PRESCHOOLERS' SPATIAL/ARCHITECTURAL DESIGN SKILLS DURING CONSTRUCTIVE PLAY TIME

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ABSTRACT

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This study aimed to examine to what extend preschoolers use spatial / architectural design skills during constructive play time. An observation form of Spatial – Geometric – Architectural (SPAGAR) by Ness, Farenga and Garofalo (2017) was used as means of natural observation technique. Data were collected from 31 children in two different classrooms and they were observed in the construction area during play time. During the observations, children's constructions were photographed, and photographs were placed under related categories in the SPAGAR form with help of field notes. Observations lasted 10 days at both classrooms, 20 days in total. The material type in the construction area were different for each classroom: one classroom had bricks and the other classroom had blocks as construction materials. The findings highlighted that types of materials would affect children's design of construction in terms of the spatial relations and architecture principles. Bricks supported spatial relations especially symmetry such as line and plane symmetry. On the other hand, blocks promoted both spatial relations and architectural principles. Line symmetry was the most observed category in the classroom with bricks. Additionally, categories of line symmetry, patterning, engineering, and trabeated construction were the popular ones in classroom with blocks.

Keywords: preschoolers, constructive play, spatial relations, architectural principles, observation.

ÖZ

ANAOKULU ÇOCUKLARININ YAPI-İNŞA OYUNU ZAMANINDA GÖSTERDİKLERİ UZAMSAL/MİMARİ TASARIM BECERİLER

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Bu çalışma okul öncesi çocukların yapı-inşa oyunu zamanı süresince uzamsal / mimari tasarım becerilerini hangi boyutta kullandıklarını incelemeyi amaçlamıştır. Ness, Farenga and Garofalo (2017) tarafından geliştirilen Uzamsal – Geometrik – Mimari (SPAGAR) gözlem formu doğal gözlem tekniği ile kullanılmıştır. Veriler, iki farklı sınıftaki 31 çocuktan toplanmıştır. Gözlem, oyun zamanı süresince blok merkezinde gerçekleştirilmiştir. Gözlem süresince, blok merkezinde çocukların yaptıkları ürünler fotoğraflanmıştır ve bu fotoğraflar saha notları yardımıyla SPAGAR formunda ilgili kategorinin altına yerleştirilmiştir. Gözlem, her iki sınıfta 10'ar gün, toplamda 20 gün sürmüştür. Sınıflardaki materyaller birbirlerinden farklılık göstermekte olup; bir sınıfta tuğla şeklinde (bricks), diğerinde ise blok (blocks) şeklinde yapı-inşa malzemeleri bulunmaktaydı. Sonuçlar, çocukların blok merkezinde inşa ettikleri yapılarda kullanılan malzeme türünün uzamsal ilişkilere ve mimari prensiplere etkisinin olduğunu göstermektedir. Tuğla (bricks) şeklindeki yapı-inşa malzemelerini kullanan çocukların oluşturduğu yapılar incelendiğinde, uzamsal ilişkilerden özellikle çizgisel simetri ve düzlemsel simetri gözlenmiştir. Diğer yandan, çocukların blok (blocks) şeklinde yapı-inşa malzemeleri ile oluşturdukları yapılarda hem uzamsal ilişkiler hem de mimari prensipler gözlemlenmiştir. Tuğla şeklinde yapı-inşa malzemeleri olan sınıfta çizgisel simetri sıklıkla gözlemlenen kategori olurken. Blok şeklinde yapı-inşa malzemeleri olan sınıfta çizgisel simetri, örüntü, mühendislik becerileri ve kemersiz yapılar gözlenmiştir.

Anahtar Kelimeler: anaokulu çocukları, yapı-inşa oyunu, uzamsal, mimari, tasarım, gözlem.

To My Family

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CHAPTER 1

INTRODUCTION

1.1 Statement of the Study

As a general view for years, intelligence is seen as a cognitive skill that enables person to learn something (Diezmann & Watters, 2000). Researchers pointed out that the intelligence was just associated with literacy and numeracy skills for many years. Therefore, educators focused on developing these skills in formal educational settings. With Howard Gardner's Multiple Intelligence Theory, the term for intelligence has been changed (1997). He approached the intelligence not just these two domains as literacy and numeracy skills, he also discussed the intelligence with at least eight cognitive facets (Diezmann & Watters, 2000). These facets are spatial, logical-mathematical, linguistic, musical, bodily-kinesthetic, intrapersonal, interpersonal, and naturalistic. Then he added ninth intelligence which is existence intelligence.

Spatial intelligence is underestimated among other multiple intelligence types because people are using spatial intelligence generally unconsciously to navigate themselves in their daily life (Van Schaik, 2008). Einstein also agreed with this idea and pointed that if you give some words like disappointed, red, hard to people, they will get the meanings of these words because they faced with these words in their elementary experiences; however, if you mention "place" or "space" words to them, not everyone will get same image in their brain about these words (1954). Furthermore, Aydemir and Karalı (2014) found similar results in their research as spatial intelligence was the least shown intelligence type among secondary school students when it is compared to other multiple intelligence types. As a definition, spatial intelligence is "an ability to visualize and interpret location, position, distance, direction, relationship, movement, and change over space" (Sinton, Bednarz, Gersmehl, Kolvoord, & Uttal, 2013, p.44).

According to Piaget, spatial thinking starts from early years and keeps going throughout years (1954). Furthermore, education for spatial thinking should be made explicit and included into to the curriculum (Vygotsky, 2012). Therefore, spatial thinking should be seen as one of the necessary components in education because it starts from early years and goes after it so it should be included into to the curricula.

The current research was conducted during constructive play time to see to what extent spatial/architectural elements was observed in children's constructions. As cited in Ness, Farenga and Garofalo (2017), Copley stated that free time (in the form of play or recess) is one the best time for teachers to see their student's spatial thinking and problem-solving abilities. Therefore, play time was one of the ideal time periods for conducting this research. This study also aimed to examine the play tendencies of children in terms of their spatial / architectural skills.

1.2 Research Question

RQ1: To what extent preschoolers use spatial / architectural designs during constructive play time?

1.3 Significance of the Study

K-12 curricula should involve opportunities for developing children's spatial thinking skills in terms of two reasons (Ness, Farenga, & Garofalo, 2017). Firstly, children and adolescents exhibit great tendency to engage in activities that include spatial skills such as building structures that using constructive play materials. Secondly, as cited in Ness, Farenga and Garofalo (2017), current and prospective jobs will be depending on student's spatial abilities such as manipulating the objects mentally or physically or ideas for carrying out various functions related to specific fields ([NRC], 2006).

Ness, Farenga and Garofalo (2017) stated that young children's spatial thinking abilities help them to understand the spontaneous geometric tendency that connected with science, technology, engineering and medicine (STEM). As cited in Ness, Farenga and Garofalo (2017), higher spatial ability foresees incline toward and achievement in STEM discipline (Newcombe, 2010). Spatial ability is important in numerous disciplines such as geographic information system (GIS), in mapping, critical thinking activities, science- and engineering-related activities, STEM education, arts, humanities, architecture, medicine and mathematics (Ness, Farenga, & Garofalo, 2017). Although most of the research about spatial intelligence constructed in elementary grades, there are some research established in the early ages, too. For instance, Cohen and Emmons (2017) made their studies about usage of spatial language in block play with 14 children ages between three to nine. According to their study, some children used spatial words frequently while some of them did not prefer to use too much. Also, they concluded that there was a positive correlation between children's usage of quantity of spatial words and their quality of structure by blocks (Cohen & Emmons, 2017). Moreover, Jirout and Newcombe (2015) constructed their studies in building blocks for spatial skills; they worked with 1100 children whose ages were between four and seven, and they sought for block design performance and spatial experiences-performance. Jirout and Newcombe could not find any gender preferences toward block play. Also, there was no SES differences in terms of block design performance (2015).

Research about the spatial intelligence is usually conducted during play time in the block area. In block area, children usually have a chance to create something which is three-dimensional and creating 3D representations which then allow them to plan and discuss their constructions with their peers (Brooks & Wangmo, 2011). Researchers from all around the world also wandered to learn block play's advantages in their research. Generally, they work with elementary and middle school children and they wanted to learn the relation between block play and mathematics field. For example, Pirrone, Tienken, Pagano, and Di Nuovo (2018) made their research about the influence of building block play on mathematics achievement and logical and divergent thinking. In their experimental research, they clearly found the positive influence of these abilities on mathematics achievement (2018). Although most of these studies from elementary school level, there are some research including early ages such as Trawick-Smith, Swaminathan, Baton, Danieluk, Marsh and Szarwacki (2016) worked with preschool children to look some relations between block play and mathematics learning. They worked with 41 kindergarten children and they hypothesized a connection between kindergarten children's structure complexity, math learning ability, and block play characteristics (2017). As seen in the literature, the topic studied in the international arena, but it was not studied well enough in Turkey. For example, there are many studies on the multiple intelligence in educational settings and most of these studies performed in elementary, middle, high school and undergraduate. However, to the knowledge of the researchers, there is not any study examining spatial / architectural skills from the perspective of play experiences of children. Therefore, having information about these skills children demonstrate during play is not only give us a strong argument for advocating the importance of play in early years, but also supporting its importance for nurturing academic skills that heavily emphasized in the curriculum. Moreover, the study hopefully contributed to play and early childhood education research in terms of early childhood spatial skills which has a limited place in the research area. With the light of all these findings, the study will also shed light into to the importance of spatial / architectural skills in the early years for supporting the early academic skills emphasized in the curriculum.

1.4 Definition of Terms

Spatial Intelligence: Thurstone describes the spatial intelligence as a combination of three abilities: defining an object from different angles; imagining the object and its movements mentally; and consideration of special relations of people's bodily orientation (as cited in Gardner, 2006).

Architectural Principles: They are the main components of a structure or system. Through these principles, constructions have aesthetic, strength, and static.

Constructive play: It is a type of play including constructive materials such as blocks or Lego®. These materials (Blocks, Lego®) need to be manipulated to create a construction or the environment.

CHAPTER 2

LITERATURE REVIEW

2.1 Spatial and Geometric Thinking

The notion of space and geometry has been studied by ample researchers for many years in umpteen branches of science. However, Werner and Piaget's studies are considered the milestones in the field of education. Werner (1957) probably was the pioneer for this subject in the education area; however, Piaget stole the spotlight by his theory of spatial conception of the child (Ness, 2001). Werner described space and spatial cognition topics in his organismic development theory as follows in a developmental order: action in space, perception of space, conceptions of space, orthogenetic law, and hierarchic integration (1957). Moreover, Werner believed that the space concept progressively becomes active in children till they are at six or seven years old. Similarities between Werner and Piaget's studies become a debate; although, there are some major differences. For instance, Werner did not create his theory on the basis of deep investigations and work with a certain age group unless Piaget, because he made his investigation extensively and with a large number of participants. On the other hand, Werner found his theory by working with young children who had mental illnesses (Ness, 2001). Furthermore, spatial and geometric thinking are not passive skills, not require others or exterior factors; in other words, children must develop these skills actively by themselves via interacting with the environment, progressively, with controlling the objects (Ness, 2001).

Although saturated quantity of research about spatial development, Piaget's topological primacy thesis is still the key stone of the current topic (Ness, 2001). Piaget and Inhelder (1967) developed the theory of spatial and geometric development with help of clinic methods instead of standardized methods with working around 140 children the ages between two and half years and seven years. Piaget and Inhelder believed that children start to develop perceptual space when they are very young such as in infancy with help of interacting with objects and other individuals around them (1967). Moreover, during the first year of life, children advance some basic spatial relations such as *proximity, separation, order, enclosure, and continuity*.

First of all, *proximity* is developed; thus, it can be classified as first basic spatial relation element of human's life (Piaget & Inhelder, 1967). Proximity is one of common points between Piaget and Werner because Werner stated that a space of nearness starts to show up in babies, during first weeks in the world and he named this development as premordial space and Piaget called it as proximity means that babies' nearness toward objects in their perceptual field (Werner, 1957; Piaget and Inhelder, 1967). The other spatial relation is *separation* and the confusability of separation and proximity is high because separation occurs subsequently proximity and it means the ability of differentiating two objects by children which used to be seen blurred in past (Piaget & Inhelder, 1967). The another one is *order* and the infant knows the order of elements. For example, the infant knows the pap is coming when the infant saw the door opening, and caregiver was coming with a plate and then sucking starts. The *enclosure* is another one of these spatial relations. It was described as 'insideness' or surrounding by Piaget and Inhelder (1967). As an example, for one-dimension, B is in the middle of ABC and for three-dimension example, placing an object inside a box. It is a complex relation when compared to other three elements (proximity, separation, and order). Lastly, *continuity* includes perception of related elements which emerge lines or surfaces (Piaget & Inhelder, 1967).

According to Piaget and Inhelder (1967), there are four main stages in children's development in terms of topological primacy from birth to seven years old of human life. Stage 0 occurs between birth, and two and a half years. There is a perceptual space of children which composed of objects around them in this stage. Then, Stage I has two sub-stages. Substage IA occurs between two and a half years, and three and a half years. In this stage, children are not capable of distinguishing objects directly, but they get help from tactile and visual examination for differentiating objects. Substage IB generally is in three and a half years, to five years. In here, children topologically can distinguish shapes, not in Euclidean form. Also, Stage II has two substages. Substage

IIA exists between four and a half years, and five years. In this stage, children are now able to distinguish shapes with paying attention to their angle and dimensions. Substage IIB happens from five years to five and a half years. In this stage, children go further; for example, they are able to differentiate rhombus and trapezoid as quadrilaterals. Final step of topological primacy process is Stage III and exists by six and a half years. Furthermore, Piaget mentioned that this is stage is bridge between topological thinking and projective thinking; thus, after this stage completed, children start level of projective thinking and Euclidean geometry.

In projective space, children are able to manipulate many objects and shapes while being aware of their relationships. After thinking level of projective, Euclidean thinking exists. This thinking level starts with some abilities such as manipulating perspectives and surfaces (Piaget & Inhelder, 1967). Moreover, Ness (2001) stated that projective and Euclidean thinking exists in lately of childhood; therefore, the current study focused on only spatial and geometric thinking skills from these disciplines.

2.2 Importance of Play

The play subject has an extensive place in early childhood education area, even there are some slogans of it such as 'play is the business of children' and 'play is the children's way of learning' (Johnson, Sevimli-Celik, & Al-Mansour, 2012). As a definition, Verenikina, Harris, and Lysaght stated "modern and classical theories of play have identified the many ways in which play may affect children's wellbeing and advance their cognitive, social and emotional development." (2003, p.100).

Play enables to support cognitive, physical, socio-emotional areas, and provides a base for learning during early years. Moreover, children can have a chance to explore themselves and the world, discover their problem-solving skills, ability to work with others, ability to learn a topic via play (Bento & Dias, 2017).

Besides all these, play has a significant role in learning, too. Learning occurs not only with curriculum's objectives but also through play. Children can discover and learn via play. As a result of this, children are able to communicate with other people (Nolan, Kilderry, & O'Grady, 2006). Moreover, learning should be addressed in a holistic way. Thus, children's involvement and inclusion should be together to create this holistic concept (Greve, 2013).

To ensure this holistic approach, the pedagogy needs to take play into consideration. According to UNICEF (2018), quality of pedagogy and education in the early ages is related with learning via play or playful learning. Play and learner-based pedagogy are significant for early learning. Therefore, teachers should have a tendency and some required skills for including play-based learning into classrooms (UNICEF, 2018). Besides the pedagogy, play is important for development, too. For instance, according to Greve (2013) play eases whole development of the child.

There are some schools starting to apply play-based curriculum. As a definition, intentional and co-construction of knowledge are the components of play-based learning. Also, this learning type is associated the relations with peers and teachers inside of children's worlds (Nolan & Paatsch, 2018). Studies represented that children in the schools with play-based curriculum advanced their abilities related with emergent literacy skills during primary school years including the schools in socioeconomically disadvantaged neighborhood. Moreover, children in these schools (with play-based curriculum) developed their social communication skills compared to traditional curriculum schools (Reynolds, Stagnitti, & Kidd, 2011).

There are some play types that can be included into play-based curriculum. For example, Smilansky (1968) created four types of play with the help of Piaget's classification of play. The first type of play is the functional play and there are iterative movements with objects or without objects. The second type is constructive play in which child is creating or constructing something with objects. The third one is dramatic play includes children's desires and requirements in their imaginary world. The fourth and final type of play is games with rules which is an acknowledgment of pre-decided rules of the game (as cited in Rubin, Maioni, & Hornung, 1976).

A research about children's preferences in terms of these types had conducted. Rubin, Maioni, and Hornung (1976) observed preschool children from middle and low socio-economic status (24 children from middle SES and 16 children from low SES) for 30 days, during free play time. They concluded that there are differences on play preferences in terms of SES. For example, children from middle SES represented generally cooperative, associative and constructive play than children from low SES and as a reason for this finding, they stated low SES do not provide children enough space and objects to play with at their home.

As a result, children should have opportunities to play in their environment. The school is one of their environments as well as their home. They need to have same chance play at both environments. For school, play time is one of the best time periods for them.

2.3 Play Time

For the current study, term of "play time" was used instead of free play or unstructured play time. Clark, Wyon, and Richards described free play time as "…children were free to occupy themselves as they chose and, through the teacher occasionally suggested an activity to an unoccupied child, there was almost no redirection of activity." (1969, p.206). Moreover, during play time, children are free to do whatever they want and how to do it and they can decide when to finish it or they can experience anything else (Santer & Carol Griffiths, 2007).

There are many international researches about play time and its place in early childhood education. For example, Jarusriboonchai, Meissner, Almeida, and Balaam (2019) conducted an ethnographic study with children aged five to seven during play time in Newcastle, UK. They found through their observations that children performed different types of play such as reading books, playing with puzzles, having conversation with the classmates and the teacher and playing with computers, and also having pretend play, doing some physical activities, and playing with constructive materials. Moreover, they observed that constructive play was integrated into other types of play. For example, a girl who was playing with her doll also created a bed for her doll with construction materials. Also, Kontos (1999) recorded teachers' talk in Head Start's early childhood classrooms during play time and teachers' involvement during play time. According to the results, the teachers generally tried to get involved with children to play and facilitated the children's play.

