

## A Review of Theses and Dissertations Published in Turkey on Early Geometry Skills in 2000-2020

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**Abstract:** This study was carried out to review the theses and dissertations on early geometry skills published in Turkey. In the study, which was organized as a methodological evaluation study, the data were obtained through document analysis method. The research is limited to 20 studies, published between 2000-2020, of which full texts could be accessed from the Turkish National Thesis Center database. The full texts of the theses and dissertations were accessed by using the keywords "geometry in preschool period", "early childhood geometry", "early geometry skills", and "geometric shape". The data obtained within the scope of the research were analyzed and discussed according to the publication year of scientific studies, language, university, research design, research method, subject, and sampling type. When the documents were analyzed, it was seen that most of the thesis studies were master's theses, mainly belonging to the year 2010 and after, and all of the doctoral dissertations belonged to 2011 and later. It has been determined that the language of the majority of the theses was Turkish, mostly from Selçuk University and Gazi University and conducted following quantitative methods.

**Keywords:** Early geometry skills, Geometry, Pre-school

### Introduction

Since ancient times, human beings have made mathematics a part of their lives in the face of situations involving mathematical skills such as numbers, shapes, counting system, and grouping. For example, they used numbers to share a property, they thought that whatever form they used in building a house would get better results, they started to use mathematical operations in harvesting and shopping. This requirement has caused the fields of mathematics to change over time and the development of mathematics research. Instead of counting with a finger, numbers began to be used in higher-level operations, and even the abacus and then various technological machines were developed. In time, it was determined that geometry does not only consist of

shapes, but also includes the definition of the area inhabited, the relationship between shape and area. With the changes in the fields in which mathematics is used, the research on mathematics diversified and the importance and difference of mathematics teaching for each education level was determined. In particular, the importance of developing mathematics skills in early childhood has been demonstrated (Clemson & Clemson, 2001). One of the mathematical skills that started to develop through the curiosity and natural experiences of children in this period is expressed as early geometry skill (Clements & Sarama, 2009).

According to Copley (2000), geometry, which includes shapes, size, position, direction and movement, is a sub-field of mathematics and defines and classifies the world we live in. Clements and Battista (1992) expressed geometry as "*the study of the spatial properties, relations and transformations of objects in space.*" Geometry is generally concerned with establishing certain relationships through thinking and reasoning. Generally, although geometry is called shape and area, it also includes points, lines, planes, and other two-dimensional and three-dimensional shapes (Cooke, 2007). Understanding the concepts that are considered as building blocks of geometry such as point, line, plane, angle is important because they are used in various applications (Chapin & Johnson, 2006).

It allows children to understand geometric concepts and gain skills related to geometry, to analyze and interpret the world they live in (Özerem, 2012). Geometry, which is the study of space and shape, is important because it forms the basis of learning most of the mathematics and other subjects (Clements, 1998). Children's relationships with geometry begin in infancy and gradually increase. A toddler discovers the space, directs his / her movements, learns to orient himself / herself in space. This awareness, which starts with the bodies first, continues to increase in time with the positions of the objects, the distance between them, the movements under, above, inside and outside of the objects (Schwartz, 2005). Children who discover that everything around them has a shape, begin to distinguish shapes three weeks after they are born (Kesicioğlu, Alisinanoğlu, & Tuncer, 2011). When children begin to see similarities and differences in shapes, they become aware of geometric forms. While the spherical properties of three-dimensional objects draw their attention, they then distinguish three-dimensional shapes such as cones, cubes, cylinders, and two-dimensional shapes such as rectangles, triangles, squares and circles (Schwartz, 2005). At the same time, children interpret the physical world with geometric ideas and make use of the geometric vocabulary they have created in recognizing and naming shapes such as square, triangle, circle, rectangle, hexagon, sphere, and cube that exist around them (Clements & Sarama, 2009). For this reason, qualified educational environments and processes should be planned and implemented in order for children to learn geometric shapes, especially in the early period (Clements & Sarama, 2009).

Geometry skills should be supported by various activities from an early age in order to establish a strong foundation of geometry in children (Clements & Sarama, 2004). Climbing, swinging, sliding, block, building, lego and manipulative tabletop games should be preferred frequently in the preschool period in order to improve the spatial abilities of children (Smith, 2006). At the same time, it is very important to ensure that children use

words related to the spatial field in games and activities during the day. Spatial field words, which are location, location words, motion words, distance words and transformation words, contribute significantly to the development of spatial perception of children (Copley, 2000). Children learn geometry as they connect with the objects and shapes, they see and interact with. For example, as children are exposed to geometric shapes and repeat their names, the name of the geometric shape is connected to each other in time (Schwartz, 2005). It is important for children to encounter concrete materials for learning the geometric shape in the preschool period. For example, in the learning of the square shape, concrete materials can be given, and the similarities and differences can be determined by comparing the features such as the number of sides and the length of the sides according to the shapes such as rectangles, triangles and circles. In addition, while the child is learning the shapes, he / she may be asked to present the forms of the same shape with different position, skewness and flatness to the child and make a comparison (Aktaş Arnas & Aslan, 2005). Teachers should take advantage of children's curiosity and do purposeful and qualified activities related to early geometry skills. Being aware that every child has a different level of geometry knowledge, examples of various geometric shapes should be presented in the classroom, children should be provided with geometric shapes, and activities related to the spatial field should be carried out to develop the spatial thinking of children (Jung & Conderman, 2017).

