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Examination of Mother-Child Math Talks' Content and Process during Shared Book Reading

Belma Turker-Biber
Aksaray University, TURKEY

Aysegul Akinci-Cosgun*
Aksaray University, TURKEY

Feyza Aydin-Bolukbas
Aksaray University, TURKEY

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Abstract: The study aims to analyze, in terms of content and process, the math talks between the mother and child during the shared book reading of the illustrated storybooks with math contents. The study group under the research is comprised of nine pairs of mother and child. The process of the study 18 videos which were recorded when two storybooks with math contents were read by the mothers. In the data collection process, each pair of mother and child together read two storybooks given to them in their home environment, and the entire process was video-recorded. Subsequently, interviews were held with mothers for identifying their views about supporting their children's math skills. It was shown that the content of mother-child math talks in the home environment was mostly about the learning area of numbers and counting skills. It was a remarkable result that math concepts such as sorting/ranking and properties/features of objects were not in the contents of mother-child math talks. The results from interviews with mothers, it was inferred that the mothers viewed themselves as inadequate for talking to their children about math concepts, and performed the math talks mostly on the basic skills such as counting the numbers.

Keywords: *Math talk, math-themed storybooks, mother-child shared book reading.*

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Introduction

Early literacy and math skills of the children in the preschool period is a strong predictor of their academic skills in the forthcoming years (Aunio & Niemivirta, 2010; Claessens et al., 2009; Huntsinger et al., 2016; Merz et al., 2014). According to the US National Council of Mathematics Teachers, the math skills to be taught to the children in the preschool period are the content skills (numbers and operations, algebra, geometry, measurement, data analysis, and probability) and process skills (establishing communication, establishing relationships, problem-solving, and representation) (National Council of Teachers of Mathematics [NCTM], 2000). The basic math skills were referred to in the achievements and indicators in the area of 'cognitive development' in the Republic of Turkey Ministry of National Education Preschool Education Program (2013). These skills are counting, pairing, grouping, sorting, patterns, establishing part-whole relationships, performing simple addition and subtraction operations, arithmetic, geometry, measurement, data collection, creating/reading tables, fitting graphical representation, problem-solving, reasoning, and association.

Early Numerical Competencies involve in general, the skills concerning the learning area of numbers and operations which is the building block of mathematics. They can also be called the sense of numbers or early numerical competencies (Powell & Fuchs, 2012). As per Powell and Fuchs (2012), children with early numerical competencies can recognize the basic numbers symbolically, sort, count, know mentally the position/place of the numbers, differentiate between the amounts represented by the numbers, create number patterns, and perform addition/subtraction operations.

These skills which were addressed by NCTM as early arithmetic involves the understanding of the counting principles and the quantitaties of the numbers, the value of small quantities, identification of the numbers, and the solution of simple arithmetic problems (NCTM, 2000). Even if the children are expected to be equipped with basic skills such as simple counting skills, ordering number cards, identifying without counting how many items are in a small set, and conservation before starting kindergarten, most children attending kindergarten with different levels of math knowledge (Klibanoff et al., 2006). While some children have basic skills such as quantities, numbers, and simple addition/subtraction, some

* **Corresponding author:**
Aysegul Akinci Cosgun, Aksaray University, Faculty of Education, Early Childhood Education Department, Turkey. ✉ aysegulakinci2011@gmail.com

children have difficulties with certain skills such as identifying the numbers and counting from 1 to 10 (Lembke & Foegen, 2009). The individual differences in children's early numerical competencies are explained with theoretical and empirical studies based on a sociocultural perspective. Accordingly, the informal activities which are children experiences in the home environment and daily life have an effect on these differences (Baker, 2015; Cannon & Gingsburg, 2008; Ramani & Siegler, 2014; Rouse et al., 2005).

Math Activities Performed Together by the Parent and Child in The Home Environment

The relevant literature ascertained that the quality of the home environment and the stimulants offered by the parents to the child at home were positively associated with the child's learning (DeFlorio & Beliakoff, 2015; Huntsinger & Jose, 2009; Kwing-Cheung & McBride, 2017; Melhuish et al., 2008; Umek et al., 2006). The parents play an important role in the child's early learning by creating a home learning environment that will enable the child to gain awareness of daily situations (Cross et al., 2009; Hart et al., 2016). In the home environment, performing math activities that are suitable for the children's development characteristics is positively related to early math knowledge obtained by the children enrolled in kindergarten and primary school, particularly (Galindo & Sonnenschein, 2015; Hart et al., 2016; Huntsinger et al., 2016; Kerkhof, 2017; LeFevre et al., 2009; Thompson et al., 2017; Zippert & Rittle-Johnson, 2020). Children's math skills are positively affected by the activities to be performed by them with the parents such as playing jigsaw, playing board games, playing with blocks, cooking and doing measurement activities, and reading storybooks (Hart et al., 2016; Ramani & Siegler, 2008; Ramani et al., 2014; Skwarchuk, 2009; Zippert et al., 2019; Zippert & Rittle-Johnson, 2020).

