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CHILDREN'S MATHEMATICS INTEGRATED PLAY EXPERIENCES DURING PLAY TIMES

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Abstract: Children have mathematical understanding beginning from the early years of life. Mathematics education during these years has a significant effect on children's future lives. Play is a significant issue in children's lives and can be used as a way for teaching and learning. It presents a rich learning environment. In this study, therefore, we mainly focused on which mathematical concepts, skills and play types children preferred and found out mathematical concepts and skills observed in various play types children preferred while they were playing. This study was a qualitative study and 15 children from different age groups participated. The results of this study indicated that measurement related skills and number related skills were frequently used and pretend play and object play types were used mainly by children. Besides, pretend play and object play types were frequently used by children while they were using measurement and number related skills.

Keywords: Play types, mathematical skill, early childhood, mathematics education

1. Introduction

Children are born with mathematical skills and conceptions (Geist, 2009). This takes the attention of researchers and there is a growing body of knowledge about early childhood mathematics education. Researches are generally about its significance and effects on children's future academic and social lives (Clements, Fuson, and Sarama, 2019; Rudd, Lambert, Satterwhite, and Zaier, 2008). There are also researches indicating that children's achievement in mathematics gives ideas about their future academic success not just in mathematics as well as in other subjects and their lives (Clements and Sarama, 2014; Duncan et al., 2007; Schoenfeld and Stipek, 2011). Hence, there are various effects of it on children and their lives.

Children gain and experience mathematical concepts and skills during their everyday lives. They observe and explore mathematical dimensions of surroundings. During these processes, they have a chance to experience quantities, patterns, measuring, sharing, space related terms, solving real life problems; therefore, children should be provided opportunities for meaningful mathematics explorations (Guberman, 2004). In addition to everyday experiences, early childhood mathematics education is significant for the acquisition of mathematical understanding and gaining mathematical skills (Perry and Dockett, 2002). When these issues are considered altogether, early year mathematics education is significant for various reasons. Moreover, mathematics education has three major related goals; children's gaining mathematical understanding as well as thinking, children's gaining mathematical skills like reasoning and predicting, and lastly, issues related with an affective domain like enjoying learning mathematics (National Association for the Education of Young Children ([NAEYC], 2010). These goals can be achieved through a variety of instructional ways.

In the current literature, there is not any agreement on how the instructional process should be planned. For instance, according to Palmer and Björklund (2016), there are different opinions about which instructional method should be used in early childhood. One of the instructional methods is play due to its appropriateness to children's development level, in other words, play is the best way in children's learning (Pyle, 2018). Play can be used during early years even though there are different understandings regarding play (Gasteiger, 2015). And it is significant due to the fact that children develop cognitively, physically, socially and emotionally while they are playing and play provides

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children to use their creativity, imagination, dexterity and physical, cognitive and emotional strength (Ginsburg, 2007). As well play provides exploring the world the children can master, and when needed, they can practice adult roles. Hence, it has a value in itself (Samuelsson and Carlsson, 2008).

This study, therefore, was aimed to examine mathematical concepts and skills as well as the play types children (3-6 years of age) preferred during their play times and also to determine the mathematical concepts and skills observed in various play types.

1.1. Play

There are various understandings and conceptions regarding play. Wood (2010, p.12) clarified this situation as "conceptualizing play is depended on researchers' lenses." But it is generally accepted as the work of children. For instance, Piaget considered play as an enjoyable method and it gave chance to children for reflecting on their prior experiences. Besides, Piaget mentioned the play to be the path that children take to learn about their individual boundaries at their own pace (Englebright, 1996). Vygotsky, on the other hand, concentrated on social interactions and viewed play as giving the child to imagine creatively (Izumi-Taylor, Samuelson, and Rogers, 2010). In this Vygotskian's approach to playing, play is limited to dramatic or make-believe play. He also believed that play creates a zone of proximal development (Vygotsky, 1966). Since children have a chance to act like an older age one and behave accordingly. It is also seen as a particular attitude or approach to materials, behaviours, and ideas and not the materials or activities or ideas themselves (McLane, 2003). This approach to play focuses on process. In addition, McLane (2003) referred to play as a special mode of thinking and doing. When these definitions of play are considered, they include the following properties summarized by Hughes (1998). According to Hughes (1998), the play has five essential characteristics; intrinsically motivated, freely chosen, pleasurable, non-literal, and actively engaged in. These characteristics are covered in various approaches to play.

