



### A Study of Mathematical Content Provided in Illustrated Children's Books \*

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ARTICLE INFO	ABSTRACT
<p><b>Article History:</b>            Received: 11 January 2017            Received in revised form: 21 March 2017            Accepted: 24 April 2017            DOI: <a href="http://dx.doi.org/10.14689/ejer.2017.69.9">http://dx.doi.org/10.14689/ejer.2017.69.9</a></p> <p><b>Keywords</b>            Early childhood, mathematics, NCTM, Picture story books.</p>	<p><b>Purpose:</b> Early childhood is of critical importance in terms of cognitive, affective and physical development. Undoubtedly, a substantially stimulating environment and opportunities offered to children, as well as appropriate educational materials, have an impact on their development. The object of this study is to investigate the mathematical content included in illustrated children's books prepared for pre-school children. <b>Research Methods:</b> The research was planned as a descriptive study, and</p>

criterion sampling method was used in creating the study group. One hundred seventy-four illustrated children's books offered for sale by bookstores in Adana and Ankara provinces and included by academicians in their private libraries were surveyed. As a result of the survey, 52 illustrated children's books that met the criteria constituted the research study group. A document analysis was conducted to collect research data. Thereunder, a "book review form" developed by the researchers was used to investigate the mathematical content of the books. **Implications for Research and Practice:** As a result of the study, it was discovered that the books investigated most frequently contained the numbers and operations category, followed by geometry, measurement, algebra, data analysis and probability, respectively. Furthermore, the books were found not to contain specific categories or use of different methods and tools in calculations, distinction, algebraic symbols and mathematical models, quantitative changes, symmetry and translation movements, repeated measures, data collection, data organization, data visualization, data recognition, and understanding and applying basic probability concepts. Such results suggest that the illustrated children's books published in our county fail to satisfy the mathematical standards recommended by nationally and internationally recognized programs as the standards to be taught during the pre-school period, and that efforts must be made to enhance the quality of books published for such purposes. For future studies, it is recommend that researchers examine in detail how mathematical categories provided in the books are dealt with, or if and how teachers include illustrated children's books in mathematics activities performed in class.

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## Introduction

The pre-school period is the phase during which the basis for mathematical thinking and mathematical concepts and skills required for real life and future academic progress are developed (Jennings, Jennings, Richey, & Dixon-Krauss, 1992). During this period, it is quite important for children's meaningful mathematics experiences to present mathematics in a certain context (NCTM, 2000). Illustrated children's books that are frequently used in pre-school education can provide the said contextual basis by relating mathematical concepts and skills to real-life situations (Shih & Giorgis, 2004).

In this age of significantly and fast change, the basis for skills that make real life easier, such as an analytical approach, versatile approaches to work and problem-solving, increasingly relies on mathematical thinking (NCTM, 2000). Therefore, it is critical to provide mathematics education in a meaningful way starting from the pre-school period (Ginsburg & Golbeck, 2004). There are two basic elements of providing education in a meaningful way: The first is to integrate the concepts into real-life problems. This is argued as a technique that stimulates motivation among both teachers and children. The second element, on the other hand, is the discussion among children about what they have learned. Thus, what has been learned is transferred to new situations, which is the basic indicator of meaningful learning (Jennings et al., 1992; NCTM; 2000). Using illustrated children's books in pre-school mathematics education is regarded as one of the strategies employed to bring these two elements together.

Given the goals of pre-school education in Turkey, it is important to teach mathematical concepts and skills that will prepare children during the pre-school period for primary school. These mathematical concepts and skills are grouped by the National Council for Teachers of Mathematics (NCTM) under the topics of numbers and operations, algebra, geometry, measurement, data analysis and probability, problem solving, reasoning and proof, communication, connection and representation (NCTM,2000). Illustrated children's books used in the process of teaching the targeted concepts and skills can introduce mathematical concepts to children and raise awareness of mathematics in them by means of story patterns based on life (Anderson, Anderson & Shapiro, 2005).