2.4 Play Time in Turkey

Besides international studies, there are studies investigating play time and its place in early childhood education curriculum in Turkey. For instance, Özyürek and Kılınç (2005) made a research with 20 early childhood educators about the effects of the learning centers on children during play time. Teacher participated to the study stated that play time usually took one hour for a day. Also, the learning centers were not moved throughout the year; in other words, teachers designed these centers for classroom at the beginning of the year and did not make any changes on them. On the other hand, just a few teachers created temporary centers for specific interests. Moreover, teachers of the study shared that they took gender and age issues into consideration while designing the centers in their classrooms.

Özgünlü and Veziroğlu-Çelik (2018) carried out a study with 30 early childhood educators in İstanbul, Turkey. They aimed to have their opinion about unstructured play in preschool. Findings showed that teachers regard these types of plays as the learning tool, the way of self-expression, enjoyment and support for development. Also, the teachers described their involvement in play as an observer, a playmate and a problem solver. Their involvement started as preparing the physical environment and being an initiator of the play and then continue their role as being observer, playmate, and problem solver as needed.

Erşan (2011) worked with 40 early childhood educators in Ankara to obtain teacher's opinions about free play activities. She stated that teachers placed free play time as the first activity of the day on a daily schedule and spend almost one hour for free play time. The findings of the study presented that teachers defined free play as an activity without a purpose. Furthermore, teachers did not pay attention to children' interests or needs while designing the learning centers. Moreover, through the observations, the researcher indicated that teachers did not guide or observe children.

As seen from the aforementioned studies, play is crucial for children's socioemotional development and some types of it support the development of social skills. For instance, in sociodramatic play children can build empathy while considering themselves to be someone else and pretending in that specific role. Also, children learn how to work in a collaborative way with their peers and solve their problems occurred during play (Ashiabi, 2007). Besides sociodramatic play, other types of plays are also critical for children's development such as constructive play.

2.5 Constructive Play

There are usually constructive play centers with different types of materials such as planks, bricks and blocks in almost all preschool settings. Construction centers usually have materials that enable to construct, and blocks and Lego® are the most popular ones played by children in these centers. In many studies, it was called as blocks or Lego®; however, Ness and Farenga (2016) used VCPO term which means visuo – spatial constructive play objects for construction materials. Although many studies used as blocks, it was used as constructive play materials in this study.

Most of the educators are unaware that these blocks have a lot of benefits for educational purposes rather than just a free play time activity (Park, Chae, & Boyd, 2008). There are various evidences that block play increases higher-order thinking skills, logical thinking, academic knowledge, communication skills, and creativity (Pirrone et al., 2018; Jirout & Newcombe, 2015). Additionally, Ness and Farenga (2016) stated that some specific materials promote children's scientific, mathematical and technological foundations which are important for some occupations and disciplines such as architecture and engineering.

As mentioned in Cohen's paper (2015), Frobel and Montessori also thought similar ways and they emphasized that blocks are such beneficial materials that help increase creative expressions of young children. Some researchers found that block play makes contributions to main developmental domains such as social, cognitive, and physical (Cohen, 2015). For example, for physical and cognitive domain, children are mentally awake and they learn how to interpret the steps of sensory information while holding a block (Hanline, Milton, & Phelps, 2010). Isbell and Raines (1991) believed that it has many contributions to the language development as well. For instance, there is a common belief that pretending play is good at supporting the language, but Isbell and Raines said that the block play makes contributions to the language fluency and the development of speech structures better than pretending housekeeping game (1991). Wellhousen and Kieff were other researchers who investigated the benefits of block play (2001). They found that problem-solving, logical thinking, logical knowledge, math knowledge, knowledge in physical domain, learning math in very early ages including counting, identifying the shapes, sorting, classifying, and half-part relation can be promoted via block play (2001).

Besides these studies, there are some longitudinal studies to get deeper information the process of block play. For instance, Hanline and colleagues (2010) made a research started from early education and ended in elementary years. They found that children who have better representations in building block play in preschool years got better reading abilities and pace in elementary grades when it was compared to other children who had lower representation skills (Hanline et al., 2010). Furthermore, in another longitudinal study lasted for three years, the researchers and worked with 65 children for 421 times observations about block play learning. The results indicated that the complexity in block play increased with time and given more time for constructive block play allowed children to create more complex structures (Handline, Milton, & Phelps, 2010).

2.6 Spatial Intelligence and Constructive Play

In traditional view, only boys are good at block play and they have better spatial intelligence than girls. It was thought that being good at spatial things and block play come from birth. However, some current research showed that it is different than what they taught. The difference between boys and girls in terms of spatial abilities occur because of children's play preferences (Sherman, 1967). Baenninger and Newcombe found similar results and they concluded that environmental effects on spatial intelligence are valid and boys have higher spatial abilities because of teachers and parental expectations (1995). Moreover, boys' preferences for toys give rise to spatial intelligence (Serbin & Conner, 1979). Thus, it can be estimated that block play promotes spatial intelligence across the gender.

According to Coplan (2011), block play is seen as an activity that associated with spatial thinking skills. The relationship between block play and cognitive advantages are seen as promoting or preventing children's intellectual development (Ness & Farenga, 2016). Furthermore, historically, early childhood educators, cognitive psychologists and elementary education specialists used blocks or bricks in free play time to evaluate children's intellectual development (Hirsch, 1996).

Within the light of these studies, it can be said that there are many studies conducted about the advantages of multiple intelligence, spatial intelligence and constructive play. The research made in different grades and ages; however, there are less studies made with young children about these topics. Although, there are some investigations that conducted early ages, they generally looked at the relationship between block play and mathematical abilities. For example, Park and his colleagues investigated the relationship between block play and mathematical learning and, they found that block play not only enhance children's mathematical skills, but also form the basis for future mathematical learning (Park et al., 2008). Moreover, some researchers looked at the effects of block complexity and teacher and peer relations in terms of mathematic learning and they found that there is interlaced connection between the block complexity and ability to math learning (Trawick-Smith et al., 2017). Although there are some studies about math and block play in early ages, there are other studies about block play and spatial intelligence despite their number is too low. For instance, Ferrara, Hirsh-Pasek, Newcombe, Golinkoff, & Lam (2011) examined spatial language during block play and they found that engaging with blocks inherently increases spatial language, particularly during guided play. Moreover, there is a study that explored the development of spatial skills through block play intervention and the findings demonstrated that spatial skills and block play support each other, because both of them include physical manipulation, rotation, and combination of construction materials (Casey, Andrews, Schindler, Kersh, Samper, & Copley, 2008). Additionally, Brosnan (1998) analyzed spatial ability in children's play with Lego®. They worked with 50 children and asked them to create specific 3D constructions via blocks. Then, they concluded that children who were able to finish their 3D constructions had better spatial abilities than other children who could not complete the task.

2.7 Spatial Intelligence and Usage in Educational Settings

There are many definitions for intelligence; however, looking the intelligence definition within scope of Turkish language will be more helpful to understand the concept because of conducting the study in Turkey. Intelligence is stated in Turkish Dictionary as the person's intellectual skills such as thinking, reasoning, making judgments, and concluding (TDK, 2005, p.2228). Gardner defined the term of intelligence as solving problems and creating products that are accepted by at least one cultural setting or more (1983).

Spatial intelligence means that re-creating a scene by different ways even this scene is not exist or accessible anymore and transforming and changing a perception of a visual world (Gardner, 1983). Moving in an environment and creating a view mentally is explanation of spatial intelligence (Furnham, 2014). Thurstone describes the spatial intelligence as combination of three abilities such as; first, defining an object from different angles; second, imagining the object and its movements mentally; third, consideration special relations of people's bodily orientation (as cited in Gardner, 2006). People or young learner can develop this intelligence with some ways. For instance, visual art activities, preferring to use technology, creating a tale or a card game or a movie, visualizing the objects or scenes, using mind maps, creating a chart can be used to develop it (Alqatanani, 2017).

In the last century, preferences toward education have altered; as moving from teacher-centered to learner-based (Alqatanani, 2017). Also, multiple intelligence theory is one of the helpful theories that can meet the learner-based requirements. It is seen not just as a theory but also an instructional technique (Campbell, Campbell, & Dickson, 1996). Students can develop self-confidence, ability to being aware of themselves, creative thinking, honoring other people, being easy-learner and deciding their future jobs via the method that uses multiple intelligence theory (Bümen, 2005). Gardner stated that this theory can be used in all educational settings from kindergarten to high school and even further such as in life (1983).

There are some ways to enhance spatial skills from beginning early year's settings such as building block play facilitates for higher-order thinking skills (Pirrone et al., 2018). Cohen and Emmons (2017) conducted their research at block area and they concluded that children used spatial words while playing unit blocks; location/direction words were produced mostly, and shape words were the least used words during their study.

2.8 Architectural Principles and Constructive Play

Architecture and children's block play have some common points. Firstly, mathematical skills observed during children's block play and mathematical skills used by architects have similarities based on principles such as enclosure, foundation, trabeated construction, posting, engineering and proportional reasoning (Ness, 2001). Moreover, Frank Llyod Wright, who was an architect, mentioned the positive effects of using Froebel's Gifts during his early life in his autobiographies (as cited in Brosterman, 1997). Froebel's Gifts, which were designed by Friedrich Froebel for children and these gifts support children in terms of exploration and creation. Like Wright, there are other architects who affected by Froebel's Gifts throughout their career such as Charles-Édouard Jeanneret (as cited in Brosterman, 1997).

The relationship between mathematics and architecture underlies in block play as proves by the literature (Ness, 2001). For example, young children should develop wealthy mathematical abilities, and construction play enables this to children while playing and constructing (Ginsburg, Inoue, & Seo, 1999). Additionally, children have similar problematic situations in their designs same as architects. Both groups consider having a construction that can stand, and that has symmetry, aesthetic, and efficiency (Allen, 1995).

Çavdar (2012) stated that when children have opportunity to get architectural education in their childhood, they easily make decisions about their environment. For example, when children get architectural education, their creativity increases as well. Moreover, through architectural education, children start to become more sensitive to their environments (Çavdar, 2012). Furthermore, Ness and Farenga (2016) mentioned that some play materials such as construction materials support children's scientific, mathematical and technological basis; as a result, architecture and engineering disciplines are supported.

2.9 STEM and Early Engineering Skills

NAEYC has indicated the importance of STEM (Science, Technology, Engineering and Mathematic) in the early childhood education (2003). Also, Uttal & Cohen (2012) investigated the connection between STEM and spatial thinking and stated that spatial thinking ability is a good predictor for STEM success in the future, and spatial thinking increases ability in STEM. Similarly, Zimmermann, Foster, Golinkoff, and Hirsh-Pasek (2019) agreed with this idea and mentioned that spatial thinking decide the course STEM for future. Also, they advised to educators that starting spatial thinking and STEM education as early as possible (2019). Moreover, the National Assessment Governing Board had highlighted the significance of technology and engineering education. Then, the U.S. National Academies categorized technology and engineering education into four targeted disciplines (Bybee, 2010).

For many people, STEM just carries science and mathematics; however, technology and engineering part of it affect daily life (Bybee, 2010). If science and mathematics stand for basic knowledge, then engineering and technology stand for applying this knowledge into reality (Savinskaya, 2017). Moomaw and Davis (2010) found that the curriculum that contains STEM would help children to focus, expand their vocabulary, work together with others, and create scientific relations. Furthermore, Haden et al. (2016) stated that STEM learning can be promoted by hands-on play opportunities and conservations with adults. Also, play can advance children's skills that are base of STEM and support their learning (Honey & Kanter, 2013). Moreover, combining children's emergent spatial thinking skills with construction blocks during play time and spatial – and – geometric skills are important for promoting STEM skills in elementary and upper levels (Ness & Farenga, 2016).

In STEM education, children work in groups, experience laboratory explorations and projects; and as a result they develop 21st century skills and become good at decision making in personal health, national security, and individual health (Bybee, 2010).

Children start being capable of learning STEM skills from very early ages because they are the explorers and experimenters; therefore, STEM can be included into preschool curriculum to support education's objectives such as enabling inquiry-based learning (Savinskaya, 2017). Moreover, Swift and Watkins (2004) indicated that mathematics and science education should be started by early ages for affectivity. Moomaw and Davis (2010) stated STEM can be integrated into preschool curriculum. Likewise, Copple and Bredekamp (2009) mentioned that an integrated curriculum such as STEM and early childhood education are related in terms of developmentally appropriate practice. Also, many educators believe that when the fields are integrated into each other, children learn better (Moomaw & Davis, 2010). Therefore, there are some responsibilities for teachers; for example, they can strengthen children's abstract thinking with help of mathematics and science curriculum that contains more hands-on, inquiry based activities (Dejarnette, 2012).

2.10 Summary

Spatial thinking skills are crucial for some occupations such as scientist, engineers or architects besides many scientific and technical innovations ([NRC], 2006). Besides these professions, it is important for every person's daily life. For example, in this century, we started to hear some words such as GIS or GPS in daily life. GIS is geometric information system and GPS is global positioning system and both of these are quite necessary in hands-on maps thanks to quickly changing technology. In map reading, people's eyes read the map which is 2D and try to screen these 2D images in their brain as 3D (Ness, Farenga & Garofalo, 2017).

There is a relation between relative location and spatial thinking, and they can be seen in early ages; thus, their education should continue in elementary grades and even higher grades. Therefore, teachers play critical roles to support constructive play and create environments for constructive play to nurture children's spatial skills and early engineering play behaviors. Moreover, children can improve their spatial abilities if adults support them and provide appropriate play interventions to them (Ness, Farenga & Garofalo, 2017). Especially, the time devoted to constructive play is very critical for children to demonstrate such skills since it will guide the educators to follow the child's spatial-geometrical skills along with early engineering play behaviors. There are some studies that had done by using SPAGAR coding system. As a result, it was founded that children have a great tendency toward engaging some activities including shapes, patterns, engineering and architectural relations (Ginsburg, Lin, Ness, & Seo, 2003; Ness, Farenga & Garofalo, 2017).

CHAPTER 3

METHODOLOGY

3.1 The Design of the Study

The current study aimed to explore to what extent preschoolers use spatial / architectural design skills during constructive play time. It is a qualitative research and the reason behind the selection of qualitative research method for the current study was the curiosity toward children's spatial / architectural design skills. To investigate these skills, children were observed in their natural settings which is an opportunity that can be possible through qualitative research. This research type makes the world more visible with its materials such as observation notes, interviews, photographs, records and so on, and it tries to interpret the value given by people towards a case in their natural settings (Denzin & Lincoln, 2011). Moreover, the qualitative research was chosen because it allows better interpretation of the context (Silverman, 2014), and in the current study, it was aimed that trying to understand spatial / architectural design skills of preschoolers.

3.2 Participants

The data was gathered from 31 children preschool children (48-60-month-olds) living in Nevşehir and attending two different schools. Convenience sampling, which is a group of people who are reachable and available for the study, was used (Fraenkel, Wallen, & Hyun, 2015). While using convenience sampling, there are some points to be considered. For example, according to Lamont and White (2005), in order to obtain results beyond the individuals studied, it is also necessary to ensure that having a sample sufficient diversity about key demographic and theoretical features is reached. In this study, firstly, it was assured that both schools had construction area and enough number of materials in there. Furthermore, there were adequate diversities in sampling because two schools had different materials in construction area; therefore, these two schools were chosen. Moreover, it was ensured that both schools had play-time and the duration of play time is adequate for the observation and the data collection. The detailed explanations of these classrooms are given in the further sections below.

3.3 Setting

The observations of the current study were carried out in two different classrooms. The schools were chosen from Nevşehir located in the middle of Turkey. The city zone is famous for one of the touristic attractions in Turkey, Cappadocia. Therefore, parent's occupations are commonly related to tourism. Also, farming and trading are other common occupations in the region. The environment of the school where Classroom A is selected as low income and their average monthly income is between 1000 and 2000 Turkish Liras. On the other hand, Classroom B's neighborhood is classified as high income and their average monthly income is between 2000 and 3000 Turkish Liras. Settings of classrooms described at below and summarized in *Table 3.3.1*.

Table 3.3.1

Settings of Classrooms

	Classroom A	**Classroom B**
Type of school	State school	Private school
Duration of education	Half day	Full day
Daily schedule	**Daily Schedule of Classroom A** 08.30 – 09.15 Play time 09.15 – 10.00 Breakfast 10.15 – 10.45 Literature activities 10.45 – 11.30 Art activities 11.30 – 11.45 Science activities 11.45 – 12.40 Game – music activities	**Daily Schedule of Classroom B** 08.30 – 09.30 Play time 09.30 – 10.00 Breakfast 10.00 – 12.30 Integrated activities 12.30 – 13.30 Lunch 13.30 – 14.00 Play time 14.00 – 15.30 Activities 15.30 – 16.00 Snack time 16.00 – 17.00 Outdoor time
Duration of play time	45 minutes	30 minutes + 30 minutes

Table 3.3.1

Settings of Classrooms (Continued)

<table>
<tr><td>Daily schedule</td><td>
<table>
<tr><th colspan="2">Daily Schedule of Classroom A</th></tr>
<tr><td>08.30 – 09.15</td><td>Play time</td></tr>
<tr><td>09.15 – 10.00</td><td>Breakfast</td></tr>
<tr><td>10.15 – 10.45</td><td>Literature activities</td></tr>
<tr><td>10.45 – 11.30</td><td>Art activities</td></tr>
<tr><td>11.30 – 11.45</td><td>Science activities</td></tr>
<tr><td>11.45 – 12.40</td><td>Game – music activities</td></tr>
</table>
</td><td>
<table>
<tr><th colspan="2">Daily Schedule of Classroom B</th></tr>
<tr><td>08.30 – 09.30</td><td>Play time</td></tr>
<tr><td>09.30 – 10.00</td><td>Breakfast</td></tr>
<tr><td>10.00 – 12.30</td><td>Integrated activities</td></tr>
<tr><td>12.30 – 13.30</td><td>Lunch</td></tr>
<tr><td>13.30 – 14.00</td><td>Play time</td></tr>
<tr><td>14.00 – 15.30</td><td>Activities</td></tr>
<tr><td>15.30 – 16.00</td><td>Snack time</td></tr>
<tr><td>16.00 – 17.00</td><td>Outdoor time</td></tr>
</table>
</td></tr>
<tr><td>Duration of play time</td><td>45 minutes</td><td>30 minutes + 30 minutes</td></tr>
<tr><td>Number of children</td><td>10 boys and 9 girls</td><td>6 boys and 6 girls</td></tr>
<tr><td>Age of children</td><td>5-year-olds</td><td>5-year-olds</td></tr>
<tr><td>Centers in the classroom</td><td>Drama Center, Library Center, Montessori Center, Math Center, Science Center, Construction Center</td><td>Library Center, Cognitive play Center, Construction Center</td></tr>
<tr><td>Materials in construction area</td><td></td><td>


</td></tr>
</table>

Table 3.3.1

Settings of Classrooms (Continued)

Physical layout of the classrooms	 	 
Monthly payment for school per child	10 Turkish Liras	600 Turkish Liras
Number of the teachers	One home-room teacher	One home-room teacher and one teacher's aide
Experience of the teachers	6 years	1 year
Degree of the teachers	Undergraduate, Early Childhood Education	Undergraduate, Early Childhood Education

3.3.1 Classroom A

Classroom A's location was far away from the city and the neighborhood of the school can be described as a farming area of the city. The classroom had 19 five-year-old children. The school where Classroom A is chosen is a state school and the tuition fee for per child is 10 Turkish Lira. There were 10 boys and 9 girls in the classroom. The class was located at the end of first floor and the teacher prefers to use the garden and corridor when upper grades are at their course hours. The observation took place at 5-

year-old kindergarten classroom. There was a teacher who is 28 years old and she had 6 years of experience in the field. This year was her second year at this school. She had bachelor's degree from early childhood education field.

