it all day long.

They answered as *dönüm*and *evlek* for the question whether there is area measurement unit different from the books that they used in daily life in the village. Ali stated that these units can come from their own origins. He mentioned that it was important to know their cultures, to learn what were used in the past and how they operated math when they learned these.

After the measurement units used in Middle Asia, the measurement units used in The Ottoman Empire were passed. 'The archine' which is most familiar one started to be discussed. Even if all of the students didn't use this term in their daily lives, they mentioned they heard it before certainly. There were meaningful dialogues like Yakup: "I heard but I didn't know how long it is".Yasin: "Teacher, do the tailors use it?""Yes, tailors use it", "Where do you know?""His father is a tailor, teacher.""Then, your father is a measuring man", "Where do you know?""I don't know but my father measures by ruler generally. I have heard archine, also. Should I ask my father?".After this really important anecdote, Yasin who felt that his father took attention and value by class and teacher because his work is related with measuring, Yasin continued to indicate that his father is a tailor and he can ask some problematic issues about measurement to him in following activities too. Yasin was quite happy to have a tailor father and comfortable about it and it was observable from his performance in classroom.

The archine which is defined as length from fingertip to elbow wasresembled to cubit by Ali. Rüya: "Namely, archine is something like that?" she shows with her hand. Yakup, Yağmur, Yeşim, Emre tried to show archine by their hands without direction. Yağmur: "They still do it like that. I saw it. They get it through this finger."Yakup: "sometimes paddler pass across here, he also does like that, my grandmother buys fabric." This activity was helped students to realize that the villagers are still using some of the old measurement units instead of their newer versions, get deep into their own culture, understand and discover the mathematical practices had been used by their culture.

When the Ottoman measurement units were talked about, *the point* measurement unit drew their attention. Mehmet said: "They couldn't measure it"Rüya: "They measured". Ali imagines by saying that ; "dot, dot, dot, dot, … 12 points are getting together 1 *hat* (line) occurs". Yakup: "Where do they use the point?",Ali: "they used in field, Yakup",(he was kidding). Ali: "Teacher, 12 lines umm.."(he is trying to convert), Rüya: "131 points" (12 lines 1 finger, 1 line 12

points, I multiplied 12 by 12) she did this operation by herself without being asked. They were trying to convert each other and understand the relation between them, they were trying to show by their bodies stating every unit.With this activity, students started to compare, visualize and discuss the sizes of different units. The measurement units were meaningful, related with real life and beneficial piece of knowledge for students, instead of ordinary mathematical expressions. Converting the units each other became an activity which was done just for themselves in order to understand better the relationship between units; instead of exercises that asked by teacher to be solved. They comprehended the real point of what measurement units refer and where they are used anymore; besides they stated to make fun of it.

When we pass from length measurement units to area measurement units in Ottoman Measurement System, Osman told that: "1 finger 4 lines square (being corrected), Osman was so enthusiastic to join the activities and always try but can't give the right answer. Osman was a student who quite has difficulty in understanding mathematics and lack of prerequisite knowledge, he usually makes an effort during the classes but he is still quite weak about association and implementation of mathematical concepts in regular classes. However, when I paid attention to his words especially during the presentation activity, he was involuntarily associating area and yield, linking his hidden mathematical knowledge about land measurement (dönüm) and its effect on the quantity of olives, and comfortably using mathematical concepts. He also continued his high interest and participation for a while more in activities. When I compare Osman's previous situation in mathematics classes with his comfortable, self-confident and mathematically literate behaviors, it gave me a hope about I might make progress even on this student with ethnomathematical program. However after a while to the last activities, some situations are observed which revealed that Osman was only active in verbal expression required in activities and had difficulties in converting it into mathematical learning.

By passing the Republic Period measurement systems, change of measurement systems with law, Ferhat objected to the statement of "old measurement systems were removed completely" saying not completely, mostly, because some of them were still used like archine and dönüm. He started a discussion and whose father is a green grocerYakup added "I help my father sometimes. Men come and say that give me one *okka* of tomatoes and one okka of potatoes. They got used to okka and say okka for kilo."

The activity of converting the area of the land stated by old area measurement units in real Ottoman Turkish land title given the translation of it was made. This activity was completed easily through the units given in the table, then mixed conversion exercises were done. The exercises about converting these Ottoman length and area measurement units each other were made. At first the students were trying but after a few most of the students got bored because of much review or complicated mathematical calculations.The students were quite bored and they were in the mood of not to be able to do. Many couldn't do the conversions of one-stepped. In fact, what those units mean was discussed and talked thoroughly. They showed the magnitude of the units by hands and arms. At that time, they seemed entertaining so much. But, as the application is concerned they couldn't do the activity of how many fingers three lines are (1 line: 12 fingers). Especially when many old measurement units like line, point, finger… got together the minds of the children got confused. Their focusing became difficult. That these units were discussed in the previous lessons seemed to cause the students get bored.

Especially İsmail, Eren, Yakup, Ferhat made converting operations and seemed like don't want to continue that kind of units. Yasin was still trying but couldn't manage to convert and didn't seem to be continuing. He was a kind of lazy, never moved and spoke. When I asked what the problem is, he replied: "I couldn't slept well".Yağmur seemed like sleeping at that time but she was giving the right answer when she was asked to convert the units.

When we came at the end of the activity of Ottoman measurement units they were realized to get really bored. They weren't answering the questions as I wanted; I had to make them play games of gathering attention to make them focus again. The reason of why students started to get boring at the end –even if they started and continued very motivated- could be explained by they probably consumed the topic even if it was interesting at first, after 6 hour long task with the same topic. Also the rest was all mathematical calculations about some units they even do not find meaningful. Trying to deal with those units they just mathematically met had to be a kind of complicated mass of knowledge, instead of a way to understand their world. Yakup and Yasin also supported their boredom in this activity with indicating in activity assessment forms by determining the activity as one of they don't like, even if Ferhat and Osman determined it as their favorite one.

We suspended the matter of olive during this activity. During this period, that the students brought the subject of olive was intriguing. Probably, due to the fact that the other activities go over the olive, they needed making the association with olive. They were talking about their memories, which are related to the subject or not, they were trying to explain the questions directed through the olive. When they were observed to get bored in this activity prepared by assumption of reflecting their own cultures, when the olive subject gets into the matter, that they became more motivated, excited and happy was seen. That's why, this finding let us to remember that the real culture is not the one that carried by the roots, it is the values that we create through our existence. This finding also could be identified as a warning for the activity development process.

During this activity, all of the task sheets were distributed at the beginning of the activity and that they had to have them in the lessons until finishing was mentioned. But, despite all warnings a big part of the students said that they forgot their task sheets. Although I cared for the subject of keeping the task sheets with them and mentioned that I am careful, the students who forgot this were ashamed of this situation. This could have had effect on the situation of getting bored, not being able to focus on the matter. Some of them also verified it with their replies to the students' activity assessment forms that they felt bored just a few times during the instruction and those times were the ones they forgot their task sheets.

After these converting exercises when that we will solve the problems of conversion of measurement units which are related to the stories passing in the Ottoman period into each other was told, Mehmet said: "I love these kinds of things, I don't like those with solutions, I can't do them"(he means the converting exercises).Mehmet again revealed that he prefered problem situations than exercises and other students approved him. The students made many comments on the problem's topicsuch as handcrafts on fabric they have in their homes, the old family members doing that, etc. as every time.

They were excited when they were solving problems. Ali said: "teacher, we found" with self-confidence. But, he found the area of the rectangular shaped fabric by skipping the operations of converting units. Ali followed the steps saying himself "Let me see, archine. I found. Now convert". Students were observed to love problem solving in comparison with exercises. And then, problem solving activity related to Topkapı Palace, about which they know who lived and in which period

they were used was passed. The region which Topkapı Palace covers was bigger in the past and they decided it would be suitable to represent by old measurement unit-dönüm. There were the ones who converted the region which was 80000 m^2 to dönüm putting 000 and removing 000, they were enabled to reach the right answer by right directions. Whether they did right or wrong, that they loved and adopted problem solving activity was observed from their high participation in the class, the statements they used by saying they prefer it and their willingness to share memories.

To sum up, this activity is differed from other activities by presenting students some other cultures' mathematical practices instead of themselves. According to the results of our study, this aim of the activity is welcomed by students. From their dialogs and behaviors, students seemed to be excited about other cultures' practices about measurement, have a curiosity for unknown mathematical applications and a tendency to discover the different one. They also appreciated to learn about their former measurement system used to be used in Ottoman times and revealed it in activity assessment forms too. They were interested and familiar about the alphabet and sharing their experiences such as old land registers that their families owe and some measurement units they still use in daily lives. In other words, students were getting to know related concepts about measuring, learning about the other cultures and their different measurement systems, realizing the idea of different cultures may develop different measurement system due to various reasons and needs. Throughout this way, it is observed that students were unconsciously discussing and questioning some basic concepts about measurement, gaining intellectual information and abilities and becoming motivated to work on the related activities about land measurement. Besides those positive findings, students started to get bored and a decrease in their motivation was observed. The possible reasons for this decrease was explained above and it mainly linked to long lasting activity period and using too much irrelevant units in last exercises.

4.1.5 Activity 4: Rating the Remaining Area of Olive-Tree

With this activity which is designed to increase students' problem solving skills about the area of plane regions, the students who didn't know the concept of intra agriculture, started to give examples understanding what it means after the first sentence read. All of them knew this application in their daily practices, and why, for

what purpose and how it is made. Yakup, Yağmur, Rüya, Yasin, Emre contributed saying planting the cherry between vineyard seen often in the village and İsmail: “we plant things like watermelon which is short-lived between olives or cherries”.

After the problem case was read and understood, all of them got some hints about the required steps and started solving enthusiastically. Rüya and Yakup reached the right result without any direction in the main activity.Yağmur finished the main activity just after a small direction related about the order of the steps. Yasin was trying to reach the result excitedly, enthusiastically. He was on his sheet and listening the directions carefully and asking like “so we will subscribe the olive oils land than the whole, no?”. I corrected his faults, and he moved on and then smiled by the happiness of reaching the right result. I supported Yasin during the activity but I think that he understood well because I tried to make him find the answer by himself. Ali was among the ones who finished at last, but when I made him tell it was seen that he followed the steps well and was describing the operation by logical explanations. His paper was complicated, “teacher, excuse me for this, it is a mass.”

The most noteworthy element during this activity was about classroom atmosphere. In class, sharing atmosphere was felt, the ones who complete the activity in advance compared their results with others, guided to the ones who couldn’t do and were trying to make them reach the right result. Students were included in the problem enthusiastically. Another point drawing the attention is that the students’ motivation was high and when they did wrongly, they weren’t hurt when corrected and seemed motivated to make it continue.Being in there and enjoying the joy of mathematical activities seemed to be more important for them, instead of reaching the correct result quicker than the others aggressively.

The ones who finished the main activity passed to the other exercise activities regarding the same gain. These activities were solved easily. The main point to finding the remaining area seemed to be understood with all of the students. In the ones which require conversion, support and remembrance were given. Yasin started application for the new exercises by the question “It is the same logic, isn’t it teacher?”.Yasin wanted to answer all the small questions while direction was made. He almost was creating an image like the most hardworking of the class generally.

During the activity, there wasn’t any student who seemed bored, numb. Students were studying focused on papers and worked vividly when we passed to

especially the part of application and operation of the problems. When they saw that they did right, they were observed to have pleasure. Only Mehmet was like a bit bored, he told that he argued with his friends, there were conditions that he didn't do anything standing still with the stress that created. That he looked around unhappily and he didn't take any pleasure even if support was given. According to observations, another student who started to take attention during this activity was Emre. He was acting his regular performance in previous activities. He was looking like fine, excited and participating just like he always used to do but he in this activity he started to show more attention. He was much more willing to take the board, insisting me to check his result and communicating with others about the activity.

Ali: "I can't do it. Let me divide 22 into 12. What happens if we multiply?" He was speaking to himself. His behaviors were quite comfortable even if he said that he couldn't do, he needed help. He added like "I found, teacher. Can I convert into dm?".He actually had no relation with Ali at the beginning of the activity. While I was wandering between the desks, they were studying individually actively. Sometimes they turned to group activity by themselves. The ones who finish earlier started join the groups, clusters became and helping started. They were wandering around; there was an environment which supports freedom and joy. The activity which started with a problem situation quite related with their daily practices about olive farming again let the students feel familiar and owner of the knowledge. Then, with the help of this comfort and confident, they started to solve the exercises after getting the real sense of first problem. These kinds of problems were internalized by all students and it was an important acquisition for our method.

4.1.6 Activity 5: The Area of the Land of Nomads

Task sheets drew the attention. The students started to laugh seeing the familiar faces from the village on photos. The students who saw top view of the village were excited surprising at how I found. They talked about the qualities of their villages which they liked and didn't like.Yakup told that; "the village is not good when you stay so long, it is boring", Eren; "teacher, when I go to İzmir, I throw up and feel nauseous. I don't like İzmir. I prefer to live in here". Mehmet; "who doesn't like İzmir, impossible". The information related to the history of village is

read.Emre joined the discussion much and commented of whether nomad culture, nomadic life is good or not. Mehmet: “The Ottomans gave soil to Nomads. Why did it give? Aiming they could have houses.” He just commented. While trying to find the place of the school to get to know the map, all were included, they were discussing among them.

When I said that we would try to find surface area of the map, Yakup said “How will we find it? This shape is untidy”.Rüya answered we could divide, we could make a rectangle, Yağmur answered like “What happens if we divide into squares?”,İsmail: “when we combined the shape in certain points, squares and triangles occur.” These strategies were the ones wanted to solve the problem and the students were confirmed in that way. They actually came to this point by themselves without a direction as explained with dialogs. It was good to watch their developing strategies unconsciously, with the nice glow of the activity related with their village. Everybody divided into different shapes and compared to the others. The only condition was that the parts were supposed to be square, rectangle, triangle, namely, the polygons they know how to calculate their areas.

Although Yakup found it odd at first, he was able to finish the division operation when the activity began. Yasin progressed in the same way, he asked me to check. All were trying to separate into the parts on task sheet individually. Many did right separating operation even if they did differently, because there was no wrong answer. Yağmur and Yasin made trapezium which they didn’t know how to find its area, it was corrected. Mehmet made small unit squares; “How will we make decimal here?” (He meant the areas which are smaller than the scale size, the ones which aren’t 200 m utterly). As he realized himself, when he was in predicting stage because dividing into so small parts would cause dealing with the small numbers, he was asked to create bigger shapes.

When they started to predict the length of sides of the shapes which they created comparing to the scale, Rüya had difficulty firstly, she asserted that her mind was complicated but then she mentioned her joy saying that I found. Some already developed their own strategies. İsmail signed his finger by pilot pen; he was using it as ruler of 200 m. Everybody continued to study individually. Rüya and Yakup were discussing strategies and the results they found cooperating.By completing the activity in a successful way, I wanted them to collect all they learnt by this activity. Ali who wanted to take floor summarized like when they met an object, area of

which they didn't know how to calculate they could find dividing it into small parts and adding the areas of these parts. It was interesting that Ali, normally who starts to begin speaking in classroom not easily, was quite relaxed and participating in these activities. It is observed that he was interrupting the activity without hesitating to clarify something in his mind about measurement; he was really willing to answer the questions and solving the exercises on board, was giving the correct responses spontaneously, etc. His non-routine practices such as looking forward to the next activities, coming classroom as getting prepared, taking part in discussions, coloring the class environment with his jokes were taking attention.

Different exercises regarding overlearning the same gain were done. The students who got the strategy started to progress in the exercises. The same joyful study environment continued. Yasin was solving out of his desk shaking again, he reached the wrong answer, turned back to his desk, thought about it and an idea appeared and he went into the question again.Yağmur was coming near me finishing the exercises and she was surprised to hear that she reached the right answers and turned back to her place happily. Mehmet did nothing, looked as if he tried but he wasn't there actually. It doesn't work even though I tried and was interested. Mehmet, who also has quite lower achievement level, was very active especially in the first activities. During the discussions about measurement methods in the field, he was correcting our faults and proposing the ones he used to apply to measure the gardens. He was just sharing and applying his own experiences but they were spontaneously turning into mathematical contribution. He was quite good at developing strategies to the problem situations about measurement. He also seemed to be relaxed and happy to be in there. However, a decrease in his performance was observed especially to the last activities. Generally, even if he proposed practical and logical mathematical statements, he wasn't able to conclude the required steps to solve the problems. Because he doesn't have enough mathematical base, he had an obstacle to step further of participation in mathematics classes.

4.1.7 Activity 6: Olive and Culture; Thousand Years Old Mystical Motif- the Tree of Life

There were several absent students during this activity and we made the lesson with 6-7 students. Whatever I planned this one hour long lesson for discussing

the place of olive in folk culture through proverb, poem, ballad, art, embroidery as a warming-up activity, it was recoverable for those absent ones in short time.

The tree of life motives which we met in the works of art of embroidery in Anatolia were talked about. The importance of tree of life in antique cultures, its philosophy and meaning, its place in Shaman culture in the Middle Asia. They resembled the tree of life motives to olive tree given in the shapes. In the sources, the tree which is symbolized as tree of life was also believed to be the olive tree. It shouldn't be a coincidence for a so important symbol to be referred to as olive tree.

One of the motives drawn on plotting paper, often taken part in the handicrafts of different cultures was distributed to the students. They liked to see that an element which they are familiar with in their own culture is a significant symbol in the world and it is reflected to the art and that they will do mathematical activity through this symbol seemed exciting.Ali indicated his maze by saying that "what an important tree was olive, I didn't know that", Mehmet; "are we going to write a poem about olive or draw an olive tree like this?".

While continuing the activity in another day, the previous warming up activities was summarized for the others and we passed to the main task. The gain concerning the relation between the length of sides and area through the question of what kind of a change occurs if all the side lengths are doubled was focused. Many of the students claimed the area would be doubled also at first. The students were asked to find the area of partly complicated motive. Ali and Yasin started to count the unit squares in the area motive covered. İsmail started to find the area of the motive composed of rectangle by short method multiplying the width and length. Emre started to divide the shape into the parts of each 4 squares and then mentioned that he got the result multiplying the number of parts with 4. There was a striking rise in his performance, concentration and enthusiasm in these last activities.Emre who has hyperactivity and concentration disorder probably felt better and participated with a higher performance when he could feel that he can achieve to complete the task quicker and without spreading.

The students seemed quite focused on the activity; all of them were trying to find the area of the motive. Ali was solving the activity excited as every time making weird hand gestures. When the students were asked to find the area of the motive, they made the separating the area which they can't find the area which was the gain of previous activity practical by themselves without any direction. Then, the areas of

some parts were calculated in the situation where all the lengths of sides were doubled as mentioned in the problem case. They drew again making the side length of branches in rectangular shape, leading becoming bigger doubled. They compared to the old ones finding the areas of new shapes. Ferhat and Rüya completed without having difficulty. Alireached the area of the new shape instead of drawing the new shapes, the sides of which were doubled making the width and length doubled putting it on the old shape. İsmail found the new areas and noted them by calculations on mind without drawing and operation. Yasin couldn't use a high level strategy but got the right result, he was joyful.

Upon the question of Ali, "Can we do without drawing?" it was stated that the ones who found the relation between old and new areas could continue using this relation without drawing. Consequently, almost all students realized that when a regular object's sides were doubled the area would increase 4 times. İsmail touched on a very important subject saying: "I will tell something, but it can be nonsense, if we increased one side (width) two times, the area would increase two times more, but when we increased both sides (width and length) 2×2 as calculating the area it increases 4 times." He made a statement which was understood by the students easily.

Finally, instead of drawing the other parts the side lengths of which were doubled, we quadrupled the old area and reached the total area adding all of them. The same activity was applied in the condition all side lengths were made half. Overlearning problems were passed. The problems were solved without doubt generally by the class. Yasin asked which activity we will make tomorrow, he was wondering and impatient.

With this activity, the students were presented a mathematical task about art, maybe for the first time in a mathematics classroom. The art presented was also related with olive tree which is deeply involved in their culture. Besides that they also had the chance to know the importance of olive tree in various cultures, history and mysticism; and appreciated that they are culturally that into in olive. The expected results of this unique activity were gained. Students were enthusiastically concentrated in their tasks and completed them. All students were included. Also, there was an energetic, sharing and happy classroom environment due to the activity.

4.1.8 Activity 7: The Universal Symbol of Peace-dove & Olive Branch

The ones who didn't attend the class were remembered to follow this activity which was the follow-up of the previous topic.Meanwhile, Yasin told me an event happened just before the class and he was sad and complaining about it. According to him, Yasin wanted to help his friend Yakup who is one of the most successful students in class and missed the previous topic because he was absent. Yasin offered him to explain this topic in board and started but Yakup teased and laughed him. Yasin complained like: "teacher, I was trying to help him, tell him, but he made fun of me! (a little bit reproachful).It was a quite resourceful data for the study because Yasin's explaining –even attempting to explaining- a mathematical topic to Yakup was a moment that even couldn't be imagined normally. Because Yasin was one of the low performers, while Yakup was one of the high. Yasin's improved self confidence during the activities showed up with this very concrete dialog.

The stories of goddess Athena and Prophet Noah legend emphasizing the importance of the olive in mythology and religion were read and commented on. We talked on peace and connected it to meaning of peace dove as a universal figure. Then, we moved the activity withpeace dove motive on the plotted paper. The students made expressions to start impatiently.Yasin was asking; "are we going to find the area of dove, teacher?",Yağmur; "I will divide it into triangles and rectangles". They were interested in the task and started before the problem was presented.

For the problem which how much the new area of the shape, the side lengths of which were tripled would be asked, Yağmur suggested dividing the shape into firstly squares, rectangles and triangles and then making it bigger one by one again. That we do drawing was impossible was realized, because the shape which would get bigger would not fit into the paper practically. There was a need for a different method; a more practical method could be used. Mehmet tried to assert the gain of the previous lesson;"If it is two, it becomes 4, we will do like that." He touched on the right strategy but he couldn't explain mathematically completely. How much the area of polygons, the perimeter of which rises 2, 3, 4 times more would increase was asked just as in the method İsmail suggested by Ali's stating the strategy we learned in the previous lesson, which Mehmet mentioned. All responded right explaining;

they got the logic of it. The second step with Eren's "9 times then" followed the first step of the activity suggested by Yağmur's "first, let's find the area".

At the end of the activity everybody reached the result even in different times. The ones remaining behind the one who finished immediately were solving as small groups. Some of these groups were accompanied by the ones finishing early such as Rüya, Yakup, İsmail, some tried to complete only the burden of operation as they knew the method. To the end of the lesson even if many finished and started chatting one group with Ali, Yasin and Mehmet was still calculating in a concentrated way and trying to reach the result. In addition; Yakup who weren't in the lesson last week stated that the activity reached its aim commenting like "By this activity, it was understood, it was an easy subject, I learnt immediately before it finished". With the help of this activity, students encountered a joyful experience with mathematical tasks related with discussions about universal values and issues for a better world.

4.2 Students' Views About the Activities

In this part, students' written comments and evaluations about activities from the activity assessment forms which delivered to them after the application are stated. In order to evaluate their views and ideas, and verify the data derived from observations, the meaningful statements that could be considered as data are stated below.

İsmail: He states that he liked the topic because they wandered around and had enjoyable times during the activities. He indicated that he will never forget area measurement skills because they learned them by practically applying. Besides all, he realized that measurement in mathematics is not made up of only metric system. He couldn't be able to pick some favorite activities because he thinks that each one was better than the other. Mostly he felt happy and successful but the day he forgot his task sheets at home he felt bored. He preferred to continue our future classes with similar activities that related with their practical daily lives, instead of the regular activities in books.