Presenting mathematical concepts under real life situations in illustrated children's books increases children's interest in mathematics and enables them to develop a deeper understanding (Barnaby, 2015). Furthermore, stimulating their interest in mathematics through stories and images makes it easier for them to create mathematical connections (Shatzer, 2008). For a child that is able to create a connection between mathematics and the story, mathematics becomes more effective and more applicable to daily life situations (Barnaby, 2015; Hong, 1996).

Considering children's future lives, the experiences they gain during the pre-school period must be so arranged as to shape their attitude toward mathematics positively (Keat&Wilburne, 2009). However, the research suggests that the traditional methods used for small children's mathematics education are not effective in developing a positive attitude toward mathematics (Baroody, Lai, & Mix, 2006; Hong, 1996).

Whereas, it would provide a basis for a positive attitude toward mathematics if teachers sought to go beyond such methods as study pages, exercise books and representation and present creative, expedient and effective methods of mathematics education (Jennings et al., 1992). Illustrated children's books are suggested as an effective means of developing a positive attitude through the integration of mathematics and children's literature (Shih & Giorgis, 2004).

A literature review suggests that the current research is mainly focused on recommending the names of quality books that may be used in mathematics education (Forrest, Schnabel & Williams, 2006; Griffiths & Clyne, 1991; Mc Duffie & Young, 2003; Radebaugh, 1981; Shatzer, 2008; Shih & Giorgis, 2004; Thatcher, 2001). On the other hand, the use of illustrated children's books in pre-school mathematics education is suggested to have a positive impact on children's understanding of mathematics (Casey, Erkut, Ceder & Mercer-Young, 2008; Hong, 1996; Van den Heuvel-Panhuizen & Elia, 2011; Van den Heuvel-Panhuizen & van den Boogaard & Doig, 2009). In addition to school activities, book reading with the participation of family has been demonstrated to be effective in children's development of mathematical concepts (Anderson, 1997; Anderson & Shapiro, 2004).

To determine of illustrated children's books in Turkey, some studies were conducted focusing on content and physical characteristics of the books (Gonen, 1993; Demircan, 2006; Isitan, 2014), gender roles (Gursimsek & Gunay, 2005), elements of violence (Daglioglu & Cakmak, 2009), values (Erdal, 2009), elements of humor (Akinci, 2015) and geographical elements (Kilic, Gulec & Genc, 2014). However, a limited number of studies have focused on the mathematical content of illustrated children's books (Ocal, Ocal, & Simsek, 2015).

The use of illustrated children's books is argued to be important in pre-school mathematics education. It appears, however, that there is little current knowledge about whether or not concepts and skills are provided in illustrated books focusing on mathematics. In this context, it is a necessity to investigate the presence of mathematical content in illustrated children's books prepared for use in pre-school mathematical education, as well as to identify any insufficiencies.

#### *Objective*

Shih and Giorgis (2004) suggest that three different types of books may be preferred to teach mathematical concepts in means of children's literature: The first is through books focusing on mathematics and written for the purpose of teaching mathematical concepts and skills. These books contain mathematics openly. Thus, children are able to create the intended content directly in their minds. The second type includes books that do not use mathematics as the basis for the story but have the story and mathematics as an inseparable whole. In these books, mathematics is embedded in the story. The third type presents activities conducted to create opportunities for mathematical thinking by using any type of illustrated children's books. In these activities, a child discovers the mathematical relationships in the book himself/herself. Accordingly, a study conducted by Ocal et al. (2005) investigated the books in the third group with regard to mathematical concepts and skills and evaluated them in view of the MoNE Pre-School Educational Program.

In contrast to the study conducted by Ocal et al. (2015), the present study focuses on investigating the mathematical content of the first and second types of books according to the classification of Shih and Giorgis (2004). Illustrated books prepared for use in mathematics education facilitate the process for children and teachers by offering the intended mathematical content in a direct and complementary manner. Given that illustrated books aimed at mathematics education would be preferred more by children and teachers from such a perspective, this study aimed to investigate the current state of such books. Identifying the mathematical concepts and skills contained and not contained in the illustrated books is believed to be important to eliminating the relevant insufficiencies.