In daily life, the parents support their young children's math skills with 'formal numerical activities' and 'informal numerical activities' (Akıncı-Coşgun, 2018; Hart et al., 2016; Skwarchuk et al., 2014). Formal activities such as numerical activity books and study papers, explanations of number concepts and identification of written numbers (Huntsinger et al., 2000; Skwarchuk, 2009), reading books (Hojnoski et al., 2014), and playing board games (Kwing-Cheung & McBride, 2017) or informal activities such as playing card games, singing songs and nursery rhymes and measuring the ingredients while cooking (Blevins-Knabe & Musun-Miller, 1996; Vandermaas-Peeler et al., 2012) are used by parents for supporting children's math skills.

The shared book reading which is among the informal activities (Sénéchal & LeFevre, 2002) provides the parent and child with the opportunity to have different math talks (Casey et al., 2004). The shared book reading is described as 'reading book with children', not as 'reading book to the children' (Han & Neuharth-Pritchett, 2014). NCTM (2000) encourages the use of storybooks as a means of introducing math ideas to the children (Casey et al., 2004) because, in general, the shared book reading offers a meaningful context for rich conversations that take place between a child and a parent (Wasik & Bond, 2001) and provides the children with the opportunity to meet a set of words and concepts which go beyond their daily experiences (Fletcher & Reese, 2005). During shared book reading, the parent can refer to the illustrations or words in the book, and hence, can encourage the child to take part in the activity (Sugai et al., 2010). In the studies about this topic, it was found that shared book reading performed with children aged 2-3 years was associated with their forthcoming academic achievements (Shahaeian et al., 2018). Reading with children, enhances children's problem-solving skills, and empowers them to have an exchange of ideas, establish reasonable relationships between the elements in the story and discuss the abstract concepts (Hindman et al., 2014; van den Heuvel-Panhuizen et al., 2016). When the mathematical language is used between the parent and child, the child can gain numerical competency besides expressing himself/herself mathematically.

In the literature, the math talks between the adult and child were analyzed in the context of a variety of activities such as shared book reading (Elliott et al., 2017; Hendrix et al., 2019; Hojnoski et al., 2016; Ramani et al., 2015), playing games (Zippert et al., 2020), cooking (Hur, 2010; Vandermaas-Peeler et al., 2012), playing with tablet (Zippert et al., 2019), and playing block and puzzle games (Ferrara et al., 2011; Zambrzycka, 2014).

In Turkey, there are few studies about math talks between adults and children. Some of them are examined the math talks in the classroom setting (Fırat & Dinçer, 2018; Parpucu & Erdoğan, 2017; Taşkın, 2013), math talks during outdoor game activities (Gürgah-Oğul & Aktaş-Arnas, 2016), and math talks in the home environment (Gürgah-Oğul & Aktaş-Arnas, 2020; Gürgah-Oğul et al., 2020). It is considered that this study would contribute to the literature on the examination of math talks during mother-child shared book reading in the home environment in the preschool period in Turkey. In the study, the process in the mother-child math talks was used for defining the type of statement (question, answer, discussion/explanation/comment, and feedback) and the content was utilized for defining the focus of the mathematical statement's context (numbers and counting, addition, subtraction, quantity, squence order, spatial relations, attributes of object). Math talk was defined as any statement which referred to mathematical content.

With this in mind, we pose the following questions:

1. How is the content of the math talks between the mother and child during the shared book reading activity in the home environment (counting the objects, quantities, addition, subtraction, and so on.)?

2. How is the process of the math talks between the mother and child during the shared book reading activity in the home environment (asking questions, answering, giving feedback, explaining, commenting, and so on.)?

Methodology

Research Design

The research is the (explanatory) case study which is one of the qualitative research methods. For Creswell (2007), the case study is a qualitative research approach in which the researcher deeply analyzed one case or a few cases limited in itself/themselves by using data collection tools comprised of multiple sources (observations, interviews, audiovisuals, documents, reports). The case which is addressed under this research is the math talks between the mothers and their children. Thus, from among the case study types, the single case study design was selected as the method for answering the research questions.

Participants

The study group consists of nine mother-child dyads in which the children are aged 48-66 months and enrolled in kindergarten. The range of the mothers' aged from 31 to 40. The purposive sampling method was used in the selection of the study group. Demographic data on the research participants were as in Table 1 below:

Table 1. Characteristics of Participant (N=9 mother-child dyads)

No	Mother-Child Dyads	Mother's Education Levels	Child's Age	Socio-Economic Status	Mothers' Occupation
1	Mother - Son	High school	5	High Income	Housewife
2	Mother - Daughter	Middle school	5	Low Income	Housewife
3	Mother - Daughter	High school	4	Middle Income	Housewife
4	Mother - Daughter	Middle school	5	Low Income	School servant
5	Mother - Daughter	Primary school	4	Middle Income	Housewife
6	Mother - Son	Undergraduate school	5	High Income	Teacher
7	Mother - Son	High school	5	Middle Income	Housewife
8	Mother - Son	Middle school	5.5	Low Income	School servant
9	Mother - Son	Undergraduate school	4	High Income	Teacher

Ethical Consideration

This study was approved by the Human Studies Ethics Committee of Aksaray University. The mothers were asked to complete informed consent forms for their own and their children's participation in the study.

