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INVESTIGATION OF THE 9TH GRADE CURRICULUM PROGRAM WITH ACTIVITIES IN TERMS OF INFORMATION TECHNOLOGIES

(Research article)

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Abstract

Although the use of technology in education is a necessity, the field of mathematics education is also a very suitable field for the use of technological resources and materials. In this research, an attempt was made to bring a different dimension to the studies on the use of ICT technologies in curricula, and it was aimed to determine which achievements and which technologies used in mathematics curricula provide. It was determined that it was used in learning areas and sample activities were developed by the researcher. This research is a survey type research and the document analysis method, one of the qualitative research methods, was used in the study. When the research findings are examined, ICT achievements in the 9th grade mathematics curriculum are mostly included in geometry, and least in numbers and algebra sub-learning. It is seen that the field is included in the field, a total of 11 achievements are directed to ICT, in two of these achievements, information processing technologies are seen as an alternative to the use of compasses and rulers, and in the other two achievements, direct guidance is made to dynamic geometry software.

Keywords: Mathematics curriculum, computing technologies, technology.

1. Introduction

The introduction of technology into educational processes has been an important factor in the development and change of methods and techniques used in teaching (Çoklar, 2015). In addition, it is seen that technology offers advantages such as offering multiple learning environments to students and teachers in educational processes, increasing interest and

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motivation in the subject being learned, making it easier to achieve learning goals and achieving permanent learning (Yalın, 2003: 82-83; Katrancı and Uygun, 2013: 773; Kenar, 2012). All these advantages have changed the purpose of using technology in education, and technology, which was initially seen as an auxiliary tool in teaching the course, has later been defined as the main element of raising individuals equipped with 21st Century skills and meeting the needs of the age (Kaya, 2019; Şahin ve Ersoy, 2010). It is also a fact that the use of technology in educational processes will contribute to the development of students' skills such as accessing information and structuring new information and technology literacy, information literacy and visual literacy (Roblyer & Doering, 2010; cited in Türker, 2019).

While the use of information and transmission technologies (ICT) in educational processes was previously seen as acquiring ICT skills used to support the lesson in teaching approaches that adopted the teacher-centered and behavioral school (Downes et al., 2001), today it includes a multidimensional field of use. In today's educational environments, the scope of information technologies includes a wide range of content consisting of dynamic mathematics software, internet and mobile services, digital contents and multiple learning materials that make it possible to share content prepared by users and participate in online communities (Rao and Shalini, 2013). Among the teaching technologies used, there are also computer software that is required by international institutions. In this context, Geogebra, which offers the opportunity to quickly switch between multiple representation formats in programs, Cabri 3D, which offers the ease of creating three-dimensional shapes and performing operations on shapes, and has simulation features for probability-related problems. Many dynamic software such as TinkerPlots are supported for use in teaching processes (Association of Mathematics Teacher Educators [AMTE], 2006). In this context, the integration of these applications into the curriculum of countries is important.

In the 2018 Mathematics curriculum in Turkey, ICT technologies were mentioned under the name of digital competence in the competencies section, and it was stated in the curriculum that this competence was supported through skills such as teaching ways to access information, evaluating and storing the acquired information, presenting it and communicating through networks by participating in collaborative networks (Meb, Ministry of Education, 2018). Similarly, technological competence is seen as the application of knowledge and methodology in the context of meeting perceived human desires and needs. Competence in science and technology includes the ability to comprehend the changes resulting from human activities and the responsibilities of each individual as a citizen.