Researchers have carried out studies in Turkey in order to investigate how to support early geometry skills and stated the importance of this skill. Accordingly, Kesicioğlu, Alisinanoğlu, and Tuncer (2011) found that preschool children made mistakes in recognizing triangle, square, rectangular, circle shapes and their distractors in the study that examined their level of recognition of geometric shapes. Turan Topal (2010) suggested that preschoolers have difficulties in associating and distinguishing geometric shapes from similar features, and although they are quite successful in recognizing typical examples of shapes, they have difficulty recognizing shapes when the kurtosis, skewness, position and size or edge features of typical examples are changed. Hacısalihoğlu Karadeniz (2014) determined that children in the mathematics education process, when supported with appropriate and rich activities, can apply the instructions regarding location and spatial relations in the map samples. Sezer (2015) stated that the variables of age and parents' education level made a difference on children's geometry skills, children aged 5-7 years had no problem in distinguishing typical (prototype) examples of shapes, but they were affected by atypical and invalid examples of shapes in shape selection. Korkmaz (2017) determined that inquiry-based mathematics activities applied in natural open spaces can be used as an effective tool to support the development of geometric and spatial thinking skills of 48-66-month-old children. Kılıç (2018) applied the Preschool Geometry Education Program (PGEP) to the children in the experimental group three days a week for 10 weeks and concluded that there was a statistically significant difference between the children in the experimental group participating in PGEP and the children in the control group, in favor of the children in the experimental group. Keser (2020) found that children's attention skills significantly predicted their early geometry skills, and that there was a positive and moderately significant relationship between children's phonological awareness skills and early geometry skills. Besides, between parents' education level and children's geometry skills and phonological awareness skills, it has been concluded that the relationship for the parents whose education level was middle school and below, high school and

university were positively and moderately, and in the group whose parents have graduate education level were positively and at a high level.

According to the relevant literature, it has been revealed that children's early geometry skills differ according to variables in early childhood, when brain development is very fast, and educational environments and different educational programs affect the development of early geometry skills. Relevant research results may contribute to a better understanding of the importance of early geometry skills and the development of their place in educational programs. However, the literature review conducted in Turkey related to early geometry skills shows that a limited number of master's theses and doctoral dissertations have been published so far. Therefore, this research is important in terms of shedding light on this gap in the related literature. Analyzing scientific theses and dissertations can provide information about the depth and extent of that topic and reveal the general view of the area studied. In this context, this study, which aims to review the master's theses and doctoral thesis prepared in universities in Turkey related to early geometry skills, is expected to give information about the general trend and the research methods while inspiring the specialists and contributing to the literature. Hence, this research was carried out to review theses and dissertations published in Turkey on early geometry skills in 2000-2020. For this purpose, answers to the following questions were sought:

1. What is the distribution of theses and dissertations on geometry in preschool period according to years?
2. What is the distribution of studies on geometry in preschool period according to the language in which it was published?
3. What is the distribution according to the universities where the master's theses on geometry in preschool period were published, the method used and the study groups?
4. What is the distribution according to the universities where doctoral dissertations on geometry in preschool period were published, the method used and the study groups?
5. What is the distribution of theses on geometry in preschool period by subject?
6. What is the distribution of studies on geometry in preschool period by sampling method?

## Method

### Research Design

This research which aims to review the theses and dissertations on early geometry skills development and evaluation in Turkey was conducted by qualitative method. Document analysis was used in the research conducted with the descriptive scanning model. Qualitative model is a method that aims to examine the subject in depth (Karataş, 2015). Document is any material that provides information on social facts and exists independently of the researcher (Corbetta, 2003). Document analysis includes the analysis of written materials that contain information about the events and facts that are aimed to be investigated (Şimşek, 2009) and enables the analysis of documents produced in a certain time frame about a research problem based on a long time period (Yıldırım & Şimşek, 2011).

## Population and Sampling

Since the aim of the study was to review the theses and dissertations on geometry skill in the preschool period, the population of the research consisted of theses and dissertations, published between 2000-2020, of which full texts could be accessed online from the database of the Turkish Higher Education Council National Theses Archive. No sampling method was used in the study as the researchers aimed to reach the whole population. Thus, a total number of 20 theses and dissertations on the topic were reviewed.