Data Collection Tools and Process

Observations and interviews were designated as the data collection techniques for the research. The research data were obtained firstly from the observations of video records of the math talks between mother and child during shared book reading. Video records allowed to explain the complexity of a situation with different dimensions and to address different points of dimensions. Especially video recordings can be used to describe the interactions between mother and child in the past (Rutanen et al., 2018).

Mothers were firstly informed about the aim of the study, the data collection process, their rights as participants, the confidentiality of identity information of the participants'. All mother-child observations were video-recorded by mothers. Before the recording, the mothers were informed by researchers. In particular, it was requested to record mother-child behaviors and discourses. Mothers were asked to read the books with their children at a suitable time of the day and take videotape by phone. The camera of the phone was set up to capture a suitable aspect of mother-child dyads. There were verbal and nonverbal behaviors, such as "how many goats there are?" and pointing to the objects on the pages in video-recorded. Each mother-child dyad read the two storybooks used in the data collection process in an average of 30 minutes. In total, approximately 270 minutes of video recording were obtained. The third researcher transcribed the recordings one by one. The transcripts were coded separately by three researchers considering descriptions of the mothers' and children's behaviors and talks.

After observations, the interviews were held with mothers. The interviews reveal what the mothers did in the home environment to find out their children's math skills and to assure the children understood the math concepts. A semi-structured interview form prepared by researchers included 12 questions. The interviews lasted approximately 15-20 minutes with each mother. Some questions in the interview form were as follows:

- Which math skills of your children do you try to support in the home environment?
- What kind of math skills are gained by children when reading storybooks?

In the context of this research, two picture books with math contents were utilized (Table 2). The original language of the books was Korean, and the books translated into Turkish by the publishing house were used. According to Shih and

Giorgis (2004), the books which focus on math and are written for the purpose of teaching math concepts also math skills contain mathematics. Hence, it is aimed that the children can create the targeted content directly in their minds. The storybooks used in the research focused primarily on the skills in "counting and the numbers", and "addition and subtraction". In the storybooks, visual and textual contents that allow the use of other math concepts are also available. Age-appropriateness and the balance between the texts and illustrations were taken into consideration in the selection of storybooks. These storybooks were given to each mother for reading together with their children and record the videos of this process.

Table 2. The Names and Context of Math-Themed Story Books

Storybook name	Publishing house	Math concepts and skills
Pirinç Kekini Yuvarla (Roll the Rice Cake)	Düşün Publ. House	Counting-numbers, Subtraction operation
Yedi Keçi ve Kurt (Seven Goats and the Wolf)	Düşün Publ. House	Counting numbers, Addition operation

Data Analysis

The data analysis was performed with the descriptive analysis method. In the descriptive analysis conducted for presenting the findings in an organized and interpreted manner, a framework is created for the data analysis departing from the conceptual context of the research or the research questions (Çepni, 2007). In this research, analyses were performed in light of an analysis framework in the literature which was prepared by Hojnoski et al. (2014). Based on the framework the mother-child math talks are analyzed under two categories (content and process). Content and process categories were explained in detail in Table 3 and Table 4.

Table 3. Content Categories (Hojnoski et al., 2014)

Content Categories	Definition	Example Statements
Numbers and counting	Statements which include the counting and reading of numbers, rote counting, one to one counting, forward counting (1, 2, 3, 4, 5), backward counting (5, 4, 3, 2, 1), determining the number in a set or asking the question, "how many," to detect the quantity of a group of objects.	The child reads the numbers consecutively. The child counts the number of animals on the page. As the child points to the buttons on the page, he/she says "I liked this one and this and this."
Addition	Statements are characterized by the process of indicating the sum of numbers or objects or the process of calculating the sum.	The child and parent talk about the process by jointly adding objects to a collection (for instance, "We had two bears, and then, we added more bears to have four bears."). After adding an object to a collection, the parent asks, "how many do you have now?". In return, after adding the object to the collection, the child says, "Now, there are three (objects)".
Subtraction	Statements are characterized by stating the difference between the numbers/objects or referring to the process of calculating the difference.	The parent or the child subtracts the objects from a collection, and they talk about the process. After removing an object from a collection, the parent or child asks, "how many (objects) remain?"
Quantity	Statements containing the definition or evaluation of the amount/number in a set or sets using general quantity words such as more, less, the same, enough, too much, quite a few, a lot, and so on.	The parent asks if there are more bears than the mice. The child compares the two objects and states his/her comments on their relative sizes: "There are many items in this basket." The parent comments, "Not many apples are present in this basket."