The roots of play lie in object oriented activities for toddlers (Scharer, 2017). Then, children develop a strong interest in the adults' world and they want to be a part of this world. Interactions between children and their roles become important. At the end of the preschool period, children begin talking about the play and stop acting. Most of the time is spent on roles starts to decrease (Gajdamaschko, 2011) and children spend more time on learning activities (Kravtsova and Kravtsova, 2010). Nowadays, there is a decrease in children's free and self-initiated play due to technological innovations, social change, and economic globalization (Elkind, 2008). However, the significance of play is still in the centres of their lives. Along with its significance, there are five main play types; physical play, object play, symbolic play, pretend play, and games with rules (Whitebread et al., 2012). Whitebread et al. (2012) summarized all these play types as follows. Physical play is the earliest one and can be seen mostly. Some researchers referred to it as "rough and tumble" play. Jumping, dancing, climbing, playing, cutting, play fighting with friends or with siblings are some examples. The object play is about children's exploration of the world, objects around themselves. This type of play begins just after infants can grasp and hold objects. After children get older, they try to arrange objects, build, make, and construct behaviours. With the help of this play, children begin to develop representational abilities as well. The third type of play is symbolic play. It emerges around the age of 12 months and children use sounds. This type of play could support children in expressing ideas, feelings, experiences, etc. Pretend play is a way of developing children's social skills and awareness of others. Besides, it is significant for developing reasoning skills. The game with rules is the last one to be explained here. From a very young age, children are interested in the adults' world. As a part of this, they tried to learn rules. Beginning from young age, they enjoy the game with rules, in some situations, they constitute new rules, modify them, and behave accordingly. In this study, these play types are considered.

There is also an increasing understanding of how play is vital for learning and development. It is generally seen as the language of children and during play, they have a chance to behave naturally. About this, children do not play for learning instead they learn through playing (National Curriculum Guidelines on Early Childhood Education and Care in Finland, 2003). Besides, Saracho and Spodek (1998) mentioned play helps children learn how to learn. Wallerstedt (2012) also studied the relationship between learning and play, she suggested that learning and play need to be seen

intrinsically interwoven and play is contingent in children's learning. This relationship between learning and play indicates that children experience various developmentally appropriate academic achievements by engaging in play. According to Bodrova and Leong (2003), children have positive attitudes towards academic learning during early childhood as a result of learning through play. Despite these findings, Weisberg, Hirsh-Pasek, and Golinkoff (2013) suspected that play had a real role in learning and it wasn't a unique contributor to learning. Instead, they approached play as a sufficient condition for learning. Although there are different understandings regarding the relationship between play and learning, researchers agreed on the fact that play provides opportunities for children's teaching and learning.

1.2. Early mathematics education and play

NCTM (2000) claimed that children should learn mathematics for life, as part of cultural heritage, for the workforce, and the scientific and technical community. When these reasons are considered, early math is significant for preparing children for future schooling and life. Being a successful child in early childhood affects future school years (Duncan et al., 2007; National Mathematics Advisory Panel, 2008; Stevenson and Newman, 1986). Therefore, early childhood mathematics education should include rich, meaningful, high-quality, and challenging mathematics experiences (NAEYC, 2002). A broad range of basic concepts and skills are covered during this process; counting, comparing, exploring and understanding shapes and spatial relations, measurement, patterning, matching, grouping, problem solving, sorting, graphing, adding and subtracting, etc. (Common Core State Standards I [CCSSI], 2020; MONE, 2013; NCTM, 2000). Children are curious and eager to learn, so they could learn these mathematical concepts and skills both in various activities and during play experiences.