## Data Collection and Analysis

In the study, master's theses and doctoral dissertations on early geometry skills covering the years 2000-2020 and available online in January-February were downloaded and used as documents.

In the first stage of document analysis, the full texts of the theses and dissertations in the study group were accessed from the database. The keywords "geometry in preschool period", "early childhood geometry", "early geometry skills", "geometric shape", "mathematical concepts" were searched in Turkish and English from the database. The selection criteria of the theses and dissertations listed online were as follows:

- a. Theses were between the years 2000-2020.
- b. Focusing on geometry in early childhood, pre-school education or the geometry skill of preschool teachers.
- c. One of the scales used in the thesis or the dissertation was about early geometry skill.
- d. Early geometry skill not being evaluated within the scope of the same measurement tool as other mathematical skills.

Theses or dissertations which did not comply with the above-mentioned criteria in the database of the Turkish National Thesis Archive were not evaluated. Accordingly, 15 master's theses and 5 doctoral dissertations on early geometry skills were examined in this research.

The documents included in the study were selected in accordance with certain criteria determined by Scott (1990). In this sense, Scott (1990) suggested that the validity and reliability of the documents should be evaluated according to the criteria of (1) the fact that the document is authentic, (2) it is believable to include its accuracy, (3) it is far from imitation, (4) it contains current meaning. Detailed examinations were carried out by the researchers to determine the compliance of the documents with the criteria.

In order to ensure validity in qualitative research, it is necessary to report the data in detail and explain the ways to reach the results (Yıldırım, 2010). In this study, it was aimed to present the data research process and the reported data in detail in order to ensure validity. In order to ensure the reliability of the study, the collected data were analyzed separately by the researchers, and then compared, synthesized, and reported.

Master's theses and doctoral dissertations included in the research were collected by taking into account the five stages of document review (Şimşek, 2009):

1. In the first step of *accessing the documents*, the documents needed and the keywords to access these documents were determined. Accordingly, the documents needed in the research were obtained with the keywords from the National Theses Archive of the Turkish Council of Higher Education. The determined documents were filed in pdf format and saved to the computer.
2. *In checking the originality*, the documents were accepted as original since the researchers accessed the data from the National Thesis Archive of Turkish Higher Education Council.
3. The theses and dissertations to be included in the research at the stage of *examining and understanding the documents* were done by the researchers. The accessed theses, in line with the aims of the research; were classified in terms of type, year of publication, language, university, to whom it is intended, subject, research design, sampling type, and data collection tools.
4. Descriptive statistics were included in the *analysis of the data*. Descriptive statistics were conducted in terms of factors such as the frequency and percentage used in themes such as the status of master's thesis, doctoral dissertation being published as an article, publication year, language, subject, sampling method of included in the scope of the research (Arıkan, 2011; Yıldırım & Şimşek, 2011).
5. *The use of data* is the last step of document review. At this stage, the findings of the research were analyzed and interpreted by the researchers. Information and recommendations that were expected to shed light on the literature were included.

## Findings and Discussion

In this part of the study, the findings regarding the theses and dissertations on geometry skills in the preschool period are presented and discussed in line with the sub-objectives of the research.

1. *What is the distribution of theses and dissertations on geometry in preschool period according to years?*

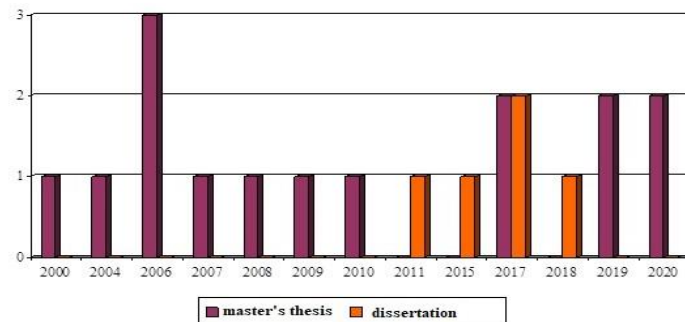


Figure 1. Distribution of studies on geometry in the preschool period by years

According to Figure 1, when the distribution of theses and dissertations included in the scope of the research by years was considered, there were 1 master's thesis in 2000 and 2004, 3 master's theses in 2006, 1 master's thesis

in 2007, 2008, 2009, 2010, and 1 doctoral dissertation in 2011 and 2015. In 2017 there were, 2 master's theses, 2 doctoral dissertations, 1 dissertation in 2018 and 2 master's theses in 2019-2020. According to this, it was seen that 60% of the master's theses were made in 2010 and after, and all doctoral dissertations were made in 2011 and after. The most thesis studies were done in 2017 with a rate of 20%. Considering the given numbers, it can be said that thesis and dissertation studies on geometry in preschool period have increased in recent years. In this case, it can be thought that researchers' interest in studying early geometry skills has increased.