Although the use of technology in education is a necessity, the field of mathematics education is also a very suitable field for the use of technological materials. Mathematics teaching should help students understand conceptual knowledge of mathematics, procedural knowledge of mathematics, and establish connections between conceptual and procedural knowledge. These three purposes are called relational understanding (Van de Wella, 1989, 6). Teaching mathematics in a healthy way in primary education enables students to develop their logical thinking abilities by seeing the connections between concepts and operations and makes it easier for them to see causality relationships. Tatar, Kağızmanlı and Akkaya (2013) state that technology makes it easier for students to understand these causal relationships in mathematics. Durmuş (2003) states the importance of technology in creating mathematical concepts and developing operation skills, and Hohenwarter, Hohenwarter and Lavicza (2008) emphasize that it enables the increase of mathematical knowledge and skills. There are many different studies showing that dynamic and visual learning environments structured with technology support academic success, motivation and permanent learning in mathematics (Karadağ ve McDougall, 2009; Kaleli Yılmaz, Ertem, & Güven, 2010; Nordin, Zakaria, Mohamed & Embi, 2010; Baki). and Özpınar, 2007) While Kimmins (1995) states that the use of technology in mathematics teaching processes improves students' problem-solving and association skills, Lavicza and Papp-Varga (2010) state that dynamite mathematics software used in these processes improves students' cooperative learning skills. Again, Umamah (2012) also states in his study that such technologies positively affect the interactions between students and teachers.

Although there have been a few studies on the place and use of ICT in curricula, it has been emphasized in these studies that digital competencies are included in all courses in the 2018 curricula, unlike the previous ones, and that this issue is addressed with an interdisciplinary approach, and that the education and training programs are adapted to 21st century skills. The need to prepare, develop and update it has been underlined (Ekmen and Bakar, 2018). It is a fact that when preparing curriculum, individual differences, people's learning abilities and different learning environments are taken into consideration, it is necessary to benefit from technology to create effective learning environments (Dickinson & Bass, 2020). In this research, we tried to bring a different dimension to the studies on the use of ICT technologies in curriculum, and sample activities were developed by the researcher by determining in which outcomes and in which learning areas the technologies used in mathematics curriculum were used. Since all levels of the secondary education program are a broad field of study within the scope of the research, the 9th grade curriculum was preferred as a basis for future studies.

2.Method

This research is a survey type research and the document analysis method, one of the qualitative research methods, was used in the study. Document analysis; It refers to a series of processes that include finding, reading and evaluating relevant sources adhering to a research purpose (Bowen, 2009; Karasar, 2005).

The curriculum studied in the research was downloaded from https://mufredat.meb.gov.tr/Programlar.aspx and served as the source of the study. In this context, the achievements in the 9th grade curriculum were examined one by one and all elements and expressions related to ICT were removed and grouped. Activity sheets were developed by the researcher for each achievement and the activities specified in the achievements were exemplified. The data obtained in the study were examined by two academics who are experts in the field of mathematics education, and the agreement rate was determined to be 100%.

2.1.Data Analysis

The data obtained from the research were presented in tables using descriptive analysis methods, and special typesetting programs were used to present the sample activities. There are no copyright issues regarding the images.

3.RESULTS OR FINDINGS AND DISCUSSIONS

When the 9th grade mathematics curriculum is examined, it is seen that a total of 41 objectives were taught in 216 lesson hours. The achievements and explanations of ICT technologies in the 9th grade curriculum are given in the table below.

Table 1 9 Gains and Explanations of ICT Technologies in the 9th Grade Curriculum

Lower Learning Area	Subject	Earnings	ICT Expression
Numbers and Algebra	Equations and Inequalities	9.3.2.2. Makes applications related to EBOB and LCM in integers	GCF and LCM functions available in spreadsheets are used.
Geometry	Triangles	9.4.1.2. It relates the lengths of the sides of the triangle to the measures of the angles opposite these sides.	The relationship between the sides and angles of triangles created using dynamic mathematics software. observation is provided.
Geometry	Triangles	9.4.1.3. Evaluates in which cases three line segments with given lengths form a triangle.	Testing in which situations a triangle will be formed by using dynamic mathematical software is provided.
Geometry	Congruence and Similarity in Triangles	9.4.2.2. It evaluates the minimum conditions necessary for two triangles to be similar.	Information and communication technologies are used.
Geometry	Auxiliary Elements of Triangle	9.4.3.1. Obtains the properties of the interior and exterior bisectors of the triangle.	Information and communication technologies are used.
Geometry	Auxiliary Elements of Triangle	9.4.3.2. Obtains the properties of the medians of the triangle.	Changes on the triangle using a compass-ruler or with the help of information and communication technologies and the effect of the changes on the medians