The early years of life belong to a distinctive phase for children in learning and focus on whole-child learning. Hence, appropriate instructional methods should be considered carefully. Play as an instructional method comes to the scene in early years but there is a false dichotomy that play versus academics should be chosen as an instructional method (Fuson, Clements, and Sarama, 2015). However, Van Oers (1996) indicated that free play gave children a chance to engage naturally in mathematics. Besides, Clements and Sarama (2018) emphasized that high-quality early math education is done with play and during free play times almost half of every minute the children engage in spontaneous mathematics experiences (Perry and Dockett, 2008; See and Ginsburg, 2004; Van Oers, 1994). In Vergnaud's (1978) study, he mentioned that play provided children intuitive mathematical knowledge of ideas from arithmetic to proportions to right angles. Play as an instructional method is taken into consideration. NAEYC (2002, p.6), on the other hand, reported that play does not guarantee mathematical development, but it offers rich possibilities. For instance, mathematical ideas are developed and even challenged through play (Ginsburg, Lee, and Boyd, 2008). Moreover, significant benefits are more likely when teachers follow up by engaging children in reflecting on and representing the mathematical ideas that have emerged in their play (NAEYC, 2002, p.6). Clements (2001) also stated that mathematics is a natural component of children's play.

There are various studies including both topics; play and mathematics. Pellegrini (1992), for instance, mentioned that object play was effective in children's first grade achievement and preschool achievement, particularly in mathematics. In Gejard and Melander's (2018) study, they investigated how geometry was actualized in children's verbal and embodied interaction with their peers, pedagogues, and material development. They found out how children orient to spatial locations, properties, dimensions, orientations, transformations, and shapes while they were playing. Teachers' involvement in children's mathematizing processes was also investigated (Björklund, Magnusson, and Palmer, 2018). The results of Björklund, Magnusson and Palmer's (2018) study indicated that how teachers interact and respond affected children's mathematizing and they claimed that mathematizing of elements of the play is possible and desirable for teaching mathematics. Seo and Ginsburg (2004) found that 88 % of children engaged in mathematical play while they were making patterns, building blocks, and counting and comparing objects. In line with Seo and Ginsburg's study, Tudge and Doucet (2004) stated that children generally engaged in mathematical play at their homes. Reikeras (2020) investigated the relationship between different kinds of play skills and mathematical skills and the

level of this relationship. The researcher found out that weak, middle or strong play skills exhibited corresponding low, medium or high levels of mathematics skills (Reikeras 2020). Objects used during plays have also taken the attention of researchers (Kullberg, Björklund, Brkovic, and Kempe, 2020; Neuman, 2013). For instance, if children play with mathematical objects before solving problems, children are found to be more successful as well as creative (Bruner, 1985). But as Macmillan (1995) mentioned the success of physical manipulations and ultimate mathematical conceptualizations is related with the success of self-regulation of the social context. When these researches are considered altogether, there is still a need for observing which mathematical skills and concepts are used by children in play times and finding out the mathematical skills and concepts observed in different play types if these play types are preferred by children during play times at school.

1.3. Research questions

(1) Which mathematical skills and concepts do 3, 4, and 5 years old kindergarten children use during play times at school?

(2) Which play types do 3, 4, and 5 years old kindergarten children prefer during play times at school?

(3) Which were mathematical skills and concepts observed in different play types preferred by 3, 4, and 5 years old kindergarten children during play times at school?

2. Method

This is a qualitative study and was conducted in a public preschool. The qualitative study helps the researchers to address and understand kindergarten children's preferences in play types, mathematical concepts and skills during play times at school.