2. What is the distribution of studies on geometry in preschool period according to the language in which it was published?

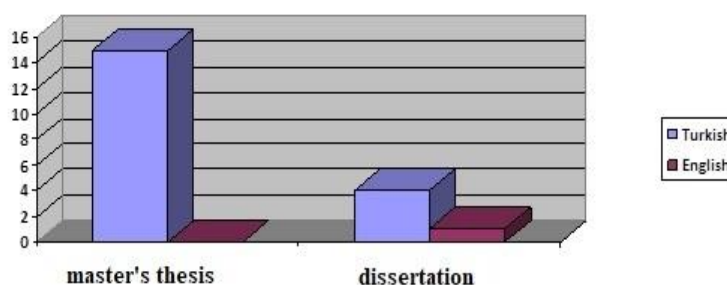


Figure 2. Distribution of studies on geometry in preschool period by language

In line with the findings shown in Figure 2, when the distribution of the studies included in the study according to the language in which they were published is examined, it was found out that the majority of them are Turkish. It is noteworthy that while all of the master's theses were in Turkish, only 20% (n = 1) of the doctoral theses were in English.

3. What is the distribution according to the universities where the master's theses on geometry in preschool period were published, the method used and the study groups?

Table 1. Distribution of the master's theses on geometry in the preschool period according to the universities where they were published, the method used and the study group

Title	University / City	Design	Study Group	Year
Comparison of structured and traditional methods in teaching some mathematical concepts to 6-year-old children who attend preschool education institutions	Gazi University Institute of Social Sciences, Ankara	Quantitative	Pre-school period	2000
Investigation of 3-6 age group children attending kindergarten to recognize basic geometric shapes and the criteria they use to distinguish shapes	Çukurova University, Institute of Social Sciences Department of Early Childhood Education, Adana	Qualitative	Pre-school period	2004

Comparative examination of structured and traditional methods in order to teach some mathematical concepts to six-year-old children attending preschool education institutions	Selçuk University Institute of Social Sciences Department of Child Development and Domestic Management, Konya	Quantitative	Pre-school period	2006
Teaching computer-aided mathematical concepts to six-year-old preschool children	Selçuk University, Institute of Social Sciences, Konya	Quantitative	Pre-school period	2006
The role of computer-aided education in preschool education	Gazi University, Institute of Natural and Applied Sciences, Ankara	Quantitative	Pre-school period	2006
The effect of concept education program on the development of geometric shape and number concepts of 6-year-old children	Adnan Menderes University, Institute of Social Sciences Department of Elementary Education, Aydın	Quantitative	Pre-school period	2007
The effectiveness of the Montessori education method in giving the concept of geometric shape to 4-5 age group children attending preschool education institutions	Selçuk University Institute of Social Sciences Department of Child Development and Domestic Management, Konya	Quantitative	Pre-school period	2008
The effect of drama method on the development of mathematical shape perception and number concept in children aged 5-6	Selçuk University Institute of Social Sciences Department of Early Childhood Education, Konya	Quantitative	Pre-school period	2009
How do preschool children perceive the concepts of geometry being taught?	Gazi University Institute of Educational Sciences, Department of Mathematics Education, Ankara	Qualitative	Pre-school period	2010
Investigation of the effect of mathematics education given to 6-year-old children with narrative method on children's mathematics achievement	Dumlupınar University Institute of Educational Sciences Department of Early Childhood Education, Kütahya	Mixed	Pre-school period	2017



The effects of Froebel gifts on the geometry skills of 60-72-month-old children attending pre-school education institution	Okan University Institute of Social Sciences Department of Early Childhood Education, İstanbul	Quantitative	Pre-school period	2017
Examination of visual perception skills and geometry skills of pre-school children	Trakya University Institute of Social Sciences Department of Early Childhood Education, Edirne	Quantitative	Pre-school period	2019
Investigation of the relationship between 60-72-month-old children's learning center preferences and geometry skills	Bolu Abant İzzet Baysal University Institute of Educational Sciences Department of Early Childhood Education, Bolu	Quantitative	Pre-school period	2019
Investigation of pre-school children's executive function skills and geometric shape perceptions	Hacettepe University Institute of Educational Sciences Department of Early Childhood Education, Ankara	Mixed	Pre-school period	2020
Investigation of the relationship between 60-72-month-old children's attention skills and geometry and phonological awareness skills (Afyonkarahisar province sample)	Afyon Kocatepe University Institute of Social Sciences Department of Educational Sciences, Afyon	Quantitative	Pre-school period	2020

As shown in Table 1, there were 15 master's theses which investigated early geometry skills in pre-school period. No master's theses were found in the search of the databases with the keywords "geometry in preschool period" and "geometry in early childhood". 3 master theses were found in the search with the keyword "early geometry skills" while 10 master theses in the search with the keyword "geometric shape", and 2 master theses in the search with the keyword "mathematical concepts" were accessible (Dere, 2000; Aslan, 2004; Kırlar, 2006; Alabay, 2006; Kacar, 2006; Aydoğan Akuyşal, 2007; Öngören, 2008; Yalım, 2009; Turan Topal, 2010; Şen, 2017; Sertsöz, 2017; Kurt, 2019; Aydın, 2019; Ögütçen, 2020, Keser, 2020).