Accordingly, the research question was determined as follows: "How do illustrated children's books for pre-school mathematics education meet the mathematical content standards set forth by NCTM?"

## Method

### *Research Design*

The present study investigating illustrated children's books for the pre-school period is a descriptive research study conducted using the survey model. Survey models are approaches aiming to reveal the current situation as is, and include researching and identifying what is intended without trying to change subjects, cases, objects, individuals or situations (Karasar, 2014). Hence, the current situation as to the mathematical content in illustrated children's books was investigated without trying to change it, and thus, the survey model was used.

### *Research Sample*

Criterion sampling method was used to create the research study group. According to the classification by Shih and Giorgis (2004), the first and second types of books featuring mathematics as the focus of the story and integrating mathematics and the story were determined as the basic criterion. As such, 174 illustrated children's books offered for sale by bookstores in Adana and Ankara provinces and included by academicians in their private libraries were surveyed. As a result of the survey, 52 illustrated children's books that were determined to meet the criteria constituted the research study group.

### *Research Instruments and Procedures*

A document analysis was conducted to collect research data during the study. Books included in the study group were surveyed by the researchers between March 2016 and May 2016. A "Content Control List" was created to study the illustrated children's books forming the study group in terms of mathematical content. A control list is defined as a measuring tool that enables the existence of the behavior aimed to be studied to be expressed as "x" or "yes" (Turgut & Baykul, 2013). At the stage of preparing this list, NCTM (2000) content standards were used that cover in detail the topics that are internationally recognized and constitute the basis for mathematics education. The areas of "numbers and operations, algebra, geometry, measurement, data analysis and probability" that are among these standards constitute some of the sub-dimensions of the control list created. In the study, mathematical expressions

contained in the books were taken as the data analysis unit and analyzed in parallel to the content control list.

**Table 1**

*Content Control List*

<b>General categories</b>	<b>Sub categories</b>
<b>Numbers and Operations</b>	Counting, and telling the number of objects counted
	Expressing numerical values with materials and models
	Recognizing numbers
	Ordinal numbers
	Object groups of equal number-division
	Addition
	Subtraction
	Basic fraction units Using different methods and tools in calculations
<b>Algebra</b>	Pattern
	Classification
	Distinction
	Sorting
	Algebra symbols and mathematical models
	Qualitative changes Quantitative changes
<b>Geometry</b>	Geometric shapes and their characteristics
	Spatial Relationships
	Symmetry and translation movements
	Spatial, visual reasoning and geometric modeling
<b>Measurement</b>	Physical measurement; length, volume, weight and area
	Non-Physical Measurements; time
	Standard units of measurement
	Non-standard units of measurement
	Measuring Tools
	Repeated Measures
	Comparison
	Estimation
<b>Data Analysis and Probability</b>	Data Collection
	Data Organization
	Data Visualization
	Data description
	Deduction Based on Data
	Understanding and Applying Basic Probability
	Concepts

An alternative way of achieving triangulation using multiple-data sources to improve the validity and reliability of qualitative research is suggested to involve the inclusion of multiple researchers in data collection and analysis processes (Merriam, 2015, p. 206). In this respect, among the books included in the study group, seven books were selected to be surveyed jointly by three researchers. Mathematical expressions that were thought to be included in these seven books were noted, and the control list was marked by a joint decision on which mathematical contents these expressions subsumed. Mathematical expressions in the remaining 45 books, on the other hand, were evaluated independently by the three researchers. Once the surveying was complete, the reliability formula suggested by Miles and Huberman (1994) ( $\text{reliability} = \frac{\text{agreement}}{\text{agreement} + \text{disagreement}}$ ) was used to identify the agreement coefficient among the researchers. Separate percentages were calculated for each sub-dimension comprising the Content Control List, and the agreement percentages were calculated to be 0.82 for numbers and operations; 0.86 for algebra; 0.86 for geometry; 0.78 for measurement and 0.84 for data analysis and probability. For codings on which the researchers disagreed, they worked together to reach a joint decision on which content standards the expressions met. This was intended to ensure reliability by precluding evaluation errors caused by disagreements. As for the research findings, analysis results were presented in tables and direct quotes were used in order to be faithful to the original data for the purpose of delivering accuracy in codings.