To understand the background of this present study, early childhood is not compulsory in Turkey. Children generally begin after being 36 months old. During the early childhood education period, children's physical, cognitive, social and emotional, self-maintenance skill, and language development are supported. Besides, the main purposes of early childhood education are preparing children for primary education, developing their language skills, constituting a common learning environment for children coming from disadvantaged social and cultural environments (Ministry of National Education [MONE], 2013). Children generally spend five hours per day at school. Daily routines at school include welcoming, play, feeding and cleaning, activity, and evaluation times (student-initiated and teacher-initiated evaluations). During play times, under preschool teachers' supervision children are supposed to arrange their play on their own or with their friends, and if children prefer they can use learning centers (like art center, drama center, science and technology center, music center, mathematics center, etc.) in their classroom.

2.1. Participants

Participants were composed of 15 kindergarten children from a public school located eastern part of Turkey. Children were registered to this public preschool that provides educational services for children aged between 36 months to 72 months. In this study, six participants were aged between 36 to 48 months (two girls and four boys), four were aged between 49 to 60 months (two girls and two boys) and lastly, five were aged between 61 to 72 months (two girls and three boys).

Participant children were selected through convenience sampling method as its aim is to do the study more economically and efficiently, besides it necessitates less time (Yıldırım and Şimşek, 2009). Children participated based on their parents' written informed consents. This study was carried out in accordance with the current ethical standards established by the researchers' university and with the permission of the Directorate of National Education.

2.2. Measure and Data Collection Process

Play at Play Times Observation Scale (POS) is a tool that measures play types and as well as mathematical concepts and skills including their frequencies (means how many times a mathematical

concept or skill is observed) and samples (a sample of a mathematical concept or skill used during observation). This tool was prepared based on current literature (CCSSI, 2020; MONE, 2013; Whitebread et al., 2012, etc.) by the researchers. The researchers formed the tool and then they sent it to two experts for their consent. According to their suggestions, POS took its final form (See App.1). Their suggestions were about wordings. The last form of POS includes four main parts. In the first part, demographic information like age, gender and number of participant children are asked. The second main part is about play types and in this part how play is organized by children can be explained. In the third part, the observer can write which mathematical skills are observed (right, wrong, partially right, not observed), the frequencies of mathematical skills are used, and sample situations in which mathematical skills are used and if mathematical skills are observed in a play, the observer can write play type as well as mathematical skills used during this play. The last part is for the observer to write if any other things s/he would like to write about the research topic.

First of all, the researchers applied University Ethical Board with POS and it approved the POS. Then, POS was sent for getting necessary research to approve for the Directorate of National Education with the Ethical Board's decision. The researchers applied a public preschool for doing this study. Preschool teachers, who were volunteer to take part in this study, were asked to send parent consent forms to families. This consent form includes the research purpose, research process and if they want their children to participate in this research. Besides, in these consent forms parents were informed that any identifiable information would not be shared elsewhere. The researchers collected signed parent consent forms. Besides, just before observation began, the researchers asked children if they were happy to take part in this study. All participant children were volunteered.

The researchers after getting these consent forms planned a schedule with each preschool teacher for observations. These teachers were 3, 4, and 5 years old children's teachers. Schedules were determined as two observations for each age group. Totally six observations were done.

Before beginning observations at school, the researchers prepared various materials and objects that were totally new to children for the first observation. In the second observations, these materials and objects were used again. Each material and object could be used for mathematical purposes. Different mathematical skills could be experienced with these materials and objects. There were a totally of 14 main materials and objects. There were a weighing machine (including various things for weighing), number symbols (including beads and fingers that would help meaningful counting on a modifiable board), two boards (one for addition and subtractions and one for number symbols and counting), a model house (this house could be filled with various materials), water pans (this could be filled with fluid), thermometer, giraffe shaped ruler, a 3D puzzle, an addition machine (including balls for making addition), a weather graphic, geometrical shapes board, a clock, etc. These materials were prepared with respect to mathematical related cognitive objectives of the Early Childhood Education Curriculum (MONE, 2013). Before observations materials were distributed on the floor of classrooms. Children were invited to the classroom, but they were not forced to use them. They were videotaped and the researchers also filled POS separately.