Table 3. Continued

Content Categories	Definition	Example Statements
Attributes of Object	Statements including the discussion or the comparison of the properties of the objects. Width, shape, dimension, color, length, weight, depth, and so on.	The parent and child discuss the figures or shapes on a page. They describe the buildings on a page as taller/bigger/longer than the others. Parent/child describes the birds' colors.
Sequence /Ranking	Statements using the terms indicating a sequence or an order (for instance, the first, the second, the third). The patterns were included in this category.	The parent asks, "What did Benny purchase with this money?", "What comes next in the pattern?", "This word comes before, does this word come next? "Can you see/sense this pattern?"
Spatial Relations	The location of objects concerning a reference point (for instance, below, under, at the bottom, over, above).	The child explains the indicated: ''The mouse is in the quilt." The parent asks where exactly an object is on the page and asks for information by using spatial relations.
Talks Irrelevant to Math	No math concept or content was clearly stated.	The parent asks, "What type of food does he/she cook?" The child comments, "Look at the cat."

By content category, Table 3 shows which math skills and concepts are addressed by the mother-child math talks. During analyses, related cases were coded. For instance, the mother said "*The tiger ate two rice cakes. How many are left?*" was coded as subtraction category. To give an example of the addition category is "*The frog had two more rice cakes than the tiger*."

Table 4. Process Categories (Hojnoski et al., 2014)

Process Categories	Definition	Example Statements
Asking questions	The parents ask a question to the child or the child asks a question to the parent. Whatever the answer is, it is included in this code. The question words consist of 'what', 'where', 'why', 'when', 'what for', 'how', and 'which'.	The parent asks, "Which one is bigger?", "How many bears are there?", "Which bowl contains more?" The child asks, "Which animal is bigger?", "How many raindrops are there?"
Answering	Verbal responses which will be answers to the problem. In the transcription, a set of questions and answers should be present.	The child answers, "Why does he/she put the buttons on his/her eyes?", and the parent responds, "Because of being stupid." The child says "Four" to the parent's question, "How many cookies are there on the plate?".
Discussion/Explanation /Comment	Verbal dialog or soliloquy initiated by a party. It is coded as Discussing/Explaining. The comments can be about the book or they can be related to personal experiences.	While looking at two snakes on the page, the parent says, "This one is longer." The parent asks, "This morning, we saw some birds, do you remember?" The child says, "I will count all the birds.", or "We saw a lot of birds this morning. They all were eating bird food."
Giving Feedback	Parents' comments about the child's activity, and their remarks made in a way to present an evaluation of the child's performance. The statement should be preceded by a child's statement representing the performance or referring to his/her performance so that it could be coded as feedback. Moreover, indicate whether the feedback was positive (F+) or negative (F-).	The parent says, "Yes, you are right, there are three apples on the tree." The parent says, "No, there are only three apples, not four (apples)."

Table 4 shows which are likely to be observed about asking questions, receiving answers, giving feedback, and making comments to support math instruction in the process when the mothers and children read storybooks with math contents. To give an example of analysis, mother said to "You should start counting from 1, not 2" to her child who started counting at 2. This sentence was coded as giving feedback category.

Credibility and Interobserver Agreement

According to Miles and Huberman (1994), different researchers need to bring together the data coded by them in different time periods, then compare the data, and finally, reach an agreement. In this effort, the emphasis is placed on whether the coders used identical codes for the same data. For the data which are coded differently, code definitions are reviewed, and accordingly, an agreement between the coders is reached. Miles and Huberman (1994) recommend that the percentage of the agreement should be 80% at least, and, depending on the size of research data, it be even more than 90%. Math talks in all videos recorded under the research were firstly coded separately by the researchers in terms of content and process. Subsequently, all researchers came together and made comparisons for identifying the percentage of agreement between the codes. Lastly, to have an agreement on different codes used for a small number of similar data, the recorded videos were watched by the researchers together, and an agreement on the coding was reached through discussions held on the different codes. In this research, the percentage of agreement was calculated as 95% by dividing the number of codes, on which there was an agreement, by the total number of codes, on which there were agreement and disagreement. Hence, the reliability of the research data was ensured. Likewise, for securing the internal validity of the research, data triangulation was put in place, and accordingly, all three researchers have had a role as coder in the research. Besides, the study group, its characteristics, and the data analysis process were all explained in detail in the study to assure the external validity of the research.

Findings

The data obtained from the math talks taking place between the mother and child while reading storybooks with math contents were analyzed by taking into consideration the contents of talks and the process of talking.

Math Talks' Content between the Mother and Child

Table 5 displayed the data about the content categories under the research.