It was seen that the master's theses included in this study were prepared under 10 different universities. It was determined that 26.66% (n = 4) of the theses originated from Selçuklu University and 20% (n = 3) from Gazi University. It can be said that Selcuk University and Gazi University contributed to this field with a higher number of master's theses. When the methods of master's theses were examined, it was determined that 11

studies were carried out quantitatively, 2 studies were conducted with qualitative research, and 2 studies were conducted with mixed design. It was found out that all of the master's theses on geometry included pre-school children in their study group.

4. *What is the distribution according to the universities where doctoral dissertations on geometry in preschool period were published, the method used and the study groups?*

Table 2. Distribution of doctoral dissertations on geometry in preschool period according to the universities where they were published, the method used and the study group

Title	University / City	Design	Study Group	Year
Investigation of the effect of the education program prepared by direct instruction method and the computer-aided education program prepared according to this method on preschool children's learning the concepts of geometric shape	Gazi University, Institute of Educational Sciences, Department of Early Childhood Education, Ankara	Quantitative	Pre-school period	2011
Developing early geometry skill test and examining children's geometry skills	Marmara University Institute of Educational Sciences, Department of Early Childhood Education, İstanbul	Quantitative	Pre-school period	2015
Augmented reality activities for children: a comparative analysis on understanding geometric shapes and improving spatial skills	Middle East Technical University, Graduate School of Natural and Applied Sciences, Ankara	Mixed	Pre-school period	2017
The effect of inquiry-based activities applied in natural open spaces on children's geometric and spatial thinking skills	Hacettepe University Department of Early Childhood Education, Ankara	Quantitative	Pre-school period and teachers	2017
The effect of preschool geometry education program on children's geometry skills and creative thinking	Gazi University Institute of Educational Sciences Department of Elementary Education, Ankara	Quantitative	Pre-school period	2018

Table 2 shows 5 doctoral dissertations on early geometry skills found in this study. No doctoral dissertations were found in the search made with the keywords "geometry in preschool period" and "geometry in early childhood" in the database. 1 doctoral dissertation was found in the search with the keyword "early geometry skills" while 3 doctoral dissertations in the search with the keyword "geometric shape", and 1 doctoral dissertation in the search with the keyword "geometric and spatial thinking" were available. When the doctoral dissertation studies were examined, no study directly related to the geometry in pre-school period was found between 2000-2010. It was seen that research have been carried out since 2011. Studies conducted are about

geometry skills and geometric shapes (Kesicioğlu, 2011; Sezer, 2015; Gecü Parmaksız, 2017; Korkmaz, 2017; Kılıç, 2018).

It was found out that the doctoral dissertations included in the research were prepared under 4 different universities. It was seen that 20% of the dissertations originated from Gazi University. It can be said that Gazi University contributed to this field with a higher number of doctoral dissertations. When the methods of doctoral dissertations were examined, it was determined that four studies were carried out with quantitative method and one study was carried out with mixed design. It is seen that the study group of all doctoral dissertations on geometry consisted of preschool children while in one of the dissertations preschool children and teachers formed the study group.

5. What is the distribution of theses on geometry in preschool period by subject?

Table 3. Distribution of theses on geometry in preschool period by subject

Subjects (Master's Theses)	%	f
Effectiveness of traditional and constructivist methods in the acquisition of mathematical concepts	10	2
Examining the criteria used to recognize basic geometric shapes.	5	1
Effectiveness of computer aided education and traditional education methods in gaining the concept of number and shape	10	2
Effectiveness of Piaget and Montessori educational methods in developing concepts related to numbers and geometric shapes	5	1
The effect of drama method on developing the perception of shape and number concept	5	1
Recognizing the basic geometric shapes and determining how they perceive the concepts used and geometric shapes while distinguishing the shapes from each other	5	1
The effect of narrative method on mathematics achievement	5	1
The effect of Frobel gifts on the geometry skill	5	1
The relationship between visual perception skills and geometry skills	5	1
Relationship between learning centers preference, geometry skills	5	1
The relationship between executive function and geometry skills	5	1
The relationship between attention, geometry, and phonological awareness	5	1
The effect of concept education on the development of the concepts of geometric shapes and numbers	5	1
Sub-total	75	15
<b>Subjects (Dissertations)</b>	<b>%</b>	<b>f</b>
The effect of direct instruction method and computer-aided education program on geometric shape acquisition	5	1
Developing the Early Geometry Skill Test and examining the skill	5	1
The effect of augmented reality activities on understanding geometric shapes and improving spatial skills	5	1
The effect of inquiry-based activities on geometric and spatial thinking	5	1
The effect of the geometry education program on geometry skills and creative thinking	5	1
Sub-total	25	5
<b>Total</b>	<b>100</b>	<b>20</b>