The school starts for kindergarten classroom at 8.30 am and finishes 12.30 pm for week days. Children have around 45 minutes of play time during the day. There was no specified time for recess for kindergarten classroom and recess decision was left to teacher's will. She mentioned that she generally did not prefer recess because of anxiety of limited time. Regarding the parents of children, all fathers had jobs; on the contrary, mothers were not working and most of them were housewives. Father's occupations were varying from private sector employees, farmers, and craftsman to technicians and instructors. Regarding the mothers, one of them did not go to school, seven mothers were primary school graduates, eight mothers were middle school graduates, and two mothers were high school graduates. Also, three fathers were primary school graduates, five fathers were middle school graduates, seven fathers were high school graduates, and two fathers were university graduates.

Classroom A had centers such as construction center, literacy center, drama center, dramatic play center, math center and a center with some Montessori toys. There was no specific place for art center and children could only use their own paints when they wanted to do art on the tables during play time. Moreover, almost all materials were inside transparent boxes that children could see, and the materials were at child level. There was a specified place for construction center that is placed in a small rug. Although it was placed in a small rug, children preferred to carry the construction materials to the big carpet and play on it. All the construction materials were in brick type which is a term for plastic pieces, which snap together and generally in geometric shapes such as rectangular.

3.3.2 Classroom B

The school that had classroom B was established at 2008 and located at the center of the city. Classroom B is a private kindergarten with 600 Turkish Liras for tuition fee for each child. Regarding the families, all fathers had jobs; on the contrary, a few mothers were working, and others were housewives. Mothers' occupations were government employees and secretarial, and father's occupations were self-employees, private sector employees, and government employees.

The observations took place at 5-year-old classroom. There was a lead teacher and a support teacher at the classroom. The lead teacher was 23 years old and it was her first year at her teaching career. She had bachelor's degree from early childhood education field.

Classroom B had no centers inside the classroom. Instead of centers, there were rooms such as drama room, TV room, English room. Teachers carried children to these rooms when they were going to do something related to the subjects. During play time, children were allowed to use home room classroom's tables as art making by their own paints or they could use toys boxes such as Jenga, Mangala or some table games. There were construction materials called blocks or terminologically they were called standard unit blocks. Generally, these blocks were products of toy companies, in other words, board games such as Becerikli Yapılar, Pattern Play, Equilibrio, and Block Buddies.

3.4 Data Collection Procedure and Data Collection Instrument

Observation was used to collect the data with the help of an observation form called Spatial – Geometric – Architectural (SPAGAR) form and children's construction was photographed for visual analysis. The observations lasted for 10 days in two classrooms except that the researcher had been present a couple of times in the classroom before starting to conduct the study. The number of observations was estimated from 10 days to 20 days before starting the study, but the certain quantity of observations was not decided. It was planned to continue till data was saturated. At the 10^{th} day, stopping the observations was decided because data was started to repeat. There were similar results for every day. Also, 10 days were enough for not disturbing the teaching period in the classroom.

In this study, an observation form, field notes and photographs were used as research tools. For the observation part of the study, children were observed via the observation form and photographs of their construction were taken during constructive play time and the researcher had the field notes. Data collection procedure happened in construction areas of both classrooms. Observing the area by the researcher was a good technique to collect the data. Constructions of children made in the area were the data of the current study. Thank to observation technique, SPAGAR form was filled, field notes were taken, and children's constructions were photographed by the researcher during the observation process. As a result, a set of saturated data was handled. Qualitative researchers collect data with talking with people directly and observing their behaviors and movements in their natural environment (Creswell, 2013). Observation technique was chosen because observation is a preferred technique for data collection of a study such as a phenomenon in a class or in a school (McMillan, 2000). Naturalistic data can be addressed ideally via qualitative methods including observations (Silverman, 2014). Observational studies are preferred by qualitative researchers as one of the fundamentals of qualitative area; conversely, observation is not adequate way for data collection procedure in quantitative studies because quantitative studies work with large numbers (Silverman, 2014). As cited in Silverman (2014), Street Corner Society book by William Whyte is a classic representative of naturalism and Whyte exhibited what he heard and saw in this real world of poverty through his observations and analysis.

Additionally, children were observed in the construction area during play time and they were photographed when they constructed something at the area. One SPAGAR form was filled for each construction. These constructions were in 3D structure; therefore, most of them consisted of more than one SPAGAR item. Filling the SPAGAR form depends on these constructions without outage was difficult because the researcher had to keep up with all children's construction in the area and sometimes, there were more than one child. At this point, photography was a good solution for not missing data. Via this, the researcher photographed when children created something in the construction area, and photographs were used later for double checking SPAGAR form's filling. The reason why photographs were used as a tool was that they are seen as one of the best evidences for visible ideology and objectivity is best addressed by camera because it presents the world as it is (Kuhn, 1985). It is obvious that education and photography are interlaced (Moss & Pini, 2016). Educational researchers had long since been interested in first-person observation; however, latterly, they started to focus on researcher-produced photographs and videos at school environments (Prosser, 2007). When children completed their construction or before they move to another center, their constructions were photographed. Some children mentioned that they finished, and some did not; nevertheless, their constructions were captured more than one time to not miss data. Photograph of the final version of structure was used the data. For example, a child started to create and then, it was photographed. Next, the child kept adding some block or bricks on the master construction, and then it was again photographed. This process continued this way till the child stop adding new pieces or changing the master construction. Finally, the last photograph of the construction was used as a data, not the former ones.

Field notes were one of tools to collect the data of the current study. During the entire observations, the researcher noted the flow of play time. SPAGAR form just focuses on spatial relations and architectural principles. However, other items of the process should be considered such as gender, teachers' intervention or attitude, duration of play time, atmosphere of the classroom and so on. Enough space for taking notes on SPAGAR form was left while printing the forms. The researcher was in the classroom before children come to classroom. With first child's entrance to classroom, the observation period was started. The time of beginning was noted down on the observation form as well as ending time. These field notes were used in analysis of the data. For instance, gender rate, teacher's intervention, play time duration, repetition of children's behavior during construction were helpful both in analysis and discussion of the study.

To answer research question of the current study, observation, field notes and photographs were helpful because they made it visible that to what extend children used spatial / architectural design skills during constructive play time.

3.4.1 Spatial – Geometric – Architectural (SPAGAR) Form

Classroom A and B were observed for 10 days with Spatial – Geometric – Architectural (SPAGAR) form (See *Appendix C*). The permission to use the form for this study was granted by the researcher. The form was developed by Ness, Farenga and Garofalo (2017) and there are 13 categories in the form and two main topics: spatial relations and architectural principles. Each topic has some main titles and sub-titles under it. For example, in spatial relations section, there are three main titles as symmetric relations, figural relations and direction/location. Architectural principles have six sub-titles only.

In the symmetric relations main title, observing both halves of the completed arrangements or shapes are each other's mirror images can be possible. All symmetric 3D shapes that were made by children have a meaning in this scale. Symmetric relations have four sub-titles as line symmetry, plane symmetry, rotational symmetry and patterning. For example, a symmetric view from bird eye is an example of *line symmetry*. Also, creating symmetry from profile view means that it is the *plane symmetry*. Next, placing objects in a symmetric way around a circle shape is example of *rotational symmetry*. Finally, placing blocks in an order as pattern means that there is *patterning*.

Figural relations main title has two sub-titles as figure identification and shape matching. *Figure identification* means that children are aware of shapes or figures and can be clearly seen in children's verbal expression. For example, if child says that "Can you pass me the circle thing?" it can be said that there is figure identification. During the observation of current study, children's verbal expressions were not taken account and not recorded; therefore, any figure identification were not noticed. The *shape matching* means that using a specific object to change geometric shape of the structure to solve the task or to complete rule-governed activities such as puzzles or other similar play objects. Also, Ness, Farenga and Garofalo (2017) explained that rule governed activities or games also is kind of shape matching. Therefore, some games such as puzzle related with shape matching category in this study.

The final title under spatial relations is *direction/location*. This category can be observed in words or actions or gestures. For instance, if child uses some directional or navigational words such as over, under, straight ahead, in the cabinet or building of track under a bridge and so forth, the direction/location category can be observable.

Other topic is architectural principles which seek for children's use of six general ideas that can be in both their constructions and those of architectural and civil engineers. This main title has six sub-titles as enclosure, foundation, trabeated construction, posting, engineering and proportional reasoning. Using the blocks as they are the fences or surrounding of something can be example of *enclosure*. *Foundation* can be exampled as foundation of a building or construction of a basement of the building can be a good example. If there is foundation in children's structure to make their structure more durable, it can be said that there is foundation sub-title. *Trabeated construction* (post-and-beam) is similar with all post and beams in the all buildings and it aims to add more levels or floors to the structure. *Posting* is the 11^{th} SPAGAR category and it stands for suspensions or columns or lintel construction or vertical supports. Generally, children use posting when they are constructing bridges or roadways or train tracks via blocks.

At this point, there was a confusion between Trabeated construction and Posting categories because they were not differentiable from each other. To prevent further chaos during data collection and analyzing part, an architect's opinion was received as an expert opinion. The architect suggested to create a specific rubric just for these two categories; Trabeated construction and Posting. According to this rubric, if there are just vertical supports and lintel construction same as bridges or roadways or train trucks without having any other construction on top of lintel pieces, it can be categorized as Posting. However, if there are vertical supports as supporting a building or other construction on top of lintel pieces, it can be categorized as Trabeated construction.

Engineering stands for this category as problem solving, estimating or measuring the structure formal or informal ways and sometimes, it can be with drawing of figures. For example, when children are about to finish their car park, they can recognize that their car park is not as big as their all cars; thus, they need to change it to larger. The last SPAGAR category is *proportional reasoning* which is being aware of the proportions between objects. For example, if children are aware of toy car is for car garage which was constructed by blocks. Here, children who demonstrate proportional reasoning are aware of the garage should bigger than the toy cars.

3.5 Data Analysis

Children's 3D structures were photographed, and the observation forms filled by the researcher and the researcher's filed notes were used in data analysis to see whether they are related to spatial / architecture skill. In the observation forms, there are 13 categories in SPAGAR coding system, and these categories were analyzed in terms of to what extent children demonstrated or not demonstrated during play time by using content analysis.

There is an analytic strategy created by Creswell (2013) and this strategy was used during data analyzing. According to this strategy, after observations and taking notes, field notes (including filled forms and records) are summarized. Then, codes are identified. After, some significant themes or patterns are distinguished for reducing codes to themes. However, there were already created categories and themes; thus, they were not created. Next, categories are related, and related categories are contextualized to literature. Then, the point of view is created. The result is displayed via graphs or discussion (Madison, 2005; Huberman & Miles, 1994; Wolcatt, 1994). In the current study, it was displayed by photographs and discussion.

In content analysis, the researcher firstly creates the categories and then records related items with counting under the relevant category (Silverman, 2014). The categories were not created during data analysis for study because SPAGAR coding system was used and there are 13 categories already created. Moreover, Marvasti (2004) described steps of content analysis and indicated that counting or measuring how often predetermined categories occur is the last step of analysis. For the analysis of current study, some tables that were located in findings part were created, and they represent how often SPAGAR categories observed during the observations. All kinds of expressive visual or verbal material may be used at analysis part and especially in content analysis (Van Leeuwen & Jewitt, 2004). Visual materials (photographs) were used during analysis of the current study.

A major part of history of visual research techniques was related with the articles using photography technique (Silverman, 2014). It was specified that American Sociology Journal published various articles which used photographs as data at more than a century ago (Marvasti, 2004). Moreover, it is known that photographs can provide consequential data for having information about practices of schooling (Moss & Pini, 2016). Likewise, photographs were accepted as data for the current study, and photographs of children's construction were utilized as data to place under a related category at observation form. In findings part, photographs placed under a pre-defined category were presented and the most observed categories were mentioned because Van Leeuwen and Jewitt (2004, p.13) said that "Content analysis is an empirical (observational) and objective procedure for quantifying recorded 'audio-visual' (including verbal) representation using reliable, explicitly defined categories ('values' on independent 'variable')". This should always be considered that content analysis just exhibits how something is represented, not to 'reality' (Van Leeuwen & Jewitt, 2004). Therefore, in this current study, visual research techniques and content analysis were used. Constructions were photographed during each observation. After finishing the observations, all photographs were transferred to the computer. Via help of SPAGAR form, the photograph of a construction was related one or more category in the SPAGAR. Then, the related photograph was placed under that category or categories through field notes. This process was repeated for all the photographs which were taken for that day. As a result, all photographs were organized and grouped thanks to this technique to inside of one SPAGAR form for each day. The Table 3.5.1. is an example for data set of one day's observation.

Table 3.5.1

Spatial-Geometric-Architectural (SPAGAR) Categories

Spatial Relations

1-Line Symmetry *(a symmetric view from bird eye)*

Photograph: 1

Photograph: 2

Photograph: 3

2-Plane Symmetry *(a symmetry from profile view)*

Photograph: 1

Photograph: 2

Photograph: 3

3-Rotational Symmetry *(placing objects in a symmetric way around a circle shape)*

4-Patterning *(placing blocks in an order as pattern)*

Figural Relations

5-Figure Identification *(being aware of shapes or figures and can be clearly seen in children's verbal expression)*

6-Shape Matching *(using a specific object to change geometric shape of the structure to solve the task or to complete rule-governed activities)*

Table 3.5.1
Spatial-Geometric-Architectural (SPAGAR) Categories (Continued)

Direction/Location

7-Direction/Location *(using word or gestures about direction and location)*

Architectural Principles

8-Enclosure *(surrounding)*

9-Foundation *(basement of the construction)*

Photograph: 3

Photograph: 4

10-Trabeated Construction *(adding more levels or floors to the structure)*

11-Posting *(suspensions or columns or lintel construction or vertical supports)*

Photograph: 5

Photograph: 6

Table 3.5.1

Spatial-Geometric-Architectural (SPAGAR) Categories (Continued)

12-Engineering *(estimating or measuring, creating static and balance)*


Photograph: 4


Photograph: 7


Photograph: 8

13-Proportional Reasoning *(being aware of the proportions between objects)*

14- Others *(Uncategorized)*

3.6 Trustworthiness

Trustworthiness of the data, its analysis and the findings of the study are very important standards while evaluating a qualitative study (McMillan, 2000). Researchers at qualitative studies have concerns about trueness of the observations instead of checking consistency of behaviors. Therefore, recording everything that happened during observation or the study increases the trustworthiness such as field notes, taking photos, and so on (McMillan, 2000). There are some threats that prevent trustworthiness. For example, subject characteristics is one of them and it contains such treats; age, gender, socioeconomic status and so forth (Fraenkel, Wallen, & Hyun, 2015). For this current study, age category was not a threat because children were at the same age level, 5-year-old, at both observed classrooms. Also, gender category did not pose any threat because gender diversity was almost equal in per class.

For the SGAPAR, the evidence of validity was collected with help of content-related evidence of validity which is having the opinions of people or experts who are knowledgeable in the context. For this, before conducting the study, the observation form was checked by three experts; one researcher, one early childhood educator and two architects, to learn whether the forms were appropriate to use for this study design. After the study ended, one expert who was a researcher checked the observation forms and the photographs taken by the researcher at classrooms.

Trustworthiness (reliability) can be provided with the correlation of two coders' agreement on the similar findings for the same study and this is called inter-coder reliability or agreement. For this, researchers should ensure that the other coder also understand how to apply data collection tool along the same line the researcher. Also, researchers should train the other coder about the defined criteria. Finally, the researcher should measure inter-coder agreement (consistency) with comparing both coders' results (Van Leeuwen & Jewitt, 2004). According to Patton (2002), coefficient of inter-coder agreement should be at least 80%. For the current study, one early childhood educator joined the observations for four days after learning how to use the SPAGAR observation form. Then, these two forms filled by two coders (one by the researcher and one by early childhood educator) were compared for consistency with using intercoder agreement and the coefficient was found 86,5%.

Moreover, to be present in the classroom, where the study will be conducted, for a long time is helpful in terms of validity's evidence (Creswell, 2013). Therefore, the researcher was in the classroom for a few times before starting the research; thus, children can get used to her and the data collector bias was prevented via this way. Also, being in the classroom a few times more such as two weeks before conducting the research helped to eliminate attitude of subject. Finally, homeroom classroom teachers and the researcher did not interfere in constructive play time during the observations to protect natural environment of classroom.

3.7 Ethical Issues

Ethical issues should be considered, and the researcher makes sure that there is not any possible physical or psychological harm for participants especially in research with human (Fraenkel, Wallen, & Hyun, 2015). Visual methods are generally used at educational and social research, and institutional ethics committee and researchers should follow ethics guidelines and principles creatively and reflexively (Moss & Pini, 2016). Ethical issues were considered throughout the study and permission from institutional ethics committee of Middle East Technical University after sharing all details of the study with them (See Appendix A). Then, the approval from the Ministry of National Education was received to start the study at two designated schools (See Appendix B).