Yakup: He indicated that he liked this topic so much because he had a chance to learn other measurement systems of various cultures. He also got interesting information such as olive is the symbol of peace. He said that he felt pretty fine during the activities because most of the students were able to solve the

problems. He added as he feels bad towards topic when others couldn't manage. He stated that he rarely got bored during the activities and those were when he finished earlier than his friends. According to him, the most boring activity was the one related with Ottoman measurement systems because it was quite hard to convert the units that they do not know and he thinks that it is not going to be useful for him in future. The most comprehensible and easy activity was finding an area by dividing it into pieces. He also prefers to continue mathematics classes with this kind of practical activities related with their daily life- maybe not olive but another topic because they already used olives-, instead of books and tests.

Ali: Ali liked the topic and thought that it is going to be useful for him in future for sure. He stated that he felt happy and successful during the activities because it was really fun. He signed all of the activities as his favorite one because all of them were interesting and there wasn't any boring one. He thought that he understood all of them properly well. He didn't want to change anything in activities, conversely he emphasized that it is better for activities to be stay the same. He passionately insisted on about continuing mathematics classes with this kind of activities instead of regular ones, actually he begged for that because it was very fun.

Osman: He stated that he loved this topic related with olive and he thought that it is going to be useful for him in future. According to him he learned why we measured area and how people did that in past, in Ottoman. He said that he felt happy because he learned many things. His most favorite activity was Halil Uncle because he felt a little bit successful in that activity. The other activity that he liked was Ottoman measurement units because he learned old measurement systems. He also prefered to continue our classes with cultural activities.

Ferhat: He stated that he pretty much liked this topic because it was quite linked with historical issues. He believed that if he will be an engineer in future, those skills that he learned in this topic will be very useful for him then. He thought that he quickly understood the point of activities and always felt successful. His favorite activity was Ottoman measurement units because it was related with history. He felt bored just one time and it was when he left his task sheet at home. He advised that the area of İzmir should have been calculated instead of their village. He also wanted to continue our mathematics classes with the activities related with their daily life.

Eren: He was indicated that he liked the topic and felt happy and successful during the activities because it was fun. He thought that these skills he got from activities will be useful for future. His favorite activity was the universal symbol of peace. He felt bored about two times during the activities because he couldn't be able to answer the questions. He also preferred to continue the classes with the same style.

Mehmet: He indicated that he loved the topic related with olives. According to him, he stopped hating mathematics and loved it due to this topic. He thought that those skills will be useful for him in future because they are living in a village and they inevitably will deal with olive farming staff. His favoriteactivities were Halil Uncle and the universal symbol of peace. He never felt bored during the activities but he actually didn't like the activity called the area of the land of nomads. He also preferred to apply that kind of activities during rest of our mathematics classes.

Yasin: He indicated that he liked the olive topic so much, except Ottoman measurement topic. He thought that this topic will be quite useful for him in future, especially when his grandfather who has olive gardens passed away, he will be the new owner of gardens and then use those skills. He stated that he felt pretty good and happy during the activities because he both had fun and understood the topics very well. His favorite activities were Halil Uncle, while planting olives and the area of the land of Nomads because he found them easier than the others. He said that he never felt bored during the activities except Ottoman measurement topic. He also preferred to continue the mathematics classes in the same style instead of following the activities and problems in books. He added that he would prefer to visit Halil Uncle's house during the activity.

Rüya: She stated that she liked that topic and she found solutions of many questions on her mind about olive at the same time. She appreciated that she learned area and land measurement units such as dönüm and hectare because she planed to have an olive garden in future and she would use those information when she needed to divide or measure the area or plant trees. She said that she got another point of view to the mathematics thanks to this topic because she learned that how ancient people used to measure and how mathematics is appeared. She thought that application process of activites was fine and that's why she felt happy and successful because we did not pass activities quickly, we explained and interpreted each of them. She couldn't select a favorite activity because she liked all of them and all of the activities were good and enjoyable. She said she never felt bored during the

activities, laughed and played in all them. While there wasn't any topic that she couldn't understand, the most easy and understandable one was converting area measurement units according to her. She preferred to continue mathematics classes with this kind of activities instead of regular ones. She also advised that it would be better if the activity sheets are gathered together and delivered as booklets.

Yağmur: She stated that she liked very much those activities related with olive, except the ones called the remaining area of olive tree and the area of the land of nomads. According to her, some questions were very hard so sometimes she was stressed. She also preferred to continue on those kinds of daily mathematical activities.

CHAPTER 5

CONCLUSIONS AND DISCUSSION

In this chapter the findings of the study are discussed. This chapter mainly consists of three parts. In the first part, the results about the contribution of an instruction enriched with ethnomathematics are elaborated. Implications and recommendations for further studies are given in the second and third sections.

5.1 The Students' Perceptions of and Engagement in Ethnomathematics-based Activities in the Area Measurement Concept

In this part, the results emerging from collected data will be discussed in main categories with the supplement of related literature.

5.1.1 The Theme is 'Olive'

The first activity presentation that aimed to motivate students on the project could be assessed as successful in terms of its aims, since students often interrupted the presentation and wanted to share their own experiences about related topics of olive. According to the quotations given by students, it can be easily said that most of the students directly, a few of them indirectly have memories and experiences about olive and olive farming. With the help of this activity, I had a chance to observe that olive and olive farming hold a place in some degree in all of my students' culture and it is an integral part of their daily lives. Picking up the relevant topic was a quite critical decision for the nature of this study. Yet, the expressions that students stated in their paragraphs and their not being able to stay without interrupting during the presentation was like approving that a suitable topic was chosen to be integrated in mathematics. The six aspects of mathematical human activity that influences children's lives are proposed by Bishop (1988a) to the teachers who want their students to derive personal relevance from learning mathematics in school to

promote their every day experiences and connect them to the mathematics lessons. Therefore, this activity seemed to be a good start to develop and apply culturally relevant mathematics for measurement as one of the Bishop's main activities of human. Overall, the "olive" topic quite took students' attention, let them to feel familiar and revealed their cultural self-confidence. Beside them,this activity also supported the theme decision about "olive" as a right one for a study which stresses to link students' cultural experiences with mathematics.

5.1.2 Culture Related Topic

During the activities it was observed that students answered the related guiding questions according to their existing knowledge gained not from school but from daily practices quite easily without any direction. Their this reaction in activities might be interpreted as an indicator of their high involvement in measurement topic in their daily lives, instead of a boring or frustrated activity. The tasks were about measurement concept but most of the students, doesn't matter their previous achievement, contributed in some way mostly by sharing their experiences about measurement issue in olive groves. With this activity, the students started to be more aware of the fact that mathematics exists outside school and in their culture, just like the Maldivian students in Adam's (2004) study after an ethnomathematics based measurement unit. When the students in our study were presented activities on olive theme in the main activities, they also seemed to appreciate the measurement topic, understand it quite well and perform better as a whole class. This result of the study may be concluded as the mathematics that they cannot link with reality and rationalize, became meaningful when it is associated with olive theme.

Also during the last activities which structured on problem situations, it was obvious that the problems about familiar contexts achieved to keep students in activities, let them to internalize the situation and being aware of the steps that they follow in real meaning. It was an expected result of an ethnomathematical curriculum because according to Adam (2004), when ethnomathematical approaches are applied, the "school" mathematics is getting more relevant and meaningful for students. Kurumeh, Onah and Mohammed (2012) also proposes ethnomathematics as a very significant strategy for increased meaningful understanding of concepts. In Lipka and

his colleagues' experimental study with indigenous Yup'ik students, cultural topics of modules that they used provided real and positive connections for students. Thus, similarly in our situation, students developed meaningful and real connections with presented mathematical tasks and performed better in activities when they were exposed to a mathematics which is related with their experiences, familiar daily practices and culture.

Most of the students' favorite activity was the first one that the wise man about olive farming was guiding the students about measurement with recorded videos. It was not quite surprising that student liked this activity so much because when they were exposed to locally familiar context and stories, as well as the inclusion of local people who were known to the students, they were becoming more connected to math (interviews with students in the village of Manokotak, Alaska, 2003). Our students were also quite interested in tasks, when they were presented ethnomathematical activities with familiar context, and they showed their interest with being excited to compare their answers with his ones, making some jokes about him and showing their desire to be closer to the wise man by one of them saying that he wished visiting Halil Uncle's house instead of watching him from video.

As well as inclusion of a local people who was known to the students may explain their interest increase, the sub-activities in this task which is quite related to their daily olive farming practices may consist the other reason. When they were taught with familiar contexts that they already knew unconsciously, they felt better and started to achieve well. About this activity, some of the students said that they liked it because they felt more successful in it or they found it easier than the others. The generally existing disconnection that students perceive as separating real life from the academic world can be minimized by employing culturally-significant examples and contexts from their everyday life (Greene, 2000) just as tried to be done in this study. Thus, if I interpret the students' expressions and literature, I can conclude that they built interest to the mathematical tasks and then it became meaningful when they were introduced with familiar activities due to ethnomathematics method.

5.1.3 Out of School Mathematics

The results of the study revealed that students had already knew some main strategies which presented in program and books due to their previous experiences in the field which requires to practice unconsciously those mathematical activities in daily practices. Most of the students started to stepping sides of gardens and calculated the estimated area ordinarily and in a confident way without waiting any guidance. However, their quick responses with self confidence in measurement activities probably cannot be associated with their previous experiences in mathematics classrooms. Actually they must be never thought about the relationship between those traditionally used methods and mathematics lessons. They were thinking mathematically and using its connection with their daily life unwittingly during those activities with the help of their previous experiences about olive farming. In Adam's (2004) study which has quite similar findings with our study, the students and even the teachers who were not aware that mathematics exists outside school and in their culture started to feel that mathematics is already included in their daily practices with the help of the ethnomathematics-based activities on measurement. In a similar way, our students saw that mathematics at work in society, connected school mathematics to real world activities and actively understood that mathematics as something that humans develop in response to particular situations with the help of the ethnomathematical instructions (Adam, 2004).

Also according to the students' views about the activities, they found important to learn how to measure due to some reasons like; planning to have olive gardens in future, being a villager, becoming an engineer in future, etc. The dialogs derived from students views about activities was quite parallel with the ones stated in Adam's study. From the interviews with students and teacher in this study, it is concluded that they changed their traditional view about mathematics and realized that they will use mathematics outside school and this led them to view mathematics as a human activity.Therefore, similarly in Adam's study,the use of context during the lesson; the teacher's helping and encouraging students to talk about mathematics in the classroom; the students' use of their own ethnomathematical experiences; and the teacher and students' linking ethnomathematics to school mathematics let us to conclude as our students realized their already existing mathematics knowledge and

its reflections in daily life, started to consider it necessary for future, and appreciated their own mathematics with ethnomathematical tasks.

5.1.4 Motivation and Interest

Another theme that emerged from Adam's (2004) study was about motivation and interest. The interviewed Maldivian teachers all appreciated the motivational aspect of ethnomathematical model because it is observed that when the measurement topic started, students were motivated and interested in learning mathematics. As the teacher and the researcher of the study, I also had a chance to observe and compare my students' behaviors and performances during those activities and I had quite similar findings which are also supported with other data resources. The data derived from all sources revealed that students generally enjoyed and didn't felt bored during the activities integrated with ethnomathematics (with some topic and situation exceptions), they were excited about discussed topics, completed the tasks in a motivated way without break out and impatiently wondered about the next activity.

Moreover, in the activity assessment forms, all of the students said that they prefer to continue to learning mathematics in the way they had during area measurement topic, because they found it enjoyable, easier and interesting, just as the %91 of the students who taught with ethnomathematics preferred in Adam's (2004) study. It means that implementation of ethnomathematical curriculum was appreciated by students, increased motivation and interest and opted for other applied methods during previous mathematics classes.Therefore, because this instruction increased motivation and interest of students which is a quite necessary aspect for meaningful mathematics learning (Zaslavsky, 1991), ethnomathematics may be identified as an effective method that contribute to success in mathematics.

Besides the increase in motivation and interest, students' mood during the activities was noticeably different. It is concluded from the observations that students were having good time and they were working in a concentrated, motivated, energetic and smiling way. Their relaxed behaviors compared to previous situations was even resulting with making jokes by using mathematical concepts, singing songs

and dancing while working on the tasks, speaking, sharing and cooperating with others. Those kinds of jokes and behaviors that started to be made by especially the ones whom are identified as shy and unsuccessful before seem to be the indicator of how students were relaxed and fearless; and enjoyed the mathematics during those ethnomathematical activities just as stated in an article says that students feel more comfortable and confident; and gain a better appreciation of math when they are taught with a cultural perspective (Schultes & Shannon, 1997).

5.1.5 Experience and Self-Confidence

This interest gained from ethnomathematical activities, seemed to be turned into self confidence naturally. Without the condition of high achievement or academic success in previous classes, the students who live in this village, related with olive farming in some way were expected to contribute and perform well due to the intention and structure of the activities. Especially the ones whom are not good at school mathematics but had first hand experiences about farming provided more creative and practical answers during the activities. They probably realized that the practices they have already been applying were working well in those tasks so they felt confident because the tasks were designed by considering promoting real life mathematics, but the olive farmer villagers' real life, not the other middle class communities. Besides, their active performance and quick strategies they developed for the problem situations without any guidance seemed to let them to feel that that was their playground and they got the ownership of the knowledge. Because, we know that when the students understand conceptions from their own point of view and with their own words, they feel that they have ownership in the subject and their motivation to learn increases (Greene, 2000). Therefore, in the activities, students' own experiences in real life turn to mathematical tasks and then self-confidence in classroom; just as consonant with the main objective of ethnomathematics is a program which is to raise student self-confidence, to enhance creativity, and to promote cultural dignity (D'Ambrosio 1990; Rosa, 2000).

5.1.6 Matching the Tasks with Real Practices

Even if students revealed that they mostly liked the activities, some of the developed activities unfortunately lacked of increasing their motivation and interest. The second activity which aims to teach converting area measurement units each other with a task about watering and fertilizing quantities while planting olive trees was not met with interest and excitement by students as much as the others and they had considerable difficulty especially in the beginning of the activity. This unexpected situation might be explained with the necessity of proficiency about length measurement unit before the area measurement –even if it is tried to be taught with a one class hour long supplementary course. In addition to that, their not being able to highly concentrate on the activities and getting bored might be because the problem situation of the activity did not manage to take their attention. After the feedbacks, for now I can admit that the topic of the activity was including many technical information and it was hard for the students in that age group. Besides that the other possible explanation for their disinterest might be about the topic of this activity wasn't referring to the students daily experiences that much. Activity was about olive farming but as they stated before, the students was mostly active in picking process of olive farming, not planting. They should be familiar at least but their families' planting practices were quite different than the ones stated in the activity as they contradicted during the discussions.The task's not being developed by nourishing from students' practices about olive planting but from technical information gathered from various websites about olive farming with the assumption of if the information is related with olive, then it will definitely touch my students' culture didn't work. Because this group was a particular one even in olive farmer communities, so I should have considered that they might have particular practices while developing this activity. Therefore,this disconnection should have been prevented by employing real culturally-significant examples and contexts from everyday life (Greene, 2000). Therefore, when the integrated topic did not match well with students' real practices, they failed to make connection and started to get bored. With this point of view, it can be concluded that this activity was weak about to serve for the targeted goals of ethnomathematics.

In most of the conducted studies about ethnomathematics as stated in literature part, the task development processes were mostly constructed on ethnographic researches. The researchers mostly spent some time with local people or local working groups to identify their mathematical daily practices and integrate it into the school mathematics (François & Pinxten, 2007, Lipka, et al., 2005, Masingila, 1993&Owens & Kaleva, 2007). Even if local people's daily practices about olive farming were tried to be determined in this study with the ways stated in methodology part with an ethnographic approach, the pursuit of presenting some different and challenging tasks and activities related with olive to the students paved the way for formation of some of these activities. A longer and detailed field research with a professional group of mathematics curriculum developers and researchers on ethnographic research for developing ethnomathematical tasks might eliminate this failure and naturally result in more meaningful and successful tasks.

5.1.7 Real Culture and Experience

The other activity that failed to influence students was the one about old Ottoman measurement system. According to the positive results of the Powell and Temple's (2001) study which suggests a board game called *Oware* - originally coming from Africa - to support New Yorker African students' mathematics in school because children have a common biological root in Africa, this study about Ottoman period measurement system that was in use of recent date was thought to be appropriate as an ethnomathematical task. In this activity which was developed with the assumption of they will like it because this former system will reflect their pure culture taken by roots as in Powell and Temple's (2001) study but students started to want to change the topic by proposing olive stuff for the agenda after a while. In this activity that students defined its Ottoman measurement units' converting part as irrelevant, useless and filled with complicated measurement concepts; it was clear that they got bored and try to change the topic to olive which they prefer to work on it. That's why, this finding let us to remember that the real culture is not the one that carried by the roots, it is the values that we create through our existence. From an ethnomathematical perspective, mathematics is a human creation that emerges as

people attempt to understand their world (Adam, Alangui, & Barton, in press). However, with this activity students exposed to a mathematical task that includes many never heard measurement units for them, so it probably was a mass of meaningless expressions, instead of a way to understand their world.In other words, applying ethnomathematics program in classrooms will help the students to enrich their construction of mathematical ideas when it is presented by investigating and exploring the mathematics in their cultural products and practices, instead of adding the trivial and formalistic elements connected to a specific culture in the tasks (Powell & Frankenstein, 1997).This finding also could be identified as a warning for the activity development process as subjecting the mathematics in students' daily cultural practices and product which they understand their world instead of adding some cultural elements about their history into the tasks.

5.1.8 Short & Problem-based Activity

Besides those possible factors discussed above, the 6 hour long length of both of the activities that students got bored might be another reason to understand their boredom. Especially the 3rd activity wasappreciated by students at first, but after a while they probably used up the interesting elements existing in activities and started to get bored of them. However, when the situation is compared with especially last small problem based activities, students' being quite concentrated of tasks easily, non-stop motivation during 2 hour long performances, and their preferences about less longer activities in activity assessment forms clearly revealed the deficiency of those long activities. By considering this, especially the students like Emre who has hyperactivity and concentration disorder probably will feel better and participate with a higher performance if he could feel that he can achieve to complete the task quicker and without spreading. Because Emre was observed as quite active, happy and focused during the last short and problem based activities on the contrary of first long ones. He also supported this idea by choosing one of those short problem based activities the universal symbol of peace as his favorite one in activity assessment form. Thus, the length of the activities might be critical for concentration and interest

of students, so very long activities should be avoided during the ethnomathematical activities.

The mentioned motivation decrease in long activities considerably increased to the last activities which include problem situations at all. Besides the length of the activities, this finding might be tied to the idea of problem solving activities are more effective and motivating than regular exercises for students in ethnomathematical programs, as Masingila (1993) suggested teachers to introduce mathematical ideas through situations that engage students in problem solving. With this point of view, it might be concluded that an ethnomathematics-based program is needed to be presented with culturally relevant problems for a better concentration and understanding.

Another gaining which observed during the activities was students' easily being integrated in problem solving method and following the steps familiarly. Due to the nature of the activities, students were usually facing with problem situations and fulfilling the required steps appropriately. Therefore, they naturally developed or improved their problem solving skills with the help of ethnomathematical activities. Also, any troubles in reading and interpreting the problems didn't been observed during the activities. They easily completed even the complicated problems by following appropriate steps because probably they connected and explained the meaning better when they were exposed to a familiar context such as olive.

5.1.9 Comparison of Students' Performances

The most remarkable and interesting finding of the study to me was the observable changes in previously low performer students' performances during the instruction. At the beginning of the study I had the same distance with all of the students in means of expectations. I actually didn't have any idea about on whom this method will be effective. The aim was to have a positive increase on all of the students' performances, but while designing the activities, the needs of especially the members of culturally particular villagers were considered to be fed as determined in ethnomathematical principles for developing culturally relevant instruction in mathematics. Thereby, as the teacher when I compare my students' previous and

recent performances, I had consonant results in this study with the aims of the ethnomathematical program that stress to improve disadvantaged students mathematics(Benn, 1997; Bishop, 2002).

During the activities, as a researcher and a teacher I could realize the improvement in my students. There was an observable progress in their expressions, questions and behaviors ever since the first activity. However, the most meaningful changes in means of performance were observed in the students who may be categorized as middle or lower middle achiever group. According to the stated situation of those students in result part, Yasin, Ali and Yağmur were the ones who had the most considerable improvement in terms of classroom performances. Especially Yasin and Ali's described practices were quite unique for me. Those students who used to be striving but feeling their failure were looking like anxious and worried and they needed to have intense motivators to take part in activities in general before the instruction. However, for now the reverse was observed and they were willing to take part in activities, exercises and problems almost quicker and with more pleasure than the others.

In anyway, probably the tasks were quite relevant them culturally, as they were not used to; the problem situations in activities seemed very familiar so it was meaningful to them, and then they realized their potential to deal with them. Due to the fact that ethno teaching approach is a viable option in promoting meaningful learning(Kurumeh, Onah & Mohammed, 2012), they probably started to feel the ownership of the knowledge may be for the first time and achieved to apply it in classroom. In means of those acquisitions, these activities integrated with ethnomathematics were fairly useful not to leave those lower middle achiever students behind.

Activities of those students sorted above could be identified as a meaningful data only when they are compared with their previous situations in classroom. During the activities, the group that can be defined as higher-middle achievers, such as Rüya, Yakup, İsmail, Ferhat, Eren, had also good contributions. The activities also took their attention, they were willing to take part in and they were happy as they said. However, as their teacher, who knows their previous level and has the chance to compare it with now, during and after instructions, I don't think that those students provided considerable data in means of the performance difference with the ethnomathematical method. Because those students who already had high attitude

and achievement before the instruction didn't show a change in their behaviors and performances in class with the instruction. In other words they just continued their already high positive attitude and performance during the activities too.

Similarly, low achiever students also failed to provide considerable data in means of performance difference. For example, Osman and Mehmet's, as lowest achievers in regular classes, observed situation during the activities revealed that they were highly motivated and happy and especially Mehmet was contributing so much about their daily mathematical practices during the instruction. However, even if they proposed practical and logical mathematical statements, they were only active in verbal expressions required in activities and had difficulties in converting them into mathematical learning and applying in tasks.According to the results of the study, ethnomathematical program couldn't achieve winning the unsuccessful students, probably because they don't have enough mathematical base to step further of participation in mathematics classes. In this case, it can be concluded that at least some prerequisite attitude and knowledge level is required for ethnomathematical activities to result in positive effect on students' performances.

In short words, this study revealed that the instruction integrated with ethnomathematics didn't cause visible performance differences in high and low achievers of the classroom compared to their previous performances. However, middle and lower-middleachievers whose prerequisite knowledge and self-confidence was limited showed considerable difference in means of performance and behaviors due to the ethnomathematical activities. Those students who actually have a potential to achieve in mathematics but give up, refused or don't know how to use it for some reasons started to get the ownership of the knowledge again with the help of attractive, culturally relevant and familiar mathematical activities. The high achievers didn't have a breaking point like the others during these activities because they were already attached and integrated to the mathematics. Thus, ethnomathematical activities didn't play a critical role in their performances but in any way they appreciated and enjoyed the activities in general, and wanted to continue the classes with similar activities in future.

Those middle and lower-middle achievers were actually social and culturally disadvantaged students whose mathematical experiences in school are not culturally consonant with their home experiences (Bishop, 2002). This mismatch probably constituted one of the contributing factors to the low achievement of those students

in mathematics (Lubienski, 2001). Yet, if it is remembered that school curriculum is constructed with the values of middle class and the achievers are usually the ones whom are quite familiar those values (Oakes 1990; Secada 1992; Tate 1997), the performance increase of disadvantaged students may reveal that the results were meaningful and consonant with ethnomathematical philosophy with the activities which valued and referred to disadvantaged ones' culture.

5.1.10 Promoting and Representing Students' Cultures in Classroom

Those students were unconsciously and self-confidently participating to the activities when they were feeling themselves as an expert –even better than teacher- about daily measurement activities. This situation which brings achievement together could be explained by their own culture's unusedly being promoted in classroom, so their feeling themselves important and comfortable to expose their potential. As Zaslavsky (1998) suggested that the problems faced by underrepresented minorities are a result of the schools ignoring the ethnomathematical knowledge that these children bring from their homes and communities. In order to prevent this, in this study, students were presented ethnomathematical tasks which are nourished from their culture and the mainly promoted culture was this particular group of students' culture during this implementation.