Table 5. The Frequency of Math Talks in Content Category

Content Categories	Frequency	%
Numbers and Counting Skills	102	51.3
Subtraction	39	19.6
Addition	18	9.1
Multiplicities	5	2.5
Properties/Features of the Objects	0	0
Sorting/Ranking	0	0
Spatial Relations	2	1
Math-Related Talks	**166**	**83.5**
Talks Irrelevant to Math	**33**	**16.5**
Total	199	100

It was found that, of all math talks about the storybooks which mother read to the children 83.5% (f=166) contained mathematical expressions, whereas 16.5% (f=33) were talks irrelevant to math or unrelated to the storybook content.

In Table 5, more emphasis placed on the numbers and counting skills drew attention during the math talks. Of all math talks taking place between the mother and child during the shared book reading, 51.3% consisted of the numbers and counting skills. This percentage is approximately equal to half of all math talks. The following can be given as an example dialog for the mother-child math talks about the numbers and counting skills during the shared book reading: Arda was asked by his mother to count the cakes on the page. As Arda quickly counted the cakes by heart, his mother asked him to count them with his finger on a one-on-one basis. Arda started counting the cakes, however, he did not say a number for each cake. His mother said that he should count the cakes once again by matching each number with a cake. Arda expressed his astonishment upon realizing that he failed to count accurately, and counted the cakes accurately next time. During the entire process, the mother and Arda focused on the counting skill related to the learning area of numbers. These statements were exhibited below:

Mother: These belong to the frog, and those belong to the tiger, let's see, count them (by pointing at them with your finger).

Arda: 1, 2, 3, 4. (When mother pointed at them with her finger, he said to his mother, "don't count", and "1,2,3,4,5...")

Mother: No, the thing happened, count them one by one.

Arda: 1, 2, 3, 4, 5, 6, 7, 8.

Mother: Good job, count also those belonging to the tiger.

Arda: 1, 2, 3, 4, oops, I got confused.

Mother: OK, start from here.

Arda: 1, 2, 3, 6, 4, 5, 6.

Moreover, in another example, the mother launched a math talk by asking her daughter, Selen, how many cakes there were. While counting the cakes, Selen skipped a cake. Her mother said that she should count the cakes once again, and next, Selen accurately counted the cakes belonging to the tiger. Subsequently, how many cakes the frog had was asked by her mother to Selen. This time, Selen counted the cakes starting from 2. Her mother told that she was supposed to count the cakes starting from 1. Selen counts the cakes accurately, and, to indicate the cardinal number, her mother says how many cakes each has in total.

Mother: Selen, how many cakes does the tiger have?

Selen: 1, 2, 3, 4, 5.

Mother: Count it once again...

Selen: 1, 2, 3, 4, 5, 6.

Mother: Yes, now count also the cakes belonging to the frog.

Selen: 2, 3, 4, 5.

Mother: No, we count starting from 1!

Selen: 1, 2, 3, 4, 5, 6, 7, 8.

Mother: Yes, how many cakes did the tiger have? Six, right? Yes, the frog also had eight cakes.

Selen: Yes.

Another point that catches the eye in the mother-child math talks is the high number of talks about the subtraction operation. Of all math talks, approximately 20% pertained to the subtraction operation whilst 9.1% were about the addition operation. In this context, math talks referred to the addition operation for approximately half of the times when they spoke about the subtraction operation. An example dialog about the math talks on the subtraction operation is as below (Roll the Rice Cake-Arda/Subtraction):

Mother: The tiger ate two of the cakes. How many were left? Let's see, count the remaining cakes.

Arda: 1

Mother: No, don't count these cakes, don't count those which I covered with my hand.

Arda: 1, 2, 3, 4, 5, 6.

Mother: The tiger ate two cakes, and so six cakes were left, correct.

Mother: Well, later, the tiger ate three more cakes from the remaining six cakes, how many cakes were left this time? Arda, subtract these (by showing those covered by her hand), and count!

Arda: Let me count, 1, 2, 3, 4.

Mother: Good job!

In this example, aspiring to make Arda notice the fall in the number of cakes because the storybook character, tiger, ate some cakes, the mother posed different questions and provided a setting for the talk that would enhance the skill in performing the subtraction operation.

Figure 1. A tiger eating cakes

Even if there were a variety of animal and object multiplicities in the illustrations in the storybooks, statements on the multiplicities were present only in a highly small number of math talks (2.5%). An example of mother-child math talks on the multiplicities can be given as follows (Roll the Rice Cake-Arda/Multiplicities):

Mother: How many more cakes did the frog have than the tiger? The frog had two more cakes than the tiger, didn't it? (More)

Arda: Yes.

Mother: Good job!

Upon looking from a general perspective, it was discerned that the mothers had no math talk with their children about math concepts such as the properties/features of the objects and sorting/ranking.

By content category, Table 6 shows separately the breakdown of math talks taking place between the mother and child while reading storybooks titled 'Seven Goats and the Wolf' and 'Roll the Rice Cake'.