For photographing, all permission was taken before conducting the study and also children' verbal consent was received before taking photographs. Moreover, children's faces were cropped from the photographs and just constructions were presented in order to increase the confidentiality instead of using pixilation of faces or positioning a black bar across the eye part of face (Moss & Pini, 2016).

CHAPTER 4

FINDINGS

This chapter presents the results of the observations of play times observed by Spatial-Geometric-Architectural (SPAGAR) form. Classroom A's play time observations will be presented firstly, and the Classroom B's findings will be presented secondly.

4.1 Findings from Observations of the Classroom A

Classroom A's play time was observed for 10 times with an average of 40 minutes of observation each time. Classroom A's play time was in the mornings except first day of observation. There were bricks (commonly known as Lego® or Duplo® bricks) as construction materials.

4.1.1 Findings from the First day of Observation

The observation took place after integrated activities before children left from school. When children came to school, the teacher started to her activity plan and the play time was occurred that day after all activities finished because the teacher presented Italy as a country including the Pisa Tower to children according to her daily plan. Then, children started to play. There were 19 children, 10 boys and nine girls in the classroom. Play time took 26 minutes for first day. 12 children played in construction area and 2 of them were girls and 10 of them were boys. Teacher did not interfere to play time but after the presentation and art activities, at transition moment, teacher gave them a direction and she said "Now, you can play. You can play with everything. Even, you can do a tower like the Pisa Tower that we have learnt today."

It can be said that children were inspired by the Pisa Tower as it can be seen by photos at engineering section because there is skewness in their construction same as the Pisa Tower. All photographs taken during the observation placed under related categories inside Spatial-Geometric-Architectural (SPAGAR) Categories (see Appendix 1).

Also, one construction which was called tower by children could not be categorized; thus, it was placed in others category.

Line symmetry was the most common observed category during the observations. Line symmetry is an example for a symmetric view from bird eye (see Figure 4.1.). When these constructions were examined, there is a symmetry while looking bird eye to them. Additionally, there were *foundation* element at some these constructions, and they were supported for bottom of construction clearly (see Figure 4.2.). It could be said that there was static at their construction and it was an example to *engineering* category (see Figure 4.3.).

Figure 4.1. Line Symmetry

Figure 4.2. Foundation

Figure 4.3. Engineering

4.1.2 Findings from the Second Day of Observation

The second observation occurred in the morning, in play time. There were 19 children, nine boys and 10 girls in the classroom. Play time took 22 minutes for second day. 12 children came to construction area and seven of them were girl and 5 of them were boys. Teacher did not participate to play time and got prepared for coming activities in the classroom.

Line symmetry, which is a symmetric view from top of construction, again was the most common observed category during the observation for second day (see Figure 4.4.). All photographs taken during the observation grouped and placed related category in SPAGAR form. All photographs were taken for second observation can be found at Appendix 2. Also, one construction could not be categorized; thus, it was placed in others category.

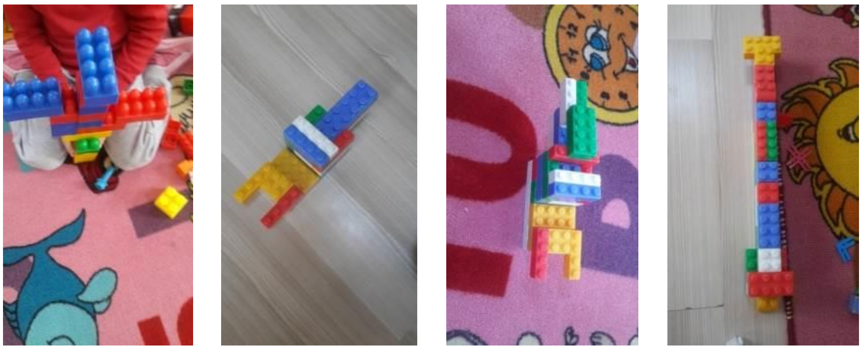

Figure 4.4. Line Symmetry

4.1.3 Findings from the third day of observation

The play time was again the morning and observation, as well. There were 17 children, nine boys and eight girls in the classroom. Play time took 40 minutes for third day. Nine children participated to construction play and four of them were girls and five of them boys. Moreover, teacher prepared materials for her upcoming lecture without joining play time.

At third day of the Classroom A, *line symmetry* was again the most common observed category during the observation. Figure 4.5. shows examples for both line and plane symmetry. Additionally, there was a *patterning*, which means placing blocks in order, repeating a design like stairs (see Figure 4.6.). Moreover, throughout the whole observations, an example construction for *Trabeated Construction Category* was only observed this day (see Figure 4.7.). If there is a lintel construction and one more placed on top of the lintel; thus, it could be classed as Trabeated Construction. All photographs taken during the observation placed under related categories inside Spatial-Geometric-Architectural (SPAGAR) Categories (see Appendix 3). Also, eight constructions could not be categorized; thus, they were placed in others category.

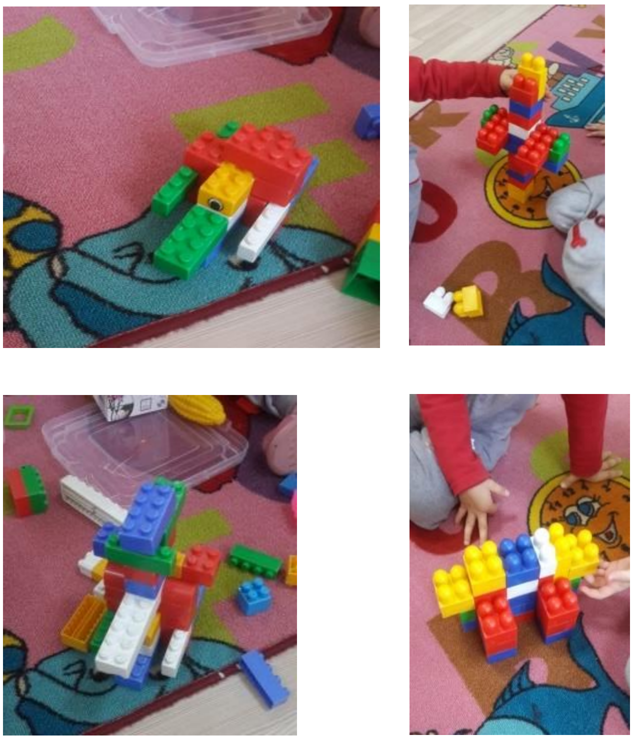

Figure 4.5. Line Symmetry

Figure 4.6. Patterning

Figure 4.7. Trabeated Construction

4.1.4 Findings from the Fourth Day of Observation

As always, play time was occurred in the morning of daily schedule. There were 18 children, nine boys and nine girls in the classroom. Play time took 50 minutes for that day. Seven boys and three girls, 10 children, played at construction area. Teacher took care of her preparations during play time.

At fourth day of the Classroom A, *line symmetry* again was the most common observed category during the observation and then *engineering category* followed it with four examples. Engineering observed when there were static and balance at children constructions and they were some examples to engineering category (see Figure 4.3.). The constructions in Figure 4.3. are example for balance in the structure. All photographs that were placed under relevant categories are available at Appendix 4. Also, four constructions could not be categorized; thus, they were placed in others category.

Figure 4.8. Engineering

4.1.5 Findings from the Fifth Day of Observation

When children came to classroom, they started to play and play time was in the morning of schedule. There were 15 children, eight boys and seven girls. Play time took 40 minutes for that day. Only seven boys play with construction materials, not girls for that day. Also, teacher did not interrupt children’s play.

At fifth day of the Classroom A, *line symmetry* was the most common observed category during the observation (see Figure 4.9.). When these constructions were examined, it could be said that there is a symmetry while looking bird eye to them. Additionally, there were *foundation* element at some these constructions, and they were supported for bottom of construction clearly (see Figure 4.10.). Also, it could be said that there were static and balance at their constructions and they were some examples for *engineering* category (see Figure 4.11.). All photographs taken during the observation placed under related categories inside Spatial-Geometric-Architectural (SPAGAR) Categories (see Appendix 5). Also, four constructions could not be categorized; thus, they were placed in others category.

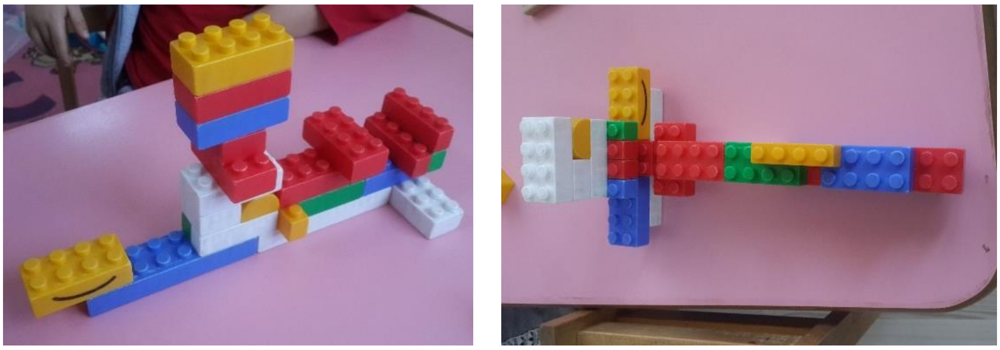

Figure 4.9. Line Symmetry

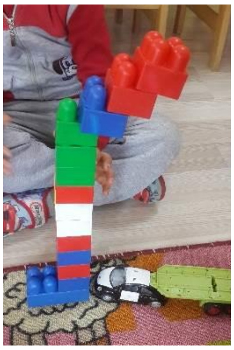

Figure 4.10. Foundation

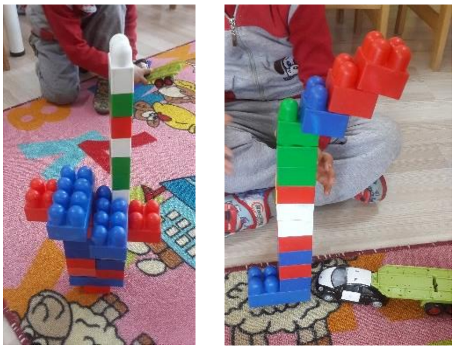

Figure 4.11. Engineering

4.1.6 Findings from the Sixth Day of Observation

Children had their play time in the morning, as usual. There were 20 children, 10 boys and 10 girls in the classroom. Play time took 39 minutes for that day. Seven children; six boys and one girl created 3D images in construction area.

At sixth day of the Classroom A, *line symmetry* again was the most common observed category during the observation (see Figure 4.12.). Furthermore, throughout the whole observations two examples construction for *Enclosure* Category were observed and one of them was observed at this day (see Figure 4.13.). Enclosure means creating an inner space with surrounding it. Moreover, five constructions could not be categorized; therefore, they were placed under others category. Photographs of all construction organized in SPAGAR form for that day (see Appendix 6).

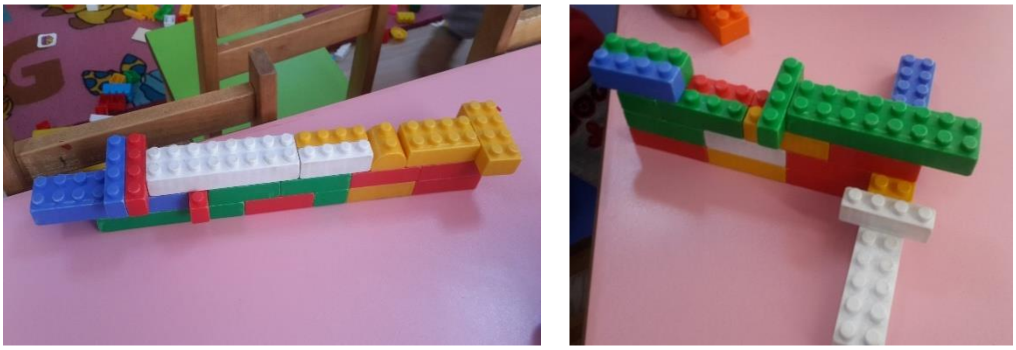

Figure 4.12. Line Symmetry

Figure 4.13. Enclosure

4.1.7 Findings from the Seventh Day of Observation

Play time was in the beginning of the day. There were 20 children, 10 boys and 10 girls. Play time took 44 minutes for that day. 13 children came to play with construction materials to area and nine of them were boys and four of them were girls. Again, teacher did not interfere the play time.

At seventh day of the Classroom A, *plane symmetry*, which is the symmetry from profile view, was the most common observed category during the observation (see Figure 4.14.). Furthermore, throughout the whole observations three examples construction for Posting Category were observed and one of them was observed at this day (see Figure 4.15.). In posting category, there are vertical supports and lintel construction same as bridges or roadways or train trucks without having any other construction on top of lintel pieces, it can be categorized as Posting. In Figure 4.15, structure is in bridge shape; with its lintels thus, it was grouped under posting category. Check Appendix 7 to see other photographs in SPAGAR form.

Figure 4.14. Plane Symmetry

Figure 4.15. Posting

4.1.8 Findings from the Eighth Day of Observation

Morning again was time for play for eighth day. There were 17 children, 10 boys and seven girls in the classroom. Play time took 30 minutes for that day. 10 children came to construction area and none of them was girl. Again, teacher made some preparation for her integrated activity.

At eight day of the Classroom A, *plane symmetry* was the most common observed category during the observation (see Figure 4.16.). Also, Figure 4.17. was one example for plane symmetry and *patterning* and also for *engineering* category because it contained symmetry from profile view and patterning like stairs and static and balance. All photographs taken during the observation placed under related categories inside Spatial-Geometric-Architectural (SPAGAR) Categories (see Appendix 8). Also, nine constructions could not be categorized; thus, they were placed in others category.

Figure 4.16. Plane Symmetry

Figure 4.17. Plane Symmetry, Patterning, Engineering

Figure 4.18. Engineering

4.1.9 Findings from the Ninth Day of Observation

Play time again was in the morning. There were 11 children, seven boys and four girls. Play time took 40 minutes for that day. Four girl and seven boys in total 11 children played with bricks. There were no interfere by teacher.

At ninth day of the Classroom A, *plane symmetry* was the most common observed category during the observation. Also, Figure 4.19 was an example for patterning and there is repeating construction between layers. There were shape and color pattern; one long-one short brick and also one red-one blue pattern. Furthermore, throughout the whole observations two examples construction for Enclosure Category were observed and one of them was observed at this day (see Figure 4.20.). Enclosure means creating an inner space with surrounding it. Moreover, Figure 4.21 is an example for engineering in terms of balancing. All photographs taken during the observation placed under related categories inside Spatial-Geometric-Architectural (SPAGAR) Categories (see Appendix 9). Also, eight constructions could not be categorized; thus, they were placed in others category.

Figure 4.19. Patterning

Figure 4.20. Enclosure

Figure 4.21. Engineering

4.1.10 Findings from the Tenth Day of Observation

Play time was in the morning. There were 19 children, 10 boys and nine girls in the classroom. Play time took 40 minutes for that day. Only five boys were in the construction area. Teacher got preparations for coming activities.

At tenth day of the Classroom A, *engineering* was the most common observed category during the observation (see Figure 4.22). It can be said the child found a solution for his tower to prevent its falling because of being skewed. Beside static and balance items, problem solving can be also grouped as engineering. Figure 4.23 is an example for patterning in terms of shape and Figure 4.24 is an example for line symmetry. All photographs taken during the observation placed under related categories inside Spatial-Geometric-Architectural (SPAGAR) Categories (see Appendix 10). Also, three constructions could not be categorized; thus, they were placed in others category.

Figure 4.22. Engineering

Figure 4.23. Patterning

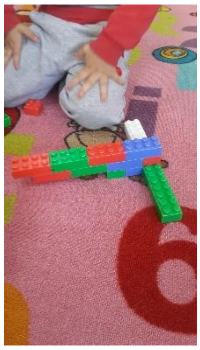

Figure 4.24. Line Symmetry

4.2 Summary of Findings from Classroom A

To sum up, the summary of findings from Classroom A's was tabled by *Table 4.2.1*. The rows represent SPAGAR categories and the columns are for number of observations days. Numbers inside the cells are the quantity of placed photographs of related construction. Thanks to this, this can be concluded that there is an intensity in spatial relations by a long way in SPAGAR form.

Table 4.2.1.

Summary of findings from Classroom A

Day of Observation / **SPAGAR**	1. day	2. day	3. day	4. day	5. day	6. day	7. day	8. day	9. day	10. day
Spatial Relations										
1.Line Symmetry	3	6	10	5	4	4	1		3	2
2.Plane Symmetry	3	2	8			1	5	5	7	
3.Rotational Symmetry										
4.Patterning									1	1
5.Figure Identification										
6. Shape Matching										
7.Direction/Location										
Architectural Principles										
8.Enclosure						1			1	
9.Foundation	2				1					
10. Trabeated Construction			1							
11.Posting	2						1			
12.Engineering	3			4	2	2		3		3
13. Proportional Reasoning										
14.Others	2	1	8	4	4	5		9	8	3

4.3 Findings from Observations of Classroom B

The Classroom B's play time was observed for 10 times by Spatial-Geometric-Architectural (SPAGAR) Categories. The duration of observations were 20 minutes to 40 minutes and the average of observations is 27 minutes. Classroom B's play time was in the mornings in every day. There were block types including Becerikli Yapılar" such as Pattern Play, Equilibrio, Block Buddies as construction materials.

4.3.1 Findings from the First Day of Observation

Play time was in the morning. There were 12 children, six boys and six girls in the classroom. Play time took 29 minutes for that day. For the first six minutes of play time, no children play at the construction area. At sixth minute, two children started to play with "Becerikli Yapılar" which is a construction game consists of 200 pieces of wooden sticks. For that day, five boys played with these wooden sticks and teacher did not make inference to them.

At first day of the Classroom B, *patterning* and *foundation* categories were the most common observed categories during the observation. Figure 4.25. is the example for both foundation, patterning and trabeated construction. Moreover, there is a *rotational* symmetry example which is placing objects in a symmetric way around a circle shape. In this example, blocks were placed around the center (see Figure 4.26.). Moreover, Figure 4.27 is an example for trabeated construction. All photographs taken during the observation placed under related categories inside SPAGAR Categories (see Appendix 11).