Another considerable finding of this study was the increase in students' motivation and self-confidence when their culture was represented in classroom. As also one of the basic elements of ethnomathematical program, I tried to value this particular sub-culture's practices and carry them on activities, instead of middle class ones as in existing program. I tried to give students the message of their livings and practices are valuable and the increase in especially some group of students' self-confidence and performances might be interpreted as the proof of that. For instance, during the activities it was observed that Yasin was often giving anecdotes about his father who is a tailor. Usually a father who is a tailor is not something to be proud of in regular classrooms covered with middle class values, but this father was related with measuring activities due to his job and this was making it an important, desirable and popular job during the measuring activities in classroom. Thus Yasin

felt it and started to usually say that he can ask it to his father, his father must know it because of his job, etc. Yasin was quite happy and comfortable about it and it was observable from his performance in classroom. Also, the other students were feeling that their experiences were similarly seeing value, being found meaningful and worth to share with others and their comfortable contributions about daily practices could be linked to the same reason.

5.1.11 Awakening of Disadvantaged Ones

I believe that by using ethnomathematical method, this study got little but very meaningful step in order to give voice to the community and value to local olive farmer villagers' knowledge. The interesting anecdote from observations about Yasin's explaining a mathematical topic to Yakup , but Yakup's not accepting it wasa very concrete example to explain it better. It was a quite resourceful data for me because Yasin's explaining –even attempting to explaining- a mathematical topic to Yakup was a moment that even couldn't be imagined normally. Because Yasin was one of the low performers, while Yakup was one of the high. However, I think it is a quite meaningful acquisition for this study if Yasinwas evolved to easily and confidently attempting this step which was not possible for him in general. He gained that self-confidence during the activities because he learned the topics and felt ready to share with others in these activities. In addition, Yakup's laughing and not taking his offer serious was the indicator of how ironic was the situation. In this study, the target group was not the ones who are raised with middle class urban values, it was the sub-cultural group. Thus villagers' daily practices and values were promoted during the activities and rural people got back the power in classroom. In this manner, I think this study proved that if the teacher promotes students' own values - even in mathematics because they are also producing mathematical knowledge as a human practice- instead of the ones presented in existing programs; they can expose their real potential and might give them a chance to be successful in mathematics.

5.1.12 Classroom Environment

Besides the factors related with student performances, one other positive acquisition gained by this method was related with classroom atmosphere. According to the observations, the students who were following task steps were not hesitating to exchange knowledge, discuss about the concepts and ask for help. There was a sharing, communicative, productive and exciting classroom environment that flavored with fun and jokes. It was nice to observe such a classroom environment because any kind of social conflict may be repelled in this classroom sharing and it constitutes a precondition for a successful ethnomathematics program because the students who share feel an ownership of their activities (Presmeg, 1988; Vithal & Skovsmose, 1997).

Also during the activities, the former situation of the students who finish earlier was not a problem anymore because the students who completed the task were starting to help or watch the others without any direction. Especially high achievers were walking around the classroom, checking and guiding the others just like an assistant teacher, communicating with others, or discussing their strategies with peers and it was observed that they were having fun while doing this. Finally, almost all of the students were looking like happy. They constructed a classroom environment that everybody respects each other and progress all together. Yakup had a related expression about this topic in his activity assessment form that reveals he felt pretty fine during the activities because most of the students were able to solve the problems. He added as he feels bad towards topic when others couldn't manage. This idea probably was the result of his preference for a sharing point of view instead of aaggressive one. Or maybe he appreciated this peaceful classroom environment because everybody was concentrated on the tasks so an active and motivated working environment was provided. In both ways, a liberal environment let students to experience communication and sharing was tried to be provided the students during the instructions and its positive results in performances were gained just like in coherent results with the related literature which say culturally based mathematics curriculum alters the social organization and communication in the classroom (Lipka, at all., 2005).

5.1.13 Awareness

Even if I concluded above that ethnomathematical activities didn't play a critic role in already successful students' performances, it should be underlined that the ones who indicated in activity assessment forms that they appreciated to learn about other cultures and their practices were only successful students in the classroom. Those students Rüya, Yakup, İsmail, Ferhat were the only ones who focused on they got another point of view to the mathematics thanks to this topic, they learned that how ancient people used to measure and how mathematics was appeared, measurement in mathematics is not made up of only metric system, gained interesting information such as olive is the symbol of peace, and appreciated historical issues they learned. The others whom haven't reached this accumulated knowledge level yet were busy with their relatively lower level needs such as feeling success and self-confidence in mathematics classroom maybe for the first time, instead of the pleasure of intellectual discussions. Therefore, according to the results of this study, it might be concluded that ethnomathematical pedagogy contributed the higher achievers with wondering and learning other cultures' mathematical practices, and developing intellectual point of view about mathematics. The others also liked the activities and probably gained a point of view about those cultural issues but they couldn't concentrate on the difference and linkage with other field subjects to the mathematics because of their own joy of victory about achieving mathematical tasks.

When the students generally who used to use metric system for measuring learned the existence of different measurement systems of various cultures, they started to feel and discuss the relationship between mathematics and culture. During the spontaneous discussions they asked higher-up questions and felt the former integration of Western Mathematics to our culture by mentioning historical issues by themselves. Besides that, especially after the discussions about the relationship between mathematics and culture, they realized that mathematics is not only about numeric calculations; it is a discipline which is a cultural practice that is shaped by needs and environment, and makes individuals conscious about social and cultural issues. While they were talking about the measurement units that is still in use in their village, they felt that how mathematics is intertwined with their culture and it couldn't be left easily just like other cultural elements. During those activities

students started to think about social, political, cultural issues, they were getting more aware of the phenomenon surrounding them, developed basic thinking skills, and understand diverse issues and problems existing in society (D'Ambrosio, 1995).

In addition, the students were encountered with quite unusual tasks such as the combination of mathematics and art with ethnomathematics-based activities. They discussed the meaning, the place in other cultures and popularity of the most common figure of Anatolian handcrafts. They appreciated to learn about it and also surprised to have a measurement task about it in mathematics class. As stated in İzmirli's (2011) collection, mathematics, along with music, arts, literature, and sciences is a people product to humanize themselves and it is vital for human societies. This study resulted in positively of integrating this cultural product as a resource, which student took to the classroom with their cultural roots, and mathematics in means of both performance in tasks and awareness about sociocultural issues. Besides, students' not getting bored any single moment of the activity and their wish to continue moregave a clue about how and in which format ethnomathematical activities are needed to be designed.

5.2 Implications of the Study

Because of ethnomathematics is a quite new and intact field of area especially in Turkey, there exists countless implications still waiting to be practiced. With the findings of the present study and previous researches, some suggestions can be made for the educators.

It is a dilemma that there isn't enough study on culturally relevant mathematics education in Turkey, as a multicultural society. Therefore, this study might offer good practices for culturally mathematics education in our country, in order to let children be successful in mathematics by feeding their needs with culturally relevant methods. In such kind of absence of studies, any research, methods and task integration about ethnomathematics seem to be valuable as a starting point. This study also focuses to develop a specific example for the application of ethnomathematics concepts with students come from sub-populations. Therefore, this study may not only provide practical task plan examples for teachers

who want to integrate their lessons with ethnomathematics, but also may pave the way for other studies and widen this research area for more practices in future.

First, the activities used in this study might be a resource for the teachers who would like to apply ethnomathematics program in their classrooms. Since there isn't enough resource in means of ethnomathematical tasks in Turkey and worldwide, teachers need to develop the tasks by themselves for their particular student populations. Also, because of the mathematical thinking and methods are quite different in different cultures, teachers should look for suitable activities from diverse cultural contexts and analyze how these activities may be integrated into their teaching to create a truly simulating and enriching environment to help all students fully develop their potentials (Gerdes, 2001). Therefore, these plans might be a guide/sample for teachers in other culturally similar villages. They also might lead other teachers, who are willing to make ethnomathematics-based activities, about how they can adapt the ideas to their own cultural context.

However, according to the experience I gained during this study, I can suggest that with a professional group of curriculum developers and researchers on ethnographic research and a longer and detailed field research for developing ethnomathematical tasks would be result in more meaningful and successful tasks. Therefore, if the professional researchers about both mathematics and ethnographic field research come together and compose a study group, it would provide healthier results to be used in classrooms.

As also mentioned above, there is a lack of resources about ethnomathematics curriculum for practice. Due to the fact that only a limited number of mathematics textbooks written from an ethnomathematical point of view are published, it would be difficult for teachers and school boards to develop a common curriculum (Zaslavsky, 1998). So, the curriculum developers should produce textbooks and teaching materials that include ethnomathematics-based activities for students. Those textbooks also should include strategies and methods about how to develop an ethnomathematical activity for more practical application.

In order to find teachers who will be willing to apply ethnomathematical activities –so the materials discussed above-; awareness about the existence of this particularly new research area and its implications should be raised at first. In order to inform and encourage mathematics teachers to use this program, some courses related with ethnomathematics for pre-service teachers should be offered or these

topics should be mentioned in mathematics education courses. At least, one course that deals with questions and issues concerning education, race, ethnicity, and culture is needed to be added on mathematics education faculties' programs, and multiculturalism perspective should be integrated into all their courses (Presmeg, 1998).

The preferential duty should be done as precondition of implications sorted above is adopting a multicultural perspective and developing a culturally relevant policy which is quite critic and essential for ethnomathematical program especially for these days' multicultural societies. According to the related literature, it is suggested that mathematical concepts and ethnomathematical perspectives must be integrated in the curriculum in a way that is sensitive to all cultures because when schools are ignoring the ethnomathematical knowledge that these children bring from their homes and communities, the underrepresented minorities are facing with academic problems. It should be remembered that society and classroom as a micro society have the similar sociocultural situations so a mathematics which is in a relevant context also needed to be accepted in order to have meaning for all students Zaslavsky (1998).

One of the most achievable steps in order to extend this field of research, raise awareness about it, developing policies and related programs is organizing scientific networking environments such as academic panels and conferences. Throughout this way, ethnomathematics and its advantages should be known in academic communities and the institutions such as Ministry of National Education and professional program developer groups and they should be involved in promoting this method (Kurumeh, Onah & Mohammed, 2012).

5.3 Recommendations for Further Studies

First of all, scholars, theorists, researchers, and practitioners in the field of ethnomathematics should work towards devising a unified, universally-applicable operational definition of the discipline because at present time there is no universally accepted operational definition of what constitutes ethnomathematics and its instructional elements. This is actually quite necessary for this research field because a common operational definition will facilitate further studies about

ethnomathematics (Ethnomathematics: Historical Overview, Critical Analysis, Implications and Applications, nd).

Ethnomathematics requires more studies especially in our country. However, when the existing researches in this field all around the world were evaluated, qualitative studies are constructing the majority of all. This lack of quantitative data on the subject makes a credible determination of the ability of ethnomathematics to encourage material improvements in the current math achievement gap very difficult (Ethnomathematics: Historical Overview, Critical Analysis, Implications and Applications, nd).Therefore especially future quantitative researches should have priority. Basically, in further experimental studies the relationship between ethnomathematics and math achievement can be tested. Besides the quantitative studies of the efficacy of ethnomathematics-based pedagogy and curricula, some empirical studies that assess all of the major elements of ethnomathematics-based instructional methodologies should be conducted. There isn't any study about ethnomathematical task development method so it is hard to construct material and tasks about ethnomathematics. Thus, for practical usage, future research on the subject should focus on the development of more specific frameworks for the application of ethnomathematics concepts with different student sub-populations (Ethnomathematics: Historical Overview, Critical Analysis, Implications and Applications, nd).

This study aimed to develop ethnomathematical tasks about area measurement topic and observe its contribution in students' performances. However some further studies may develop ethnomathematical tasks about other topics in mathematics curriculum and examine its effect on students' performances, achievement and attitudes. It also will help to produce other practical examples to be applied in classrooms and guide new attempts for in–class applications. In addition to that some studies also might be implemented at different grades and the impact of ethnomathematics-based instruction on different grades might be investigated.

Finally, ethno teaching techniques might also be incorporated with other subjects' curriculums as well as mathematics. The planners of all other subjects' curriculum should study on ethno pedagogy in order to let students develop positive attitude towards the subject as it will link home and school practices (Kurumeh, Onah & Mohammed, 2012).

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APPENDICES

APPENDIX A

Task Sheets

DÜZLEMSEL ŞEKİLLERİN ALANLARI

- Düzlemsel bölgelerin alanlarını strateji kullanarak tahmin etmeyi
- Standart olmayan birimlerle alan ölçmeyi
- Standart birimlerle alan ölçmeyi
- Dolaylı alan ölçmeyi
- Düzlemsel bölgelerin alanları ile ilgili problem çözmeyi

Halil Amca zamanında pek fazla okula gidememiş, koşullar fırsat vermemiş. Fakat yıllardır geçimini bu topraklarda zeytincilik yaparak geçiren Halil Amca, alan ölçme konusunda birçok matematikçiden iyi tahminler yapar olmuş. Varı yoğu zeytin olan Halil Amca, zeytincilik yaparken pek çok yerde matematiği kullandığından çok iyi tahminler yapar hale geldiğini söylüyor. Bir zeytinliğin alanının ne kadar olduğunu, hangi alanın diğerinden fazla olduğunu, bir araziye ne kadar fidan dikileceğini, çok iyi bir matematikçi gibi şıp diye tahmin edip, biliverirmiş. O yüzden köyde çok önemli birisi olarak görülüp herkes tarafından sayılır ve sevilirmiş. İnsanlar zeytin yetiştiriciliğiyle ilgili bilemedikleri bir şey olduğunda hemen ona koşarlarmış. Bir de, iyi matematikçi olduğunu bildiklerinden kimse onu kandıramazmış. Haydi biz de Halil Amca gibi tahminlerde bulunup, ölçüp, biçip, üstüne bir de matematik bilgimizi ekleyip iki farklı zeytinlikten hangisinin alanının daha geniş olduğunu bulalım. Arazilerin alanlarını kıyaslayarak, tahmin edelim, ölçelim, biçelim büyük olana karar vermeye çalışalım. Deneyelim bakalım gerçek sonuçlara ne kadar yaklaşabileceğiz... Belki biz bu çalışmaları yaparken, Halil Amca da bize yardımcı olur, kim bilir ☺

Alan ölçmeye neden ihtiyaç duyarız?

Zeytin yetiştiriciliğinde alan ölçmek gerekli midir? Neden?

Halil Amca diyor ki... !

Ölçme, karşılaştırma ihtiyacından doğmuştur.

Filiz'in dedesi zeytinliklerini çocukları arasında pay etmeye karar verdi. Büyük kızına büyük araziyi vermeyi düşünüyor.

1. Arazi

2. Arazi

Sizce bu iki zeytinlikten hangisinin alanı daha büyüktür?

Nasıl tahmin edersiniz?

Halil Amca diyor ki... !

Büyük olan araziye karar verdik fakat emin miyiz?

Elimizde herhangi bir ölçme aracı olmadan, bu arazilerin ne kadar büyüklükte olduklarını tahmin edebilir miyiz? Nasıl?

Halil Amca diyor ki... !

Kulaç, adım, ayak ve parmak gibi ölçü birimleri **standart olmayan** uzunluk ölçme birimleridir. Bu ölçme birimleri ile yapılan ölçmenin sonucu, ölçmeyi yapan kişiye göre değişir.

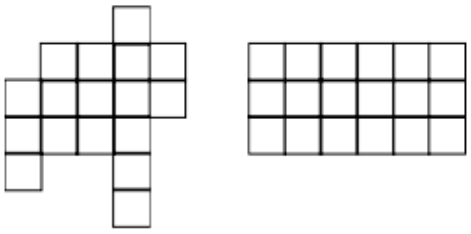
1. Arazi

2. Arazi

SORULAR

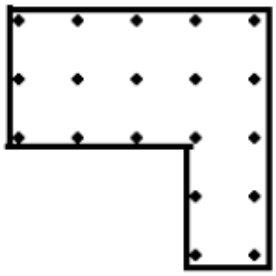
Örnek:

Aşağıda krokisi verilen tarlalardan hangisinin alanı daha büyüktür?



Örnek:

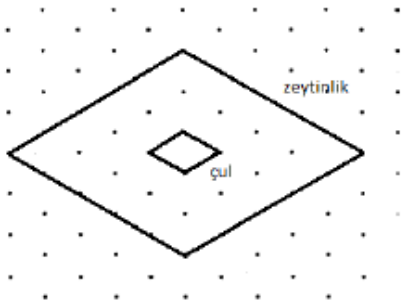
Zeynep zeytine gittikleri günlerden birinde, zeytin topladıkları bu arazinin alanını çok merak etmiş ve dedesine sormuş. Dedesi ise; "sana bir ipucu vereceğim fakat zeytinliğin toplam alanını kendin tahmin edeceksin" demiş. Zeynep kabul etmiş. Dedesi ipucu olarak kare şeklinde dikilmiş zeytin ağaçlarının her ikisinin arasındaki mesafenin 5 metre olduğunu söylemiş. Bu ipucu Zeynep'in şekildeki zeytinliğin alanını yaklaşık olarak tahmin etmesi için yeterli midir?



Zeyneplerin zeytinliği

Örnek:

Zeytin toplayan köylüler, eşkenar dörtgen şeklindeki zeytinliği şekildeki çullarla tamamen kaplamak istiyorlar. Bunun için kaç tane çula ihtiyaçları var hesaplayınız.

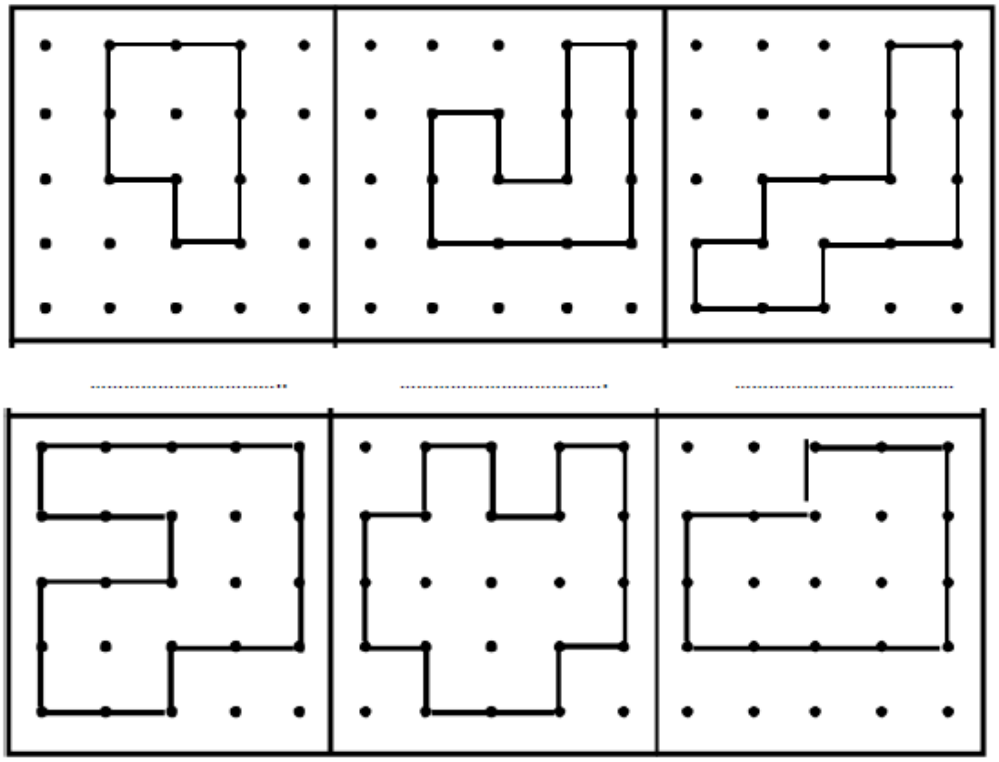


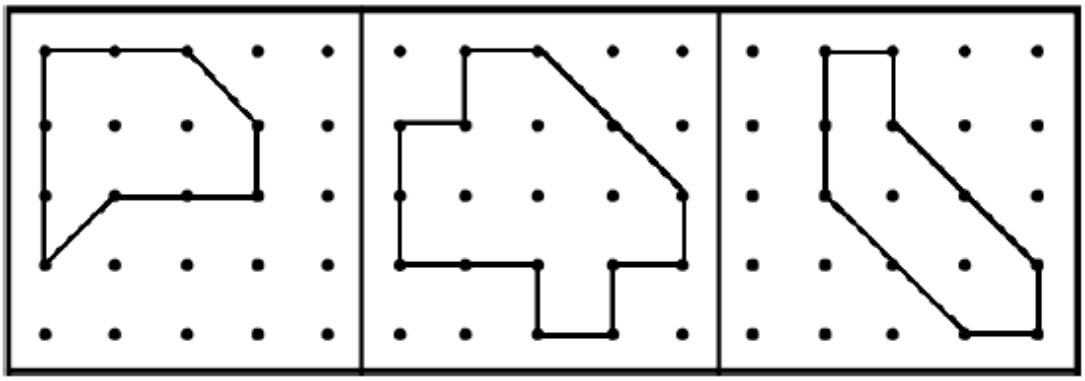
Örnek:

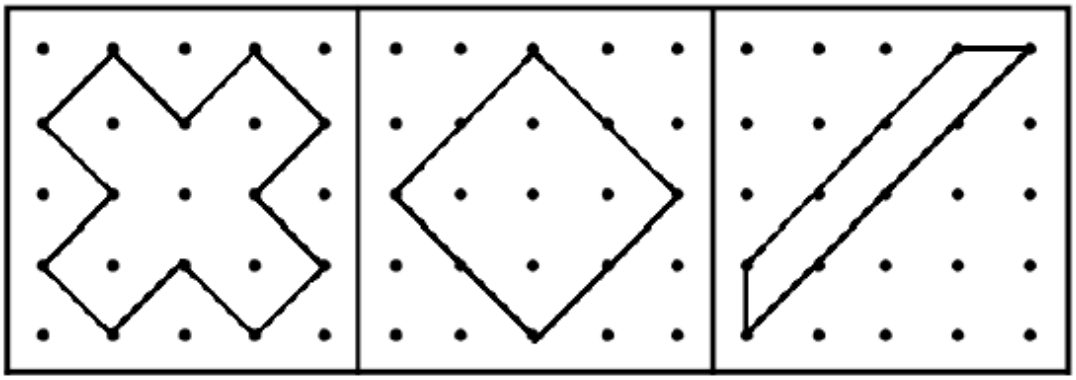
Fikret, sürekli zeytin toplamaya gittikleri zeytinliğin alanını merak etmektedir. Elinde zeytinliği ölçebilecek uzunlukta bir cetvel olmadığı için alanını tahmin etmeye karar verir. Öncelikle alanını ölçebileceği başka bir eşya arar ve zeytin toplarken kullandıkları çullardan kare şeklindeki birini seçer. Çulun bir kenarının alanını 3 metre, alanını ise 3x3=9 metrekare olarak bulur. Daha sonra çulu, zeytinlik arazisinin üzerine yerleştirerek, tüm zeytinliği yaklaşık 50 çul ile kaplayabileceğini fark eder. Buna göre zeytinliğin alanı yaklaşık olarak kaç metrekaredir?