## Results

This section presents in table form the frequency and percentage distribution of the results acquired with respect to mathematical content of the illustrated children's books included in the study group. First, general mathematical skills provided in the books were investigated in the study. Table 2 presents the results pertaining to general mathematical skills provided in the books.

**Table 2**

*Frequency and Percentage of General Mathematical Content Skills in the Illustrated Children's Books*

General Category	<i>f</i>	%
Numbers and Operations	532	44.7
Algebra	37	3.1
Geometry	358	30.0
Measurement	256	21.5
Data Analysis and Probability	7	0.5
<b>Total</b>	<b>1190</b>	<b>100.0</b>

When Table 2 is reviewed, the general categories of Numbers and Operations, Algebra, Geometry, Measurement, Data Analysis and Probability are provided. According to this, the illustrated children's books investigated appear to include the special sub category of Numbers and Operations (44.7%) most. This is followed by the

special sub categories of Geometry (30.0%), Measurement (21.5%), Algebra (3.1%) and Data Analysis/Probability (0.5%), respectively.

**Table 3**

*Frequency and Percentage of Numbers and Operations Category in the Illustrated Children's Books*

General Category	Special Sub Categories	f	%
<b>Numbers and Operations</b>	Object groups of equal number-division	1	0.2
	Expressing numerical values with materials and models	0	0.0
	Recognizing numbers	35	8.3
	Counting, and telling the number of objects counted	252	60.1
	Ordinal numbers	56	13.3
	Addition	21	5.0
	Subtraction	42	10.0
	Understanding and showing the basic fraction units	12	2.8
	Using different methods and tools in calculations	0	0.0
	Total	419	100.0

In Table 3, special sub categories under the general category of Numbers and Operations are provided. Accordingly, the illustrated children's books in the study group appear to include the special sub categories of Counting, Telling the Number of Objects Counted (60.1%) most. These are followed by Ordinal Numbers (13.3%), Subtraction (10.0%), Recognizing Numbers (8.3%), Object Groups of Equal Number-Addition (5.0%), Understanding and Showing the Basic Fraction Units (2.8%), Division (0.2%), Showing Numerical Values with Materials and Models (0.0%), and their special sub categories, respectively. Also, a sub category of Numbers and Operations skills, "Using Different Methods and Tools in Calculations" appears not to be provided in any of the illustrated children's books investigated. Failure to include this skill, a special sub category of the Numbers and Operations skills that constitute the basis for the pre-school mathematics curriculum, is considered to be an important insufficiency in these children's books. The following are examples of the Numbers and Operations Category:

- "Three walnuts came from the monkey basket"
- "Tonton also counted, "one bird, two birds, three birds"
- "... This time you have come first"
- "... He munched up half a cucumber"

“... The dog with eyes as large as a saucer is given a narrow cushion, the one with eyes as large as a plate a wide cushion, and the one with eyes as large as a pan lid the widest cushion.”

**Table 4**  
 Frequency and Percentage of Algebra Category in the Illustrated Children's Books

General Category	Special Sub Categories	f	%
Algebra	Pattern	2	3.5
	Classification	5	8.7
	Distinction	0	0.0
	Sorting	18	31.5
	Algebraic symbols and mathematical models	0	0.0
	Qualitative changes	32	56.1
	Quantitative changes	0	0.0
	Total	57.0	100.0

In Table 4, special sub categories under the general category of “Algebra” are provided. Accordingly, the special sub category of “Qualitative Changes” (56.1%) appears to be provided most frequently, followed by “Sorting” (31.5%), “Classification” (8.7%) and “Pattern” (3.5%) categories, respectively. An important finding is that the categories of Algebraic Symbols and Mathematical Models, Distinction and Quantitative Changes are not included in the books at all. The followings are some examples of the Algebra category:

“... We wait in winter for summer to come to swim in the sea. Thus, there comes summer, after summer comes fall, after fall comes winter comes, after winter comes spring, and after spring comes summer again...”