Figure 4.25. Foundation, Patterning and Trabeated Construction

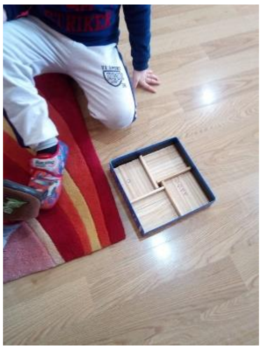

Figure 4.26. Rotational Symmetry

Figure 4.27. Trabeated Construction

4.3.2 Findings from the Second Day of Observation

In the morning, there was play time. There were 11 children, six boys and five girls in the classroom. Play time took 26 minutes for that day. Also, children played with construction game same as the day before which was called "Becerikli Yapılar" again at second day. Only two boys played with them and teacher continued to her work.

At the second day of the Classroom B, *patterning* category was the most common observed category during the observation. Figure 4.20. represents *line symmetry* example. Moreover, there was a lintel construction and other lintel and vertical constructions were placed on top each other; thus, it could be classed as *Trabeated Construction*. Also, there was a patterning at Figure 4.20. All photographs taken during the observation placed under related categories inside Spatial-Geometric-Architectural (SPAGAR) Categories (see Appendix 12). Also, two constructions could not be categorized; thus, they were placed in others category.

Figure 4.28. Line Symmetry

Figure 4.29. Patterning and Trabeated Construction

4.3.3 Findings from the Third Day of Observation

The third observation occurred in the morning, in play time. There were 11 children, six boys and five girls in the classroom. Play time took 20 minutes for that day. Unlike the day before, teacher allowed children to play with other construction play materials beside "Becerikli Yapılar" such as Pattern Play, Equilibrio, Block Buddies and so on. Five girls and three boys; eight children played with these blocks. Again, teacher did not make contribution to their play.

At third day of the Classroom B, *plane symmetry* and *Trabeated construction* categories were the most common observed categories during the observation. Rule governed activities were related with shape matching category at SPAGAR. Rule at this activity is that children should place sticks in a manner to fit them all; thus, Figure 4.30. represents *shape matching*. Moreover, there is *enclosure* (see Figure 4.31.), *foundation* (Figure 4.32.), and engineering (Figure 4.33.). All photographs taken during the observation grouped in SPAGAR form (see Appendix 13).

Figure 4.30.
Shape Matching

Figure 4.31.
Enclosure

Figure 4.32.
Foundation

Figure 4.33.
Engineering

4.3.4 Findings from the Fourth Day of Observation

Play time was in the morning. There were 10 children, five boys and five girls in the classroom. Play time took 40 minutes for that day. Eight boys; four girls and four boys spent time in construction area. Also, teacher did not make contribution to play time.

At fourth day of the Classroom B, *engineering* category was the most common observed category during the observation (see Figure 4.36.). Moreover, there is a *rotational symmetry* example which is placing objects in a symmetric way around a circle shape. In this example, sticks were placed around the center (see Figure 4.34.). Also, *enclosure* category in other words surrounding was observed for this day (see Figure 4.35.). All photographs taken during the observation placed under related categories inside Spatial-Geometric-Architectural (SPAGAR) Categories (see Appendix 14). Also, three constructions could not be categorized; thus, it was placed in others category.

Figure 4.34. Rotational Symmetry

Figure 4.35. Enclosure

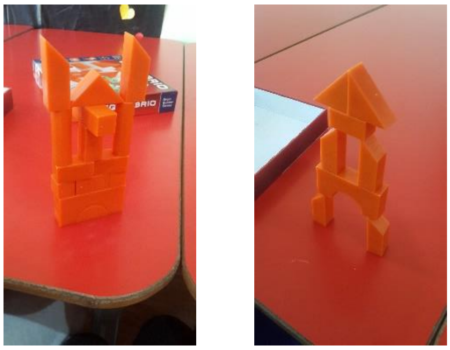

Figure 4.36. Engineering

4.3.5 Findings from the Fifth Day of Observation

The play time was again the morning and observation, as well. There were 12 children, six boys and six girls in the classroom. Play time took 33 minutes for that day. Three boys and five girls came to construction area. Also, teacher prepared materials for next activity.

At fifth day of the Classroom B, *engineering* category was the most common observed category during the observation (see Figure 4.40.) These constructions include static and balance in Figure 4.39. Moreover, there were *line symmetry* examples (see Figure 4.37.), and examples for p*atterning and Trabeated construction* (see Figure 4.38.), and example for posting (see Figure 4.39.). All photographs taken during the observation grouped and placed related category in SPAGAR form (see Appendix 15). Also, eight constructions could not be categorized; thus, they were placed in others category.

Figure 4.37. Line Symmetry

Figure 4.38. Patterning and Trabeated Constrcution

Figure 4.39. Posting

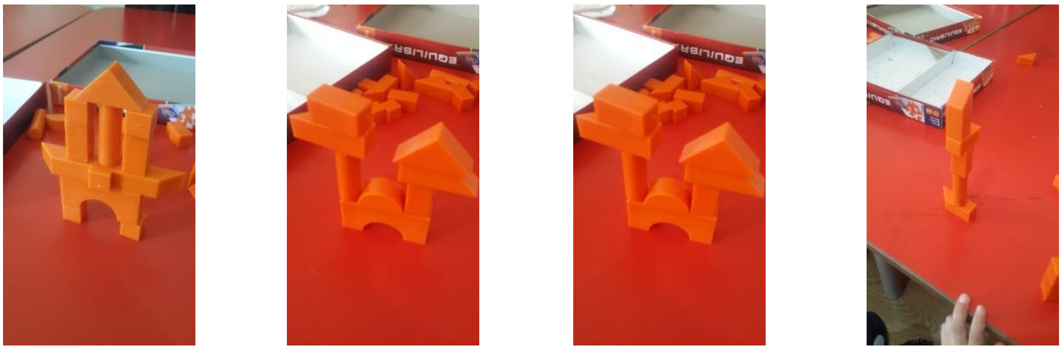

Figure 4.40. Engineering

4.3.6 Findings from the Sixth Day of Observation

Play time was in the morning. There were 11 children, six boys and five girls in the classroom. Play time took 27 minutes for that day. Two boys and three girls in total five children came to construction area. Teacher got prepared for her upcoming activity.

At sixth day of the Classroom B, *trabeated construction* category was the most common observed category during the observation (see Figure 4.42.). Figure 4.41. placed under *shape matching* category because of being rule governed activity. Also, there is posting example and a lintel piece placed as horizontally and there was nothing placed on top of it (see Figure 4.43). All photographs taken during the observation placed under related categories inside Spatial-Geometric-Architectural (SPAGAR)

Categories (see Appendix 16). Also, fifteen constructions could not be categorized; thus, they were placed in others category.

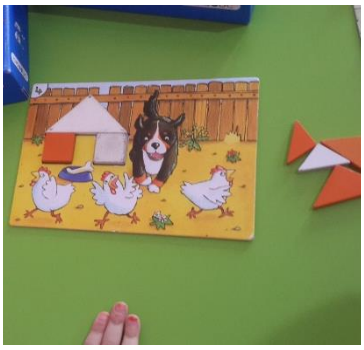

Figure 4.41. Shape Matching

Figure 4.42. Trabeated Constrcution

Figure 4.43. Posting

4.3.7 Findings from the Seventh Day of Observation

Children had play time in the morning according to daily schedule. There were 12 children, seven boys and five girls in the classroom. Play time took 28 minutes for that day. Four boys and three girls played with construction materials. Again, teacher did not present a participation to play time of children.

At seventh day of the Classroom B, *plane symmetry* category (see Figure 4.46.) was the most common observed category during the observation and then *engineering* category (see Figure 4.45.) followed it with eight construction examples. There were examples of Trabeated construction (see Figure 4.44.) All photographs taken during the observation placed under related categories inside Spatial-Geometric-Architectural (SPAGAR) Categories (see Appendix 17).

Figure 4.44. Trabeated Construction

Figure 4.45. Engineering

Figure 4.46. Plane Symmetry

4.3.8 Findings from the Eighth Day of Observation

The play time was again the morning and observation, as well. There were 11 children, six boys and five girls in the classroom. Play time took 25 minutes for that day. Three boys and two girls played with construction materials. Teacher did not interfere to play time.

At eighth day of the Classroom B, *engineering* category was the most common observed category during the observation (see Figure 4.49.). Moreover, there were examples of *plane symmetry* (see Figure 4.47.), line symmetry (see Figure 4.48.), posting (see Figure 4.50.), and *Trabeated construction* (see Figure 4.41.). All photographs taken during the observation placed under related categories inside Spatial-Geometric-Architectural (SPAGAR) Categories (see Appendix 18). Also, four constructions could not be categorized; thus, they were placed in others category.

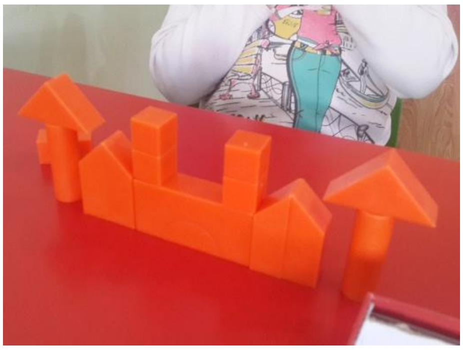

Figure 4.47. Plane Symmetry

Figure 4.48. Line Symmetry

Figure 4.49. Engineering

Figure 4.50. Posting

Figure 4.51. Trabeated Constrcution

4.3.9 Findings from the Ninth Day of Observation

The play time was again the morning and observation, as well. There were 11 children, six boys and five girls in the classroom. Play time took 20 minutes for that day. Three boys and three girls played with construction materials.

At ninth day of the Classroom B, *line symmetry* (see Figure 4.52.) and *engineering* categories (see Figure 4.45.) were the most common observed categories during the observation. Moreover, there were examples of *patterning* (see Figure 4.43.) and shape matching (see Figure 4.44.). All photographs taken during the observation placed under related categories inside Spatial-Geometric-Architectural (SPAGAR) Categories (see Appendix 19). Also, seven constructions could not be categorized; thus, they were placed in others category.

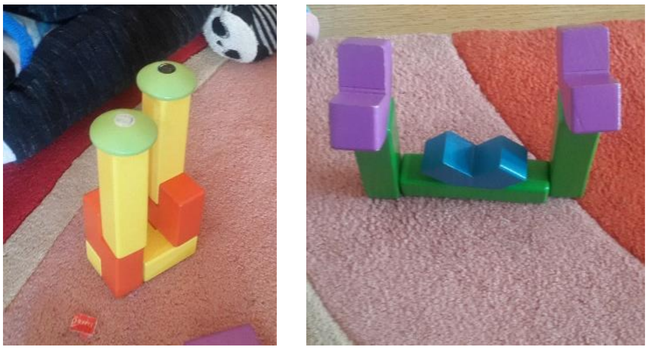

Figure 4.52. Line Symmetry

Figure 4.53. Patterning

Figure 4.54. Shape Matching

Figure 4.55. Engineering

4.3.10 Findings from the Tenth Day of Observation

Play time was in the morning. There were 10 children, five boys and five girls in the classroom. Play time took 20 minutes for that day. Four boys and one girl played with construction materials. Teacher did not interfere to play time.

At final day of the Classroom B, *patterning* was the most common observed category during the observation (see Figure 4.56.). Moreover, there were examples of *Trabeated construction* and *patterning* categories (see Figure 4.47.) and *engineering* (see Figure 4.48.). All photographs taken during the observation placed under related categories inside Spatial-Geometric-Architectural (SPAGAR) Categories (see Appendix 20). Also, one construction could not be categorized; thus, it was placed in others category.

Figure 4.56. Patterning

Figure 4.57. Patterning and Trabeated Construction

Figure 4.58. Engineering

4.4 Summary of Findings from Classroom B

All in all, *Table 4.4.1.* represents the summary of findings from Classroom B. The rows represent SPAGAR categories and the columns are for number of observations days. Numbers inside the cells are the quantity of placed photographs of related construction. The table demonstrates that Classroom B is popular with five categories; symmetry, patterning, engineering, and trabeated construction.

Table 4.4.1.

Summary of findings from Classroom B

Day of Observation / **SPAGAR**	1. day	2. day	3. day	4. day	5. day	6. day	7. day	8. day	9. day	10. day
Spatial Relations										
1.Line Symmetry		1			4	7	4	5	8	1
2.Plane Symmetry			4	6	9	7	12	5	5	
3.Rotational Symmetry	1			1				1		
4.Patterning	3	2	2	2	6	2	4	2	5	3
5.Figure Identification										
6. Shape Matching			1			1		3	2	1
7.Direction/Location										
Architectural Principles										
8.Enclosure			2	2	1	1		3		
9.Foundation	3		2			1	3	1	5	2
10. Trabeated Construction	2	1	2	2		10	5	3	3	2
11.Posting				1	3	1	5	3		
12.Engineering	2		2	7	10	8	8	7	7	1
13. Proportional Reasoning										
14.Others		2	5	3	8	15	15	4	7	1

4.5 Summary of the Findings

All in all, 20 observation's findings presented day by day at above and all observations' summary tabled at below by *Table 4.5.1.* Check mark in the cells means that the category was observed at least one during the play time of the day.

Table 4.5.1.

Summary of observations

Day of Observation / SPAGAR	Classroom A										Classroom B									
	1. day	2. day	3. day	4. day	5. day	6. day	7. day	8. day	9. day	10. day	1. day	2. day	3. day	4. day	5. day	6. day	7. day	8. day	9. day	10. day
Spatial Relations																				
1.Line Symmetry	✓	✓	✓	✓	✓	✓	✓		✓	✓		✓			✓	✓	✓	✓	✓	✓
2.Plane Symmetry	✓	✓	✓			✓	✓	✓	✓				✓	✓	✓	✓	✓	✓	✓	
3.Rotational Symmetry											✓			✓				✓		
4.Patterning									✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
5.Figure Identification																				

Table 4.5.1.

Summary of observations (Continued)

6. Shape Matching													√			√		√	√	√
7.Direction /Location																				
Architectural Principles																				
8. Enclosure						√			√				√	√	√	√		√		
9. Foundation	√				√						√		√			√	√	√	√	√
10. Trabeated Construction			√								√	√	√	√		√	√	√	√	√
11.Posting	√						√							√	√	√	√	√		
12. Engineering	√			√	√	√		√		√	√		√	√	√	√	√	√	√	√
13. Proportional Reasoning																				
14.Others	√	√	√	√	√	√		√	√	√		√	√	√	√	√	√	√	√	√

CHAPTER 5

DISCUSSION, CONCLUSION, IMPLICATIONS, LIMITATIONS OF THE STUDY AND RECOMMENDATIONS

5.1 Discussion

The study was carried out during constructive play time at the two preschool classrooms. Classroom A's average duration for play time was 40 minute and B's average was 27 minutes. However, recently, a study conducted with 460 pre-school teachers from different location of Turkey revealed that their play time took generally one hour to two hours in a day (Tuğrul, Boz, Uludağ, Metin, Aslan, Sevimli-Çelik, & Sözer Çapan, 2019). Hereunder, the observed classrooms' play time duration can be classified as not much as the general. Therefore, having more play time and observing it may allow more data about construction play. Teachers should support children's constructive play and provide them plenty of time, diverse materials and stories, and secure environment (Park, 2019) because play could not exist when it was accelerated; construction play must be nourished by time. Thus, children should have time in the construction area and, as a result, they have time to create something with construction materials. In classroom A, observation time is longer than Classroom B and children spent more time with constriction play in Classroom A; thus, they had greater chance to create something with materials, as a result, the more constructions were photographed for data analysis. If Classroom B had longer period for constructive play time, different data set would obtain and, construction play would be more nourished. Children's free play is a good time for teachers to observe their way of thinking (Aras, 2016). Again, Tuğrul and colleagues highlighted that teachers should be active, observe them to familiarize children and to identify their needs and interests. Also, the same study said that most of the teachers participated in the study stated that they observed children during play and help them when necessary (Tuğrul et al., 2019). Conversely, the current study revealed that both teachers got prepared for future activities instead of observing children or involving their play. Similarly, it was found that adults participated seldomly to children's play at free time (Ginsburg, Lin, Ness, & Seo, 2003). Play has possible benefits for development and learning of children and teacher's role during play time can affect it, negatively or positively (Aras, 2016). A solid foundation for children can be ensured by teacher's involvement to child's play during early ages (Tarman & Tarman, 2011). According to Kontos's research (1999), teachers join children's play during play time and they generally prefer join activities such as constructive or manipulative play.

Even starting from the very early ages, human brain places different sort of spatial relations such as mathematical and verbal reasoning. (Gersmehl & Gersmehl, 2007). One of the ways to develop spatial relation is playing with blocks which supports such critical skills as counting, patterning, and grouping which is necessary for spatial relation (Johnson, Sevimli-Celik, & Al-Mansour, 2012). The current study confirmed that spatial relations were observed at both classrooms and it was the most observed category of SPAGAR. Alike, patterning category from spatial relations also was observed in Classroom B and it was one of the most populas. In Classroom B, there were different block types and especially, the patterning was observed with one of the blocks types which was in thick-stick-shape and had different sizes and colors. Children demonstrated size patterning and color patterning while playing with these thick-sticks. The difference between classrooms may occurred because of material's dissimilarity. Classroom A had bricks which are generally in plastic form and snap together and this material's snap spots may cause the symmetries to children and the quantity of blocks can be seen as inadequate; therefore, even if children decide to create a pattern, they faced inadequate number and color of blocks problem and children in Classroom A did not demonstrated a tendency toward patterning in their construction. They placed the bricks random colors without seeking the specific color. There were a few constructions suitable for patterning category and their shapes were in pattern, not colors. This may be happened because the number of bricks was not adequate. In other classroom, there were construction as an example of color patterning and it can be said that there were variety at blocks.