Table 6. Math Talks Considering Each Storybook by Content Category

Content Categories	**Book 1: Seven Goats and the Wolf**		**Book 2: Roll the Rice Cake**	
	f	**%**	**f**	**%**
Numbers and Counting Skills	58	61	44	42.3
Addition	12	12.7	6	5.8
Subtraction	7	7.3	32	30.8
Multiplicities	0	0	5	4.8
Properties/Features of the Objects	0	0	0	0
Sorting/Ranking	0	0	0	0
Spatial Relations	2	2.1	0	0
Math related talks	**79**	**83.1**	**87**	**83.7**
Talks Irrelevant to Math	**16**	**16.9**	**17**	**16.3**
Total	95	100	104	100

In Table 6, it was identified that the mother-child math talks focused mostly on the numbers and counting skills when the storybook, 'Seven Goats and the Wolf', was read (61.0%, f=58). Besides, math talks pertained to addition (12.7%, f=12), subtraction (7.3%, f=7) and spatial relations (2.1%, f=2). Mother-child math talks proceeded in line with the contents on which the storybooks focused. The first storybook had images and contents primarily conducive to the development of counting and addition skills. Thus, less emphasis was placed on the subtraction operation in this book. On the other hand, it is a noteworthy finding that the mothers had no math talk with their children about the quantity, properties/features of the objects, and sorting/ranking. When the other book, 'Roll the Rice Cake', was read, 42.3% of the math talks taking place between the mother and child pertained to the numbers and counting skills (f=44). Additionally, in this case, it is discerned that the mother-child math talks were about subtraction (30.8%, f=32), and addition (5.8%, f=6). Due to the rice cakes eaten by the characters, tiger, and frog, the storybook content makes it possible to focus on the decreasing number of cakes. Thus, while reading this storybook, the mothers and children might have come across math talks about the subtraction operation more frequently. Although the book content included images through which it would be possible to talk about the skills related to the properties/features of the objects, sorting/ranking, and spatial relations, it was found that the mothers did not dwell on these skills and talk about them. Moreover, another remarkable point in Table 6 is that the mothers and children had talks irrelevant to math, corresponding to 16.9% of all talks while reading 'Seven Goats and the Wolf' (f=16) and 16.3% of all talks while reading 'Roll the Rice Cake' (f=17). This situation demonstrates that, even if the storybook contents focused on different skills, the number of talks devoted by the mothers to the topics irrelevant to math did not change significantly.

Math Talks' Process Between the Mother and Child

In the research, the findings were obtained also about what the mother and child did in the process of math talks taking place between them. The mothers asked questions, created the platform for discussion or providing explanations, expected answers, and gave feedback for several purposes such as attracting the child's attention to the storybook, continuing the math talks and interactions, and providing instruction. By process category, Table 7 indicated the breakdown of math talks taking place while the mother-child shared book reading was being performed on the storybooks with math contents.

Table 7. The Frequency of Math Talks' Process

Process Categories	f	%
Asking questions	93	43.5
Giving feedback	54	25.2
Answering/expecting an answer	43	20.1
Discussion/explanation/comment	24	11.2
Total	**214**	**100**

In Table 7, it was discerned that the math talks taking place between the mother and child pertained mostly to the category of 'asking questions' (43.5%, f=93). This category was followed by the categories of 'giving feedback' (25.2%, f=54), 'answering' (20.1%, f=43) and 'discussion/explanation/comment' (11.2%, f=24). As per the review of dialogs that took place between the mother and child, a dialog in which the questions were asked, answered, and feedback was given is given below:

Mother: Selen, how many ducks are there? (asking questions)

Selen: 1, 2, 3, 4, and 5 (answering)

Mother: Yes, good job! (giving feedback)

Mother: Let's see, count them, do we have 10 apples? (asking questions)

Selen: 1, 2, 3, 4, 5, 6, 7, 8. (answering)

Mother: 9 and 10, well, you made an error because you counted them rapidly (giving feedback)

Mother: Selen, how many flowers are left? Let's see, count the flowers. (asking questions)

Selen: 1, 2, 3, 4, 5… That's it (answering)

Mother: Count the flowers once again, not rapidly this time. (giving feedback)

Selen: 1, 2, 3, 4, 5, 6. (answering)

Mother: How many flowers did the goat need to put in the vase? (asking question)

Selen: 10 flowers. (answering)

Mother: No, it was supposed to put 6 flowers in the vase, wasn't it? (asking questions, and giving feedback)

Selen: Right, yes (answering)

Across all mother-child math talks as in the case of this dialog, it was observed that the children frequently received feedback such as 'good job, it is right' or 'no' from their mothers after they were questioned by their mothers about the storybook.