There were a totally of six observations (two observations for each age group were done and children in different age groups had never observed and participated play times at the same time) arranged and each observation lasted about 20 to 30 minutes. Generally observations finished when children did not want to play anymore and wanted to leave the classroom. All children participated in their sections with their same age groups.

2.3. Validity, reliability and data analysis

Pilot study of POS was done in two public preschools with the permission of the Directorate of National Education. During each observation in these schools, four observations (two observations with five years old children, one with four years old, and one with three years old children) were done. As a result of these observations, the researchers controlled the data. Some changes in wording and enlarging the spaces for writing in-depth were done. This pilot study is significant for the reliability of POS.

Besides, the approval of the Ethics Committee of the researchers' university was obtained beforehand. For ensuring the validity of this study, sample observation processes and experts' opinions were taken into account. Participant teachers were asked to participate voluntarily in this study. In particular, participants' views were recorded in detail.

For analysis of data gathered in this study, the content analysis method was used. During this process, observers' notes in the observation forms were analyzed by two researchers and similar examples were brought together. Data gathered were examined by two of the researchers when they came together and besides, another expert also studied the same data and her opinions were also taken. The coder concordance reliability (researchers and expert) was calculated with respect to Miles and Huberman's (1994) formula and it was found as 0.92.

3. Results

This part presents play types and mathematical skills used by children from different age groups. At the end of the data analysis process, play types are presented under five categories (physical play, pretend play, object play, symbolic play, and games with rules) and mathematical concepts and skills were formed with respect to the Early Childhood Education Curriculum and included to POS.

The play types used by children (3, 4 and 5 years old) during play times at school are presented below. Two observations done in each age group were taken and presented together in the following Table 1.

Table 1. *Play Types observed in Different Age Groups*

	36-48 months old children	**49-60 months old children**	**61-72 months old children**
Play types			
Physical play	-	-	-
Pretend play	6	3	1
Object play	1	3	6
Symbolic play	-	-	-
Games with rules	-	1	3

As seen in Table 1, none of the children preferred using physical and symbolic plays during observations. They preferred pretend play, object play, and games with rules. Especially participant children used pretend play and object play types. 49 months older children preferred game with rules type. Besides, 36-48 months old children frequently used pretend play, 49-60 months old children generally preferred pretend play and object play. 61-72 months old children, on the other hand, frequently used object play type.

While observations of 36-48 months old children, two children used 3D puzzle pieces and put one on top of the other. They talked about this structure as a building. Near this structure, they talked about their position as well as the position of puzzle pieces.

A girl aged between 49-60 months old determined small pieces of toys she placed them to a house shaped toy. She talked both as a mom and as a daughter. She talked positions of those pieces of toys.

61-72 months old boy chose addition operation board. He explained what was on this board to his friend. They played with this addition board and they tried to do addition operations on their own.

Table 2 presents mathematical skills observed in six observations. There were four options in the POS; right, partially right, wrong, and not observed. Partially right option means; children use a mathematical concept or skill appropriate to its meaning while speaking, but used or did something wrong instead of his speech or vice versa. These observations were shown as 1st and 2nd observations done in that age group.