According to table 3 which presents the findings related to the master's theses, the trend of research topics were as follows: effectiveness of traditional and constructivist methods in the acquisition of mathematical concepts

and basic geometric shapes (10%), the effectiveness of computer-aided education and traditional education methods (10%), the effectiveness of Piaget and Montessori methods (5%), The effectiveness of the drama method (5%), the narrative method (5%), the effectiveness of Froebel gifts (5%) and the effectiveness of concept education (5%). Meanwhile, the criteria used in recognizing and distinguishing basic geometric shapes (5%), and determining the concepts and how geometric shapes are perceived when recognizing basic geometric shapes and distinguishing shapes from each other (5%) were also studied in the theses. In the relational aspect, the relationships among geometry skills and visual perception skills (5%), children's learning center preferences (5%), executive function skills (5%), attention skills and phonological awareness (5%) were studied.

When the doctoral dissertations were examined, mostly studied topics were as follows: the development of the Early Geometry Skill Test and the examination of the skill (5%), the effectiveness of direct instruction method and computer-aided education in the acquisition of the geometric shape concept (5%), the effectiveness of augmented reality activities (5%), the effectiveness of inquiry-based activities (%) 5) and the effectiveness of the geometry education program (5%).

6. What is the distribution of studies on geometry in preschool period by sampling method?

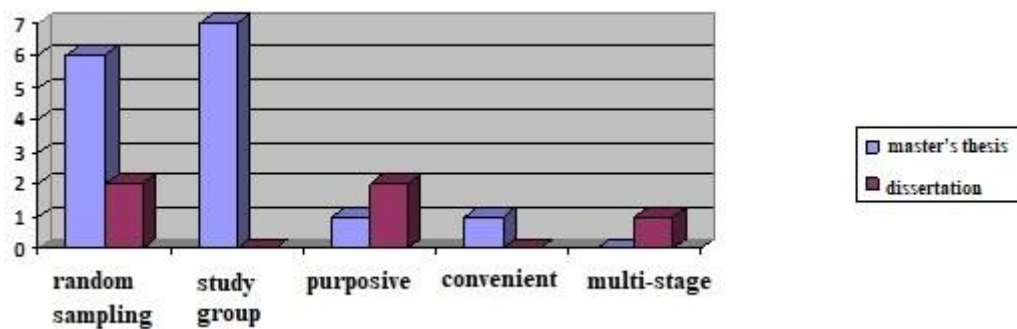


Figure 3. Distribution of studies on geometry in preschool period by sampling method

In line with the findings shown in Figure 3, it was found out that 46.66% (n = 7) of the master's theses included in this study used a study group, 40% (n = 6) used random sampling, 6.66% (n = 1) used purposive sampling and 6.66% (n = 1) used the convenient sampling method. In doctoral dissertations, it was determined that 40% (n = 2) used random sampling, 40% (n = 2) purposive sampling, and 20% (n = 1) multi-stage sampling method. Accordingly, it was seen that random sampling method was preferred most in theses and dissertations. In the second order, it was seen that the determining a study group was preferred in the studies examined.

### Conclusion and Suggestions

In this research, theses and dissertations on early geometry skills were reviewed. Based on the results of the analysis made within the scope of the research, it can be said that scientific studies on geometry skills have

gained more importance over the years. The fact that early geometry skills are dealt with from different dimensions enriches the literature, but it is not considered sufficient. More scientific research is needed on early geometry skills. Suggestions with regard to the results obtained from this study which aims to review the thesis and dissertations on early geometry skills and published in Turkey in the years 2000-2020 are given below:

According to the results of this research, academics can direct their graduate students to study on early geometry skills. In this context, comprehensive master's theses and doctoral dissertations, which will serve as the basis for early geometry skills programs while providing information on the investigation of children's geometry skills, and leading to the development of early geometry skills, are required. In this study, only master's theses and doctoral dissertations published in Turkey were discussed. Researchers can conduct new studies by scanning the different databases such as Web of science, ULAKBİM, and Google Scholar which list national and international research carried out so far. Longitudinal studies on the development of early geometry skills and qualitative and mixed studies can be conducted more. More research can be done to link early geometry skills with different areas of interest.

## Notes

\*Theses examined within the scope of the research.