Conversely, other categories from spatial relations were observed in Classroom A, such as such as line and plane symmetry, and they were the most popular ones for that class. Symmetry is one of the sub-categories of spatial relations. Ng and Sinclair (2015) stated that children prefer to use symmetry for sorting, comparing and constructing from kindergarten to Grade 3. Moreover, higher level of thinking can be supported via exploring and creating solitary, and geometry and symmetry (Knuchel, 2004). Additionally, Seo and Ginsburg conducted a research with 90 children between four to five years old and they concluded that children at an early age have the capability of identifying symmetry (2004). In the current study, symmetry was observed in both classrooms. Line and plane symmetry were observed almost every day in Classroom A; however, less observed in Classroom B. In addition, rotational symmetry was observed at least. Because of having only bricks, generally in cube and rectangular prism form, children showed a tendency to line and plane symmetry in Classroom A; however, rotational symmetry never observed in this class. When it was compared to A, Classroom B represented less line and plane symmetry; however, rotational symmetry was observed a couple of times. Rotational symmetry is rotating objects around central's axis as repetition. This symmetry does not require certain shape of objects or specific properties; thus, material's variety does not affect this category. This difference between Classroom A and B may occurred because of disparity between their socioeconomic status (SES). Classroom A's SES was lower than B's and it can be concluded that lower SES is an obstacle for rotational symmetry. Ness (2001) found that children from low SES are rich in terms of spatial and geometric concepts; specifically, in symmetry. He supported this finding with earlier studies which defended the idea of children from low-income did not have ability toward mathematic because of their SES (Starkey & Klein, 1992). However, Ginsburg, Inoue and Seo, (1999) highlighted that it might be misleading categorizing children's math abilities based on their SES.

Additionally, Bornstein and Stiles-Davis (1984) conducted their research about line symmetry type. They found that children at age four can distinguish only vertical symmetry, children at five years old can distinguish both horizontal and vertical symmetry, and children at six years old can distinguish horizontal, vertical and oblique symmetry. The researchers focused on distinguishing symmetry types in 2D images.

However, the current study focused on children's usage symmetry types in 3D constructions. Then, it was found that observed children at 5-year-old used symmetries such as line, plane, rotational and these types can be classified 3D versions of both horizontal and vertical symmetries. In the current study, 5-year-olds represented symmetry with their 3D constructions. This similarity between these two studies shows that age is important to demonstrate symmetry. Both studies underlined that five years old is a step for symmetry.

According to Leikin, Berman, and Zaslavsky (2000), mathematics teachers believe that symmetry is a bridge that links different branches of mathematics such as geometry, probability, algebra, calculus. Similarly, symmetry is one of the effective ways for solving problems as well (Ng & Sinclair, 2015). To teach symmetry, teachers should provide children some tasks and communicative opportunities and then, children concentrate to action of symmetry and the result of what they did (Ng & Sinclair, 2015). As a result, they develop problem solving skills. In current study, problem solving skill was placed under the engineering category which was one of the most observed categories among the five mostly observed; symmetry, patterning, engineering, and trabeated construction. The reason might be the close connection of engineering and symmetry which are nurturing each other frequently. Similarly, within the almost all engineering figures, at least one sort of symmetry was observed. This kind of symmetries generally were observed in Classroom B and children tried to create high rise buildings. To do this, they generally used engineering skills; they had to place floor horizontally and they had to use posts (columns) to support the upper part for high rise buildings. Therefore, they placed these posts at least two; as a result, the symmetry occurred for engineering support. Again, this result might be observed due to the material's type because materials enabled children to create high rise construction, and symmetry and engineering observed in one construction.

In addition to these spatial relations, some architectural principles were also observed in the construction (blocks) play. Blocks enable children to learn some basic architectural terms and features (Miller, 2004). Similarly, Ness (2001) indicated that while playing with blocks, preschool children display some fundamental architectural principles such as enclosure, foundation, trabeated construction, posting, engineering, and proportional reasoning. In the current study, architectural principles were commonly observed in the Classroom B where blocks are the primary materials for children. Except proportional reasoning, all architectural principles such as enclosure, foundation, trabeated construction, posting, and engineering were observed in Classroom B, generally. The reason of absence of proportional reasoning in the observations was no-recording children's talks during play time. The difference on architectural principles in both classrooms may be occurred owing to distinctness of materials. Construction materials which does not have snap spots same as bricks may allow more architectural construction identical to Classroom B.

Manipulating the object and social interaction with people are components of some play activities such as engineering design and problem solving (Haden, Cohen, Uttal, & Marcus, 2016). According to researcher's field notes of the current study, it was observed that in both classroom, children preferred to engage solitary and group play. When a child encountered a problem at his/her construction, some of his/her classmates helped him/her to solve the problem whether he/she was playing alone or not. As a result, they communicated each other to solve the problem. In addition, in some of group plays, children tried to construct the biggest construction with its solid and stable foundation in both classrooms; as a result of this, they communicated and, they represented some architectural principles such as foundation, trabeated construction, and engineering.

Moreover, playing with construction materials specifically with blocks supports the grounds and practices of engineering as well as spatial relations (Jirout & Newcombe, 2015). Additionally, construction, puzzle and block play can enhance spatial relations, and this can be related with engineering and problem solving (Tõugu, Marcus, Haden, & Uttal, 2017). Additionally, engineering was also popular category during the observation of the current study, and it was generally observed in Classroom B.

The general problem for children was surviving their construction standing. Also, one obstacle for standing was shapes and materials of blocks in Classroom B. There were some blocks in curve shapes and bevel cut which is curve cut. Alike, surface of some of them was in slippery materials. Thus, children faced some problems in their construction to keep them standing when they used these blocks. Therefore, they had to use their engineering skills for it. However, in Classroom A, there was not such problems because they did not have these kind of construction materials, just had bricks. There were couple of examples for engineering category in Classroom A, and their construction had balance and static components from engineering category.

There were some repetitions during the study and children in these classrooms represented some attitudes while constructing. Firstly, some children were inspired by the subject taught by the teacher that day and it was reflected in their block constructions. For example, teacher introduced children Italy as a country and mentioned Pisa Tower in Italy in Classroom A at first day of the observation. After related activities, children had constructive play time and it was observed that some children created Pisa Tower by bricks. It was obvious that they were inspired because there was the skewness in their constructions same as Pisa Tower. Likewise, Equilibrio and Pattern Play are member of box games and there are some images for children to guide them in their constructions. Classroom B had both box games and the teacher had removed images for guidance from Equilibrio game to enable children to create authentic constructions. Although she removed the images, some children copied the construction on the cover of the box and some of them were inspired by the image. Secondly, some children were inspired by their classmates and imitated their construction as same as the original one. Certain children had their own design or image on their brain and created the same construction day after day. For example, one child from Classroom A created a plane which had line symmetry by bricks almost in every day. In general, almost all of children who spent time in construction area created their construction by trial and error. According to Hussain, Lindh, & Shukur (2006), trial-and-error method is one of the ways of learning journey. According to researcher’s field notes of the current study, children demonstrated two different attitudes during construction. One of them was that a child decided to create something via construction materials and got a brick randomly and started to the construction. Then, s/he got another brick randomly and tried to add this piece to his/her construction. If s/he could not able to add this piece, s/he moved another piece; conversely, if s/he was successful on adding, s/he kept going on this way. This attitude generally observed in Classroom A. This attitude may be observed because of having inadequate number of bricks because there was not much option for children to choose. The other attitude generally observed in Classroom B. In here, the child searched for a specific block for his/her construction. When s/he found it, his/her aim was trying to fit the piece into the construction. If s/he was unsuccessful, the child tried to find a solution to keep the piece in the construction. This attitude in Classroom B enhanced children engineering skills. This attitude may occur in this classroom through variety of blocks quantity and types.

With help of the researcher field notes and photographs of construction, it was noticed that there was a difference between the constructions of girls and boys in Classroom A. For instance, girls rarely attended to construction play in Classroom A. Similar to Classroom A, Børve and Børve (2017) observed children play preferences in terms of gender and they set forth that boys preferred to spent time at places offer them construction play such as Lego®. Alike, seventeen children were observed for two weeks during play time by Taş (2018) and she concluded that girls spent time with pretended play such as role playing, and boys were generally in construction area and played with blocks. Similarly, other research had also similar result and there were boy's majority while playing with blocks (Fennema, 1974; Farrell, 1957).
Conversely, Tokarz (2008) started her paper with a case and in the scene, boys were playing with blocks and busy with constructing highest tower by blocks. Two girls were watching boys, and girls would to join to the construction, but girls moved to art center because boys got all blocks for their heights tower's construction. Discrepantly to Classroom A, the participation to construction play in Classroom B was equal in terms of gender. This equality may occur through plenty of blocks.

Moreover, Casey, Pezaris, & Bassi (2012) found at their study that there were characteristics in terms of gender and children's constructions such as boys' constructions had both height and structural balance. Likewise, generally boys were the ones who tried to build longest tower at the current study.

Generalizing gender's preferences toward spatial tendency covers the individual differences and there are some girls have strong ability of spatial relations; inversely, some boys are unsuccessful to accomplish spatial tasks (Newcombe, 2010). In this context, there were some girls who were very good at some architectural principles such as enclosure or trabeated construction; contrary, there were some boys who had no signalize passion toward construction and never showed up in construction area. Therefore, individual differences should never be forgotten.

Socioeconomic status was not taken into consideration at the beginning of the study, but the findings was compared with the literature. When the differences of constructions were considered within the scope of SES, boys generally were the one who spend most time at the construction area in the Classroom A; whereas, there were almost equal participation from both gender to the construction area in the Classroom B. Classroom A's socioeconomic level could be classified as low and Classroom B's could be high socioeconomic status (SES). Indeed, boys from low SES were dominant at the construction area; however, boys and girls from higher SES engaged almost equally in the construction process. On the other hand, a study conducted to investigate the relation between socioeconomic status and sex difference in spatial relations by Levine, Vasilyeva, Lourenco, Newcombe, and Huttenlocher (2005) was differed from the current study's findings. They found that boys and girls from low socioeconomic background displayed similar performance on spatial tasks; conversely, boys who were from middle and high socioeconomic background differed from girls on spatial tasks. The reason behind these divergent results was explained with freedom which means exploring the neighborhood and SES background of their childhood. According to Entwisle, Alexander, and Olson (1994), exploring environment and neighborhood set ground for spatial relations and boys had more freedom than girls for exploring (as cited in Levine, Vasilyeva, Lourenco, Newcombe, & Huttenlocher, 2005). Moreover, O'Neil, Parke, and McDowell (2001) stated that boys who came from low socioeconomic background possibly would not have this freedom to explore the neighborhood same as boys from higher socioeconomic background because of danger at environment (as cited in Levine, Vasilyeva, Lourenco, Newcombe, & Huttenlocher, 2005).

Conversely, a comparative and cross-cultural research conveyed between young American and Chinese children about relation of mathematic activities and constructive play. They could not a found meaningful difference between lower and higher-SES groups (Ginsburg, Lin, Ness, & Seo, 2003). In the current study, the difference between SES groups was found about gender's participation to construction play, and their preferences toward math was not examined like the researcher.

There is a longitudinal study created by Wolfgang, Stannard and Jones which sought for relation between block play performance of preschoolers and their later school achievement in Mathematics (2001). There was not significant relationship between block performance and standardized math test at elementary levels. Nevertheless, there was a significant relationship between block performance and standardized math test at 7^{th} grade and high school. The researcher linked these results with Piaget's formal operational thinking (1977) because around age 11 when children starts to middle school, they are at Piaget's level and include abstract thinking (as cited in Wolfgang, Stannard, & Jones, 2001).

With help of these research, this can be deduced that block play or construction play has ample important role at mathematical achievements. Mathematics is one of the components of STEM (science, technology, engineering and mathematics) and importance of STEM is increasing at the present time because it lies at the roof of today's and future's occupations. Spatial relations are one of the important components of STEM (science, technology, engineering and mathematics), and people called spatial thinkers have tendency toward science and mathematics than less spatial thinkers (Newcombe, 2010). STEM promote some fundamentals via block play such as concrete experiences, problem solving skills, improvement at understanding abstract concepts; spatial relations, balance and motion (Hansel, 2015).

All in all, 10 days observations were made with help of SPAGAR at both classrooms revealed some findings. Spatial relations were observed mostly in Classroom A which had brick as construction materials and SES could be classified as low, and architectural principles were observed in Classroom B which had different types of blocks and SES could be classified as high. The difference in structures in these classrooms may exist because of material's differences; bricks versus blocks. Also, tendency toward construction play differed by gender in these classrooms. For instance, boys were powerful in construction area in Classroom A; on the other hand, girls and boys showed an interest in construction in Classroom B.

5.2 Conclusion

The current study presented to what extend preschoolers use spatial / architectural design skills during constructive play time. First of all, symmetric relations were observed mostly and almost at every time. These symmetric relations occurred more often in Classroom A, which had bricks in construction area. Line symmetry and plane symmetry were two types of symmetry and unremarkably observed at both classrooms. In Classroom B, architectural principles were observed with spatial relations. Engineering and trabeated construction categories were popular in Classroom B, which had blocks as construction materials. Materials may be the main reason behind these differences. There was a huge difference between structure of constructions in terms of tendency to spatial relations and architectural principles. Brick in other words Lego® or Duplo® Bricks may push children to create something related to spatial relations; therefore, some spatial relations such as line symmetry, plane symmetry, patterning were greatly observed in the classroom which had bricks. On the other hand, blocks such as wooden sticks and types of blocks may allow children to form constructions related to architectural principles such as engineering and trabeated construction.

Children's socioeconomic differed from class to class. Classroom A's SES could be classified as low and Classroom B's as higher status. These differences on status may affect children's performance in construction area.

Another main point was gender differences. Gender was not included to the research design at the beginning, but findings remarked the gender's distinctness. Boys were active in Classroom A's construction area; whereas, children participated equally in terms of gender to construction area in Classroom B. Gender's tendency toward construction play may exist because of quantity and quality of construction materials.

There were some repetitions in the current study. Some children got inspired by the topic that currently taught by teacher and the inspiration could visible at their constructions. Some children got inspired by their classmates and copied their constructions. Some children had their own design or image on their brain and created the same construction repetitiously.

To sum, there could be many reasons behind preschooler's usage of spatial / architectural design skills during constructive play time and these reasons can be material's distinctness, SES, and gender.

5.3 Implication

The results of the current study submitted some educational implications in the following.

Trawick-Smith, Swaminathan, and Liu (2016) found that teacher's interference to children's play during play-time affect positively children's academic achievement especially the math achievement. It is obvious that all interactions do not have positive impacts. Thus, teachers should develop their interactions with children in a positive way. There are some ways to develop it. For example, teachers can have a portfolio, or a map to help them. In the portfolio, there can be some tricks for teachers to engage the constructive play time; for example, there can be some initial sentences to guide teacher while engaging. Also, there can be some clues or paths to challenge children's play to make positive contributions.

There are some points that should be considered in schools and educating pre-service teachers. Early childhood educators could provide such materials as blocks, puzzles, or shape sorters that support spatial thinking skills (Toub, Verdine, Golinkoff, & Hirsh-Pasek, 2019). Moreover, teachers can attend in-service trainings which are related to the topic. Additionally, teachers can give more importance to the construction area and aware of its needs. Then, teachers can encourage children to engage in the construction play. Furthermore, teachers should encourage children to bring other toys from other centers to construction center as a result, children's game can be flourished and integrated.

Also, pre-service teachers should have more practice courses. Furthermore, pre-service teachers should have a private guidance for their practicum; thus, they can be leaded by the guide. For example, this guide should watch the pre-service teacher throughout the whole practicum and give feedbacks to enhance prospective teacher's teaching styles.

Long period of play time ensures children more engagement with toys. Therefore, Trawick-Smith, Swaminathan, and Liu (2016) suggest that the government should increase play time rather than shortening it for direct instruction. Roger and Sawyer highlighted that while children are playing with construction materials, they sometimes want to continue their unfinished construction at forthcoming play time; therefore, teachers should give enough time to children for their request (as cited in Tarman & Tarman, 2011). Similarly, the current study witnessed a scene in a similar way. When teachers wanted them to clean-up for lecturing, children represented their unhappiness for pausing their play (construction) with their gestures and speeches. As a result, enough time should be provided to children. Also, a place in the classroom could be reserved for construction; thus, children can work on their own construction in later time and there can be a collaboration in the classroom for that construction.

Also, teachers should prepare their classroom to fight with cultural stereotypes for girl's play. Teachers can place images that women are in some construction related occupations or place books to encourage girls such as Mothers Can do Anything by Joe Lasker (Tokarz, 2008).

5.4 Limitations of the Study and Recommendations for Further Studies

There were some limitations of the current study. One of the limitations of the study occurred because of using natural observation technique. In this technique, no intervention carried out to not interrupt the flow and the nature. For instance, figure identification and direction/location categories were only supported with researcher's field notes. However, an audio-record would allow more concrete and more evidence rather than just field notes. At the beginning of the observations, audio-record was used for a few days; nevertheless, they were checked children's speech during construction were not clear because there were much more noises in classroom during constructive play time. While SPAGAR categories were created by Ness, Farenga and Garofalo (2017), they worked with a couple of children individually. Working with children separately just for observation would violate nature of construction for this research design.

For further studies, increasing construction material's quantity would enrich the data. For example, Classroom B had adequate quantity of blocks; thus, there were enough data for analyzing. However, the number of bricks of Classroom A was insufficient. Also, two classrooms were observed in the current study and increasing the number of classrooms would help to enrich the data. Moreover, while designing the current study, SES and gender were not taken into consideration but the results indicated some hints on the effects of these two factors. Therefore, it is recommended for further studies to focus on these two factors deeply.

In the current study, there were two types of construction materials including blocks and bricks. In the further studies, focusing more construction materials would allow deeper information such as planks and so forth. In the current study, only one center; construction center was observed. Further studies might investigate to what extent construction center is selected by children among other centers during constructive play time.

Additionally, the current study was conducted with five-year-old children. Further studies might include four- and six-years old children to compare the spatial/architectural design differences among the groups. Also, longitudinal studies would be conducted to follow the progress of spatial / architectural design skills of children starting from the age of 3 to 6 years. Furthermore, teacher's involvement was not taken into consideration during the current study. Observing teacher's involvement during constructive play time might help to see the effects of teacher presence on spatial / architectural design skills.

Further studies can also focus on video recording technique in which all the steps of the construction (from beginning till the end) made by children are recorded. With the video recording, the child's thinking steps or trial-error process can be examined in depth. However, recording all the children at the same time might be difficult. Thus, further studies might focus on small groups of children. Lastly, SPAGAR form can be revised for additional categories because there were some constructions at the current study that the researchers could not place them on the form. Therefore, the researchers created a new category for these uncategorized constructions which was "others" as 14th category.