“Its curved tail is getting smaller and smaller.”

“... Then who ever goes down first will eat the candies.”

“... Should I only put the round ones?” They are perfect for soups...”

**Table 5**  
 Frequency and Percentage of Geometry Category in the Illustrated Children's Books

General Category	Special Sub Categories	f	%
Geometry	Geometric Shapes and their characteristics	135	93.1
	Spatial relationships, Spatial/visual reasoning and geometric modeling	8	5.5
	Symmetry and translation movements	2	1.3
	Total	145	100.0

In Table 5, special sub categories under the general category of “Geometry” appear to be provided. Accordingly, the sub-category “Geometric Shapes and Their Characteristics” (93.1%) appears to be provided most frequently, followed by Spatial,



Visual Reasoning and Geometric modeling (5.5%) and Symmetry and Translation movements (1.3%) sub categories, respectively.

The followings are some examples of the Geometry Category:

“The square spoke in a fury”

“Three men put round onions and potatoes in the soup”

**Table 6**

*Frequency and Percentage of Measurement Category in the Illustrated Children's Books*

General Category	Special Sub Categories	f	%
Measurement	Using non-standard units of measurement	20	5.6
	Using standard units of measurement	7	1.9
	Measuring Tools	0	0.0
	Comparison	91	25.8
	Estimation	4	1.1
	Physical Measurements; length, area volume and weight	162	46.0
	Non-Physical Measurements; time	68	19.3
	Total	352	100.0

In Table 6, special sub categories under the general category of Algebra are provided. Physical Measurements appear to be provided most frequently, followed by Non-Physical Measurements; Comparison, Using Standard Units of Measurement, Estimation, Using Non-Standard Units of Measurement and Measuring Tools, respectively. The followings are some examples of the Measurement Category:

“She rolled a large and little heavy bolder toward Bonbon.”

“...First, a lightning flashed, then the sky thundered in a fury, and the earth shook once again”

“He began to think about what it was moving inside the apple. Or...was it the fat walnut...or...the shining moon that made the apple laugh?”

“Put on the red pants we left to learn your leg length and tell us if its length is short, long, or the same”

“The little brother has the smallest feet. The middle brother’s feet are bigger than the little brother’s. The oldest brother’s feet are bigger than the middle brother’s. Three brothers ordered their shoes and left the shop.”

**Table 7**

*Frequency and Percentage of Data Analysis and Probability Category in the Illustrated Children's Books*

General Category	Special Sub Categories	f	%
<b>Data Analysis and Probability</b>	Data Collection	0	0.0
	Data Organization	0	0.0
	Data Visualization	0	0.0
	Data description	0	0.0
	Deduction Based on Data	6	100.0
	Understanding and Applying	0	0.0
	Basic Probability Concepts	0	0.0
	Total	6	100.0

Table 7 presents the results regarding the data analysis and probability category provided in the illustrated children's books included in the study group. Per this analysis, only the special sub category of deduction based on data under the general category of data analysis and probability appears to be provided, and the special sub categories of data collection, data organization, data visualization, data description and understanding and applying basic probability concepts are not seen at all.