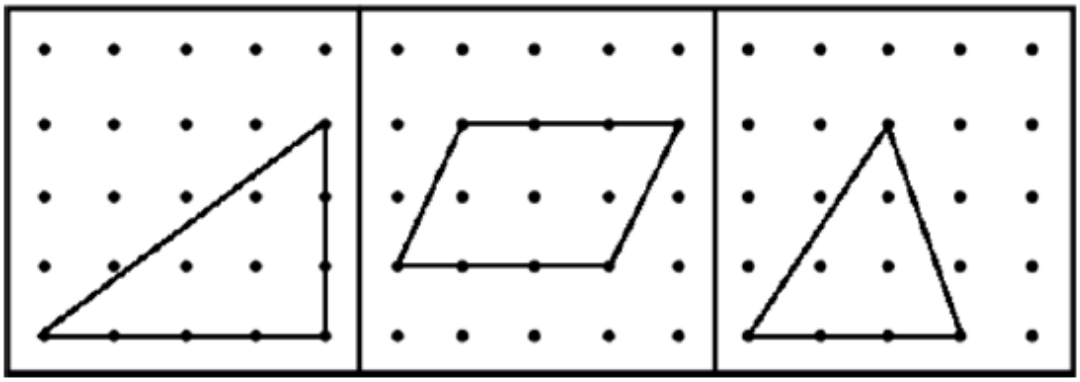
Örnek:

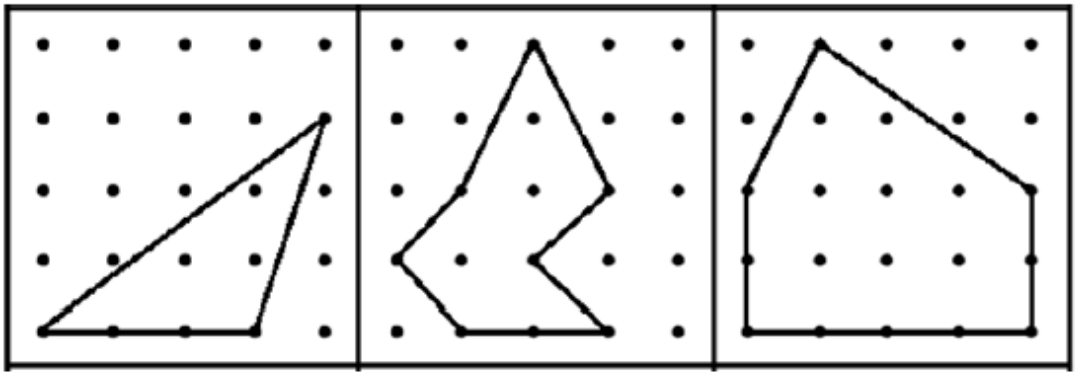
Yandaki 1 br^2 yi kullanarak, aşağıdaki çokgensel bölgelerin alanlarını tahmin ediniz:







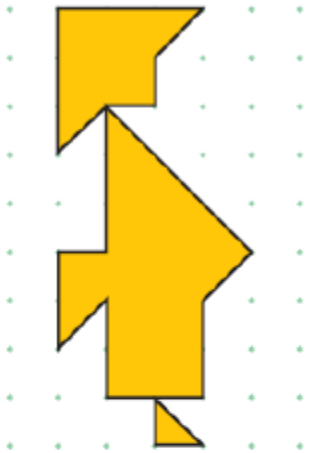




Örnek:

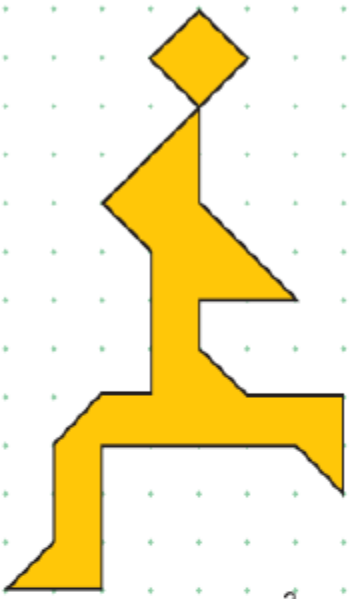
Yandaki karesel bölgenin alanını 1 cm^2 olarak kabul ediniz. Şekilde verilen çokgenlerin alanları kaç cm^2' dir?

Şekil 1



..... cm^2

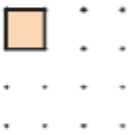
Şekil 2



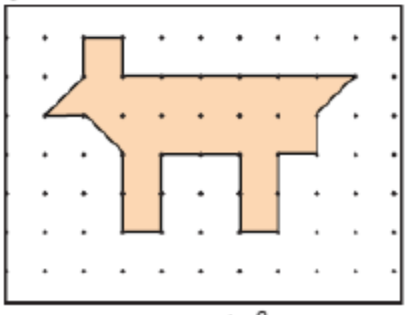
..... cm^2

Örnek:

Yanda verilen karesel bölgenin alanı 1 br^2 dir. Buna göre aşağıda verilen çokgensel bölgelerin alanları kaç birim kareden oluşmaktadır?

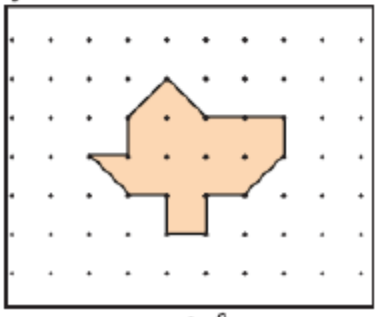


Şekil 1



..... br^2

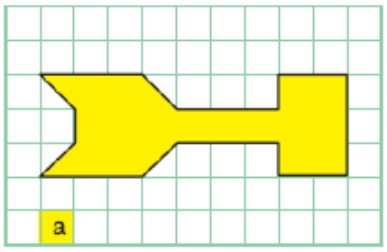
Şekil 2



..... br^2

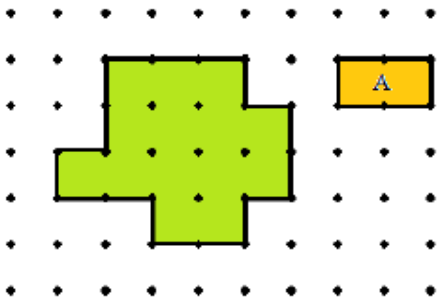
Örnek:

Şekilde verilen alanın kaç tane a birim karelik bölgeden oluştuğunu bulunuz:



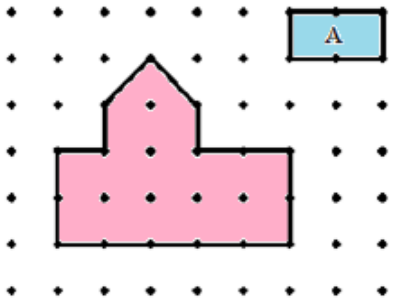
Örnek:

Şekildeki alanın kaç tane A birimlik bölge ile kaplanabileceğini bulunuz.



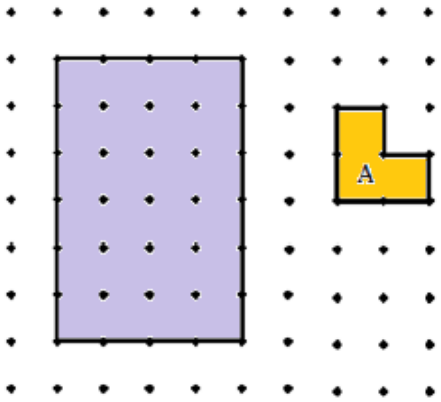
Örnek:

Şekilde verilen alanın kaç tane A birimlik dikdörtgenselsel bölgeden oluştuğunu bulunuz.



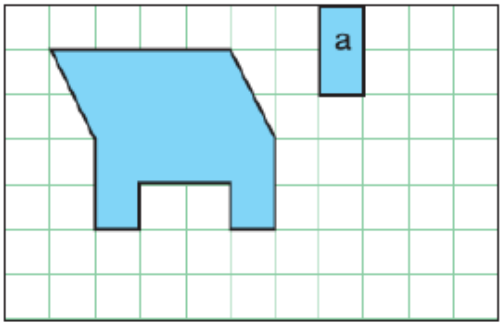
Örnek:

Şekilde verilen alanın kaç tane A birimlik bölgeden oluştuğunu bulunuz:



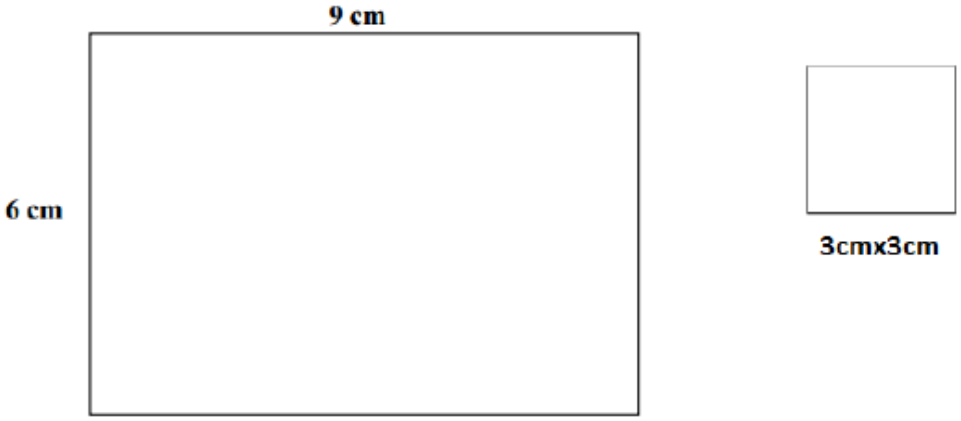
Örnek:

Şekilde verilen alanın kaç tane A birimlik bölgeden oluştuğunu bulunuz:



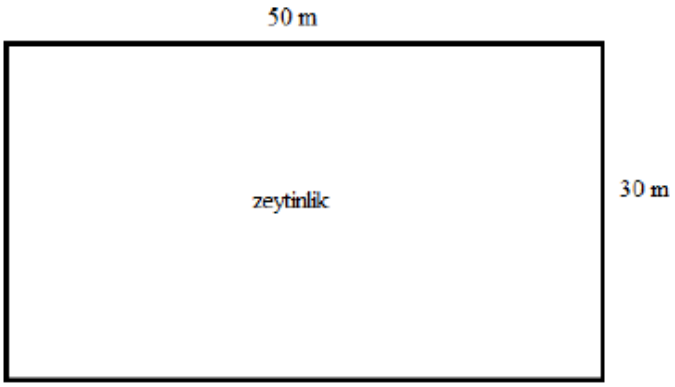
Örnek:

Aşağıdaki alan, bir kenarı 3 cm olan karelerden kaç tanesiyle kaplanabilir?



Örnek:

Şekilde eni ve boyunun uzunluğu verilen dikdörtgen şeklindeki zeytinlik, bir kenar uzunluğu 5m olan kare şeklindeki çullardan kaç tanesiyle tamamen kaplanabilir?



Örnek:

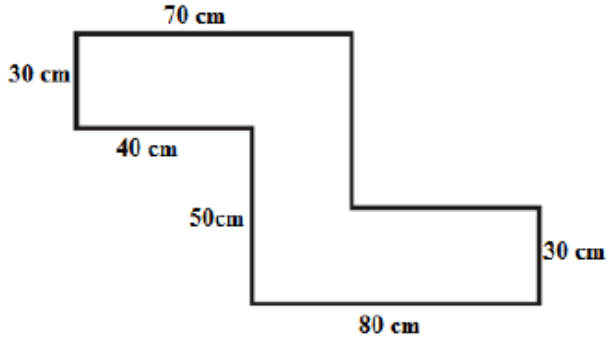
Bir kenar uzunluğu 60 m olan zeytinlik, eni 6 m boyu ise 10 m olan dikdörtgen şeklindeki aşağıdaki çullardan kaç tanesiyle kaplanabilir?

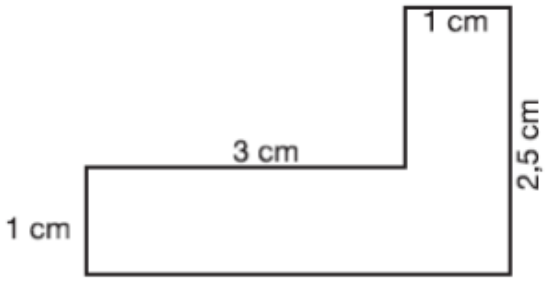
Örnek:

Bir kenar uzunluğu 60 m olan zeytinlik, eni 3m boyu ise 5 m olan dikdörtgen şeklindeki aşağıdaki çullardan kaç tanesiyle kaplanabilir?

Örnek:

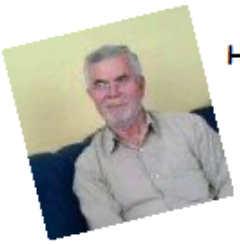
Aşağıda verilen çokgensel bölgeler bir kenarı 1 cm olan karelerle kaplanacaktır. Kaç kareye ihtiyaç olduğunu tahmin ediniz. İşlem yaparak tahmininizle karşılaştırınız.





Büyük olan araziye karar verdik. Fakat "ne kadar" büyük?

Arazileri karşılaştırırken hangi arazinin ne kadar büyük olduğunu kesin olarak belirlemek için ne yapmalıyız?



Halil Amca diyor ki...!

Herkesçe aynı olan, kişiden kişiye değişmeyen ve geniş toplum kitleleri tarafından bilinen ve kullanılan ölçme araçlarına standart ölçme araçları denir

Standart ölçme birimlerine hangi durumlarda ihtiyaç duyarız? Ne işimize yarar? Ne gibi avantajları vardır?

En yaygın standart ölçü sistemi **metrik sistem**dir.Metrik sistem de diğer standart ölme sistemleri gibi kendi içinde alt ve üst birimlere ayrılmıştır ve bunların birkaçını bir arada taşıyan ölçü araçları yapılmıştır. 1 m' lik cetvelin dm, cm ve mm'leri ayrıntılı göstermesi gibi. Böylece ara değerleri de kesin olarak ölçebiliriz.

Bu arazileri metrik sistemi kullanarak ölçünüz.

Büyük arazileri, elimizdeki ölçme araçlarıyla hatasız olarak ölçmenin mümkün olmadığı durumlarda ne yapabiliriz?

• Su dolu bir kuyunun derinliği nasıl ölçeriz?, Bir uçağın yerden ne kadar yüksekte olduğunu nasıl anlayabiliriz?, İki şehir arasındaki mesafeyi nasıl ölçebiliriz?, Güneşin dünyaya uzaklığı nasıl ölçülmüş olabilir?

Halil Amca diyor ki...!

Doğrudan ölçemediğimiz çok büyük uzunluk ve alanları dolaylı yoldan ölçeriz. **Dolaylı ölçme** yöntemlerinin bir çoğu doğrudan ölçme imkanı olmadığı için, bir çoğu da doğrudan ölçmeye göre daha kolay oldukları için üretilmişlerdir. Arazi alanlarının havadan çekilen fotoğraflarla ya da ölçekli plan yardımıyla tespiti hep birer dolaylı ölçmedir.

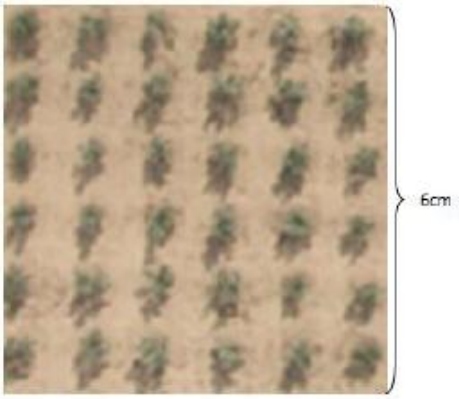
Bunun için halk, büyük arazileri ölçebilecek araçlara ya da havadan fotoğraf çekme teknolojisine sahip olan Tapu Kadastro uzmanlarına ihtiyaç duyar ve böylece büyük arazilerin kesin ölçümleri dolaylı fakat daha kolay yoldan yapılmış olur.

Bir bölgenin planı, gerçek uzunlukları belli bir oranda küçültülerek çizilir ve bu küçültme oranı planın ölçeğinde belirtilir.

Bu zeytinliklerin 1/2500 ölçekli planları yandaki şekilde verilmiştir. Arazilerin alanlarını planlardan faydalanarak hesaplayınız ve büyüklüklerini kıyaslayınız.

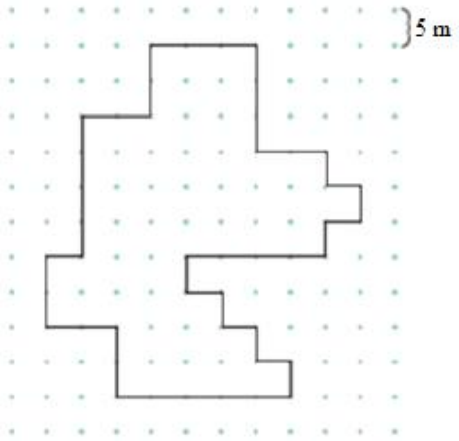
Örnek:

1:1000 ölçekle küçültülmüş fotoğrafı verilen, bir kenar uzunluğu 6 cm olarak gösterilen kare şeklindeki bir zeytin bahçesinin gerçek alanı kaç santimetre karedir?



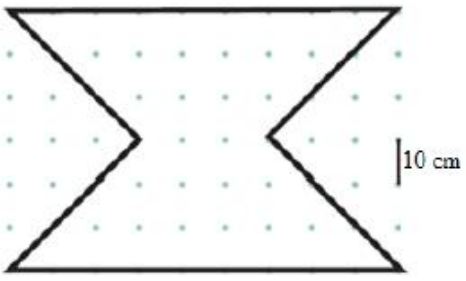
Örnek:

Şekildeki planda iki nokta arası mesafe 5 metreye denk gelmektedir. Buna göre planı verilen arazinin gerçek alanını kaç metrekaredir?



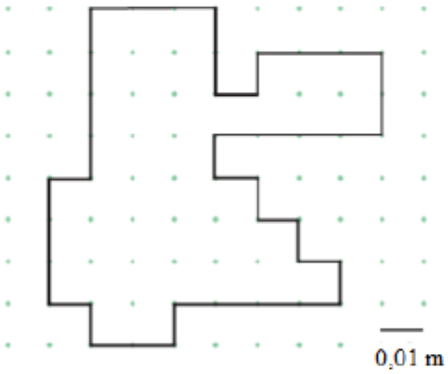
Örnek:

Şekilde bir arazinin 1 : 10 ölçekli planı verilmiştir. Bu arazinin alanı gerçekte kaç metre karedir?



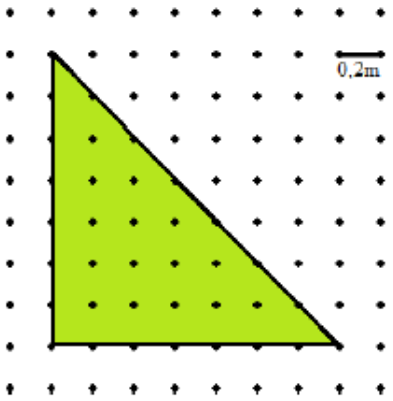
Örnek:

Şekilde 1/1000 ölçekli bir parkın alanı verilmiştir. Bu parkın gerçek alanı kaç metrekaredir?



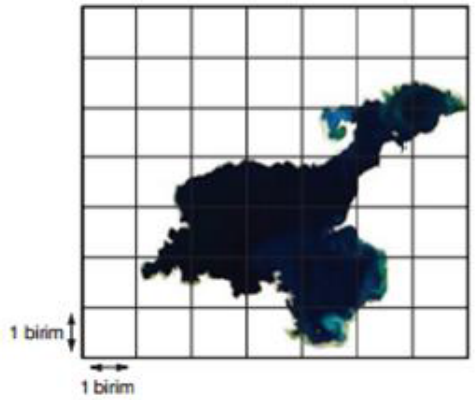
Örnek:

Şekilde 1/500 ölçekli bir bahçenin planı verilmiştir. Bu bahçenin gerçek alanı kaç metrekaredir?



Örnek:

Van Gölü'nün haritası yanda verilmiştir. Haritada 1 birim uzunluk 19 km' ye karşılık gelmektedir. Bu gölün alanı yaklaşık olarak kaç kilometre karedir?



ALAN ÖLÇME BİRİMLERİNİ BİRBİRİNE DÖNÜŞTÜRME

- Alan ölçme birimlerini açıklayıp, birbirine dönüştürmeyi,
- Düzlemsel bölgelerin alanları ile ilgili problem çözmeyi.

Zeytinlik tesis ederken,

Zeytinlik kurulacak araziye **fidan dikilecek noktaları işaretleriz.** Tabii ki işaretleme yaparken ne kadar sıklıkla ve ne şekilde (kare, dikdörtgen, üçgen, vs.) fidan dikeceğimizi önceden belirlemiş olmamız gerekir.

Daha sonra işaretlediğimiz dikim noktaları merkeze gelecek şekilde **fidan çukurlarını açarız.** Çukurlar en az 5 dm x 5 dm (50cm x 50cm) boyutlarında ve 60-70 cm derinlikte olmalıdır. Ayrıca, ne kadar geniş çukur açarsak zeytinimizin o kadar hızlı gelişeceği unutulmamalıyız. Fidan dikim çukurlarını, çapa veya kürek kullanılarak elle açılabileceğimiz gibi özellikle sayının fazla olduğu durumlarda makine olarak kepçe veya toprak burgusu ile de açabiliriz.

Çukurların yuvarlak yerine kare şeklinde olması tercih edilir. Yuvarlak şeklindeki çukurlarda dikim toprağının dışındaki daha sert yapıda olan toprak tabakasına dikilen fidanın köklerinin tümünün aynı anda fidanın gelişmesinde olumsuzluğa neden olabilir. Ayrıca, toprak burgusu ile açılan yuvarlak çukurlarda burgunun sıkıştıracağı çukur kenarındaki toprak tabakası fidan gelişmesinde gerilemeye, hatta ölüme neden olabilir. Kare şeklinde açılan çukurlarda bu olumsuzluklar olmayacaktır.

Fidanların, özellikle dikildikten sonraki ilk büyüme yıllarında besin ihtiyaçlarını karşılayabilmeleri için **çukurlara gübreleme yaparız.** Her bir dikim çukuruna 1-2 kürek yanmış çiftlik gübresi koymamız yeterlidir.

Tüplü fidanların dikimini, ilkbaharda don tehlikesi olan bölgelerde don tehlikesi geçtikten sonra başlayıp Eylül ortalarına kadar, ilkbaharda don tehlikesinin olmadı yerlerde ise yıl içindeki her dönemde yapabiliriz.

Resim 2

Resim 3

Resim 4

Fidanların dikimi sırasında, gübre ve üst toprağı iyice karıştırarak çukura koyarız (Resim 3).

Bunların üstüne fidan kökünün gübre ile direk temas etmesini önlemek için bir miktar toprak serperiz.

Tüplü fidanları toprağını dağıtmadan tüpten çıkarır ve çukurun ortasına koyarız (Resim4).

Resim 5

Resim 6

Resim 7

Daha önceden çıkan alt toprak ile kalan gübreleri karıştırıp **kenarlardaki boşlukları doldurarak sıkıştırırız**. Önce çukur yarı dolu iken, sonra tam dolu iken toprağı iyice sıkıştırırız.

Bu işlem yapılırken, her fidana hâkim rüzgâr yönünde ortalama 1,5 m. boyunda **herek dikerek** fidanla birlikte sıkıştırırız (Resim 5, Resim 6).

Fidan gövdesi dik olacak şekilde 2-3 noktadan gevşek olarak **hereğe bağlarız**. Fidan bağı gövdeyi ezmeyecek kalınlıkta ve esnek olmalıdır (Resim 7, Şekil 1).

Kalan toprakla fidanın çevresine **çanak yaparız**.

Dikim toprağının sıkışması ve fidan köklerinin toprakla tema edebilmesi için mutlaka **can suyu (en az 25-30 litre) veririz**. (Resim 8).