As summary, the study conducted in two different preschool classrooms with different types of materials. Classroom A had bricks as the materials and Classroom B had blocks in the construction area. SPAGAR (Spatial – Geometric – Architectural) observation form by Ness, Farenga and Garofalo (2017) was used to collect the data with help of photographs and field notes. Content analysis and visual research techniques were used for data analysis part. The results showed that Classroom A with bricks presented generally spatial relations in children's construction. On the other hand, children in Classroom B created construction both related spatial relations and architectural principles. Line symmetry was the most observed category in the classroom with bricks. Additionally, categories of line symmetry, patterning, engineering, and trabeated construction were the popular ones in classroom with blocks. As a result, it was concluded that types of materials would affect children's design of construction in terms of the spatial relations and architecture principles.

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APPENDICES

A. APPROVAL OF METU HUMAN SUBJECTS ETHICS COMMITTEE

UYGULAMALI ETİK ARAŞTIRMA MERKEZİ
APPLIED ETHICS RESEARCH CENTER

ORTA DOĞU TEKNİK ÜNİVERSİTESİ
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12 EYLÜL 2018

Konu: Değerlendirme Sonucu

Gönderen: ODTÜ İnsan Araştırmaları Etik Kurulu (İAEK)

İlgi: İnsan Araştırmaları Etik Kurulu Başvurusu

Sayın Dr.Öğretim Üyesi Serap Sevimli ÇELİK

Danışmanlığını yaptığınız; yüksek lisans öğrencisi Kadriye AKDEMİR'in **"Okul Öncesi Dönemi Çocuklarının Serbest Oyun Zamanında Sergiledikleri Uzamsal-Mimari Tasarım Becerilerin İncelenmesi"** başlıklı araştırması İnsan Araştırmaları Etik Kurulu tarafından uygun görülerek gerekli onay **2018-EGT-127** protokol numarası ile **12.09.2018 - 30.06.2019** tarihleri arasında geçerli olmak üzere verilmiştir.

Bilgilerinize saygılarımla sunarım.

Prof. Dr. Ş. Halil TURAN
Başkan V

Prof. Dr. Ayhan SOL
Üye

Prof. Dr. Ayhan Gürbüz DEMİR
Üye

Doç. Dr. Yaşar KONDAKÇI
Üye

Doç. Dr. Zana ÇITAK
Üye

Doç. Dr. Emre SELÇUK
Üye

Dr. Öğr. Üyesi Pınar KAYGAN
Üye

B. APPROVAL OF DIRECTORATE OF NATIONAL EDUCATION

T.C.
NEVŞEHİR VALİLİĞİ
İl Millî Eğitim Müdürlüğü

Sayı : 49405861-44-E.4170812 26/02/2019
Konu : Araştırma İzni
(Kadriye AKDEMİR)

VALİLİK MAKAMINA

İlgi : a)Orta Doğu Teknik Üniversitesi Öğrencisi Kadriye AKDEMİR' in 13/02/2019 tarihli dilekçesi.
b)Nevşehir Valiliği İl Milli Eğitim Müdürlüğünün 25/02/2019 tarihli ve 4063164 sayılı yazısı.

Orta Doğu Teknik Üniversitesi yüksek lisans öğrencisi Kadriye AKDEMİR' in "Okul Öncesi Dönemi Çocuklarının Serbest Oyun Zamanında Sergiledikleri Uzamsal-Mimari Tasarım Becerilerinin İncelemesi" konulu araştırmasıyla ilgili anket çalışmasını, dilekçesinde belirtilen okulda uygulama yapmak için izin talep etmektedir.

Anılan araştırma izninin 2018-2019 Eğitim-Öğretim yılında, ilimiz Acıgöl ilçesi Karapınar Esentepe İlkokulunda, gönüllülük esasına dayalı, eğitim öğretimi aksatmamak şartı ve Okul Müdürlüğünün muvafakatinde yapılması Müdürlüğümüzce uygun görülmektedir.

Makamlarınızca da uygun görüldüğü takdirde olurlarınıza arz ederim.

Murat DİLDÖKEN
İl Milli Eğitim Müdür V.

OLUR
26/02/2019

Aydın ABAK
Vali a.
Vali Yardımcısı

Yeni Kayseri Cad.Hükümet Konağı 50100 NEVŞEHİR Ayrıntılı bilgi için: E.YAZICI - VHKI
Elektronik Ağ: www.nevsehirmeb.gov.tr Tel: (0 384) 213 79 33 -166
e-posta: hizmetici50@meb.gov.tr Faks: (0 384) 213 20 68

Bu evrak güvenli elektronik imza ile imzalanmıştır. https://evraksorgu.meb.gov.tr adresinden cd17-6ab4-3d0f-bf53-7165 kodu ile teyit edilebilir.

C. SPATIAL-GEOMETRIC-ARCHITECTURAL (SPAGAR) CATEGORIES
(NESS, FARENGA, & GAROFALO, 2017)

Space/Geometry/Architecture Coding Sheet (NOT)

Child's Name:________________ID:______Tape #: _____

Age:______ Gender:_____ Ethnicity:______ Coder:______ Star:

Minute	Spatial and Geometric Relations								Architectural Principles				
	Line Sym-metry (SL)	Plane Sym-metry (SP)	Rota-tional Sym-metry (SR)	Pattern-ing (PA)	Figure Identifi-cation (FI)	Shape Matching (SM)	Direc-tion/ Location (DL)	En-closure (CL)	Found-ation (SF)	Trab-eated Con-struction (ST)	Posting (SO)	Eng-ineering (NG)	Relative Size (RS)
1													
2													
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NOTE:

D. TURKISH SUMMARY / TÜRKÇE ÖZET

GİRİŞ

Çalışmanın Amacı

Yıllardır kabul gören genel görüşe göre zeka, kişinin bilişsel yeteneğini kullanarak öğrenebilmesi olarak tanımlanmıştır (Diezmann & Watters, 2000). Araştırmacıların görüşlerine göre, zeka yıllarca yazın yeteneği ve matematiksel yetenek olarak tanımlanırken Howard Garder'ın çoklu zeka kuramıyla birlikte sekiz zeka boyutundan bahsedilmeye başlanmıştır (1997).

Bu zeka türlerinden biri olan uzamsal zeka, insanların günlük hayatlarında yön bulmak amacıyla bilinçsiz bir şekilde kullandığı bir yetenek olduğu için çoğu zaman göz ardı edilmiştir (Van Schaik, 2008). Uzamsal zeka; bulunulan konumu, pozisyonu, uzaklığı, yönü, ilişkiyi ve uzaydaki değişimi tahmin etme ve görselleştirme olarak tanımlanmıştır (Sinton, Bednarz, Gersmehl, Kolvoord, & Uttal, 2013). Araştırmalara göre uzamsal düşünme erken yaşlarda başladığı için uzamsal zeka konusu mümkün olduğunca okul öncesi eğitimi müfredatlarına eklenmelidir (Piaget, 1954; Vygotsky, 2012).

Bu çalışma, çocukların uzamsal/mimari elementleri hangi boyutta kullandıklarını gözlemlemek amacıyla yapı-inşa oyunu zamanı süresince yapılmıştır. Copley'e göre, oyun zamanı, öğretmenlerin öğrencilerinin problem çözme ve uzamsal düşünme becerilerini gözlemleyebilecekleri en iyi zamanlardan biridir (aktaran Ness, Farenga, & Garofalo, 2017).

Araştırma Sorusu

Okul öncesi çağı çocukları, uzamsal/mimari tasarımlarını yapı-inşa oyunu zamanı süresince hangi boyutta kullanmaktadırlar?

Çalışmanın Önemi

K-12 müfredatı iki sebepten dolayı çocukların uzamsal zekalarını geliştirmeye yardımcı olacak imkanlar içermelidir. Birincisi, çocuklar ve yetişkinler yapı-inşa malzemeleri kullanarak uzamsal yetenek içeren aktivitelerde bulunma eğilimi gösterirler. İkincisi, günümüzde ve gelecekte meslekler bu becerilere ihtiyaç duyacaktır (Ness, Farenga, & Garofalo, 2017).

Ness, Farenga ve Garofalo (2017)'ya göre uzamsal düşünme becerileri çocukların bilim, teknoloji, mühendislik, matematik (STEM), coğrafi bilgi sistemleri, haritalama, eleştirel düşünme aktiviteleri, sanat, beşeri bilimler, mimari ve tıp gibi alanları anlamalarına yardımcı olur. Jirout ve Newcombe çalışmalarında blok merkezinde oynama tercihinin ve yapı tasarımlarının cinsiyete ve sosyo-ekonomik farklılığa göre değişmediğini bulmuşlardır (2015).

Uzamsal zeka araştırmaları ilkokul ve ortaokul çağı çocuklarının yapı-inşa oyunlarının matematik başarısı üzerindeki etkisine bakmıştır. Pirrone, Tienken, Pagano ve Di Nuovo'nun (2018) araştırması bunu desteklemiştir. Trawick-Smith, Swaminathan, Baton, Danieluk, Marsh ve Szarwacki (2016) ise okul öncesi çağı çocuklarıyla yaptığı çalışmada yapının zorluğu, matematik öğrenme becerileri ve blok oyunun karakteristiği arasında ilişki bulmuştur. Alan yazına bakıldığında bu konu uluslararası alanda çalışılmasına rağmen Türkiye'de bu alanda yeteri kadar çalışma yapılmamıştır.

Çocukların oyun zamanında gösterdikleri uzamsal/mimari beceriler bize hem erken yaşlarda oyunun yeri hem de müfredatta önemi vurgulanan, oyunun akademik başarı üzerindeki etkisi hakkında bilgi verir. Bu çalışmanın uzamsal yetenek açısından okul öncesi eğitimi ile ilgili yapılan araştırmalara katkı sağlaması amaçlanmıştır. Bu bulgular doğrultusunda, bu çalışma uzamsal/mimari becerilerin, müfredatta belirtilen okul öncesi dönemi akademik becerilerini desteklemesine ışık tutacaktır.

Çalışmada Yer Alan Terimlerin Tanımı

Uzamsal Zeka: Thurstone uzamsal zekayı 3 ayrı yeteneğin birleşimi olarak tanımlamıştır. Bir nesneyi farklı açılardan tanımlamak, nesneyi ve nesnenin hareketini zihninde hayat etmek ve kişilerin fiziksel olarak belirli durumlara uyum sağlayabilmeleri uzamsal zekayı oluşturan üç özelliktir (aktaran Gardner, 2006)

Mimari Prensipler: Bu prensipler, yapı ve sistemlerin temel bileşenleridir. Bu prensipler sayesinde yapılar estetik, güç ve denge sahibi olurlar.

Yapı-İnşa Oyunları: Blok ve Lego® gibi yapı-inşa materyallerini içeren bir oyun türüdür. Oyun alanı ve alan üzerinde yapılar oluşturmak için bu tarz materyallerin (blok, Lego®) kişi tarafından elle hareket ettirilmesi gereklidir.

YÖNTEM

Çalışmanın Deseni

Bu çalışma, çocukların uzamsal/mimari tasarım becerilerini hangi boyutta kullandıklarını gözlemlemek amacıyla yapı-inşa oyunu zamanı süresince yapılmıştır. Bu, nitel bir çalışmadır. Bu yöntemin seçilmesinin sebebi çocukların uzamsal/mimari tasarım yeteneklerine karşı duyulan meraktır. Ayrıca, bu yeteneklerin incelenmesi için, çocukların doğal ortamlarında gözlemlenmesi gerekir ve nitel araştırma yöntemi de buna olanak sağlar. Bu yeteneklerin incelenmesi için, nitel araştırmanın bir özelliği olan doğal ortam gözlem yöntemi kullanıldı. Bu yöntemde kullanılan gözlem notları, mülakatlar, fotoğraflar ve kayıtlar dünyayı daha görsel bir hala getirir ve doğal ortamlarda gerçekleşen durumlara, insanlar tarafından verilen değeri yorumlamaya çalışır (Denzin & Lincoln, 2011). Nitel yöntemin seçilmesinin bir diğer sebebi de bağlamı daha iyi yorumlamaya olanak sağlıyor olmasıdır.

Çalışma Grubu

Veriler, Nevşehir’deki iki farklı okulda bulunan 31 anaokulu çocuğundan toplanmıştır. Ulaşılabilir ve çalışma için uygun olan bir grup insandan oluşan kolay ulaşılabilir örneklem kullanılmıştır (Fraenkel, Wallen, & Hyun, 2015). Kolay ulaşılabilir örneklem kullanılırken dikkat edilmesi gereken bazı noktalar vardır. Çalışma yapılan bireylerin ötesinde bir sonuç elde etmek için, demografik ve teorik açıdan uygun özellikleri olan yeterli sayıda çeşitliliğe ulaşılan bir örnekleme sahip olmak gerekir (Lamont & White, 2005).

İlk olarak her iki sınıfta da yapı-inşa malzemeleri bulunmasına ve sınıflardaki bu malzemelerin araştırma için yeterli olmasına emin olundu. Buna ek olarak, sınıflar seçilirken gözlemin yapılabilmesi için her iki sınıfın da günlük akışında oyun zamanının olmasına dikkat edildi.

Seçilen sınıflar, Sınıf A ve Sınıf B olarak kodlanmıştır. Sınıf A'nın içinde bulunduğu okulun çevresi sosyoekonomik açıdan dezavantajlı olarak tanımlanmıştır ve sınıftaki çocukların ailelerinin aylık gelirleri 1000 TL ile 2000 TL arasında değişmektedir. Sınıf B'nin içinde bulunduğu okulun çevresi ise orta gelirli olarak tanımlanmıştır ve sınıftaki çocukların ailelerinin aylık gelirleri 2000 TL ile 3000 TL arasındadır. İki sınıfın ortamı ve sınıflar hakkındaki genel bilgiler aşağıdaki tabloda özetlenmiştir.

Tablo 3.3.1

Sınıf ortamı

	Sınıf A	**Sınıf B**
Okul Türü	Devlet okulu	Özel okul
Eğitim süresi	Yarım gün	Tam gün
Ortalama oyun zamanı	45 dakika	30 dakika + 30 dakika
Sınıftaki çocuk sayısı	10 erkek, 9 kız	6 erkek, 6 kız
Çocukların yaşı	5 yaş	5 yaş
Sınıftaki öğrenme merkezleri	Drama Merkezi, Kitap Okuma Merkezi, Montessori Merkezi, Matematik Merkezi, Bilim Merkezi, Yapı-İnşa Merkezi	Kitap Okuma Merkezi, Bilişsel Oyun Merkezi, Yapı-İnşa Merkezi

Yapı-inşa merkezinde bulunan malzemeler		   
Sınıf ortamı	 	 
Okula ödenen aylık ücret (her çocuk için)	10 TL	600 TL
Sınıftaki öğretmen sayısı	Bir anasınıfı öğretmeni	Bir anasınıfı öğretmeni ve bir yardımcı öğretmen

Öğretmenlerin deneyim yılı	6 yıl	1 yıl
Öğretmenlerin eğitim seviyeleri	Okul öncesi öğretmenliği bölümü (Lisans mezunu)	Okul öncesi öğretmenliği bölümü (Lisans mezunu)

Sınıf A, devlet okulunda bulunan bir anasınıfıdır. Sınıf A'da eğitim hafta içi, sabah saat 8.30'da başlayıp öğlen 12.30'da bitmektedir. Günlük akışta sabahları ilk olarak oyun zamanına yer verilmektedir. Yapı-inşa malzemelerinin büyük çoğunluğu şeffaf kutuların içine konulmuş ve çocukların göz hizasına yerleştirilmiştir. Şeffaf kutuların önüne, üzerinde oynanması için küçük bir kilim yerleştirilmiştir ancak çocukların çoğu yapı-inşa malzemeleri ile genellikle sınıfın büyük halısının üzerinde oynamayı tercih etmektedirler. Sınıf A'nın yapı-inşa malzemeleri tuğla şeklinde, bir başka deyişle küp, dikdörtgenler prizması gibi geometrik şekillerde ve birbirine geçen yapıda oyuncaklardır.

Sınıf B, özel okulda bir sınıftır ve tam gün eğitim vermektedir. Sınıf B'nin içerisinde öğrenme merkezlerine çok fazla yer verilmemiştir. Bunun yerine, bina içerisinde drama sınıfı, televizyon odası ya da İngilizce odası gibi alanlar yaratılmıştır. Sınıf B'de yapı-inşa malzemeleri olarak blok türünden Becerikli Yapılar, Pattern Play, Equilibrio, ve Block Buddies gibi kutu oyunları vardır.

Veri Toplama Araçları

Veri, Uzamsal – Geometrik – Mimari (SPAGAR) kategoriler olarak adlandırılan bir gözlem formu aracılığıyla toplandı. Gözlem sırasında çocukların yapı-inşa alanında malzemelerle yaptıkları yapılar fotoğraflandı ve Görsel Analiz Yöntemi kullanılarak analiz edildi. Gözlemler her iki sınıf için de 10'ar gün sürdü. Toplamda 20 gün gözlem yapıldı. Araştırmacı, araştırma için veri toplamaya başlanmadan önce sınıflarda birkaç sefer bulundu. Araştırmaya başlamadan önce gözlem süresi her sınıf için 10 ile 20 gün arasında planlanmaktaydı. Gözlemin yapılacağı gün sayısına karar verilirken, toplanılacak olan verilerin analiz için uygun olması göz önüne alındı. Gözlemlerden elde edilen veriye bakıldığında, gözlemlerin 10.günde verinin tekrarlamaya başladığı görüldü ve veri toplamaya son verildi.

Bu çalışmada, gözlem formu, saha notları ve fotoğraflar veri toplama araçları olarak kullanıldı. Gözlem sırasında, anaokulu çocuklarının oyun zamanında yapı-inşa malzemeleri kullanarak yaptıkları yapılar fotoğraflandı, yapım süreci araştırmacı tarafından saha notları ile aktarıldı ve çekilen fotoğraflar SPAGAR formunda ilgili kategorinin altına yerleştirildi. Yapılan her yapı için bir SPAGAR formu dolduruldu. Moss ve Pini (2016)'ye göre eğitim ve fotoğraf ayrılmaz bir şekilde birbirlerine bağlanmıştır. Bu nedenle, oyun zamanı boyunca yapı-inşa malzemeleri ile yapılan her şey fotoğraflandı. Bu sayede gözlem sırasında gözden kaçan veriler fotoğrafların analizi sırasında değerlendirmeye katıldı.