## References

- \*Akdoğan Akuyşal, S. (2007). *6 yaş çocuklarının geometrik şekil ve sayı kavramlarının gelişiminde kavram eğitim programının etkisi*. (Yüksek Lisans Tezi), Sosyal Bilimler Enstitüsü, Adnan Menderes Üniversitesi, Aydın.
- Aktaş Arnas, Y. & Aslan, D. (2005). Okul öncesi dönemde geometri. *Eğitim Bilim ve Toplum Dergisi*, 3(9), 36-46.
- \*Alabay, E. (2006). *Altı yaş okulöncesi dönemi çocuklarına bilgisayar destekli matematiksel kavramların öğretimi*. (Yüksek Lisans Tezi), Sosyal Bilimler Enstitüsü, Selçuk Üniversitesi, Konya.
- Arıkan, R. (2011). *Araştırma yöntem ve teknikleri*. Ankara: Nobel Yayıncılık.
- \*Aslan, D. (2004). *Anaokuluna devam eden 3-6 yaş grubu çocuklarının temel geometrik şekilleri tanımlarının ve şekilleri ayırt etmede kullandıkları kriterlerin incelenmesi*. (Yüksek Lisans Tezi), Sosyal Bilimler Enstitüsü, Çukurova Üniversitesi, Adana.
- \*Aydın, M. (2019). *60-72 aylık çocuklarının öğrenme merkezlerini tercihleri ile geometri becerileri arasındaki ilişkinin incelenmesi*. (Yüksek Lisans Tezi), Eğitim Bilimleri Enstitüsü, Bolu Abant İzzet Baysal Üniversitesi, Bolu.
- Chapin, S.H. & Johnson, A. (2006). *Math matters*. Sausalito, CA: Math Solutions Publications.
- Clements, D. H., & Sarama, J. (2009). *Learning and teaching early math*. New York: Taylor & Francis Group e-Library.

- Clements, D.H. & Battista, M.T. (1992). Geometry and spatial reasoning. D. A. Grouws (Editör). *Handbook of research on mathematics teaching and learning* (pp. 420-464). Reston, Virginia: The National Council of Teachers of Mathematics, Inc.
- Clements, D.H. & Sarama, J. (2004). *Engaging Young Children in Mathematics: Standards for Early Childhood Mathematics Education*. A. M. DiBiase (Edt). USA: Lawrence Erlbaum Associates, Inc.
- Clements, D.H. (1998). *Geometric and spatial thinking in young children*. Erişim adresi: <https://files.eric.ed.gov/fulltext/ED436232.pdf>
- Clemson, D. & Clemson, W. (2001). *Mathematics in the early years*. by Routledge, London.
- Cooke, H. (2007). *Mathematics for primary and early years*. London: The Open University.
- Copley, J. V. (2000). *The young child and mathematics*. Washington: National association for the education of young children.
- Corbetta, P. (2003). *Social research; theory, methods and techniques*. London :Sage Publications.
- \*Dere, H. (2000). *Okul öncesi eğitim kurumlarına devam eden 6 yaş çocuklarına bazı matematik kavramlarını kazandırmada yapılandırılmış ve geleneksel yöntemlerin karşılaştırılması*. (Yüksek Lisans Tezi), Sosyal Bilimler Enstitüsü, Gazi Üniversitesi, Ankara.
- \*Gecü Parmaksız, Z. (2017). *Augmented reality activities for children: A comparative analysis on understanding geometric shapes and improving spatial skills*. (Unpublished Doctoral Dissertation) Doktora Tezi, Fen Bilimleri Enstitüsü, Orta Doğu Teknik Üniversitesi, Ankara.
- Hacısalıhoğlu Karadeniz, M. (2014). Okul öncesi çocuklarda mekânsal ilişkiler: harita örnekleri. *K. Ü. Kastamonu Eğitim Dergisi* 23(4), 1757-1774.
- Jung, M. & Conderman, G. (2017). Early geometry instruction for young children. *Kappa Delta Pi Record*, 53, 126–130.
- \*Kacar, A. Ö. (2006). *Okul öncesi eğitimde bilgisayar destekli eğitimin rolü*. (Yüksek Lisans Tezi), Fen Bilimleri Enstitüsü, Gazi Üniversitesi, Ankara.
- Karataş, Z. (2015). Sosyal bilimlerde nitel araştırma yöntemleri. *Manevi Temelli Sosyal Hizmet Araştırmaları Dergisi*, 1(1), 62–80.
- \*Keser, M. (2020). *60-72 aylık çocukların dikkat yetisi ile geometri ve sesbilgisel farkındalık becerileri arasındaki ilişkinin incelenmesi (Afyonkarahisar ili örnekleme)*. (Yüksek Lisans Tezi), Sosyal Bilimler Enstitüsü, Afyon Kocatepe Üniversitesi, Afyonkarahisar.
- \*Kesicioğlu, O. S. (2011). *Doğrudan öğretim yöntemiyle hazırlanan eğitim programının ve bu yönteme göre hazırlanan bilgisayar destekli eğitim programının okul öncesi çocuklarının geometrik şekil kavramlarını öğrenmelerine etkisinin incelenmesi*. (Doktora Tezi), Eğitim Bilimleri Enstitüsü, Gazi Üniversitesi, Ankara.
- Kesicioğlu, O.S., Alisinanoğlu, F. & Tuncer, A.T. (2011). Okul öncesi dönem çocukların geometrik şekilleri tanıma düzeylerinin incelenmesi. *İlköğretim Online*, 10(3), 1093-1111.
- \*Kılıç, M. (2018). *Okul öncesi geometri eğitim programının çocukların geometri becerileri ve yaratıcı düşüncelerine etkisi*. (Doktora Tezi), Eğitim Bilimleri Enstitüsü, Gazi Üniversitesi, Ankara.
- \*Kırlar, B. (2006). *Okulöncesi eğitim kurumlarına devam eden altı yaş çocuklarına bazı matematiksel*