Table 8. The Frequency of Math Talks' Process Considering Each Storybook

Process Categories	Seven Goats and the Wolf		Roll the Rice Cake	
	f	%	f	%
Asking questions	44	41.9	49	44.95
Answering	27	25.71	16	14.67
Discussion/Explanation/Comment	10	9.52	14	12.84
Giving feedback	24	22.85	30	27.52
Total	105	100	109	100

According to Table 8, upon the one-on-one review of the processes related to the mother-child math talks taking place during shared book reading, it was ascertained that the mothers asked questions approximately at the same rate for both storybooks (41.90% and 44.95%). It was observed that the children gave answers more frequently in the math talks in the context of 'Seven Goats and the Wolf' (25.7%) than they did in the context of 'Roll the Rice Cake' (14.67%). However, it can be asserted that the mothers or children more frequently created a setting for making explanations and commenting while reading 'Roll the Rice Cake' (12.84%) than they did it while reading 'Seven Goats and the Wolf' (9.52%). If both books are evaluated together, it is discerned that the mothers gave children feedback independently of the storybook contents. In light of this finding, it can be considered that the mothers were eager to teach mathematical expressions to their children and give them feedback.

Discussion

Results of this research reveal that content and process of the math talks during mother-child shared book reading which support children's early math skills. The results show that related to the contents of the math talks in the research were performed mostly on the numbers and counting skills during mother-child shared book reading. While reading storybooks to the children, the mothers frequently used expressions related to counting such as "How many? Count once again starting from 1." As another finding supporting this finding, in the interviews with the mothers, it was inferred that the mothers perceived themselves as unqualified for talking to their children about the math concepts, and, accordingly, performed the math talks primarily on the basic skills such as counting and basic addition. In a similar study conducted by Gürgah-Oğul et al. (2020) by video-recording the mother-child math talks in the home environment, it was ascertained that the math talks were most frequently on the counting. It was identified that there were similar studies asserting that the parents who were questioned about the early math support activities supported their children mostly with counting and other activities related to the numbers (Ginsburg et al., 2008). Furthermore, certain studies are demonstrating that the frequency of participating in the number-related activities at home affected children's math knowledge and skills (Gürgah-Oğul & Aktaş-Arnas, 2020; Levine et al., 2010; Ramani et al., 2015).

Considering that the math-related talks heard by the children before kindergarten had a positive effect on the enhancement of early numerical knowledge and performance of the children (Levine et al., 2010; Ramani et al., 2015; Susperreguy & Davis-Kean, 2016), it can be stated that the materials presented to the parents in the home environment and the content of these materials had effects on the content and frequency of the mother-child math talks. Another research study carried out by Gürgah-Oğul et al. (2020), it was found that the talks performed by the mothers with the children at home contained several words related the math skills, and the activities such as playing with puzzles and cooking cake raised the probability of performing math talks. As per another finding of this research, it was identified that the content of mother-child math talks focused on the skills in 'addition and subtraction operations', 'multiplicities', and 'spatial relations' as well.

According to another result of this research on the content, 'subtraction' was the second most frequently used content after 'numbers and counting skills' in mother-child math talks during shared book reading. It is thought that this situation was associated with the contents of storybooks. For Hendrix et al. (2019), the book content affects the content of verbal interaction between the parents and children during shared book reading. Therefore, making strategic choices about the book selection can be an easy way of enhancing the math talks at home.

During shared book reading, the mothers mostly showed the images in the storybooks to the children and directed questions which would encourage them to perform subtraction, and the children were able to answer most of these questions accurately. Moreover, it was observed that the mothers guided the children to comprehend the subtraction skill by appropriately employing math expressions such as 'decrease' and 'reduction'. Even if, during interviews, it was identified that the mothers used the addition more frequently as per the examples given by them to the math activities performed at home, math talks about the subtraction were found to be more frequent than those about the addition according to the observations. According to this result, it can be stated that the mothers' views about how they developed their children's math skills differed from the activities and books content that they actually performed at home. In a similar research, the results of the research study by Mutaf Yıldız et al. (2018) indicated that the parents' views about math education pertained to the children's calculation skills, but not to the math talks identified by the researchers at home through observations. Finding differences between the results of interviews and observations also in similar studies shows that the results of this current study are parallel to the results of the relevant literature.