Saha notları bu çalışmada kullanılan veri toplama araçlarından biridir. Oyun zamanı süresince yaşananlar saha notları ile kayıt altına alındı. Bu saha notları, araştırmanın analizinde ve tartışma kısmında yardımcı oldu. Yapı-inşa malzemeleri ile oynayan çocukların cinsiyetleri, oyun zamanın süresi ve sınıfın atmosferi bu araç ile aktarılabildi.

Uzamsal – Geometrik – Mimari (SPAGAR) Form

Sınıf A ve Sınıf B, Uzamsal – Geometrik – Mimari (SPAGAR) formu kullanılarak 10'ar gün gözlemlendi. SPAGAR formunun kullanılması için gerekli izin, formu geliştiren Ness, Farenga ve Garofalo'dan alındı. SPAGAR, uzamsal ilişkiler ve mimari prensipler olmak üzere iki ana başlık altında toplanmış 13 kategoriden oluşmaktadır. Her iki ana başlığın altında kategoriler ve alt kategoriler bulunmaktadır. Örneğin uzamsal ilişkiler ana başlığı; simetrik ilişkiler, biçimsel ilişkiler ve yer/yön olmak üzere 3 kategoriden oluşmaktadır. Mimari prensipler ise altı alt kategoriden oluşmaktadır.

Uzamsal ilişkilerin ilk kategorisi olan simetrik ilişkiler dört alt kategoriden oluşmaktadır. Bunlar, çizgisel simetri, düzlemsel simetri, dönüşlü simetri ve örüntüdür. *Çizgisel simetri (line symmetry)* kuş bakışı simetri, diğer bir deyişle bir yapıya yukarıdan bakıldığında ve yapının tam ortasından hayali bir çizgi çizildiğinde, yapının çizginin her iki tarafında kalan kısımlarına birbirlerinin yansıması olması, simetrisi olması demektir. *Düzlemsel simetri (plane symmetry)*, yapıya profilden bakıldığında hayali çizgi ekseninde yansıma, diğer bir deyişle simetri olması demektir. *Dönüşlü simetri (rotational symmetry)*, malzemelerin bir merkezin etrafında simetrik bir şekilde, çember yapıda yerleştirilmesi demektir. Son alt kategori olan *örüntü (patterning)* ise objeleri belirli bir sırada yerleştirmek demektir.

Uzamsal ilişkilerin ikinci kategorisi olan biçimsel ilişkiler; biçimsel özdeşleştirme ve şekil eşleştirme olmak üzere iki alt kategoriye sahiptir. *Biçimsel özdeşleştirmede (figure identification)* çocuklar şekil ve biçimin farkındadır ve bunlar çocukların sözel ifadelerinde tespit edilebilir. Örneğin, bir çocuğun "Bana yuvarlak bloğu verir misin?" cümlesinde biçimsel özdeşleştirme görülmektedir. Bu çalışma boyunca, çocukların sözel ifadeleri kayıt altına alınmadığı için, biçimsel özdeşleştirme gözlemlenemedi. *Şekil eşleştirme (shape matching),* bir problemi çözmek için yapının geometrik şeklini değiştirmek ya da kurallı bir oyunu tamamlamak için gerekli objeyi kullanmaktır. Ness, Farenga ve Garofalo (2017)'ya göre yapboz da şekil eşleştirmenin bir göstergesidir. Çünkü yapboz oyununda oyunu tamamlamak için gerekli parçayı doğru yere yerleştirmek gerekmektedir.

Yer/yön, uzamsal ilişkilerin son kategorisidir. Bu kategori, sözel ifadede, hareketlerde ve mimiklerde gözlemlenebilir. Örneğin, bir çocuk yer ve yön duygularını belirten; üstünde, altında, içinde, dışında gibi kelimeler kullanıyorsa, bu kategori gözlemlenmiş olmaktadır.

SPAGAR'ın diğer ana başlığı mimari prensiplerdir ve burada altı alt kategori bulunmaktadır. Bu kategoriler mimarlar ve inşaat mühendislerinin kullandıkları prensipler olarak tanımlanmaktadır. Mimari prensipler; etrafını çevirme, temel, kemersiz yapı, kolon, mühendislik ve orantısal düşünmeden oluşmaktadır. *Etrafını çevirme (enclosure),* yapının etrafını çit şeklinde çevirme anlamına gelmektedir. Yapının temelini oluşturmaya *temel (foundation)* denmektedir. Örneğin, bu alt kategori, çocukların yapılarını daha sağlam hale getirmek için yapının temellerini güçlendirme kaygılarında gözlemlenebilir. *Kemersiz yapı (Trabeated construction),* bütün binalarda olan kolon-kiriş ilişkisidir ve amacı yapıya kat eklemektir. *Kolon* *(posting)*, yapıdaki dikey destek ya da asma yapıdır. Bu alt kategori genelde çocukların köprü, tren yolu ya da araba yolu yapılarında görülür. *Mühendislik (engineering)* alt kategorisi, problem çözme, tahmin etme ya da ölçme becerilerini içerir. Örneğin, bir çocuk araba parkı inşasını bitirmek üzereyken, yaptığı parkın arabaları için yeteri kadar büyük olmadığını fark eder ve parkı büyütürse, çocuğun mühendislik becerileri gözlemlenmiş olur. *Orantısal düşünme (proportional reasoning)*, objeler arasındaki orantıdan haberdar olmaktır. Örneğin, bir çocuk, oyuncak arabasının içine girebildiği bir garaj inşa ederse orantısal düşünme becerisi sergilemiş olur.

Veri Analizi

Anaokulu çocuklarının oyun zamanında yapı-inşa malzemeleri ile yaptıkları ürünler, SPAGAR formu kullanılarak saha notlarının da yardımıyla gözlemlendi ve yapılan yapılar fotoğraflandı. Veriler, anaokulu çocuklarının yapı-inşa malzemelerini oyun zamanında uzamsal/mimari becerileri açısından hangi boyutta kullandıklarını öğrenmek için analiz edildi.

İçerik analizinde, kategorileri araştırmacı oluşturur. Veriyi, oluşturulan kategorilerle ilişkilendirir (Silverman, 2014). Bu araştırmanın içerik analizi için kategoriler oluşturmak yerine SPAGAR'da hali hazırda bulunan 13 kategori kullanıldı.

Marvasti (2004) içerik analizinin son aşamasını, önceden belirlenen kategorilerin ne sıklıkla verilerde rastlandığını saptamak olarak tanımlamaktadır. Bu araştırmanın analizinde ortaya çıkan SPAGAR kategorilerinin hangi sıklıkta gözlemlendiğini gösteren bazı tablolar bulgular kısmında paylaşılmıştır (Van Leeuwen & Jewitt, 2004). Araştırmaların analizlerinde özellikle de içerik analizinde her türlü sözel ve görsel materyal kullanılabilir. Bu çalışmada ise görsel materyaller içerik analizi sırasında kullanılmıştır.

Tarihe bakıldığında, görsel araştırma teknikleri fotoğraf tekniğini kullanan makaleler ile ilişkilendirilir (Silverman, 2014). Ayrıca, fotoğraflar bizlere okul deneyimi hakkında bilgi vermede oldukça büyük bir öneme sahiptir (Moss & Pini, 2016). Bunlara dayanarak, fotoğraflar bu çalışmada veri olarak kullanıldı.

Araştırmanın analizinde, içerik analizi ve görsel araştırma teknikleri kullanıldı. Gözlemler bittikten sonra fotoğraflar bilgisayar ortamına aktarıldı ve saha notları yardımıyla SPAGAR formunda ilgili kategorinin altına yerleştirildi. Çocukların oluşturduğu bazı yapılar birden fazla kategoriyi içerdiği için, SPAGAR formunda bu fotoğrafların birden fazla kategorinin altına yerleştirildiği durumlar oldu. SPAGAR formuna fotoğraf yerleştirme işlemi, çekilen bütün yapı fotoğrafları için yapıldı.

Güvenilirlik

Nitel bir çalışma değerlendirilirken güvenilirliği, analizi ve bulguları oldukça önemlidir (McMillan, 2000). Nitel araştırmalarda araştırmacılar genellikle gözlem sırasında davranışın tutarlılığından çok gözlem doğruluğuna önem verirler. Bu nedenle, gözlem sırasında olan her şey çalışmanın güvenilirliğini artırmak için fotoğraflar, saha notları ve başka yöntemler ile kayıt altına alınmalıdır (McMillan, 2000). Bu çalışmanın güvenilirliğini sarsabilecek bazı unsurlar kontrol altına alınmıştır. Örneğin, örneklem her iki sınıfta da bulunan çocukların yaşları ve sınıflardaki cinsiyet oranları eşit olacak şekilde seçilmiştir.

Güvenirlilik için gerekli uzman görüşleri alındı. Bunun için, çalışmaya başlamadan önce gözlem formunun çalışmaya uygunluğu iki mimar ve bir okul öncesi uzmanı tarafından kontrol edildi. Buna ek olarak, çalışmanın sonunda bir uzman, doldurulan formların doğruluğunu kontrol etti.

Kodlayıcılar arası görüş birliği çalışmanın güvenilirliğini desteklemek için kullanılır. Bunun sağlanması için araştırmacı diğer kodlayıcının veri toplama aracının nasıl kullanılacağını anladığından ve araştırmacı ile aynı çizgide olduğundan emin olmalıdır. Son olarak, iki kodlayıcının topladıkları veriler arasındaki tutarlılığa bakılmalıdır (Van Leeuwen & Jewitt, 2004). Kodlayıcılar arası görüş birliği en az %80 olmalıdır. Bu çalışmanın kodlayıcılar arası görüş birliği için bir okul öncesi öğretmeni veri toplama aracı konusunda eğitildi ve araştırmacı ile dört gün boyunca gözlem yaptı. İki kodlayıcı tarafından doldurulan SPAGAR formları karşılaştırıldığında katsıyısı %86,5 bulundu.

Creswell (2013)'e göre, uzun çalışmalarda araştırmacının çalışma başlamadan önce araştırmalarda bulunması güvenilirlik için önemlidir. Bu nedenle araştırmacı, gözlemlere başlamadan birkaç hafta önce sınıflarda bulunmaya başlamıştır. Böylece çocukların araştırmacıya alıştıkları varsayılmaktadır. Bunlara ek olarak, araştırmacı tarafından yapılan doğal gözlemin bozulmaması için, öğretmenlerin oyun zamanında her zamanki gibi davranmaları istenmiştir.

BULGULAR

Bu bölümde SPAGAR formunun yardımıyla yapılan gözlemlerin sonuçları bulunmaktadır. İlk olarak Sınıf A'nın bulguları, sonrasında da Sınıf B'nin bulguları paylaşılacaktır.

Sınıf A, 10 gün boyunca ortalama süresi 40 dakika olan oyun zamanlarında gözlemlendi. Oyun zamanı birinci gözlem günü hariç günlük akış planında ilk sırada yer almaktadır. Sınıf A'da tuğla şeklindeki (Lego®) yapı-inşa malzemeleri bulunmaktadır. Bulgular, Sınıf A'da uzamsal ilişkilerde bir yoğunluk olduğunu ortaya koymuştur. Çizgisel simetri ve düzlemsel simetri en çok gözlemlenen kategoriler olmuştur.

Sınıf B'nin çocukları 10 gün boyunca oyun zamanında gözlemlendi. Oyun zamanı ortalama 27 dakika sürdü. Bu sınıfta yapı-inşa malzemelerinden bloklar bulunmaktaydı ve Becerikli Yapılar, Pattern Play, Equilibrio, Block Buddies bu sınıfta bulunan blok çeşitlerinden bazılarıydı. Sınıf B'nin bulguları, bu sınıfta simetri, örüntü, mühendislik ve kemersiz yapının çoğunlukla gözlemlendiğini göstermiştir.

TARTIŞMA

Bu çalışma seçilen iki anasınıfının oyun zamanında gerçekleşti ve oyun zamanları bir sınıfta 40 dakika diğerinde 27 dakika sürdü. Oyun zamanı süresi boyunca her iki sınıfta da sınıfın öğretmenleri bulunmaktaydı ve her iki öğretmen de hiçbir şekilde oyun zamanın akışına müdahalede bulunmadan bir sonraki etkinlik zamanı için materyal hazırladılar. Türkiye'de 460 anaokulu öğretmeni ile yapılan çalışma, oyun zamanının genellikle bir saat sürdüğünü ve öğretmenlerin çoğunun oyun zamanı süresince çocukları gözlemlediğini, gerekli durumlarda da sürece dahil olduklarını belirtmiştir (Tuğrul, Boz, Uludağ, Metin, Aslan, Sevimli-Çelik, & Sözer Çapan, 2019).

Erken çocukluktan başlamak üzere, insan beyni matematik ve sözel ilişkilendirme gibi farklı uzamsal ilişkileri ayrıştırabilmektedir (Gersmehl & Gersmehl, 2007). Sayı sayma, örüntü, gruplama gibi kritik becerileri geliştiren yapı-inşa oyuncakları, uzamsal ilişkileri de desteklemektedir (Johnson, Sevimli-Celik, & Al-Mansour, 2012). Bu araştırmada uzamsal ilişkiler her iki sınıfta da gözlemlenmiştir. Buna ek olarak örüntü de iki sınıfta da gözlemlenmiş olup Sınıf B'de en çok gözlemlenen kategorilerden birisidir. Sınıf A'da örüntü kategorisinin Sınıf B'de olduğu kadar çok gözlemlenmemesinin nedeni, Sınıf A'daki malzemelerin gerek miktar gerek şekil gerekse renk açısından yetersizliğinden olabilir.

Simetri, SPAGAR'daki kategorilerden birisidir. Ng ve Sinclair (2015)'e göre, anaokulundan üçüncü sınıfa kadar olan çocuklar sıralama, karşılaştırma ve yapı-inşası için simetriyi kullanmaktadırlar. Üst düzey düşünme becerileri, tek başına yaratma sürecinde geometri ve simetriyle desteklenebilir (Knuchel, 2004). Bu çalışmada çizgisel simetri ve düzlemsel simetri her iki sınıfta da hemen hemen her gün gözlemlendi. Sınıf A ise bu simetrilerin daha çok gözlemlendiği grup oldu.

Leikin, Berman, ve Zaslavsky (2000)'e göre matematik öğretmenleri simetriyi; matematiğin geometri, cebir, hesaplama gibi farklı dallarını bağlayan bir köprü olarak görmektedirler. Ayrıca simetri, problemleri çözmede oldukça etkili bir yöntemdir (Ng & Sinclair, 2015). Bu çalışmada problem çözme becerileri, mühendislik kategorisinin özelliklerinden birisi olarak ele alındı. Simetri ve mühendislik bu çalışmada en çok gözlemlenen beş kategoriden ikisidir. İkisinin de bu şekilde popüler olmasının nedeni bu iki disiplinin karşılıklı olarak birbirini beslemesidir. Diğer bir deyişle, hemen hemen her mühendislik kategorisini içeren yapılarda simetri de gözlemlendi.

Uzamsal ilişkilerin yanında bazı mimari prensipler de gözlemlendi. Miller (2004)' e göre, bloklarla oynamak çocukların bazı temel mimari terim ve özelliklerini öğrenmesine olanak sağlar. Bu çalışmada mimari prensipler çoğunlukla Sınıf B'de gözlemlendi. İki sınıf arasındaki bu farklılık sınıflarda bulunan malzemelerin farklılığından kaynaklanmış olabilir.

İki sınıfın saha notları incelendiğinde, yapı-inşa malzemeleriyle oynamayı seçen çocukların cinsiyetlerine bakıldığında farklılık gözlemlendi. Sınıf A'da genellikle erkek çocukları yapı-inşa malzemeleriyle vakit geçirirken, Sınıf B'de kız ve erkek çocukları neredeyse aynı oranda bu alanda oyun oynadılar. Bu noktada genelleme yapmaktan kaçınarak bireysel farklılıkların altını çizmek gerekir. Örneğin, Sınıf A'da bazı kız çocuklarının mimari prensiplerde oldukça etkin olduğu gözlemlenirken, bazı erkek çocuklarının hiçbir şekilde yapı-inşa malzemeleriyle ilgilenmedikleri fark edilmiştir.

Uzun oyun zamanına sahip olmak, çocukların oyuncaklarla daha çok etkileşmesine olanak sağlar. Devlet, çocukların oyun zamanını kısaltıp, didaktik eğitime daha çok odaklanma politikasından bir an önce kurtulmalıdır (Trawick-Smith, Swaminathan, & Liu, 2016). Roger ve Sawyer yaptıkları araştırmada oyun zamanı bitiminde çocukların yapı-inşa malzemeleri ile yaptıkları yapıyı bitiremediklerinde üzüldüklerini ve daha sonrasında devam etmek istediklerini belirttiklerini gözlemlemişlerdir (Aktaran Tarman & Tarman, 2011). Bu nedenle, çocukların gelişimi açısından, oyun zamanlarında başladıkları çalışmayı sürdürebilmeleri için çocuklara yeterli zaman tanınmalıdır.

İleriki çalışmalara yönelik öneriler

Bu çalışmada gözlemlenen sınıflarda tuğla şeklinde malzemeler ve bloklar olmak üzere iki tür yapı-inşa malzemesi vardı. Oyun zamanında kullanılan malzemelerin miktarı ve çeşitliliği ileriki çalışmalarda arttırılabilir. Buna ek olarak, bu araştırma tasarlanırken sınıflardaki çocukların sosyoekonomik durumları ve gözlemlenen çocukların cinsiyetleri hesaba katılmamış olup, saha notları aracılığıyla analize aktarılabildi. İleriki çalışmalar çocukların sosyoekonomik durumlarına ve cinsiyetlerine odaklanarak tasarlanabilir. Bu çalışma anaokulu çocukları ile yapıldı, ilerideki çalışmalarda diğer erken çocukluk grubundan çocuklarla da çalışılabilinir.

Çalışma boyunca çocukların yapıları fotoğraflanarak veri toplandı. İleriki çalışmalarda oyun zamanının başlangıcından bitişine kadar olan süreç video ile kayıt altına alınabilir. Böylece yapılar oluşturulurken meydan gelen bütün süreç adım adım izlenebilir.

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