Resim 8

İklim şartları ve toprak özellikleri yönünden zeytin yetiştiriciliğine oldukça uygun olan köyümüzde bir arazi satın alıp, zeytin dikimi yapmaya karar verdik. Geçen sonbaharda toprağın drenajını sağlamak, köklerin gelişimi için gerekli olan mikroorganizmaları aktive etmek ve organik madde miktarını arttırmak için toprağı derince işledik. İklim şartlarını, ağacın gelişimi ve verimliliğini, elde edilecek ürünün değerlendirme şeklini (yağlık, sofralık, siyah, yeşil, vs.) dikkate alarak bölgemize en iyi adapte olmuş çeşit olan trilya zeytinini ekmeye karar verdik. Dikim sıklığı ve dikim şeklimize uygun olarak fidan dikilecek noktaları işaretledik ve bölgemizde en uyun dikim zamanı olan Mayıs ayında çukurları açmaya karar verdik. Yukarıda okuduğumuz bilgilere göre en az 5 dm x 5dm (50cmx50cm) boyutlarında kare şeklinde çukurlar açmamız gerekiyormuş. Ve aynı zamanda çukurlarımız ne kadar geniş olursa zeytinimiz o kadar hızlı gelişirmiş. Biz de üşenmedik zeytinlerimiz hızlıca gelişebilsin diye 1m x 1m ($1m^2$) boyutlarında kare şeklinde çukurlar açtık. Fakat işte tam da bu noktada tıkandık. Her şeyin mükemmel olmasını, en verimli zeytini en az masrafla yetiştirmek istiyoruz, bunun için epey araştırma yaptık fakat bazı konularda işin içinden çıkamadık. Yukarıdaki bilgileri ve matematik bilginizi kullanarak belki bize siz yardımcı olabilirsiniz. İşte bir türlü işin içinden çıkamadığımız o konular:

(a) Araştırmalarımıza göre, fidan dikiminden sonra zeytinin besin ihtiyacını karşılayabilmesi için dikim çukurunda her 25 dm^2 lik alana 1 kürek düşecek şekilde gübre dökülmesi gerekiyormuş. Fakat biz çukurlarımızı 1 m^2 lik açtık. Her bir çukura kaç kürek gübre doldurmamız gerektiğini bulamıyoruz.

(b) Çukurları kapatıp zeytin fidanını diktikten sonra, toprağın sıkışması ve köklerin toprakla yeterince temas etmesi için 100 cm^2 ye en az 1 litre can suyu verilmesi gerektiğini öğrendik. 1 m^2 lik dikim alanlarımıza kaç mililitre su vermemiz gerekir?

(a)

cm^2 lik kartonu dikim noktası merkezde olacak şekilde çukura yerleştirelim.

Çukurun alanı kaç metre kare hesaplayalım:

Her 25 dm^2 lik alana 1 kürek gübre kullanılacak fakat bizim alanımız m^2 cinsinden. Ne yapmalıyız?

1 m^2 nin içinde kaç tane dm^2 vardır?

Her bir çukura kaç kürek gübre dökmemiz gerektiğini artık hesaplayabiliriz:

(b)

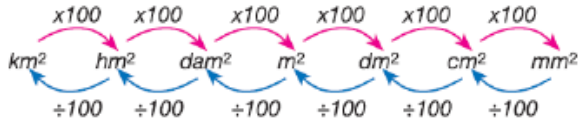
100 cm^2 ye 1 litre can suyu vermemiz gerekiyor fakat bizim alanımız m^2 cinsinden. Ne yapmalıyız?

1 m^2 nin içinde kaç cm^2 vardır?

Her bir çukura kaç litre can suyu dökmemiz gerektiğini artık hesaplayabiliriz:

m^2 , dm^2 , cm^2 arasındaki ilişkiyi gösteren matematiksel ifadeyi yazınız:

Bir düzlemsel şeklin alan ölçüsünü ifade etmek için milimetrekare, desimetrekare, hektometrekare, dekametrekare ve kilometrekare birimleri de kullanılır. Bu birimlerin sembolleri sırasıyla mm², dm², hm², dam², km²dir.



ÖRNEK:

Aşağıdaki tabloyu uzunluk ölçüm birimlerini dikkate alarak doldurunuz:

Kilometrekare (km^2)	Hektometrekare (hm^2)	Dekametrekare (dam^2)	Metrekare (m^2)	Desimetrekare (dm^2)	Santimetrekare (cm^2)	Milimetrekare (mm^2)
1	100	?	1 000 000	?	10 000 000 000	?
?	2	?	?	?	20 000 000	2 000 000 000

ÖRNEK:

Bir Kenar uzunluğu 1 km olan kare şeklindeki bir arazinin alanının kaç hektometrekare, dekametrekare ve metrekare olduğunu hesaplayınız, tablo oluşturarak gösteriniz:

ÖRNEK: Tablolardaki boşlukları doldurunuz.

mm^2	cm^2	km^2	m^2
70 000 000 000			
1 000 000 000 000		10	
	650		
			90 000

m^2	dam^2	hm^2	km^2
			0,0004
12000			
		300	
	4600		
		16000	

ÖRNEK: Aşağıdaki boşlukları doldurunuz.

$36\ m^2$ = ... dm^2

$33\ km^2$ = ... hm^2

$8\ hm^2$ = ... dam^2

$45\ m^2$ = ... dm^2

$69\ mm^2$ = ... cm^2

$27\ hm^2$ = ... m^2

$34\ m^2$ = ... cm^2

$3250\ dam^2$ = ...hm^2

$3000\ dam^2$ = ... hm^2

$32000\ dam^2$ = ...hm^2

$25\ km^2$ = ... hm^2

$0{,}15\ hm^2$ = ...m^2

$0{,}0530\ km^2$ = ... dam^2

$0{,}24\ hm^2$ = ... dam^2

$2870\ cm^2$ = ... m^2

$0{,}46\ m^2$ = ... cm^2

$29\ km^2$ = ... dam^2

$650\ dm^2$ = ... dam^2

$59000\ dam^2$ = ... Km^2

$432\ km^2$ = ... m^2

$6000\ cm^2$ = ... Dm^2

$285\ dm^2$ = ... dam^2

$90000\ cm^2$ = ... m^2

$457\ hm^2$ = ... m^2

$280\ 000\ mm^2$ = ... dm^2

$180\ dm^2$ = ... dam^2

$12\ hm^2$ = ... dam^2

$3000\ m^2$ = ... dam^2

$23\ m^2$ = ... dm^2

$4700\ hm^2$ = ... km^2

$75\ m^2$ = ... hm^2

$100\ 000\ m^2$ = ... km^2

$782\ dm^2$ = ... m^2

$2{,}9\ hm^2$ = ... dam^2

$17{,}8\ dam^2$ = ... cm^2

$0{,}186\ dm^2$ = ...mm^2

$0{,}00076\ km^2$ = ... dam^2

$2\ m^2$ = ... dm^2

0, 15 dam^2 = ... m^2 = ... dm^2

0,0003 km^2 = ... hm^2 = ... dam^2

7500 dm^2 = ... m^2 = ... dam^2

59000 m^2 = ... hm^2 = ... km^2

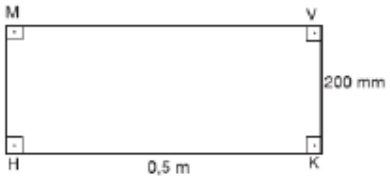
0,02 m^2 + 3 dm^2 = ... cm^2

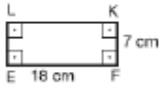
0,6 dam^2 + 0,4 m^2 = ... dm^2

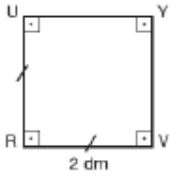
6 km^2 + 2 dam^2 = ... m^2

ÖRNEK:

Aşağıda verilen karesel ve dikdörtgensel bölgelerin alanlarının kaç mm^2 olduğunu bulunuz:

a) 

b) 

c) 

ÖRNEK:

Metrekaresi 150 TL den satılan 1 hm^2 lik bir arazinin tamamını almak isteyen bir çiftçi kaç TL ödemelidir?

ÖRNEK:

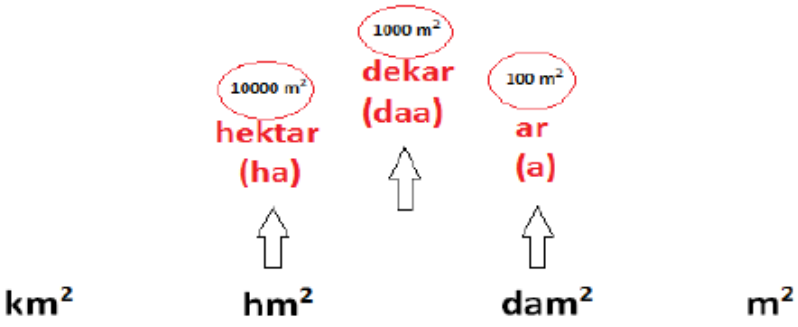
Ünlü bir zeytinyağı markası, gelecekteki üretimlerini arttırmak için Ege Bölgesi'nde 25 km^2 lik zeytinlikler tesis etmiştir. İlerideki yıllarda 1 m^2 den yaklaşık 10 kg zeytin elde edileceği tahmin edildiğine göre, bu arazinin tamamından kaç kg zeytin elde edilir?

Arazi ölçme birimlerinin alan ölçme birimlerinden farkı ne olabilir?

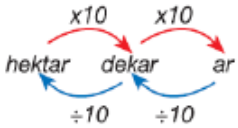
Arazi ölçme birimleri (ar,dekar,dönüm, hektar) günlük hayatta nerelerde kullanılmaktadır? Bilgi toplayınız.

Özellikle bağ, bahçe, arsa, tarla alanı ölçmede ar, dekar, hektar ve km^2 gibi arazi birimleri kullanılırlar. Bunların arazi ölçüleri diye adlandırılmaları büyük alanları ölçerken kullanışlı olmalarından ötürüdür.

Arazi ölçme birimleri, alan ölçme birimlerinin ara basamaklarına verilmiş adlardır ve aralarında 10'ar kat ilişkisi bulunur.



Bağ, bahçe, arsa gibi alanları ölçmek için arazi ölçü birimleri kullanılır. Bunlar ar (a), dekar (daa) ve hektar (ha) birimleridir.



1 ar 100 metrekaredir. — *1 a = 100 m^2*

1 dekar 1000 metrekaredir. — *1 daa = 1000 m^2 (1000 m^2ye "1 dönüm" de denir.)*

1 hektar 10 000 metrekaredir. — *1 ha = 10 000 m^2*

1 kilometrekare 100 hektardır. — *1 km^2= 100 ha*

Aşağıdaki tabloda boş bırakılan yerlere uygun değerleri yazınız:

a	daa	ha	m^2
		1	
	800		
1500			
			20 000

ÖRNEK:

Aşağıda verilen işlemlerin boşluklarını doldurunuz:

$2500\ m^2$ = ... daa

$7{,}5\ m^2$ = ... a

126 a = ... m^2

120 daa = ... ha

$312\ km^2$ = ... a

213 a + 2 ha = ... dönüm

600 dekar= ..... dönüm

$5700\ dam^2$ = ... daa

49 ha = ... a

$800\ m^2$ = ... a

$29\ dam^2$ = ... a

6 a = ... m^2

3700 a = ... daa

$8000\ m^2$ = ... daa

$40\ 000\ m^2$ = ... ha

$5\ km^2$ = ... ha

$3800\ km^2$ = ...ha

$6700\ dam^2$ = ... ha

270 ha = ... km^2

5 a = ... m^2

3 ha = ... a

12 daa = ... m^2

8 ha = ... daa

$8\ km^2$ = ... ha

170 daa = ... a

9 a = ... m^2

$7\ km^2$ = ... ha

13 daa = ... m^2

29 daa = ... a

$5000\ m^2$ = ... daa

4 daa = ... a

301 ha = ... daa

41, 16 a = ... ha

0,9 ha = ... m^2

1000 hm^2 = ... dönüm

18 daa = ... m^2

37 daa = ... a

4 a = ... m^2

7000 m^2 = ... daa

0,5 a = ... daa

43 a = ... daa

0,03 a = ... m^2

4734 m^2 = ... hm^2 = ... ha =..... a

6 ha - 300 a = ... daa

0,6 daa + 8 m^2 = ... m^2

0, 84 ha - 600 m^2 = ... a

ÖRNEK:

1 dönüm zeytinliğimiz var, 1 a kadar araziden ortalama 2 çuval zetin toplanıyorsa, bizim arazimizden yaklaşık kaç çuval zeytin toplanır?

5 dönüm zeytinliğimiz var, 1 daa araziye yaklaşık 40 adet zetin fidanı almamız gerekiyor. Bu durumda bizim arazimize ne kadar fidan gerekir?

1 a zeytinlik 500 TL ye satılıyorsa, 1 ha kadar zeytinlik yaklaşık kaç TL'ye satılır?

ÖRNEK:

7 dönüm arazinin 3 dekarı nadasa bırakılıyor. 30 arlık kısmına zeytin dikilirse geriye kaç metrekarelik alan kalır?

ÖRNEK:

Tablo: 2009 Yılı Bazı İllere Göre Tarım Alanları

İller	Toplam Alan (daa)	Ekilen Alan (daa)	Nadas (daa)
İstanbul	700 997	632 441	-
Balıkesir	4 236 910	2 950 204	39 420
Aydın	3 910 979	1 662 313	22 642
Kütahya	3 232 139	2 642 505	456 183
Ordu	2 363 388	319 037	63 226
Muş	2 853 457	2 247 451	571 666

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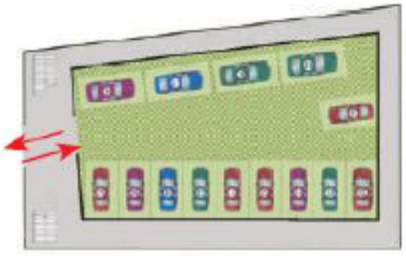
Şekilde verilen tabloya göre;

a) 2009 yılında, ekili alanı en fazla ve en az olan iller arasındaki fark kaç hektardır?
b) Kütahya ve Aydın illerinde tarım alanı dışında kalan alan kaç ardır?
c) Ordu ve Muş illerinde nadasa bırakılan alanlar arasındaki fark kaç metrekaredir?

ÖRNEK:



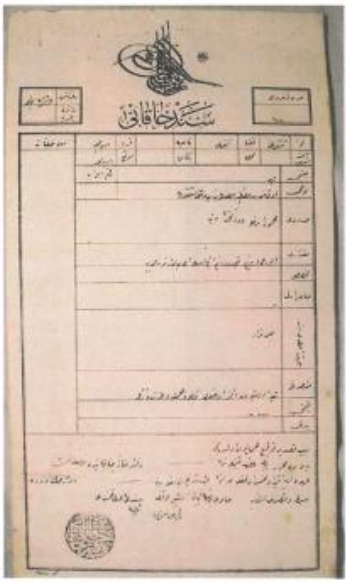
Şekildeki otopark krokisine göre, otoparkın toplam alanı 1,52 dam^2 dir. Her bir araç için 8 m^2 alan ayrıldığına göre boş olan alan kaç desimetrekaredir?

ESKİ ve YENİ ALAN ÖLÇÜM BİRİMLERİ

NELER ÖĞRENECEĞİZ?

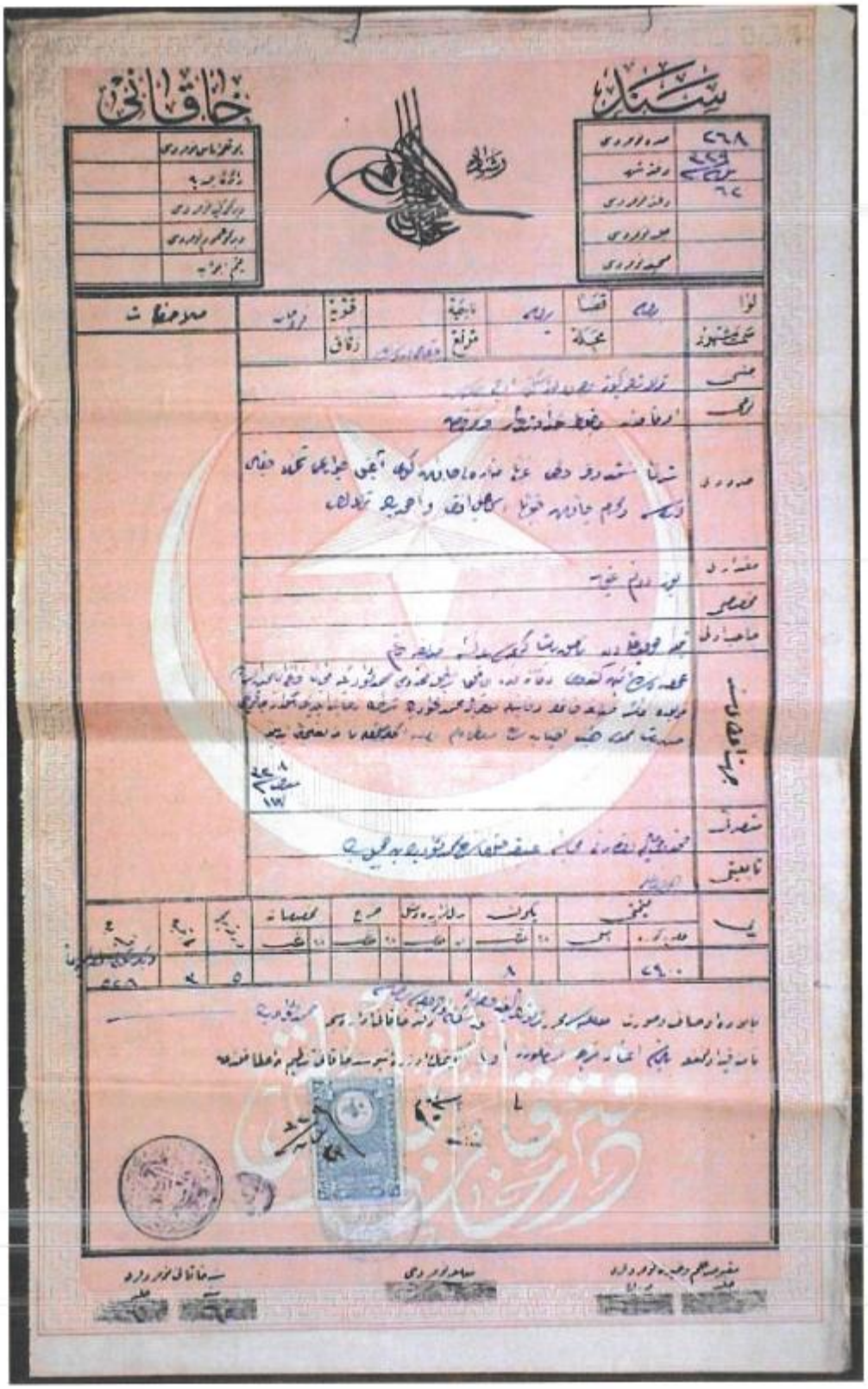
- Eski ve yeni alan ölçüm birimlerini tanıyıp kullanmayı,
- Farklı alan ölçüm birimlerinin, farklı oranlarla büyüyüp küçülebildiğini (sadece 100 er 100 er değil),
- Ölçme birimlerinin, hangi ihtiyaç durumlarına göre oluşturulduğu ve hangi durumlara göre değişebildiğini.

Bir ölçmecinin her zaman için çok eskiden kalma belgelerle karşılaşma olasılığı vardır. Böyle durumlarda karşısına değişik alan ölçü birimleri çıkmaktadır. Oldukça iyi bir ölçmeci olan Fatma, büyük dedesinden kalan Osmanlıca bir tapu buluyor. Babasının anlattığına göre, bu tapu bir zeytinlik tapusuymuş. Komşu arazi sahibi akrabalarıyla huzur içinde yaşayan Fatma'nın ailesi, tahmini büyüklüğünü bildikleri zeytinliklerinin kesin ölçülerini bulup araziyi çitle çevirmeye hiç gerek duymamışlar. Bu yüzden tapu yıllardır evin bir köşesinde duruyormuş. Taa ki Fatma'nın eline geçene kadar. Fatma hiç tanımadığı büyük dedesini çok merak ediyor, onun hakkında hep bir şeyler öğrenmek istiyormuş. Tarihi bilgilere her zaman ilgi duyan Fatma'nın, ölçme konusuyla da arası epey iyi olduğundan, bu Osmanlıca tapunun şifresini çözmek için gereken her şeyi yapmayı kafasına koymuştur. Fakat cslında daha 80-90 yıl önce, büyük dedesinin zamanında kullanılan ölçü birimleri hakkında hiç bir şey bilmemektedir ve tahminlerine göre bu zeytinlik tapusunda hep eski birimlere yer verilmişti. Gelin, küçük ölçmeciler olarak hep beraber Fatma'ya yardım edelim!



Osmanlı Tapu Örnekleri

1



Osmanlı Döneminden kalan bir tarla tapusu

ESKİ ZAMANLARDA KULLANILAN ÖLÇÜ BİRİMLERİ

Henüz şehirler yokken, yazı bile bulunmamışken, ticaret bütün dünyaya yayılıvermişti. İnsanlar bolca seyahat eder ve ticaret yaparlardı.

Büyük ihtimalle, tıpkı şimdi olduğu gibi, o zamanlarda da tüccarların sorduğu ilk ve en önemli soru "ne kadar" olmuştur. Böylece ticaret gelişirken, ölçme de gelişmiştir.

Örneğin kumaş, en önemli ticari mallardan biri olagelmiştir. Bu kadar önemli bir mal birinin kulacıyla ya da karışıyla falan ölçülemezdi. Çünkü kumaşı alan kişi dev gibi birinin kollarını kullanmak isterken, satıcı ise bir bebeğinkini tercih ederdi.

Böylece, eski insanlar sabit (standart), yani kişiden kişiye değişmeyen ölçü birimleri yapmaya karar verdiler.

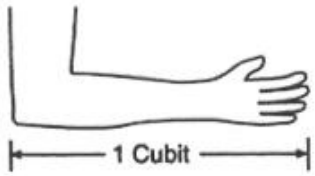
Herhangi bir büyüklüğü ya da niceliği ölçmek için, tarih boyunca Mısırlılar, Babiller, Çinliler, Hintliler, Romalılar, Yunanlar ve Meksikalılar gibi birçok uygarlık kendi ölçme sistemlerini kendileri geliştirmişlerdir.

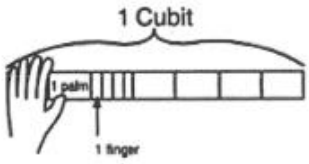
Mısırlılar ve diğer eski uygarlıklar vücutlarının parçalarını ölçme birimi olarak kullanmışlar.

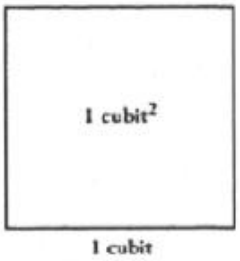
Bu çok değişik tarihi ölçü sistemlerinden bazılarına bir göz atalım:

MISIRLILAR

Mısırlılar, herkesin kullanabileceği ortak bir uzunluk ölçüsü bulmaya karar verdiler ve firavunlarının kolunu ölçüp, bu uzunluğa "cubit" (kübit) dediler. El ve parmak ise daha küçük uzunlukları ölçmek için kullanıldı. Mısırlıların sistemine göre 1 kübit = 7 el = 28 parmak idi. Bazı arkeologlara göre, Mısırlılar ölçüm yapmak için 100 kübitlik (yaklaşık 52 metre) sarılı ipler ya da çubuklar kullanmaktaydılar.







İSİM	EŞDEĞERİ	METRİK KARŞILIĞI
1 kübit	7 el	52.4 cm
1 el	4 parmak	7,48 cm
1 parmak		1,87 cm

Mısırlılar, uzunlukları ölçmek için zaten sabit bir ölçü seçmişlerdi; eski firavunun dirseği ile parmakları arasındaki uzaklık= yaklaşık 52 cm. Artık tarlalarının alanlarını hesaplamak onlar için hiç de zor değildi. Alan ölçmek için, her kenarı 1 cubit olan (1 cubit x 1 cubit = 1 cubit^2) bir kare oluşturdular ve herkes tarlalarını bu kareler ile ö çtü. Nasıl ölçmüş olabilirler? Bu ne işlerine yaramış olabilir?