*kavramları kazandırmada yapılandırılmış ve geleneksel yöntemlerin karşılaştırılması olarak incelenmesi.* (Yüksek Lisans Tezi), Sosyal Bilimler Enstitüsü, Selçuk Üniversitesi, Konya.

\*Korkmaz, H. İ. (2017). *Doğal açık alanlarda uygulanan sorgulama temelli etkinliklerin çocukların geometrik ve uzamsal düşünme becerilerine etkisi.* (Doktora Tezi), Eğitim Bilimleri Enstitüsü, Hacettepe Üniversitesi, Ankara.

\*Kurt, N. (2019). *Okul öncesi dönemdeki çocukların görsel algı becerileri ile geometri becerilerinin incelenmesi.* (Yüksek Lisans Tezi), Sosyal Bilimler Enstitüsü, Trakya Üniversitesi, Edirne.

\*Öğütçen, A. (2020). *Okul öncesi dönem çocuklarının yürütücü işlev becerileri ve geometrik şekil algılarının incelenmesi.* (Yüksek Lisans Tezi), Eğitim Bilimleri Enstitüsü, Hacettepe Üniversitesi, Ankara.

\*Öngören, S. (2008). *Okulöncesi eğitim kurumlarına devam eden 4-5 yaş grubu çocuklarına geometrik şekil kavramı kazandırmada montessori eğitim yönteminin etkililiği.* (Yüksek Lisans Tezi), Sosyal Bilimler Enstitüsü, Selçuk Üniversitesi, Konya.

Özerem, A. (2012). Misconceptions in geometry and suggested solutions for seventh grade students. *Procedia - Social and Behavioral Sciences* 55, 720 – 729.

Schwartz, S.L. (2005). *Teaching Young Children Mathematics.* Penn State Press.

Scott, J. (1990). *A Matter of record documentary sources in social research.* Cambridge: Polity Press.

\*Şen, A. P. (2017). *Froebel armağanlarının, okul öncesi eğitim kurumuna devam eden 60 – 72 aylık çocukların geometri becerilerine etkileri.* (Yüksek Lisans Tezi), Sosyal Bilimler Enstitüsü, Okan Üniversitesi, İstanbul.

\*Sertsöz, A. (2017). *6 yaş çocuklarına öyküleştirme yöntemi ile verilen matematik eğitiminin çocukların matematik başarılarına olan etkisinin incelenmesi.* (Yüksek Lisans Tezi), Eğitim Bilimleri Enstitüsü, Dumlupınar Üniversitesi, Kütahya.

\*Sezer, T. (2015). *Erken geometri beceri testi'nin geliştirilmesi ve çocukların geometri becerilerinin incelenmesi.* (Doktora Tezi), Eğitim Bilimleri Enstitüsü, Marmara Üniversitesi, İstanbul.

Şimşek, H. (2009). Eğitim tarihi araştırmalarında yöntem sorunu. *Ankara Üniversitesi Eğitim Bilimleri Fakültesi Dergisi*, 42(1), 33-51.

Smith, S.S. (2006). *Early childhood mathematics.* USA: Pearson Education, Inc.

\*Turan Topal, Y. (2010). *Okul öncesi çağındaki çocuklar öğretilen geometri kavramlarını nasıl algıladılar?* (Yüksek Lisans Tezi), Eğitim Bilimleri Enstitüsü, Gazi Üniversitesi, Ankara.

\*Yalım, N. (2009). *5-6 yaş çocuklarında matematiksel şekil algısı ve sayı kavramının gelişiminde drama yönteminin etkisi.* (Yüksek Lisans Tezi), Sosyal Bilimler Enstitüsü, Selçuk Üniversitesi, Konya.

Yıldırım, A. ve Şimşek, H. (2011). *Sosyal bilimlerde nitel araştırma yöntemleri.* Ankara: Seçkin Yayıncılık.

Yıldırım, K. (2010). Nitel araştırmalarda niteliği artırma. *İlköğretim Online*, 9(1), 79-92.