## Discussion and Conclusion

### *Discussion*

The findings acquired by the present research conducted to investigate the mathematical content in the illustrated children's books prepared for use in pre-school mathematics education suggest that the numbers and operations category is provided most frequently in the investigated books, followed by geometry, measurement, algebra, data analysis and probability categories, respectively. The books investigated hereunder appear to frequently provide the concepts and skills relating to the numbers and operations category that constitutes the basis for the development of mathematical concepts. The study by Öçal et al. (2015) that investigated the mathematical concepts and skills provided in the randomly selected illustrated children's books reached similar conclusions. Given that children begin using numerical terms frequently starting around age two (Avcı & Dere, 2002), it is believed to be important to provide books that use such expressions frequently and that are therefore appropriate for the development of mathematical concepts. In parallel, the skill of manipulating numbers is known to have a high percentage among the achievements and indicators provided in the MoNE 2013 Pre-School Education Program (Özen Uyar & Yılmaz Genç, 2016). In this context, the use of numbers included among the priority skills to be taught to children may be supported greatly by illustrated children's books offered during the pre-school education period. While the sub categories under the numbers and operations dimension of counting, telling the number of objects, ordinal numbers, subtraction, recognizing numbers and addition, are observed to be provided frequently in the books investigated, the missing categories of showing numerical values with materials and models and using different methods and tools in calculations give rise to the thought that the development of children in such areas is

not adequately supported by books. The findings of the study conducted by Powell and Nurnberger-Haag (2015) aiming to evaluate the numbers and the characteristics of counting show parallelism with the results of the present study. Accordingly, the study conducted by surveying books revealed that teaching of the number 0 and the numbers greater than 10 is very limited.

When the research findings regarding the measurement category are reviewed, concepts and expressions relating to physical measurement such as length, area, volume and weight and non-physical measurement such as time (Yıldırım Hacıbrahimoglu, 2016) appear to be frequently provided. Even if children in the younger age group do not use standard units, they are able to measure using non-standard units, thus developing an understanding of the nature of the units and gaining awareness of concepts of measurability (NCTM, 2000). In this respect, it is believed that illustrated children's books that give children the opportunity to learn how to measure using standard and non-standard units with different tools throughout the course of the story should be more frequently used. However, it is believed to be as important as the provision of mathematical concepts and skills in the books that these books are integrated effectively by teachers into classroom activities. A study conducted by Jennings et al. (1992) concluded that books included in mathematics activities improved children's interest and success in mathematics, as well as increasing the number of mathematical terms they used in their free games.

When the research findings are examined, the books included in the study group appear to provide the content relating to the sub category of Geometric Shapes and their characteristics under the geometry category at a high rate. A study conducted by Casey et al. (2004), focusing on the development of children's spatial skills, concluded that the children in the group in which the blocks and illustrated story books were used together proved to be more successful in mathematics activities than the children in the group in which the story books were not used. The study conducted by Casey et al. (2008) revealed that girls' geometry skills developed more than the boys' as a result of the activities during which relevant story books were read in addition to the geometry studies. Based on the results of the present study, it may be suggested that such skills can be developed by including illustrated books featuring mathematical content in activities in areas in which children are found to lack mathematical skills.

The books investigated herein appear to provide only the examples of expressions relating to deduction, based on data from the data analysis and probability category, that is comprised of five sub categories. Considering that skills relating to this category include concepts that will form the basis for future academic life, the investigated books' providing some such content gives rise to the thought that this category is neglected. A study conducted by İnan (2014) found that a high number of pre-school teacher candidates believed that data collection and probability topics were not provided in pre-school mathematics education. Considering, based on such findings, that the frequency of providing data analysis and probability content in mathematics activities may be low, it is believed to be important to support such skills through the use of illustrated children's books.

### *Conclusion*

When the research results are examined in general, the illustrated children's books included in the study group are seen not to contain the special categories related to using different methods and tools in calculations, division, algebraic symbols and mathematical models, quantitative changes, symmetry and translation movements, repeated measures, data collection, data organization, data visualization, data recognition, and understanding and applying basic probability concepts. Such results acquired hereunder suggest that the books prepared in our country fail to meet the NCTM mathematics standards.