			depending on the triangle types is observed.
Geometry	Auxiliary Elements of Triangle	9.4.3.3. It shows that the middle perpendiculars of the triangle intersect at a point.	Compasses-ruler or information and communication technologies are used.
Geometry	Auxiliary Elements of Triangle	9.4.3.4. It determines the location of the point where the heights of the triangle intersect, depending on the type of triangle.	By drawing the heights of a triangle using a compass-ruler or with the help of information and communication technologies Emphasis is placed on intersections. Examples are made on different types of triangles.
Geometry	Right Triangle and Trigonometry	9.4.4.3. Calculates trigonometric ratios of acute angles in a right triangle.	Information and communication technologies are used.
Geometry	Area of Triangle	9.4.5.1. Solves problems related to the area of a triangle.	The area of a triangle whose area, base and height are changed with the help of information and communication technologies Observe how it changes.
Data, Counting and Probability	Displaying Data Graphically	9.5.2.2. Interprets data groups that reflect real-life situations by representing them with appropriate graphic types.	Graphic types are drawn using information and communication technologies.

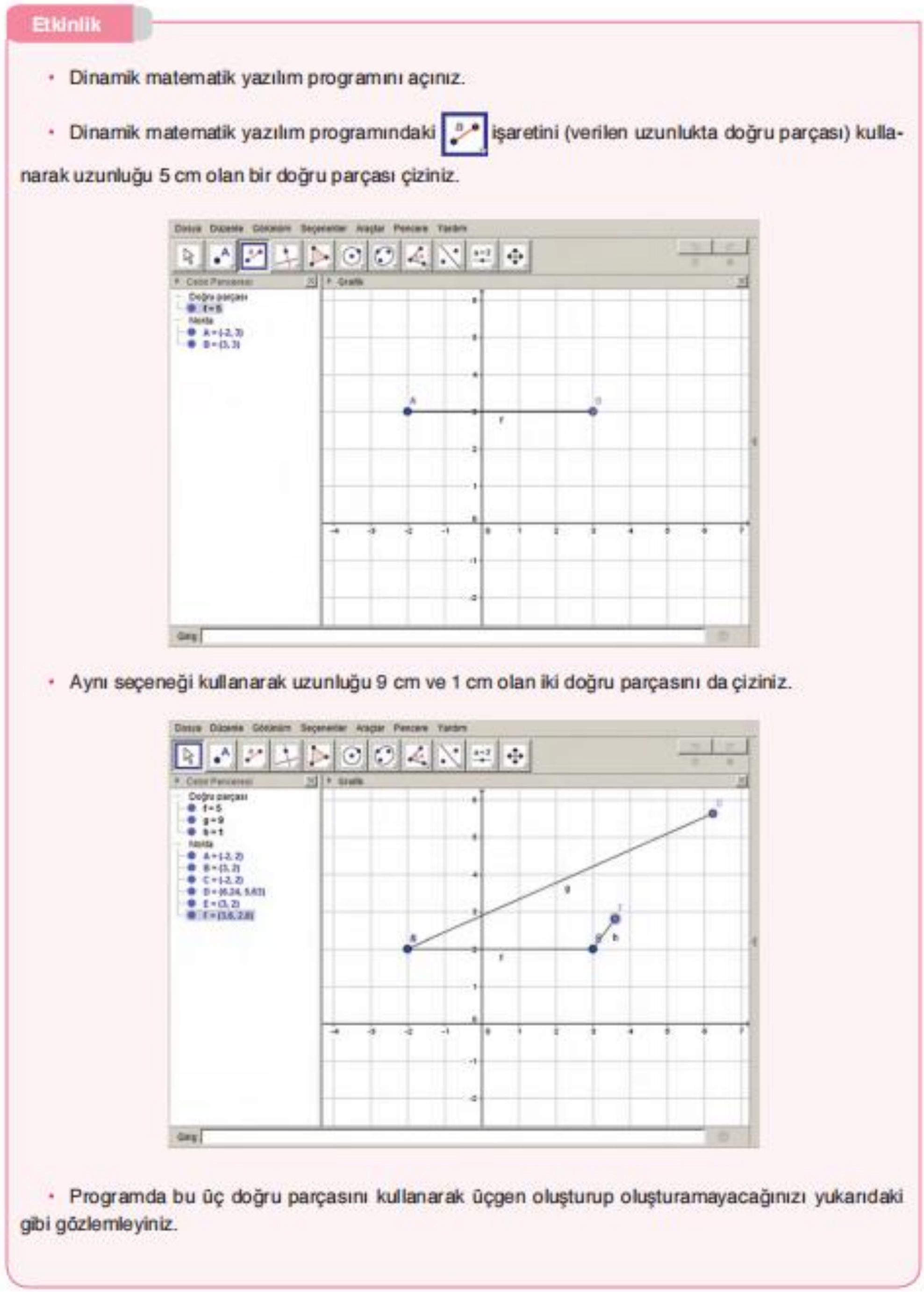
When Table 1 is examined, it is stated that the number of achievements included in ICT in the 9th grade curriculum is 11 and that applications made with compasses and rulers can be used instead of ICT in all three of these achievements. However, when the explanations of the objectives are examined, in two of the objectives, teachers, students and textbook authors are directed to dynamic mathematics software, and in the other two, they are directed to package programs containing tables and graphing functions. In achievements other than these, ICT is generally referred to as ICT technologies and explanations on how the activity can be carried out are not included in the curriculum. The recommendation to use dynamic geometry software in the geometry sub-learning area in the curriculum may be due to the fact that these software allow students to create shapes in the virtual environment, establish relationships between these shapes, and make generalizations by taking advantage of these relationships (Bintaş and Smart 2008). As stated by Şimşek and Yücakaya (2014), in the renewed 2018 curriculum, emphasis was placed on the use of dynamic geometry software in order to contribute to the development of students' geometric and spatial thinking skills.