Table 2. *Mathematical Concepts and Skills observed during Play Times*

	36-48 months old children	**49-60 months old children**	**61-72 months old children**
Mathematical Concepts and Skills			
Numbers (symbols and counting)	R^1:3, PR^1:1; R^2:2	R^1:6, W^1:2; R^2:2, PR^2:1	R^1:1; R^2:5, W^2:1, PR^2:2
Addition (Adding)	NO^1; NO^2	NO^1; NO^2	R^1:1, W^1:1; NO^2
Subtraction (Subtracting)	W^1:1; NO^2	NO^1; NO^2	NO^1; NO^2
Geometrical shapes (shapes and properties)	R^1:2; R^2:1	NO^1; R^2:3, W^2:1	NO^1; NO^2
Spatial sense	PR^1:1; R^2:3	NO^1; PR^2:1	NO^1; R^2:1
Pattern and patterning	NO^1; NO^2	PR^1:1; NO^2	NO^1; R^2:1
Graphics (Reading, explaining, and forming graphics)	NO^1; NO^2	NO^1; NO^2	W^1:1; NO^2
Measurement	R^1:3, PR^1:2; R^2:7	W^1:2; R^2:6, PR^2:2	R^1:4, PR^1:2; PR^2:2
Problem solving	R^1:1, PR^1:1; PR^2:1	NO^1; NO^2	NO^1; NO^2
Estimation	NO^1; NO^2	NO^1; NO^2	NO^1; NO^2
Part and whole relationship	NO^1; NO^2	NO^1; NO^2	NO^1; NO^2
Cause and effect relationship	NO^1;R^2:1	NO^1; NO^2	NO^1; NO^2
Comparison	NO^1; NO^2	R^1:1; R^2:3	NO^1; NO^2
Matching	R^1:1; R^2:2	R^1:2; R^2:1	R^1:2, W^1:1; R^2:3
Ordering	NO^1; NO^2	R^1:1; NO^2	R^1:1; R^2:2
Classification	NO^1, NO^2	NO^1, NO^2	NO^1, NO^2

*R: Right, PR: Partially right, W: Wrong, NO: Not observed

**^{1}:1st observation, ^{2}:2nd observation

Table 2 above represents mathematical skills (used rightly, partially right, wrongly, not observed) observed in different age groups. While observations measurement related mathematical skills and numbers (symbols and counting) were frequently used rightly by children (f=20). Estimation, part and whole relationship, and classification were used in none of the six observations. Subtraction and graphics were mathematical skills that were used but wrongly.

Children between 36-48 months old were good at using measurement (f=10) and numbers (f=5). This age group of children did not use pattern and patterning, graphics, estimation, part and whole relationships, comparison, ordering, and classification. For instance, children counted while they were showing number symbols. Besides, they put their hand on the number board and counted again while they were showing their friends. About measurement, children talked about weather condition graphic and changed weather graphic with respect to that day's situation.

49-60 months old children like the younger group used numbers (f=8) and measurement (f=6) rightly. On the other hand, they did not use classification, cause and effect relationship, part and whole relationship, estimation, problem solving, graphics, addition and subtraction. For example, a girl showed number symbols and told their names to her friends. A boy used a weighting machine and tried to find balance by putting various materials into both two boxes.

In the last age group, children were good at numbers (f=6), measurement (f=6), matching (f=5), and ordering (f=3). In none of the observations of this age group, classification, comparison, cause and effect relationship, part and whole relationship, estimation, problem solving, geometrical shapes, and subtraction were observed. Graphics were used by 61-72 months old children but wrongly. For example, a boy and a girl talked about toys that could fit to house shaped toy and they tried them (measurement). Also about numbers, they counted beads on the number board. A boy named the

geometrical shapes on the board and put small geometrical shapes on the board while he was telling their names to his two friends.

In the following Table 3, the mathematical concepts and skills observed in different play types in different age groups are presented.

Table 3. *The Mathematical Concepts and Skills observed in Different Play Types*

	Physical play	**Pretend play**	**Object play**	**Symbolic play**	**Games with rules**
Numbers (symbols and counting)	-	R^4 :1	R^5:2	-	R^5:1
Addition (Adding)	-	-	R^5:1	-	-
Subtraction (Subtracting)	-	-	-	-	-
Geometrical shapes (shapes and properties)	-	R^3:1	R^4:1	-	-
Spatial sense	-	R^3:1	R^4:1	-	-
Graphics (Reading, explaining, and forming graphics)	-	-	-	-	-
Measurement	-	R^3:4; R^4:1	R^4:1; R^5:2	-	-
Problem solving	-	-	-	-	-
Estimation	-	-	-	-	-
Part and whole relationship	-	-	-	-	-
Cause and effect relationship	-	-	-	-	-
Comparison	-	-	-	-	-
Matching	-	R^4:1	R^3:1; R^5:1	-	-
Ordering	-	R^5:1	-	-	R^4:1; R^5:1
Pattern and patterning	-	-	-	-	R^5:1
Classification	-	-	-	-	-

Only the right usage of mathematical skills is shown in Table 3. Also superscripts indicate in which age group they were observed. As seen in Table 3, classification, comparison, cause and effect relationship, part and whole relationship, estimation, problem solving, graphics, and subtraction were not used in any play types. However, measurement related skills were frequently observed in pretend game and object play types. Secondly, number related skills, matching, and ordering were observed.