Considering the pre-school age and developmental stage, children do not know how to read and write during that period, and therefore, illustrated children's books are frequently used in pre-school education. The studies conducted suggest that illustrated books that provide mathematical concepts and contents and offer entertaining and meaningful contents to children contribute greatly to the pre-school mathematics curriculum (Casey, Kersh, & Young, 2004; Hong, 1999; van den Heuvel-Panhuizen & Elia 2011). Rather than illustrated books containing mathematical expressions, books specifically prepared for use in pre-school mathematics activities offer mathematical concepts visually, and in this way, support children's understanding of abstract expressions (Montague-Smith & Price, 2012). It is considered important that illustrated children's books properly scripted for use in pre-school mathematics education, presenting mathematical concepts properly and containing mathematical contents, are accessible by teachers and families.

### *Recommendations*

Only 52 of the 174 books investigated to create the study group were found to have mathematics as the focus of the story and to integrate mathematics into the story. This rate is believed to be inadequate. Also, when it is analyzed on the basis of topics, there are some categories that are not provided at all, or provided very little, in the books investigated. Particularly, it appears to be a necessity that books focusing on such areas be published and that publishing houses and authors be advised to focus on such topics.

It is recommended that teachers frequently use illustrated children's books in preschool mathematics education, making it easier to understand mathematical concepts by means of rich visual presentations and meaningful contexts. Such story books used effectively with different reading techniques and proper interventions are believed to stimulate children's motivation in mathematics activities. A list of illustrated children's books may be published to encourage the pre-school teachers to use illustrated children's books in mathematics activities. This way, teachers can have the opportunity to access such books that have been reviewed by experts and have a proper content.

This study was conducted to investigate whether and how illustrated children's books for pre-school mathematics education meet the mathematical content standards set forth by NCTM. For future studies, it is recommended that researchers examine in detail how mathematical categories provided in the books are dealt with, or whether and how teachers include illustrated children's books in mathematics activities performed in the class.

## References

- Akinci, S. (2015). *Resimli çocuk kitaplarında yer alan mizahi unsurların incelenmesi*. Yayınlanmamış Yüksek Lisans Tezi, Hacettepe Üniversitesi Eğitim Bilimleri Enstitüsü, Ankara.
- Anderson, A. (1997). Families and mathematics: A study of parent-child interactions. *Journal for Research in Mathematics Education*, 484-511.
- Anderson, A., Anderson, J., & Shapiro, J. (2004). Mathematical discourse in shared storybook reading. *Journal for Research in Mathematics Education*, 5-33.
- Anderson, A., Anderson, J., & Shapiro, J. (2005). Supporting multiple literacies: Parents' and children's mathematical talk within storybook reading. *Mathematics Education Research Journal*, 16(3), 5-26.
- Avci, N., & Dere, H. (2002). Okul öncesi çocuğu ve matematik. *V. Ulusal Fen Bilimleri ve Matematik Kongresi*, 16-18.
- Barnaby, D. (2015). The use of Children's Literature to Teach Mathematics to improve Confidence and Reduce Math Anxiety. Unpublished master's dissertation, University of Toronto, Ontario, Canada.
- Baroody, A. J., Lai, M. L., & Mix, K. S. (2006). The development of young children's early number and operation sense and its implications for early childhood education. *Handbook of research on the education of young children*, 2, 187-221.
- Casey, B., Kersh, J. & Young, J. (2004). Storytelling sagas: An effective medium for teaching early childhood mathematics. *Early Childhood Research Quarterly*, 19, 167-172.
- Casey, B., Erkut, S., Ceder, I., & Young, J. M. (2008). Use of a storytelling context to improve girls' and boys' geometry skills in kindergarten. *Journal of Applied Developmental Psychology*, 29(1), 29-48.
- Daglioğlu, H. E., & Cakmak, O. C. (2009). Okul öncesi çocuklarına yönelik yayınlanan hikâye kitaplarının siddet ve korku öğeleri açısından incelenmesi. *Türk Kutuphaneciliği*, 23(3), 510-534.
- Demircan, C. (2006). TÜBİTAK çocuk kitaplığı dizisindeki kitapların dış yapısal ve iç yapısal olarak incelenmesi. *Mersin Üniversitesi Eğitim Fakültesi Dergisi*, 2(1).
- Erdal, K. (2009). Eğitim değerleri açısından çocuk kitapları. *Akademik Bakış*, 17, 1-18.
- Forrest, K., Schnabel, D., & Williams, M. E. (2006). Mathematics and literature, anyone? *Teaching Children Mathematics*, 13(4), 216-217.
- Ginsburg, H. P., & Golbeck, S. L. (2004). Thoughts on the future of research on mathematics and science learning and education. *Early Childhood Research Quarterly*, 19(1), 190-200.
- Gonen, M. (1993). Anaokulu öğretmenlerinin beş ve altı yaş çocukları için kullandıkları masal ve hikâye kitaplarının niteliklerinin incelenmesi. *Türk Kutuphaneciliği*, 7(2), 83-88.
- Griffiths, R., & Clyne, M. (1991). The power of story: Its role in learning mathematics. *Mathematics Teaching*, 135, 42-45.