The weight of ICT achievements in learning areas is given in Table 2.

Table 2 Distribution of ICT Gains within Sub-Learning Areas

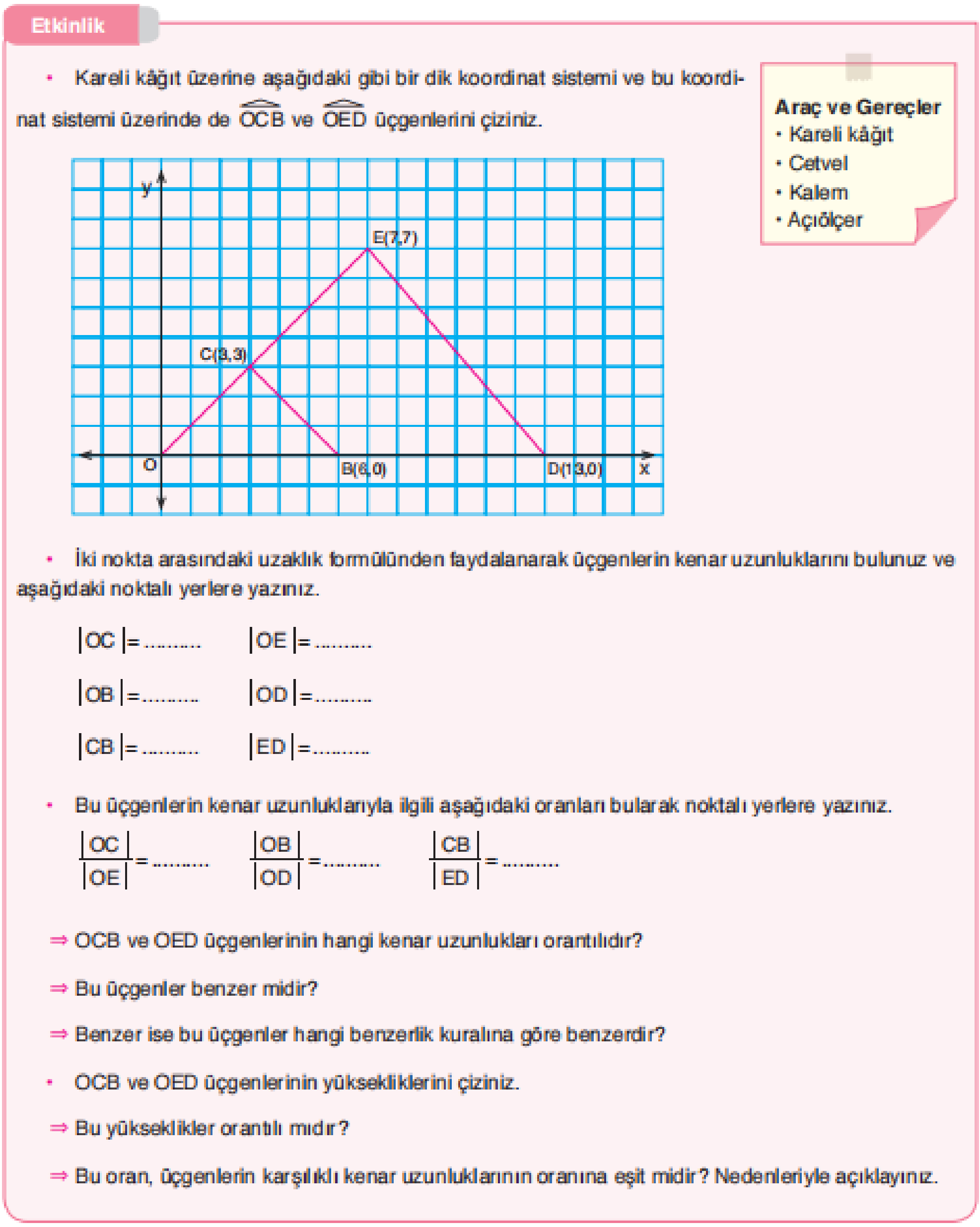
Leraning Area	Number of Wins	Number of ICT	Share of ICT achievements in all achievements (%)
Numbers and Algebra	22	1	4,54
Geometry	16	9	56,25
Data, Counting and Probability	3	1	33,3

From Table 2, it can be seen that the most frequently used ICT learning area is geometry. It is seen that the area where these technologies are used the least is the sub-learning area of numbers and algebra.In this context, sample ICT application activities developed by the researcher are given below.


Etkinlik

- Dinamik matematik yazılım programını açınız.
- Dinamik matematik yazılım programındaki işaretini (verilen uzunlukta doğru parçası) kullanarak uzunluğu 5 cm olan bir doğru parçası çiziniz.
- Aynı seçeneği kullanarak uzunluğu 9 cm ve 1 cm olan iki doğru parçasını da çiziniz.
- Programda bu üç doğru parçasını kullanarak üçgen oluşturup oluşturamayacağınızı yukarıdaki gibi gözlemleyiniz.

Figure 1. ICT activity on when three line segments with given lengths form a triangle



Etkinlik

- Kareli kâğıt üzerine aşağıdaki gibi bir dik koordinat sistemi ve bu koordinat sistemi üzerinde de $\widehat{OCB}$ ve $\widehat{OED}$ üçgenlerini çiziniz.

Araç ve Gereçler
- Kareli kâğıt
- Cetvel
- Kalem
- Açıölçer

- İki nokta arasındaki uzaklık formülünden faydalanarak üçgenlerin kenar uzunluklarını bulunuz ve aşağıdaki noktalı yerlere yazınız.

|OC| = ... |OE| = ...

|OB| = ... |OD| = ...

|CB| = ... |ED| = ...