Bir cubit ölçü çubuğu- Egizio Müzesi, Torino, İtalya.

HİNDİSTAN

Bilinen ilk ölçü sistemlerinden bir diğerini ise Hindistanlılar icat etmiş ve yüzyıllar boyunca kullanmışlar.

Milattan önce 3000-1500 yılları arasında İndus Vadisi Uygarlığı, ölçüm birimlerini standartlaştırmak için teferruatlı bir yöntem geliştirdi.

Antik Hintlilerin geliştirdiği bu ölçme sistemi de, tıpkı Mısırlılarınki gibi büyük ölçüde insan vücudunun parçalarına göre belirlenmişti.

Antik Liman kenti Lothal, Gujarat, Hindistan

Bu standart uzunluk birimleri, antik Hint tapınakları inşa edilirken ve Lothal, Surkotadai, Dolavira gibi kentler planlanırken çok işe yaramışlardır.

Hintlilerin geliştirdiği bu sistem, diğer antik ölçü sistemlerinin içinde en muazzam olanıydı çünkü bu sistemde ondalıklı sayılardan oluşan küçük birimler de kullanılıyor ve bu birimler çok küçük uzunlukları bile ölçerken hiç hata yapmadan kesin sonuçlar veriyordu. Yine bu sistem yoluyla çok büyük uzunlukları ölçmeyi de başarmışlardı.

Hintliler kullandıkları ölçü birimlerinde 'angula'yı referans aldılar ve angula, orta büyüklükteki bir adamın orta parmağının orta bölümünün uzunluğu olarak belirlenmişti.

İSİM	EŞDEĞERİ	METRİK KARŞILIĞI
Angula	1 parmak	3.4925 cm
Hasta Kishku Muzam	24 angula	83.82 cm
Goruta Orkrosa Yojana		yaklaşık 14-15 km

Yollar ve şehir duvarları yaparken gerekli olan büyük uzunluklar için goruta, orkrosa ve yojana (yaklaşık 14-15 km) kullanılırken, aynı zamanda çok küçük uzunluklar da Hint bilim adamları ve matematikçileri tarafından ölçülebiliyormuş.

Lothal kentinde yapılan kazılarda 2 mm den küçük fildişi cetveller bulunmuş. Mohenjo-daro kazıları sonucu bulunan 33.5 cm lik bir cetvelin ise çok küçük birimlere hatasız bir şekilde bölünmüş olduğu görülmüş. Yine bu küçücük birimlerden oluşturdukları karelerle alan ölçümleri de yapmışlar.

Antik Hint metinlerinden Upanishads'da, bir atom ne kadar küçüktür sorusuna; "saçınızın bir tek telinin tepesine bakınız. Bunu 100 eşit parçaya böldüğünüzü hayal ediniz. Bu parçalardan bir tanesini de 100 parçaya bölerseniz, işte o kadar küçüktür" şeklinde cevap verilmiştir.

Eski Hint ölçüm birimleri tabelası, Jaipur jantar mantar

MEKSİKA

Eski Meksikalılar, kendi ölçme sistemlerini, vücutlarını ve ürettikleri pek çok el yapımı aletlerini kullanarak geliştirdiler. Ölçüm sistemleri çok kesin sonuçlar vermiyordu çünkü vücut ölçüleri kişiden kişiye, ölçüm aletleri ise kullanılan bölgeden bölge değişiyordu. Dolayısıyla ticari işlerin büyük kısmı iyi niyete ve bu alandaki deneyime dayalıydı. Bölgeler arasında ürün takası yapan 'pochtecas' denilen tüccarlar, ülke içindeki vergi ve finansal işleri kontrol etmek için Meksika İmparatorluğu içerisinde kullanılan ölçüm sistemini standartlaştırmak istediler.

Birçok uzunluk birimi resimli sembollerle gösterilirdi;

İSİM	EŞDEĞERİ
Cemacolli	Kol
Cemmolicpitl	Kemik
Cenmaitl	El
Cenxocpalli	Ayak izi
Cenyollotli	Kalp

Meksikalıların alanları nasıl ölçtüklerine dair kesin kaynaklar olmasa da, belirtilen uzunluk birimlerinden yola çıkarak cismin uzunluk ve genişliğini çarparak alanları yüzeyleri ölçtükleri tahmin ediliyor.

Bugün kullandığımız ölçüm sistemlerinden farklı ölçme sistemlerinin var olduğunu daha önce duymuş muydunuz? Duyduysanız hangileri? Duymadıysanız sizce neden?

Neden farklı kültürler farklı ölçüm sistemleri geliştirmiş olabilirler?

Bu gelişimi gerekli kılan sosyal, politik, ekonomik ve bilimsel faktörler neler olabilir?

Bizim kullanmakta olduğumuz ölçü sistemi hangi sistemdir? Bu sistem bizim kendi kültürümüze mi aittir? Sizce, eski zamanlarda kendimize ait ölçü sistemleri kullanmış olabilir miyiz?

OSMANLI DÖNEMİ ÖLÇÜ SİSTEMLERİ

Kanuni Sultan Süleyman devri matematikçilerinden Matrakçı Nasuh'un, ağırlık ve uzunluk ölçüleri üzerine yazmış olduğu önemli bir eser.

Osmanlı dönemi ölçü sistemlerinin temelini, Selçuklu ve Beylikler Dönemi ölçü birimleri oluşturmaktadır.

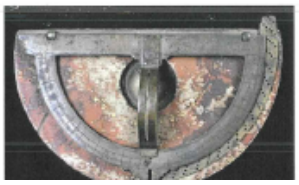
Osmanlı öncesi Türk ölçü sistemleri Orta Asya kaynaklıdır ve hem İran'la hem de Çin'le geliştirilen ticari ilişkiler sonucunda oluşmuştur.

Divan-ı Lügati't Türk gündelik yaşamda kullanılan ölçü ve tartı birimlerinin saptanmasında bu dönem için en önemli kaynaktır. Arazi ölçümlerinde kullanılan yerel ölçü adları bu kaynakta yer almaktadır.

Osmanlı'da eskiden kullanılan temel uzunluk ölçüsü '**arşın**' dı. Arşın (=68 cm), parmak ucundan dirseğe kadarki uzunluğu temel alırdı; bu bakımdan Eski Mısırlıların kübitine benziyordu. Farsça 'arş' kol, 'in' ise bu demektir.

Çarşı arşını, kumaş ölçmekte kullanılırdı. Kumaş, elde tutulup dirseğe dolandırılarak ölçülürdü. Daha sonra ipekli fiyatlarının artması dolayısı ile fiyatı yükseltme yerine ölçü birimi kısaltılarak, halka fiyatları pahalı göstermemek için 65 cm'lik Fars kökenli endaze birimi kullanıldı.

"Ben Haleb'de iken şu kadar arşın atlardım" diye bol keseden atan birine "Haleb ordaysa, arşın burada" demişler. Bir halk türküsünde, sevdiğinin belinin ince olduğunu anlatmak için "Ölçelim de o güzelin ince belini, Bir gümüş endâze ile" mısraları kullanılmış.



UZUNLUK ÖLÇÜ BİRİMLERİ

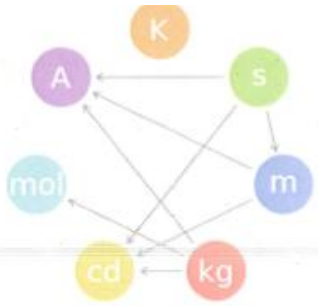
YEREL İSİM	EŞDEĞERİ	METRİK KARŞILIĞI
Nokta		0.219 mm
Hat	12 nokta	2.63 mm
Parmak	12 hat	3.157 cm
Ayak - Kadem	12 parmak	37.887 cm
Endaze		65 cm
Arşın		68 cm
Zirai	2 ayak	75.774 cm
Kulaç		1.8288 m
Berid - Menzil	600 ayak	227 m
Eski mil	5,000 ayak	1,894.35 m
Fersah	3 eski mil	5.685 km
Merhale	200 berid	45.480 km

ALAN ÖLÇÜ BİRİMLERİ

YEREL İSİM	EŞDEĞERİ	METRİK KARŞILIĞI
1 arşın^2		0, 57417 m^2
1 endâze^2		0,422500 m^2
1 evlek	400 arşın^2	229,668 m^2
Eski dönüm	4 evlek 1600 arşın^2	919 m^2
Büyük dönüm		2,720 m^2
1 ayak^2	144 parmak^2	0,14354 m^2
1 parmak^2	144 hat^2	0,00099751 m^2

1869'da çıkarılan bir yasayla Osmanlı İmparatorluğu'nda metre sistemine geçme kararı alınmış, ama bu uygulamada pek yaygınlık kazanmamıştır. Halkın, yüzyıllardır kullana geldikleri bu geleneksel ölçü birimlerini terk etmeleri pek kolay olmamıştır. 58 yıl boyunca hem uluslar arası hem de geleneksel birimler beraber kullanılmıştır.

METRİK SİSTEM

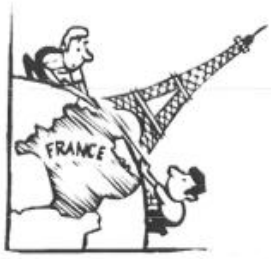


Birbiriyle ilişkili 7 uluslar arası birim. Saat yönünde Kelvin (ısı), saniye (zaman), metre (uzunluk), kilogram (ağırlık), kandela (ışık), mol (atom yoğunluğu), amper (elektrik şiddeti).

Yukarıda bahsettiğimiz bütün bu ilk ölçü birimleri iki ana nedenle itirazlara neden oluyordu;

Birinci neden, vücudun herhangi bir bölümünün büyüklüğüne dayanan bir ölçü biriminin (her insanın boyu, el ve ayak gibi organları farklı uzunluklarda olduğundan) ölçümü yapana göre değişmesiydi.

İkincisi ise, dijit, parmak, el, kübit, arşın, dirhem, kile ve kulaç gibi ölçü birimleri arasında hiçbir bağıntının bulunmamasıydı. Bunların hepsi uzunluk ölçümünde kullanılmakla birlikte, herhangi birini öbürüne doğru olarak dönüştürmek zordu.



Aynı büyüklüğün her ülkede değişik bir birimle ölçülmesi günlük yaşamda, uluslararası ticarette, özellikle bilim dünyasında büyük karışıklıklara yol açar. Bu karışıklığa son vermek için, 1960'ta Birleşmiş Milletler örgütünün öncülüğüyle uluslararası bir ölçü sistemi oluşturuldu. Fransızca adı Systeme Internationale d'Unites (Uluslararası Birimler Sistemi) olan ve tüm dünyada SI kısaltmasıyla bilinen bu sistem bugün bilim dünyasında büyük ölçüde benimsenmiştir. Ama günlük kullanımda metre sistemi ile İngiliz ve Amerikan sistemleri hâlâ egemenliğini sürdürüyor.

Eski Yunanca olan metre sözcüğü, "ölçü" anlamındadır. Metrik sistemde, uzunluk ölçüsünün birimi olarak kullanılan 1 metre, Kuzey Kutbu ile Ekvator arasındaki mesafenin 10 milyonda birine eşittir. Metrenin askatlarına ve üst katlarına, Yunanca ve Latince eklerden türetilen yeni isimler verildi. Uluslararası bir "örnek metre" yapıldı. Platinyum bir çubuktan yapılan bu metrenin üzerinde, 1 metre aralıkla iki çizgi vardır. Dünyanın her tarafında örnek olarak kabul edilen bu metreye bakılarak çoğaltılan uzunluk ölçüleri, tüm dünyada kullanılmaktadır. Fransız halkı, önceleri metrik sistemi kullanmamak için direndi. Ancak, 1837 yılında çıkarılan bir yasa ile bu sistemin kullanılması zorunluluk haline getirildi. Dünyanın her yöresindeki bilim adamları ise, bu sistemi kolayca benimsediler.

William Thomson ve James Clerk Maxwell,metrik Sistemin teorik gelişiminde etkili olan kişiler

Türkiye Cumhuriyeti'nin ilanından sonra, Atatürk Devrimleri ile, 1 Ocak 1933 ' te uluslar arası birimlerin kullanımı zorunlu hale gelirken geleneksel birimlerin kullanımı yasaklanmıştır. Örneğin bundan 80 yıl önce ülkemizde kumaşlar arşın ile ölçülür, ekmek okka ile, buğday kile ile tartılırdı. Bugün bu birimler tümüyle unutuldu; çünkü yıllardır dünyanın birçok ülkesinde olduğu gibi metre sistemini (metrik sistemi) kullanıyoruz.

Günümüzde hala kullanılagelen geleneksel ölçü birimleri var mı?

GÜNÜMÜZDE HALA KULLANILAN GELENEKSEL ÖLÇÜ BİRİMLERİ

Tarih boyunca birçok farklı kültür kendi resmi ölçüm sistemlerini oluşturmuş ve günü geldiğinde terk etmek zorunda kalmış olsalar dahi, bu sistemleri insanların kültürlerinden biranda koparıp atmak pek de mümkün olmamıştır.

Resmi olarak kullanımda olmasa da, bu alışılmış geleneksel sistemlerin bazıları dünyada birçok insan tarafından günlük yaşamda hala kullanılmaktadır. Ülkemizde de bugün güncelliğini yitirmiş olmasına rağmen eski uzunluk ölçü birimlerinden bazıları ile karşılaşılabilmektedir.

Çiftçiler arasında halen kullanılan Dönüm ve Evlek birimleri bu duruma verilebilecek örneklerden birkaçıdır.

DÖNÜM

Dönüm, 918,393 m^2'lik geleneksel Türk kökenli eski bir alan ölçüsüdür ve bir günde sürülebilecek arazi miktarını temsil etmektedir. Türkiye, İsrail, Filistin, Hırvatistan ve Balkanlarda hala kullanılmaktadır. Eskiden eni - boyu 40'ar adım olarak kullanılan bir alan ölçü birimiydi.

1931 yılında çıkartılan Ölçüler ve Ayarlar Kanununda dönüm biriminin kullanılmasından vazgeçilmek istenmiş ve yasada yer verilmemiştir. Ancak halk arasında dönüm birimi kullanılmaya devam edilmiştir.

Günümüzde ise 1000 m^2 alana eşit olan dekar yerine kullanılmaktadır.

Genelde Türkiye'de arsa ve tarlaların yüzölçümünü belirtmekte kullanılır. Eski Osmanlı alan ölçme birimlerinden dönüm'ün modern birim dekar'a olan yakınlığı sebebiyle günümüzde halk arasında dekar tabiri yerine dönüm ismi kullanılır.

1945 yılında Çiftçiyi Topraklandırma Yasası ile dönüm 1000 m^2'ye eşit kabul edilmiş ve halen bu şekilde kullanılmaktadır.

EVLEK

Evlek ise eskiden Türkiye'de ve Sırbistan'da kullanılan Türk kökenli bir alan birimidir. Evlek'in anlamı, sabanla bir geçişte işlenen arazi dilimdir.

Farklı kaynaklara göre;

1 evlek = 400 arşın kare = 229,667963 metrekare

1 evlek = ¾ dönüm = 302 metrekare

Günümüzde, Türkiye'nin bazı yörelerinde evlek kelimesi ar arazi birimi (1 ar = 100 metrekare) için de kullanılmaktadır.

Anadolu'da en fazla karşılaşılan ve kullanıldığı yere göre değişen bazı eski ölçü birimleri:					
Afyon	1 dönüm	2000.00 m^2	İzmir	1 satraç	0.57417 m^2
Ankara	1 mucur	32.3544 m^2	Karapınar	1 çiftçi dönümü	2500.00 m^2
	1 şinik	129.1883 m^2		1 yeni dönüm	2025.00 m^2
	1 yarım	516.753 m^2		1hükümetdönümü	1000.00 m^2
Aydın	1 satraç	0.57417 m^2	K.Maraş	1 çiftlik	3000.00 m^2
Bursa	1 muzur	4643.36 m^2	Niksar	1/2 tenekebuğday	1300.00 m^2
Eskişehir	1 araba ot	4-6 dönüm	Terme	1 kesim	3600.00 m^2
Erzurum	1 batman	459.336 m^2	Alaçam	1 kabak	8000.00 m^2
Ermenek	1 kutu	4.5-5 kg	Sivas	1 ölçek	918.672 m^2
Gaziantep	1 kile	160-170 kg		1 evlek	229.668 m^2
	1 timin	1/8 kile		1 kile	12861.408 m^2
Giresun	1 kod	1500.00 m^2	Tokat	1 rublağ	1837.344 m^2
	1 kıye	2500.00 m^2	Trabzon	1 kot	1200.00 m^2
	1 karış	20 cm^2	Ş.Urfa	1 timin	1837.344 m^2
İstanbul	1 kile	1837.344 m^2		1 çerik	150.00 m^2
	1 müd	36746.88 m^2			

Günümüzde eskiden olduğu gibi geçerli resmi ölçü birimlerinin yanında, anlamlarını, değerlerini ancak halkın bildiği bazı ölçü birimleri de kullanılmaktadır. Bu ölçü birimleri zamana uygunluk açısından değişiklikler göstermiştir. Bu ölçülerin her zaman belirli ve kesin bir birimi vermedikleri görülür. Bu değerler, Türkiye Türkçesinde de zamana, kullanıldıkları bölgelere ve ağızlara göre değişiklik gösterir. Bir tutam, bıkırtik, eşek sudan gelen kadar, it ölüsü gibi ağır vb. Ölçü birimlerinin pek çoğu günümüzde kullanılmamaktadır. Ancak bazı atasözleri, deyimler, manilerde ve türkülerde yaşamaktadır. Kullanılan birimlerin içerisinde farklı dillerden dilimize girmiş sözcükler de vardır.

Halk Dilinde Kullanılan Bazı Ölçü Birimleri	
Avuç	Elin ayası veya çukuru, avucun alabileceği nesne
Adam Boyu	İnsan boyu kadar yükseklik ölçüsü
Adım	Bir adıma eşit açıklık
Bir Kolaçı	İki kol uzunluğu
Fincan	Kahve fincanının alabileceği nesne
Kırık Kırpık	Ufak parça miktar ölçüsü
Grat	Bir tahıl ölçüsü
Zerrey-i Miskal	Çok ufak miktar için kullanılır.
Zırnık	Çok Az miktar ölçüsü olarak kullanılır

Ayrıca sahan, ton, arşın, bardak, çamça, damla, habbe, lokma, yudum, sürahi, çintik, tutam, pençe de ölçü birimleri olarak kullanılmaktadır.

Tüm bunların yanı sıra, Türkiye Türkçesi ağızlarında hala derlenmeyi, gün ışığına çıkartılmayı bekleyen pek çok sayıda kelime, deyim, kalıplaşmış söz bulunmaktadır.

Osmanlıca Sened-i Hâkânî Çevirisi

Sıra Numarası	SENED-İ HÂKÂNÎ						Şehr-i Defter	Eylül 311
25							Daire-i Belediye	
Liva	Saruhan	Kaza	Kırkağaç	Nahiye	( )	Karye	Yortan	Mülahazat
Semt-i Meşhûr						Rakam-ı Ebvâb		
Cinsi	Tarla ve çamlık							
Nev'i	Arz-ı mîrî							
Hududu	Şarkan Hoca-oğlu Ali tarlası ve garben yol ve şimâlen Hacı Abdullah tarlası ve cenûben bayır							
Mikdarı	İki yüz dönüm yetmiş beş ( ) dönüm on iki evlek kırk sekiz arşın							
Muhassası								
Sahib-i Evveli	Teb'a-i Devlet-i Aliyye'den Kramça oğlu kerîmesi Atike							
Cihet-i İtâ-yı Sened	Mezbûrenin vukû'-ı vefâtına mebnî oğluna intikâlinden							
Mutasarrıfı	Teb'a-i Devlet-i Aliyye'den oğlu Manad oğlu Hafız Mehmed							
Kıymeti	4000							
Bedeli								

Sebeb-i tasdîr-i tevkî-i Humâyûn oldur ki

Bâlâda muharrer dört bin kuruş kıymetli tarla ve çamlık _____ Defter-hâne-i Hâkânî'de Hafız Mehmed _____ uhdesine kaydolunmuş olmağla a'şâr-ı şer'iyyesiyle otuz bedel-i öşrünü _____ sene be-sene memûrîne edâ etmek üzere zabt u tasarrufunu hâvî merkûm yedine işbu tapu senedi i'tâ kılındı

11 Şevval sene 1314 ve 3 Mart sene 1313

Defter-i Hâkânî **(Mühür)**

Yukarıda Osmanlı Döneminden kalan bir tarla tapusunun çevirisi verilmiştir.

Tapuda eski birimle belirtilen tarlanın alanını günümüzde kullandığımız birimlere çevirelim. Nasıl düşündüğünüzü tartışalım.

Aşağıdaki eski ölçüm birimlerini kendi içlerinde birbirine dönüştürünüz.

UZUNLUK ÖLÇÜLERİ	ALAN ÖLÇÜLERİ
12 nokta = 1 hat	1 eski dönüm = 1600 arşın^2
12 hat = 1 parmak	1 eski dönüm = 4 evlek(alştrm)
12 parmak = 1 ayak	1 evlek = 400 arşın^2
2 ayak = 1 zirai	1 ayak^2 = 144 parmak^2
600 ayak = 1 menzil	1 parmak^2 = 144 hat^2
5000 ayak = 1 eski mil	
3 eski mil = 1 fersah	

Uzunluk ölçüleri:

3 hat = ... nokta

10 hat = ... nokta

6,5 hat = ... nokta

54 nokta = ... hat

108 nokta = ... hat

840 nokta = ... hat

1 parmak = ... hat

15 parmak = ... hat

1 parmak = ... nokta

120 hat = ... parmak

144 nokta = ... parmak

720 nokta = ... parmak

1 ayak = ... parmak

7 ayak = ... parmak

72 parmak = ... ayak

3 ayak = ... hat

12,5 ayak = ... hat

10 ayak = ... nokta

864 hat = ... ayak

5 zirai = ... ayak

30 ayak = ... zirai

15 zirai = ... parmak

216 parmak = ... zirai

1 menzil = ... ayak

4 menzil = ... ayak

10 menzil = ... parmak

6000 ayak = ... menzil

2400 ayak = ... parmak

1 eski mil = ... ayak

6 eski mil = ... ayak

15000 ayak = ... eski mil

1 fersah = ... eski mil

1 fersah = ... ayak

3 fersah = ... mil

3 fersah = ... ayak

Alan ölçüleri:

5 eski dönüm = ... arşın^2

1 ayak^2 = ... parmak^2

20 ayak^2 ..... parmak^2

1 ayak^2 = ... hat^2

10 ayak^2 = ... hat^2

1 parmak^2 = ... hat^2

8 parmak^2 = ... hat^2

1 parmak^2 = ... nokta^2

12 parmak^2 = ... nokta^2

ÖRNEK:

Osmanlı'da nakışlı giysiler, örtüler, gelinlikler, tülbentler çok gözdeydi. Ama nakış işlemenin zorluğu bakın 17. yüzyıla ait bir belgede nasıl dile gelmiş:

"İşletmek için emrolunan çadırşebler cümle yedidir. Her biri beşer endir. Otuz beş en olur. On nefer nakış işleyici mutemede hatun bulunmak müyesser olmadı. Bazı ekâbire hatunlara birkaç para verdim. Bana hassaten işler gönderdiler deyu bazı yerlerde söylemişler, işiderek ihtiyar etmeyip aldım. Gayri kimselere verdim. Ve bazı hatunlar dahi işlemeğe almışlar iken ince iştir, işlemeğe kudretimiz yoktur deyu getirip bıraktılar. İşliyenler dahi günde bir dirhemden ziyade işliyemezler, her bir çadırşebe dört yüz elli dirhem ve beş yüz dirhem ibrişim gider. Bunların tamamı olmasına şol ki makduru bendeî âciz ve hakir bir sarfolunmuştur. Baki ferman devletlu sultanım hazretlerinindir."