To exemplify mathematical concepts and skills observed in different play types, number related skills were used in three different play types. For instance, the game with rules type was used. In this play, they counted each other and then, talked that each would use numbers when it was their turn. Then they enlarged the game by using balls. They threw when their turn began and each counted when their turn began.

36-48 months old children used the pretend game while they were talking about measurement related issues. They covered the giraffe, while they were doing this they talked about the length of the giraffe. They used various things (like hands, toys, their feet, etc) to measure.

In the object play type, 49-60 months old children used various materials to show each other how heavy they could handle. In each trial, they added one more toy on top of each other. Later, the boy joined and they tried altogether. In an observation with 61-72 months old children, two children played with addition operation board. They tried to explain addition operations to each other. Besides, they used other toys to show the result of operations. They played altogether for a while.

4. Discussion

There are various researches about play and mathematics. However, additional research is needed on the association between play and mathematics. Little has examined the play types and mathematics learning. In this study, we mainly aimed to find out mathematical skills, concepts, and play types

children (different age groups) preferred during their play times as well as to determine the mathematical skills and concepts in different play types they used while they were playing. The findings of this study indicate similar results and also enlarge what is known in current literature.

First of all, this study showed that children in different age groups had an understanding of numbers and measurement. They tried to use their knowledge about numbers and measurement in various situations especially during play times. In a study done by Matsuo and Nakawa (2019), they designed mathematical measurement activities appropriate to five- to six-year-old children and they found out that children understood direct comparison through these activities, however, it was difficult to establish an understanding regarding measurement with non-universal units. Besides, about early numeracy skills, these skills are the strongest predictors of children's later mathematics achievement and the researchers also revealed that advanced counting competencies are more predictive than basic counting competencies (Nguyen, Watss, Duncan, Clements, Sarama, Wolfe, and Spitler, 2016). Similarly, it is well known that long before children begin school, they have the ability to think mathematically and this ability in their early lives is a strong predictor of their future academic success as well as their attention skills (Claessens, Duncan and Engel, 2009). During the early years of life, children notice and explore their surroundings mathematically; for instance, by comparing shapes, quantities, colors, etc, finding or constituting patterns, sharing their toys and other staffs, using space, solving problems in their real life, etc. Play provides these opportunities for children to learn from their own experiences. Besides, Seo and Ginsburg (2004) mentioned that children devoted 88 % of their time to making patterns, building blocks, counting, and comparing objects while they were playing. Therefore, the results of this study indicate similar results found in current literature.

When findings related to play types preferred by children are considered, according to Pellegrini (1992) 3 years old children use pretend play while 5 years old children use the object play. This study also showed similar results; 3 years old children generally preferred pretend play while 5 years old children frequently preferred object play as a play type. 4 years old children, on the other hand, preferred both of these play types while they were playing. Hence, our results are on the behalf of Pellegrini's (1992) findings.

The mathematical concepts and skills in different play types were also considered in this study, the findings indicated that measurement related mathematical concepts and skills were generally preferred in pretend play type. Results of this study indicated that 3-year-old children used measurement related skills right. Pellegrini (1992) stated that object play is effective in mathematics education. In this study, measurement, number (counting and symbols), and matching skills are used in object play as a play type.

This study is limited to children whose parents signed the consent form. In future studies, increasing the number of participant children would be effective to see the relationship between play types and mathematical skills in a broader view. Moreover, the number of materials that were located around children's classrooms could be increased or no materials could be located in their classrooms before observations.

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