- Bu üçgenlerin kenar uzunluklarıyla ilgili aşağıdaki oranları bularak noktalı yerlere yazınız.

$\frac{|OC|}{|OE|}$ = ... $\frac{|OB|}{|OD|}$ = ... $\frac{|CB|}{|ED|}$ = ...

⇒ OCB ve OED üçgenlerinin hangi kenar uzunlukları orantılıdır?

⇒ Bu üçgenler benzer midir?

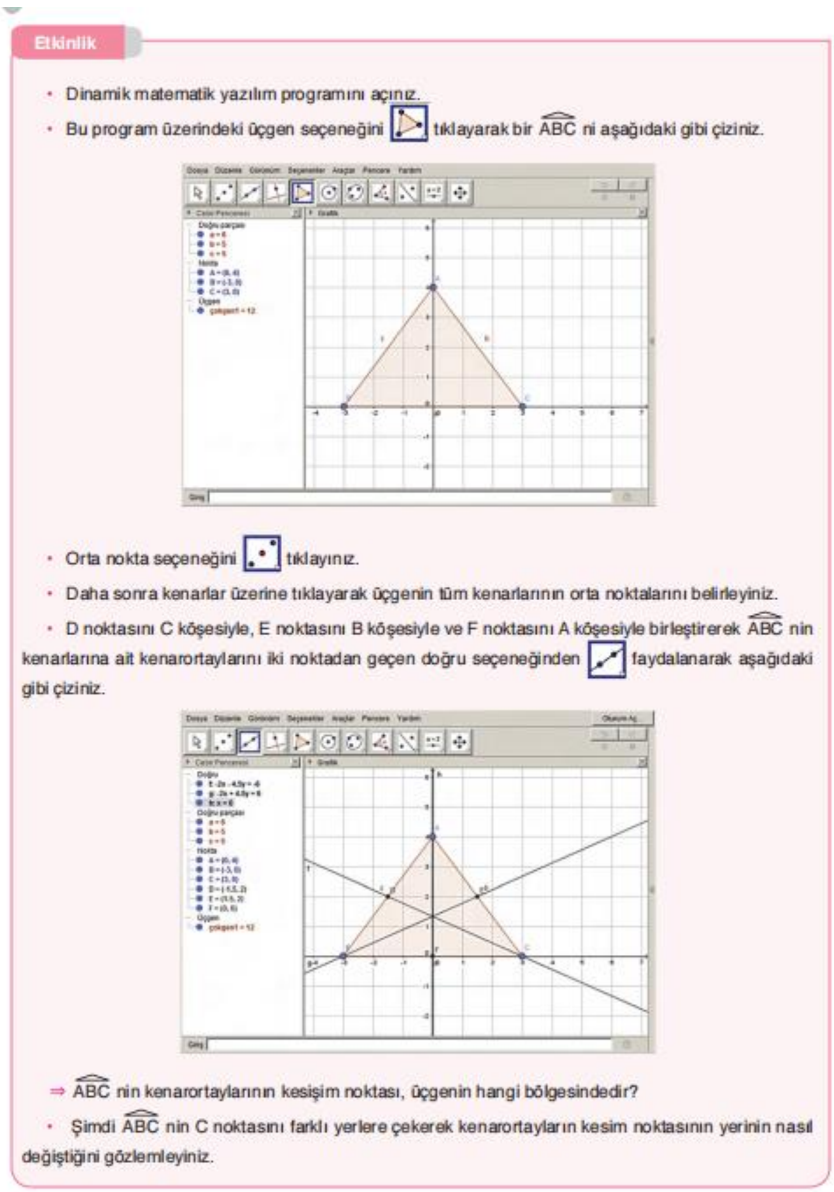
⇒ Benzer ise bu üçgenler hangi benzerlik kuralına göre benzerdir?

- OCB ve OED üçgenlerinin yüksekliklerini çiziniz.

⇒ Bu yükseklikler orantılı mıdır?