Bu fermandan kum iğnesiyle işletilmek istenen, her biri beşer en olan yedi yorgan yüzünü, çok zahmetli olması nedeniyle usta hanımların işlemek istemediği, işlemek üzere alan bazı hanımların ise yarım bıraktığı, işleyenlerin de günde bir dirhem işledikleri anlaşılmaktadır. Hatta söylentiye göre nakış öyle bir sanatmış ki, ince ve sürüncemeli bir iş olmasından dolayı nakış işleyen kızların gözü birkaç yılın içinde 'kör' olurmuş...

Fakir evlerden saraya Nakış...

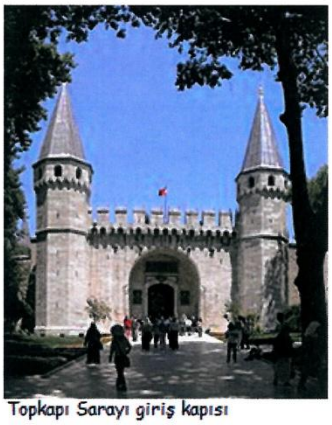
Osmanlı döneminde şehirdeki en fakir evden zengin konaklara ve saraya kadar pek çok yerde yapılan nakış işleme sanatı, bütün zorluğuna rağmen herkesin beğendiği bir el sanatıydı. Bu yüzden de evlerde yaygın biçimde süren işleme öğretiminde geleneksel yol izlenir, büyükler bildikleri teknikleri gençlere öğretirdi. Bu arada evden eve giderek işleme teknikleri öğreten ustalar da vardı.

Şekilde atlas kumaş üzerine işlenmiş Osmanlı nakış motifi örneği verilmiştir. İşlemeli giysi yapımında kullanılmak üzere yukarıdaki örneğe bakılarak nakış yapılacaktır. Aynı nakışı işlemek için kaç m^2 atlas kumaş almamız gerekir?

(*ATLAS: İnce ipekten sık dokunmuş, düz renkte, sert ve parlak bir kumaştır. Genellikle kırmızı renkte dokunurdu. Atlas, tel adedine ve dokunuşuna göre kıymetlenen bir kumaştır. Padişahlara mahsus giyim eşyaları arasında atlastan kaftanlar dikkati çekecek çoğunluktadır.)

ÖRNEK:

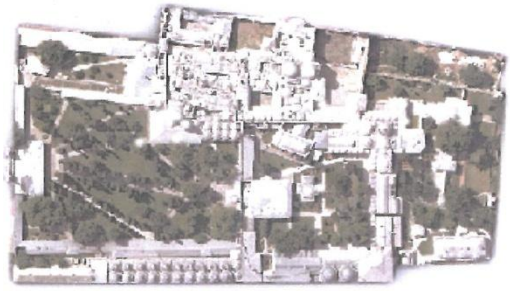
Topkapı Sarayının İstanbul Boğazından görünümü



Topkapı Sarayı giriş kapısı

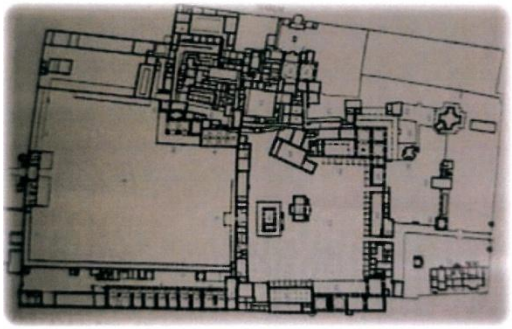
Topkapı Sarayı (Osmanlı Türkçesi: سرایی طوپقپو), İstanbul Sarayburnu'nda, Osmanlı İmparatorluğu'nun 600 yıllık tarihinin 400 yılı boyunca, devletin idare merkezi olarak kullanılan ve Osmanlı padişahlarının yaşadığı saraydır. Bir zamanlar içinde 4.000'e yakın insan yaşamıştır.

Topkapı Sarayı Fatih Sultan Mehmed tarafından 1478'de yaptırılmış, Abdülmecit'in Dolmabahçe Sarayı'nı yaptırmasına kadar yaklaşık 380 sene boyunca devletin idare merkezi ve Osmanlı padişahlarının resmi ikametgahı olmuştur. Kuruluş yıllarında yaklaşık 700.000 m.² lik bir alanda yer alan sarayın bugünkü alanı 80.000 m²



Topkapı Sarayının havadan fotoğrafı

Sizce, inşa edildiği tarihlerde Topkapı Sarayı, Osmanlıca eski metinlerde hangi ölçü birimleriyle ifade edilmiş olabilir?

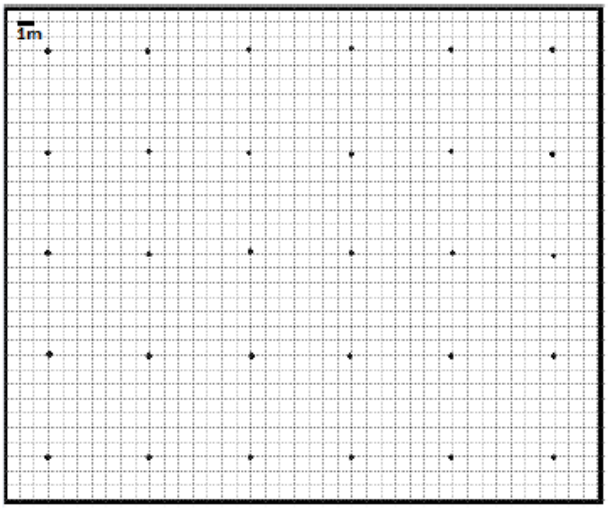


Topkapı Sarayı'nın bugünkü alanını, belirlediğiniz ölçü birimi cinsinden yazabilir misiniz?

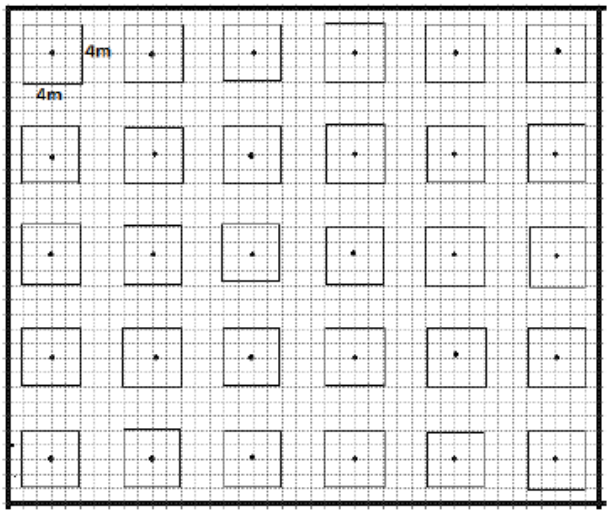
Ara tarımı

Meyve bahçelerinin ilk yıllarında sıra aralarındaki boş alanlarda yapılan yetiştiriciliğe "ara tarımı" denilmektedir. Ara ürün sadece sulama suyunun bol olduğu yerlerde, geçici bir dönem için yapılabilir. Ara ürün, bahçenin normal sulama ve ilaçlama programına uygun olmalıdır. Yine ara ürün zararlı, böcek, virüs, yabancı otlar ve hastalıklara yataklık yapmamalıdır. Ara ürün ekonomik bakımdan gerekli olabilir. Ancak ağaç geliştikçe ara ürün alanı daraltılır ve sonuçta kaldırılır. Aksi durumda ağaçların gelişmesini büyük ölçüde yavaşlamaktadır.

Zeytin bahçelerinde, hastalık bulaşma riskini artırdığı için Badem, Kayısı, Kiraz, Erik, Şeftali, Asma, Akçaağaç, At kestanesi, Karaağaç, Böğürtlen, Karpuz, Çilek, Pamuk, Bamya, Domates, Biber, Patlıcan, Patates, Ayçiçeği gibi bitkilerin ara tarımı yapılmamalıdır.



Şekilde krokisi verilen araziye kare şeklinde bodur zeytinler dikilmiştir. Dar taçlı ve kısa boylu olduğu için yaşam alanı sadece 4x4m = 16 m^2 olan bodur zeytinden arta kalan boş arazi, 7 yıl verim alabilecek şekilde kekik ekilerek değerlendirilmek isteniyor. Buna göre, kekik ekmek için kaç m^2 arazimiz olduğunu hesaplayınız.

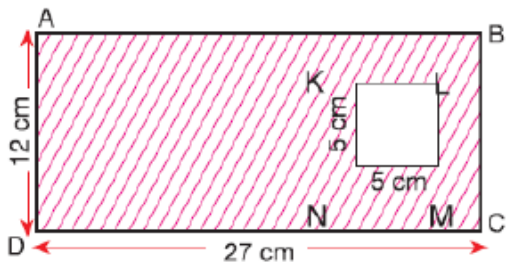


✓ Ağaçların yaşam alanı şekil üzerinde gösteriniz:

✓ Bütün alan bulunuz:

✓ Bütün alandan, ağaçların yaşam alanı çıkarılarak geriye kalan arazi miktarını hesaplayınız:

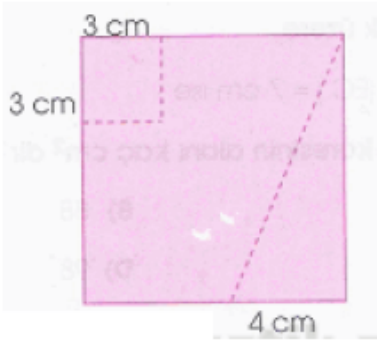
Örnek soru:



Şekilde verilen karesel ve dikdörtgensel bölgelerin alanlarını kullanarak taralı alanın kaç desimetrekare olduğunu bulunuz.

Örnek soru:

Bir kenarının uzunluğu 10 cm olan şekildeki karenin noktalı yerlerinden kesilerek parçalar çıkartılıyor. Kalan kısmın alanı kaç cm^2'dir?

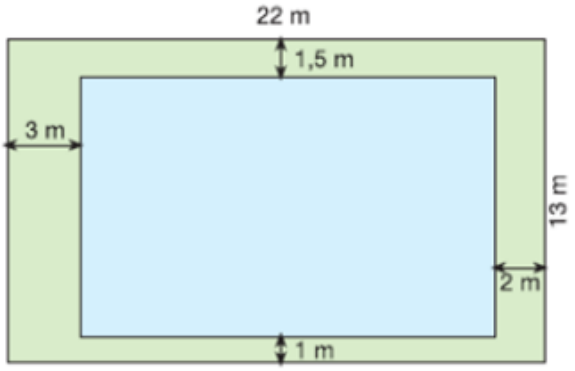


Örnek soru:

Şekilde verilen araziye zeytin dikilecektir. Zeytinler uygun aralıklarla dikildikten sonra, dışta kalan bir miktar arazi alan yetersizliğinden dolayı boş kalmaktadır. Buna göre ;

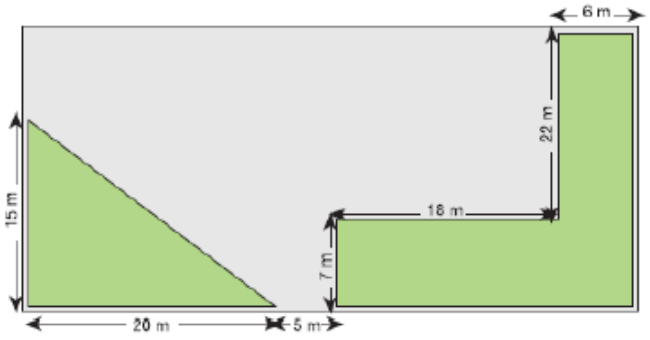
a) Zeytin dikilen bölgenin alanını bulunuz:

b) Bahçenin etrafında ağaçsız kalan bölgenin alnını bulunuz:

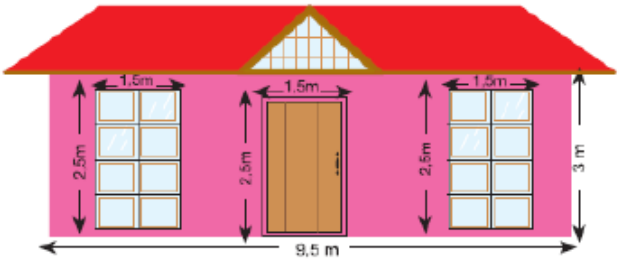


Örnek soru:

Okulunuzun bahçesine ağaçlandırma çalışması için meşe fidanı dikeceksiniz. Bahçenin krokisi şekilde veriliyor. Ağaç dikilecek alnalar yeşil renkle gösterildiğine göre ağaç dikilmeyen alanın kaç metrekare olduğunu bulunuz.



Örnek soru:

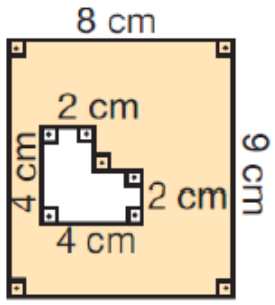


Resimde verilen evin pembe ile boyalı kısmının alanı kaç metrekaredir?

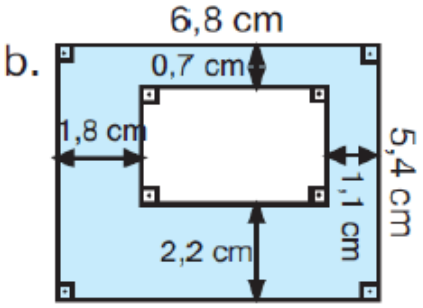
Örnek soru:

Aşağıdaki düzlemsel şekillerde boyalı bölgelerin alanını bulunuz.

a.



b.



[redacted], İzmir ilinin, Kemalpaşa ilçesinin etrafı çam ağaçlarıyla çevrili bol oksijenli güzel bir köyüdür. İzmir'e 35, Kemalpaşa'ya 13 km uzaklıkta olan köyümüzün nüfusu 1501 (450 hane) 'dir.

Köy halkı Ortaasya'dan İran'daki Horasan bölgesine gelmiş, oradan şimdi il olan Karaman'a gelmişlerdir. Osmanlılar zamanında Kendilerine toprak verilerek göç hayatından yerleşik hayata dönmüşlerdir. Spil dağı eteklerinde Sancaklı yörükleri denen bu topluluğu barındıran Akalan, Çambel, Sancaklı, İğdecik, Bozköy gibi akraba yerleşim yerleri vardır.

1990'lı yılların sonlarına doğru [redacted] ve [redacted] köyleri arasında çıkan yangında o bölgede bulunan ağaçlar yok olmuştur aynı yıl içerisinde tekrar dikim yapılmıştır.

Köyde ilk okul 1920'li yıllarda açılmıştır. Bugün 110 yaşında olan kadınlar bile okuma-yazma bilmektedir, okuryazarlık oranı % 100 dür.

Tipik Akdeniz iklimi görülür. Yılda 2-3 defa kar yağar. Donlu günlerin toplamı 15'i geçmez. Bu nedenle köyde mandalina, portakal, zeytin yetişir ancak limon yetişmez. Köyde poyraz rüzgarı çok eser. Lodos estiğinde deniz kokusunu hissedebilirsiniz.

Kemalpaşa'dan taşan sanayi köyün altına doğru gelişmektedir. Ağır endüstri, elektronik, turşu, defne, bal vb. fabrikaları köyde yaşayan halka iş imkânı sağlamaktadır. Ayrıca köyümüzde yetiştirilen üzüm, kiraz ve zeytin bahçeleriyle de ekonomiye katkı sağlanmaktadır.

Aşağıda köyümüzün belli bir oranda küçültülmüş kuşbakışı uydu fotoğrafı bulunmaktadır;

Haritadan yararlanarak, köyümüzün yüzölçümünü hesaplamaya çalışalım (tarım alanları hariç). Daha sonra da bulduğumuz sonucu gerçek değer ile karşılaştırıp, gerçek yüzölçümüne ne kadar yaklaştığımıza bir bakalım:

Yerleşim bölgesinin sınırlarını belirleyelim:

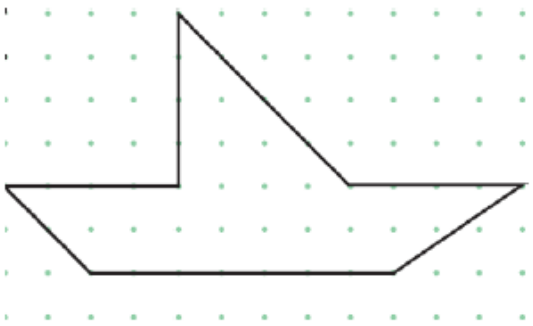
- ✓ Köyün alanını hesaplamak için, haritada verilen hangi bilgilerden yararlanabiliriz?
- ✓ Köyümüzün yerleşim bölgesi, yukarıdan baktığımızda düzgün bir çokgen oluşturmuyor! Bu durumda alanı ölçebilmek için nasıl bir strateji geliştirebiliriz?

Alan dörtgensel ve üçgensel bölgelere bölünür;

Sol alt köşede gösterilen 200 m uzunluğu referans alarak gerçek alana ulaşmaya çalışalım, elde edilen sonuç, gerçek yüz ölçüm ile kıyaslanır.

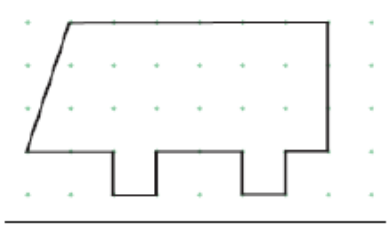
Örnek soru:

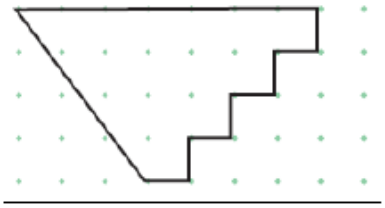
Verilen şeklin alanını, uygun üçgensel ve dörtgensel bölgelere ayırarak bulalım:

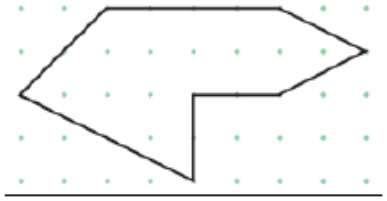


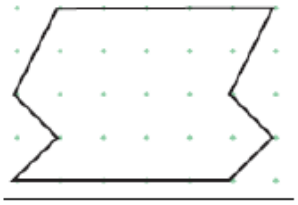
Örnek soru:

Aşağıda verilen geometrik şekilleri uygun çokgenlere ayırarak alanlarını birim kare cinsinden bulunuz.



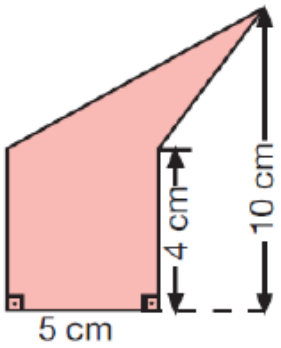






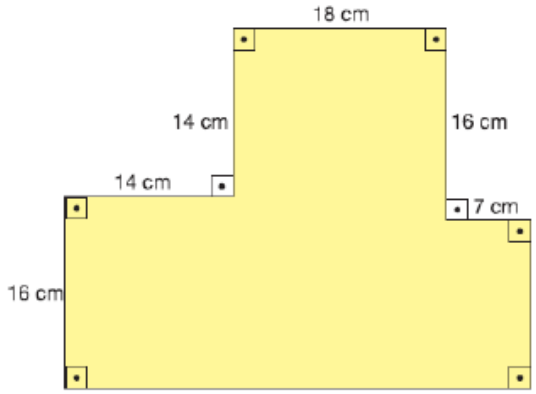
Örnek soru:

Yandaki düzlemsel şeklin alanı kaç cm^2 dir?



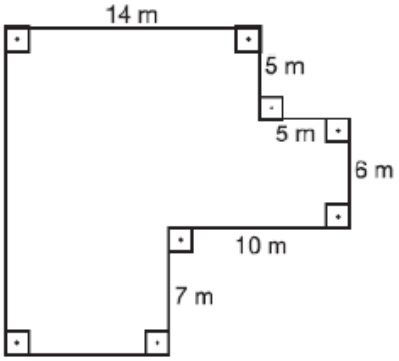
Örnek soru:

Yandaki verilen şeklin alanını bulunuz:



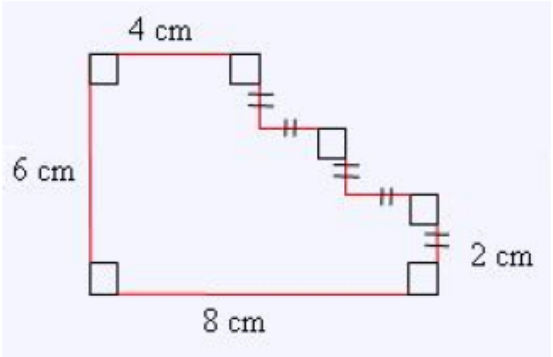
Örnek soru:

Yanda verilen şeklin alanını bulunuz.



Örnek soru:

Yanda verilen şeklin alanını hesaplayınız



Zeytin ve Kültür

Halk edebiyatında zeytin;

Zeytin ve zeytinyağı, köklü tarihi ve saymakla bitmeyen yararlarının yanı sıra, "zeytinyağı gibi üste çıkmak, Bağ babadan, zeytin dededen kalmalı, ağzına bir zeytin verip altına tulum tutar, zeytin dalı uzatmak" deyimlerinde olduğu gibi halk edebiyatına da yansımıştır. Köy tabirleri arasında da yerini almıştır: "huna huna zeytine bak yerdeki döşşek gibi" ...

Türkülerde zeytin;

Zeytinyağlı Yiyemem

Zeytinyağlı yiyemem (aman)
Basma da fistan giyemem (aman)
Senin gibi cahile
Ben efendim diyemem (aman)

Kaldım duman içi dağlarda
Sevgiliyarim nerelerde

BURSA

"Zeytinyağlı yiyemem diğer adıyla gelin nazlanması olarak da bilinen bu halk türküsü isminden de anlaşılacağı üzere bir gelinin nazlanmasını anlatır. Türkü, zengin iyi yerlerde yetişmiş okumuş bir genç kızın dağ yöresinde bir köye gelin olarak verilmesiyle başlar. Gelin kız yaşamaya başladığı yeni çevreye ve insanlara uyum sağlayamaz onlar gibi basmadan elbiseler giyemeyeceğini damak tadının onların yemeklerine uymadığını böyle bir yere gelin gittiği için yaptığı çeyizlerin boşa olduğunu söyler ve duman içi dağlarda yalnız kaldım diyerek eski yaşantısına duyduğu hasreti dile getirir..."

Zeytin Dalları Zeybeği

Zeytin dallarında tabakam kaldı
Dört yanıma baktım aman devriyeler sardı
Alim kırk kişiden bir haber aldı

Uyan Alim uyan aman uyanamaz oldum
Yağlı kurşunlara anam dayanamaz oldum

Zeytin dallarından atlayamadım
Döküldü cephanelerim toplayamadım
Zalim düşmanları haklayamadım

SİLİFKE

"Türküde adı geçen Ali, yiğit ve yakışıklı olmasından dolayı yörede sevilen birisidir. Bir olaydan dolayı dağa çıkmak zorunda kalır. Ancak bir gün jandarmalar tarafından sıkıştırılır ve uyuduğu zeytin ağacının üzerinde vurulur. Cesedi yere düşer, tütün tabakası ve bazı eşyaları ağacın üzerinde kalır. Köylüler geldiği zaman Ali'yi al kanlar içinde yerde, tütün tabakasını da ağacın üzerinde bulurlar. Bu manzara karşısında, Zeytin Dalları Zeybeği, bir köylü tarafından orada irticalen söylenmiştir."

Şiirlerde zeytin;

Her Gün Yaşamak – Arif DAMAR

"Yaşamak sadece sevmektir, inan bana.
Sevmeyenler dünyamızda yaşamıyor.
Yaşamak suda, toprakta, insanlarda görünerek;
bir zeytin ağacı gibi.
Bir zeytin ağacı gibi, ne güzel
denize yakın olacaksın,
uzayan dallarında, yapraklarında ışık
ta derinlerde köklerin.
Bir zeytin ağacı gibi, bin yıl severek
yaşamak her gün..."