In this research, the fact that the mothers had no math talk with their children about the properties/features of the objects and sorting/ranking is another important result. In a similar research study, it was discerned that the mothers rarely had math talks with their children about measuring, part-whole relationship, categorization, and operational skills (Gürgah-Oğul et al., 2020). Vandermaas-Peeler et al. (2009) stated that, even though the parents had several opportunities to make young children's daily experiences more mathematical, they missed these opportunities in general. By underlining the relationship of this situation with the education levels of families, Susperreguy Jorquera (2013) asserted that the families with high education levels engaged with math activities for a longer period of time than those with low education levels, and performed talks about several math contents including fractions. It was found that the mothers with low education levels had a high number of math talks with the children only about the numbers. Considering that most mothers attended in this current research were high school and middle school graduates, the very rare use of math concepts (multiplicities and spatial relations) outside the learning area of the numbers and math operations can be associated with mothers' low education levels. As a matter of fact, in the research study conducted by Melzi et al. (2020), it was ascertained that there was a statistically significant positive relationship between the caregivers' education levels and the variety of vocabulary used by the caregivers during the conversational narrative task. Research studies indicate that most parents hesitated about early math learning and instruction as they did not know what type of support they should give for enhancing the child's math skills (Ginsburg et al., 2008; Muir, 2012). It was identified that, when the families attended the meetings and education programs which offered information on the importance of Home Math Environment (HME) and the principles of counting, the frequency of their participation in parent-child math activities went up, and the children of these families had more enhanced math skills than the children of other families (Akıncı-

Coşgun, 2018; Niklas et al., 2016). Thus, it can be asserted that such supports to be given to the families would contribute positively to the development of children's math skills.

As an interesting result of this current study, it was discerned that, while performing shared book reading, the mothers frequently used talks irrelevant to math such as the following: "We are not supposed to open our door if a stranger knocks it, are we?", "Good job, my son. Look, by saying, 'all my cakes were finished', it was subsequently saddened, wasn't it?" Moreover, it was ascertained that the mothers failed to notice the math concepts and math knowledge in the storybooks with math contents even though math concepts and math knowledge were present in the images in the storybooks. A similar finding was obtained also in the study conducted by Hendrix et al. (2019) with low-income families. In this research study in which the effect of the type of books used during the parent-child shared book reading on the out-of-text math talks was analyzed, it was deduced that out-of-text math talks were used more frequently in the context of math books than those used in the context of non-math books. In this respect, it can be stated that the type of materials affected the frequency of mother-child math talks.

Upon the review of the results about the experiences in the mother-child shared book reading process, it was identified that the mothers asked questions to their children more frequently than they received answers from the children. The obtained results show that the mothers were not capable of creating a discussion platform. On the other hand, it was ascertained that, since the children were focused on different images in the storybooks, reciprocal short-term discussion platforms came into being, and comments were made about the story. While the acts of parents in general and mothers, in particular, offer an exemplary structure to the children in the process of interactive reading, the attributes of the storybooks can structure the parents' acts during the shared book reading (Hojnoski et al., 2016). It was identified that mothers' acts of posing questions on the images in storybooks set an example to the children and, in the subsequent pages, even before the mothers asked any question, the children counted the objects and answered the questions more rapidly. Thus, it can be said that the dynamic interaction between the mothers and children during the shared book reading resulted in bigger learning experiences (Hojnoski et al., 2016).

The mothers give quite a little positive or negative feedback to their children's answers. They give feedback that confirms the answers received by them or which pertains to what the correct answer is. Such feedback turned to be a significant finding which supported the interactive math book reading process of mothers with children. The children continued math talks based on the feedback which they received from their mothers.

Conclusion

The parents can support the children's learning, give feedback about their skills, promote deeper thinking for supporting conceptual development, help children establish connections between math ideas (National Research Council [NRC], 2009). When viewed from this perspective, this research study emphasizes that what mothers did during the shared book reading process was quite important to the children and, by taking their parents as an example, the children experienced a reading process that would contribute to their math skills. In this context, it is known that families mostly do activities related to counting (Gürgah-Oğul & Aktaş-Arnas, 2020; Levine et al., 2010). Similarly, in this research, the conversations between mother and child dyads are about numbers and counting. The content and pictures of the book that families reading with their children can play a guiding role on the math talks. It has been determined that mothers often give feedback to their children about mathematical talks and concepts while reading. It can be said that these feedbacks are important in terms of ensuring the continuity of the mathematical dialogues between children and mothers (Hojnoski et al., 2016).

Recommendations

For future investigations, the math talks will be compared with different types of books (with and without math content). The findings of this study can be expanded by considering families that come from different socioeconomic levels. Shared book reading activities between mother-child dyads can be expanded with a larger sample. Training programs for parents to read stories with math content can be prepared as a way to support their children's math skills, and the effectiveness of these programs can be examined. For teachers, using picture stories can be support children's math skills. In addition, teachers can put picture storybooks with math content in the classroom library with the aim of support preschooler's math skills and lend the books to families to read at home with their children.

Limitations

This paper aimed to analyze, in terms of content and process, the math talks between the mother and child during the shared book reading of the illustrated storybooks with math contents. We collected the data using two math-themed storybooks which include number and subtraction skills. The analyses are limited to math contents in these two storybooks.

Conflict of interest

Authors have no conflict of interest to declare.

Authorship Contribution Statement

Türker Biber: Literature review, design, data collection and processing, analysis and interpretation, writing the article. Akinci-Coşgun: Literature review, concept, data collection and processing, writing the article, references. Aydin Bölükbaş: Data collection and processing, analysis and interpretation, references.

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