⇒ Bu oran, üçgenlerin karşılıklı kenar uzunluklarının oranına eşit midir? Nedenleriyle açıklayınız.

Figure 2. ICT activity for evaluating the minimum conditions necessary for two triangles to be similar



Etkinlik

- Dinamik matematik yazılım programını açınız.
- Bu program üzerindeki üçgen seçeneğini tıklayarak bir $\widehat{ABC}$ ni aşağıdaki gibi çiziniz.
- Orta nokta seçeneğini tıklayınız.
- Daha sonra kenarlar üzerine tıklayarak üçgenin tüm kenarlarının orta noktalarını belirleyiniz.
- D noktasını C köşesiyle, E noktasını B köşesiyle ve F noktasını A köşesiyle birleştirerek $\widehat{ABC}$ nin kenarlarına ait kenarortaylarını iki noktadan geçen doğru seçeneğinden faydalanarak aşağıdaki gibi çiziniz.

⇒ $\widehat{ABC}$ nin kenarortaylarının kesişim noktası, üçgenin hangi bölgesindedir?

- Şimdi $\widehat{ABC}$ nin C noktasını farklı yerlere çekerek kenarortayların kesim noktasının yerinin nasıl değiştiğini gözlemleyiniz.

Figure 3. ICT activity to obtain the properties of the medians of the triangle

4.Conclusions and Suggestions

When the research findings are examined, in the 9th grade mathematics curriculum, ICT acquisitions are included mostly in geometry and least in the number and algebra sub-learning area, a total of 11 achievements are directed to ICT, and in two of these achievements, computing technologies are seen as an alternative to the use of compasses and rulers. In the other two achievements, it is seen that direct guidance is made to dynamic geometry software.

Studies show that technology-supported mathematics teaching processes make it easier for students to recognize geometric structures and see the relationships between these structures (Karataş & Güven, 2003; Gürbüz & Gülburnu, 2013); suggest that the use of dynamic geometry software in geometry teaching processes causes a significant difference in students' success (Erbaş & Yenmez, 2011). In order to reach generalizations in geometry teaching, geometric shapes or structures need to change direction, be moved or be observed from different angles. Again, moving angles and edges in the desired ways facilitates the discovery of geometric relationships and turns geometric structures into dynamic structures that are mobile and can transform into each other (Doğan ve İçel , 2011). In this respect, these software enable students to increase their academic success in the field of learning geometry (Şataf, 2010; Çetin, Erdoğan, and Yazlık, 2015). Şeker and Erdoğan (2017) also stated that shaping with software such as geogebra has a positive effect on students' success and self-efficacy. It states that it increases learning, enables professional structuring of learning, and makes learning concrete. In the study conducted by Çelen (2020), it is seen that geogebra makes mathematics teaching processes enjoyable and increases success in direct proportion to computer literacy.

When the study results are examined, it is observed that ICT is used only for research and presentation, especially in the field of Numbers and Algebra, and the number of ICT achievements reflected in the achievements is only one. In the study conducted by Musan (2012), it was seen that studies supported by dynamic mathematics software made it easier for students to solve problems that they had difficulty in solving algebraically, and that students had positive opinions about this period. Again, it is seen that ICT is included in one of the three achievements in the field of data, and in this sub-learning field, these technologies are generally used to draw graphs or tables. When evaluated in this context, it is seen that ICT technologies are not used in sufficient scope and quantity in the curriculum, except for the geometry sub-learning area, and social media and online elements are not included enough in the programs.

Within the scope of these results, reflecting the use of ICT in different scopes and varieties (online connections, e-content, social media use, software package programs, etc.) in the curriculum, increasing the number of ICT in the sub-learning areas of numbers and algebra and data, counting and probability, and teaching courses by the Ministry of Education. In addition to the books, it is recommended that the desired digital content and examples be included in the curriculum.

Compliance with Ethical Standards

The study was prepared considering ethical rules, and the materials used are those shared with the public by the Ministry of Education. There is no conflict of interest in this context.

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