Arif DAMAR

Yaşamaya Dair

"...
Yani, öylesine ciddiye alacaksın ki yaşamayı,
yetmişinde bile, mesela, zeytin dikeceksin,
hem de öyle çocuklara falan kalır diye değil,
ölmekten korktuğun halde ölüme inanmadığın için,
yaşamak yanı ağır bastığından. ..."

Nazım HİKMET

Ha Aşk Ha Zeytin

"Çocuktum, ayıramazdım
Ha aşk, ha zeytin
Aşkı yazsam kağıttan utanırdım,
O benden de mahcup
Zeytine uzansam dalından kırılırdım,
Benden de çocuk
İkisini de gözle toplamayı sonradan öğrendim..."

Haydar ERGÜLEN

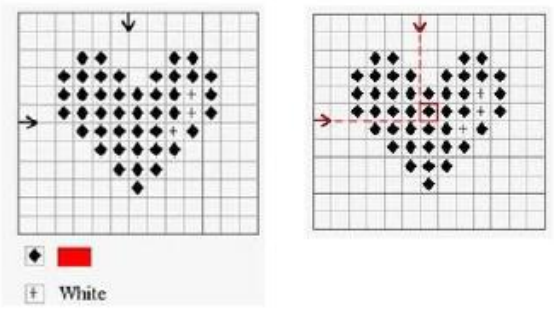
El sanatlarında zeytin;

Zeytin, zeytin ağacı ve zeytinyağı, yukarıda bahsettiğimiz gibi Anadolu Halk Edebiyatı'nda geniş yer tutmasının yanı sıra, ağacın dallarından kaşık, kepçe, tabak, masa, oyuncak; zeytin çekirdeğinden tespih, bilezik, kolye yapılmıştır ve birçok yöresel el sanatına da motif olmuştur;

KANAVİÇE İŞLEME TEKNİĞİ:

Genellikle bir zemin, (kumaş, deri, kadife) üzerine sonradan iğne iplikle örülen şekillere "**işleme**" diyoruz. Eğer işleme bir zemin üzerine değil de, tığ ile elde işlenirse, buna "**dantel**" veya "**oya**"; kumaş üzerine sonradan sökülmek üzere yardımcı bir kanava üstünden işleniyorsa, buna da "kanaviçe" diyoruz.

İşlemecilik insanlık tarihi kadar geçmişi olan çok eski bir el sanatıdır. İlk örneklerine Orta Asya Türklerinde rastlanır. Bu işleme sanatı göçlerle ve elçilerle batıya ve diğer ülkelere de yayılmıştır. Geleneksel kültür içinde devam ede gelen süs ve süsleme güzel ve güzellik olgusu da insanların tüm yaşamlan boyunca terk edemedikleri yaşam biçimi olmuştur. Kanaviçe işleme tekniği; Anadolu'da 16. yüzyıldan itibaren uygulanmış fakat 19. yüzyıldan itibaren yaygınlaşarak Anadolu halk işlemeleri içerisinde yerini almıştır. Kanaviçe ya da etamin işi seccade, pike tablo, masa örtüleri, s gibi birçok el işinde sıklıkla tercih edilen bir yöntemdir.



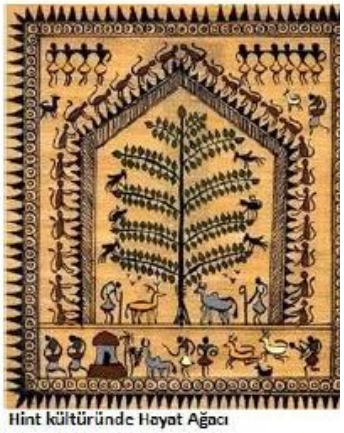
HAYAT AĞACI, kökeni tarih-öncesi denilen devirlere kadar uzanan, başta Asya Şamanistleri olmak üzere, pek çok gelenekte rastlanan bir semboldür.

Eski Türk geleneğine ve Şaman inançlarına göre, bu Dünya'yı ortasından (göbeğinden) öte-âleme ve Demir-Kazık Yıldızı'na bağlayan, dalları vasıtasıyla şamanlara yeryüzünden yüksek âlemlere yolculuk yapma olanağı sağlayan bir ağaçtır.

Eski Mısır'dan bir Hayat Ağacı örneği

Geniş anlamda sürekli gelişim ve değişim içinde yaşayan evreni sembolize eder. Evrenin üç elementini: toprağın derinliğine inen kökleriyle yeraltını, alt dalları ve gövdesiyle gökyüzünü, ışığa yükselen üst dallarıyla cenneti birleştirir.

İnsanoğlu geçmişten günümüze uzanan yolculuğunda pek çok varlığı kutsal saymış, kutsal saydığı varlıkları yazıya, dile, dine, sanata dökerek günümüze ulaşmasını sağlamıştır. İnsanoğlu'nun bu kutsal saydığı varoluşlardan belki de en bilineni Hayat Ağacı'dır.



Hint kültüründe Hayat Ağacı

Hayat Ağacı-Sivas/Divriği Ulu Camii

Toplumlarda hayat ağacının sembollerinden bir tanesi de zeytin ağacıdır. Bazı yazılı kaynaklarda tarif edilen yaşam ağacı figürü zeytin ağacına oldukça benzemektedir: Yakut geleneğinde, Yerin Göbeği'nden çıkan, çiçek açan bu ağacın tepe kısmının köpüklü, sarı, insanlara şifa verici bir sıvı içinde olduğu ifade edilir. Ayrıca Hıristiyan geleneğine göre, yaşam ağacı,12 defa meyve veren, yaprakları ulusların şifa bulmasını sağlayıcı bir ağaç olarak belirtilir (Vahiy, 22/2).

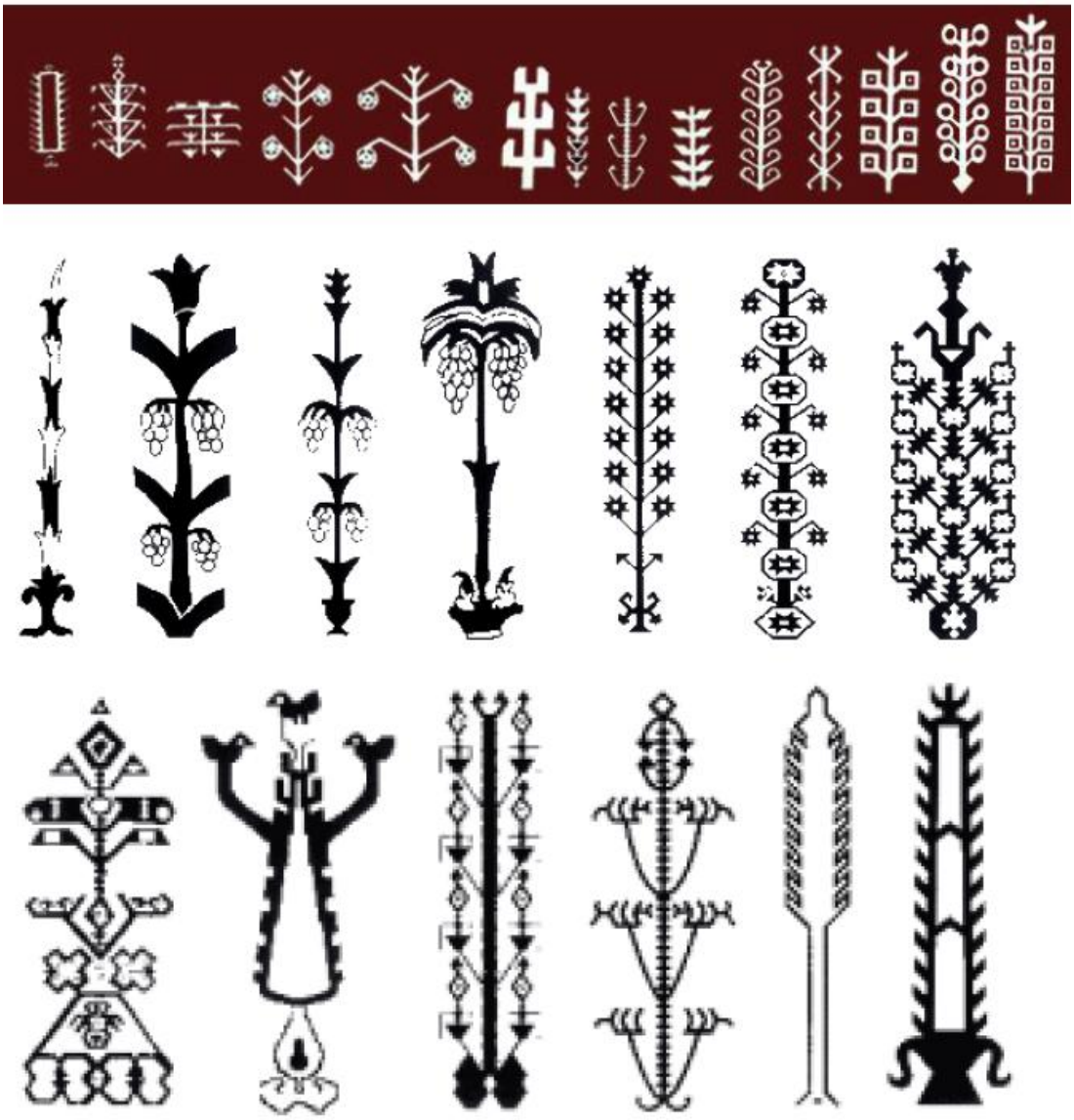
Hayat Ağacı formu, birçok uygarlığın çeşitli stilize motiflerle taş, tahta, çömlek, çini işleme, dokuma, cam, tezhip, minyatür, edebiyat ve müziğinde yer almıştır.

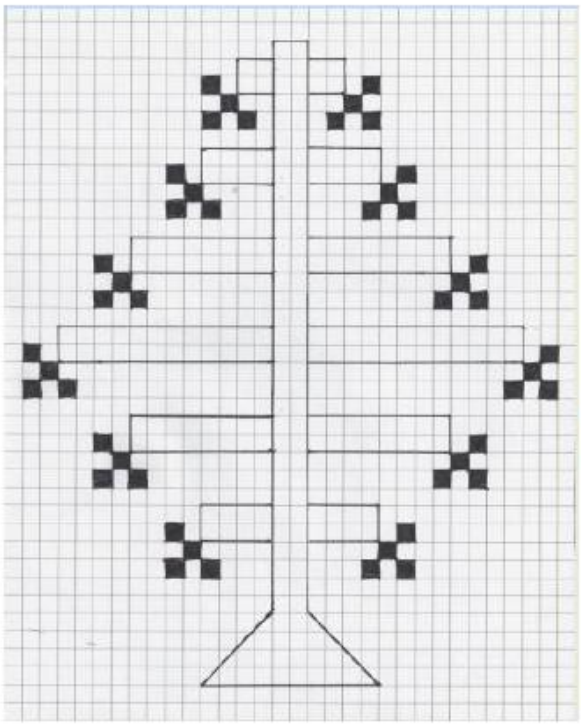
Sonuç olarak hayat ağacı hemen hemen bütün kültürlerde bir şekilde var olmuş ve önemli sayılmıştır. Var olduğu ilk dönemlerden, modern dönemlere kadar kullanımını gördüğümüz hayatağacı, bugün otantik figürler olarak karşımıza çıkmaktadır. Anadolu'da önemi hep var olan hayatağacı Türk- İslam sanatında da pek çok şekilde yer almakta ve el sanatlarından, inançlara kadar her yerde karşımıza çıkmaktadır.

Sonsuzluğun sembolü, ölümsüzlüğü araştırmanın ve ölümden sonra yaşam olduğu umudunun bir nişanı olan hayat ağacı motifi, geleneksel Anadolu işleme sanatlarında en çok kullanılan motiflerden biri olagelmiştir.

Anadolu'dan mezar motifi

ANADOLU MOTİFLERİNDE HAYAT AĞACI;





a) Şekilde verilen hayat ağacı motifinin bütün kenar uzunlukları iki katına çıkarılarak yastık üzerine işlenecektir. Oluşan yeni motifin alanının kaç birim kareyi kapladığını hesaplayınız. Yeni motif ile orijinalinin alanlarını kıyaslayınız.

Normalde 100 ilmek ile işlenen bu motifin kenar uzunlukları 3 katına çıkarılınca ne kadar ilmek atılması gerekir?

b) Şekilde verilen hayat ağacı motifinin bütün kenar uzunlukları yarıya indirilerek çarşaf kenarlarına işlenecektir. Oluşan yeni motifin alanının kaç birim kareyi kapladığını hesaplayınız. Yeni motif ile orijinalinin alanlarını kıyaslayınız.

Normalde 100 ilmek ile işlenen bu motifin kenar uzunlukları yarıya indirilince ne kadar ilmek atılması gerekir?

c) Çokgensel bölgelerin kenar uzunlukları artıp azaldıkça alanlarında meydana gelen değişimi açıklayınız.

BARIŞIN SEMBOLÜ

"ZEYTİN DALI":

Zeytin bir kültür bitkisi olarak M.Ö 4000 yılında yetiştirilmeye başlanmış ve yağının kullanılması da M.Ö 2500 yıllarında gerçekleşmiş. O günlerden bu günlere zeytin çok önemli bir bitki haline gelmiş.

Dünya zeytin ansiklopedisinin yazarı Jose M Blazquez zeytinin 6000 yıl önce Anadolu'da ortaya çıktığını savunsa da bu konuda net bir bilgi bulunmamaktadır.

Zeytin dalının barış anlamında kullanılması ise Büyük Tufan'a ve Antik Yunan mitolojisine dayanıyor...

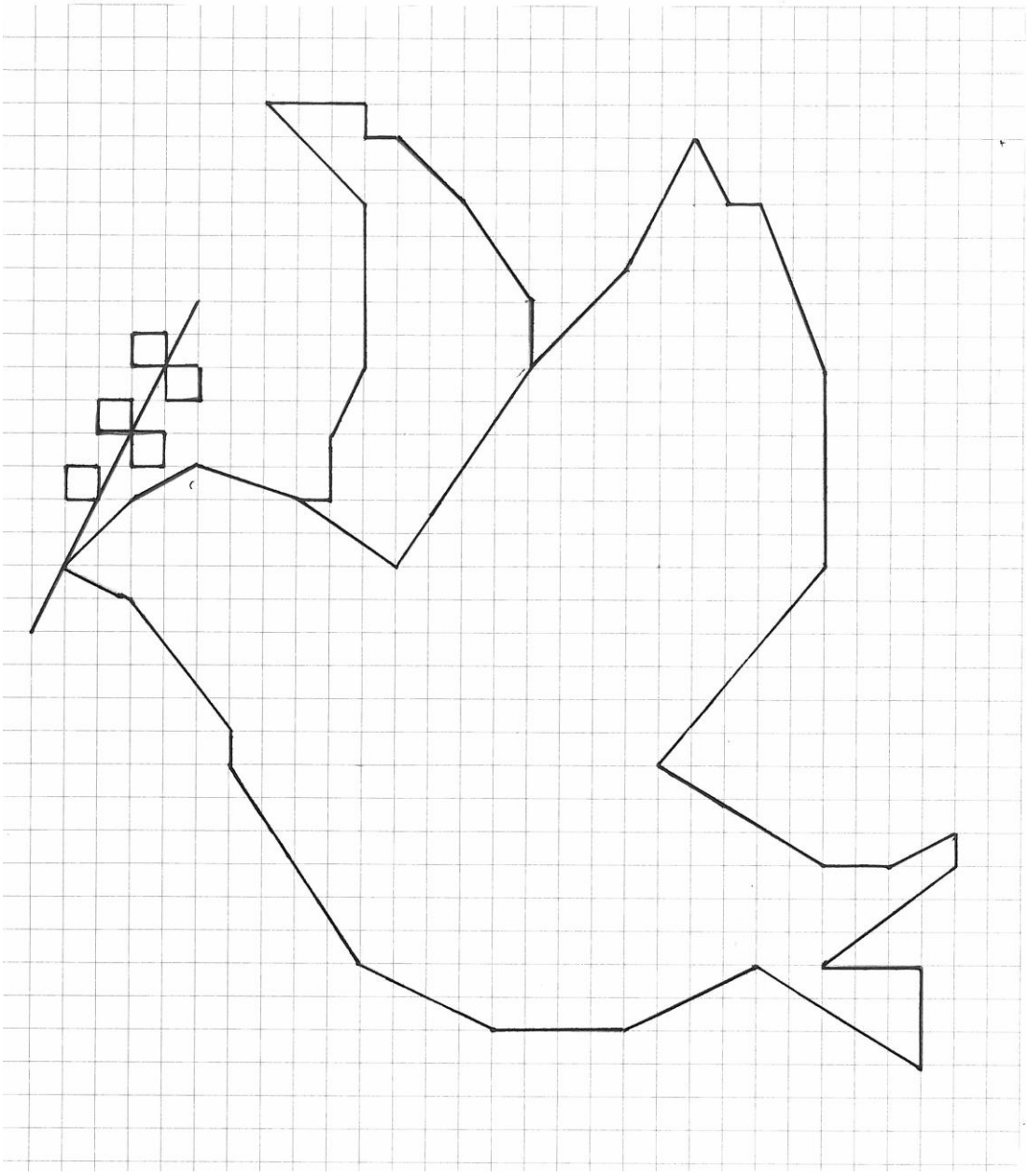
Rivayete göre Büyük Tufanda Nuh Peygamber gemisine aldığı hayvanlarla tufana karşı yola koyulur. Tufan biraz durulur gibi olunca da Hz Nuh gemideki beyaz bir güvercini güverteden uçurur. Güvercin ağzında bir zeytin dalı ile geri döner. Bu durumu Hz Nuh, tufanın bitişine ve yeniden karanın görülmesi ve bitkilerin yeşermesine işaret olarak görür. Daha başka bir değişle Allah'ın insanlığı affettiği ve kalıcı barış sürecinin başladığının da işaretidir. O zamandan bu zamana ağzında zeytin dalı taşıyan güvercin barış işareti olarak yorumlanmıştır.

Athena zeytin ağacını kutsarken

Zeytin ağacı Yunan Mitolojisi'nde çok özel bir yere sahiptir. En önemlisi zeytin ağacı, bereket ve barışın temsilcisi tanrıça Athena'nın insanlara bir armağanıdır. Yunan mitolojisinde yer alan efsaneye göre, Atina şehri yeni kurulmaktadır ve şehrin tanrısı kim olacağı söz konusu olur. Tanrılar kralı Zeus, bir yarışma düzenler. Yarışmaya göre bu şehre en değerli armağanı verecek olan, kentin koruyucusu olacaktır. Yarışmaya Zeus'un kızı tanrıça Athena ile deniz tanrısı Poseydon katılır. Yarışmada ilk önce denizler tanrısı Poseydon, denizden ihtişamlı bir at çıkarır. Bu at çok ağır yükleri taşıyabilecek ve savaşlarda çok büyük yararlılık gösterebilecek güçtedir. Athena ise topraktan bir zeytin ağacı çıkarır ve yarışmayı kazanır, bunun karşılığında hem Atina'nın koruyucu tanrıçası olur, hem de şehre adı verilir. Mitolojiye göre tanrıça Athena, zeytin ağacını barışı ve medeniyeti simgelediği için armağan etmiştir Atinalılar'a. Bu seçim "at" yerine zeytin ağacını seçmek değildir sadece... Halk bu seçimiyle aynı zamanda göçebelik yerine yerleşikliği, savaş ve talan yerine barış ve uygarlığı seçmiştir.

Örnek Soru:

Şekildeki kenar uzunlukları verilen güvercin ve zeytin dalı desenini, barışı temsil etmesi için okulumuz duvarlarının belli kesimlerine çizmeyi düşünüyoruz. Fakat oldukça küçük olan bu örnek desenin, uzaktan görülebilir hale gelmesi için, kenar uzunluklarını 3 katına çıkarmayı düşünüyoruz. Bu durumda şeklin alanında nasıl bir değişme olur? Tahmin ediniz. Eski ve yeni alanı hesaplayarak tahmininizi kontrol ediniz.



APPENDIX B

Permissions

UYGULAMALI ETİK ARAŞTIRMA MERKEZİ
APPLIED ETHICS RESEARCH CENTER

ORTA DOĞU TEKNİK ÜNİVERSİTESİ
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31 Temmuz 2013

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İlköğretim Fen ve Matematik Eğitimi Bölümü

Gönderen : Prof. Dr. Canan Sümer
IAK Başkan Vekili

İlgi : Etik Onayı

Danışmanlığını yapmış olduğunuz İlköğretim Fen ve Matematik Eğitimi Bölümü Yüksek Lisans öğrencisi Hatice Ezgi Aktuna'nın "An instruction integrated with ethnomathematics' contribution to the 6th grade students' achievement and attitude on mathematics" isimli araştırması "İnsan Araştırmaları Komitesi'' tarafından uygun görülerek gerekli onay verilmiştir.

Bilgilerinize saygılarımla sunarım.

Etik Komite Onayı

Uygundur

31/07/2013

Prof.Dr. Canan SÜMER
Uygulamalı Etik Araştırma Merkezi
(UEAM) Başkan Vekili
ODTÜ 06531 ANKARA

T.C
KEMALPAŞA KAYMAKAMLIĞI
İlçe Milli Eğitim Müdürlüğü

Sayı : 42190116-200/ 2397 03 NİSAN 2013
Konu : Akademik Çalışma.

KAYMAKAMLIK MAKAMINA
KEMALPAŞA

İlgi : Çambel Şebnem Kardıçalı Ortaokulu Müdürlüğünün 02 Nisan 2013 tarih ve 46861059-200/35 sayılı yazıları

İlçemiz Çambel Şebnem Kardıçalı Ortaokulu Matematik öğretmeni Ezgi AKTUNA Ortadoğu Teknik Üniversitesi bünyesinde yürütmekte olduğu " Etnomatematik yöntemiyle işlenen 6.sınıf alan ölçme konusunun öğrenci başarısına etkisi" konulu " Ön-test ve son- testlerin geçerlilik ve güvenirliğini test etmek için **Alan Ölçme Başarı Testi** nin Çambel Şebnem Kardıçalı Ortaokulu 6 sınıf ve Cumhuriyet Ortaokulu 6 ve 7 sınıf (40) ar öğrencilerine 8 ders saati boyunca uygulama yapmak istemektedir.

Adı geçen öğretmenin; Şebnem Kardıçalı Ortaokul 6.sınıf ve Merkez Cumhuriyet Ortaokulu 6,7 sınıf öğrencilerine uygulanacak olan "**Alan Ölçme Başarı Testi**" nin eğitim-öğretimi aksatmayacak şekilde okul Müdürlüğünün sorumluluğunda yapılması / uygulaması Müdürlüğümüzce uygun görülmektedir.

Makamlarınızca da uygun görüldüğü takdirde olurlarınıza arz ederim.

Halis MURAT
İlçe Milli Eğitim Müdürü

O L U R
...../04/ 2013

Yüksel TOPAL
Kaymakam

İZMİR MİLLİ EĞİTİM MÜDÜRLÜĞÜ
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TEZ FOTOKOPİSİ İZİN FORMU

ENSTİTÜ

Fen Bilimleri Enstitüsü ☐

Sosyal Bilimler Enstitüsü ☐

Uygulamalı Matematik Enstitüsü ☐

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YAZARIN

Soyadı :
Adı :
Bölümü :

TEZİN ADI (İngilizce) :

TEZİN TÜRÜ : Yüksek Lisans ☐ Doktora ☐

1. Tezimin tamamından kaynak gösterilmek şartıyla fotokopi alınabilir. ☐
2. Tezimin içindekiler sayfası, özet, indeks sayfalarından ve/veya bir bölümünden kaynak gösterilmek şartıyla fotokopi alınabilir. ☐
3. Tezimden bir bir (1) yıl süreyle fotokopi alınamaz. ☐

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