- Gursimsek, I., & Günay, D. (2010). Çocuk kitaplarında cinsiyet rollerinin islenişinde kullanılan dilsel ve dildisi göstergelerin değerlendirilmesi. *Buca Eğitim Fakültesi Dergisi*, (18).
- Inan, C. (2014). Okul öncesi öğretmen adaylarının matematik dersini öğretebilme konusunda hazır bulunuşluk düzeylerinin değerlendirilmesi (Diyarbakır il örneği). *International Periodical for the Languages, Literature and History of Turkish or Turkic*, 9(8), 537-550.
- Hong, H. (1996). Effects of mathematics learning through children's literature on math achievement and dispositional outcomes. *Early Childhood Research Quarterly*, 11(4), 477-494.
- Isitan, S. (2014). Caillou çizgi film karakteri ile ilgili Türkçe resimli oyku kitaplarının biçimsel ve içerik özelliklerinin incelenmesi. *İlköğretim Online*, 13(1).
- İlter, I. (2014). Çocuk edebiyatı aracılığıyla sosyal bilgilerin matematikle butunleştirilmesi. *International Journal of Human Sciences*, 11(2), 1117-1138
- Jennings, C. M., Jennings, J. E., Richey, J., & Dixon-Krauss, L. (1992). Increasing interest and achievement in mathematics through children's literature. *Early Childhood Research Quarterly*, 7(2), 263-276.
- Karasar, N. (2014). *Bilimsel araştırma yöntemleri*. Ankara: Nobel.
- Keat, J. B., & Wilburne, J. M. (2009). The impact of storybooks on kindergarten children's mathematical achievement and approaches to learning. *Online Submission*, 6(7), 61-67.
- Kilic, O. O., Gulec, H., & Genç, S. Z. (2014). Okul öncesi dönem resimli oyku kitaplarının coğrafi kavramları içermesi yönünden incelenmesi. *Ahi Evran Üniversitesi Kırşehir Eğitim Fakültesi Dergisi*, 15(1).
- McDuffie, A. M. R., & Young, T. A. (2003). Promoting mathematical discourse through children's literature. *Teaching Children Mathematics*, 9(7), 385.
- Merriam, S. B. (2015). *Nitel araştırma: Desen ve uygulama için bir rehber*. (Çev. S. Turan). İstanbul: Nobel.
- Miles, M.B. & Huberman, A.M. (1994). *Qualitative data analysis* (2. Baskı). Thousand Oaks, CA: Sage Publications.
- Montague-Smith, A. & Price, A. J. (2012). *Mathematics in the early years* (3rd ed.). London, UK: Routledge.
- National Council of Teachers of Mathematics (NCTM). (2000). *Principles and standards for school mathematics*. Reston, VA: NCTM Publishing.
- Ocal, T., Ocal, M. F., & Simsek, M. (2015). Investigating mathematical elements in story books appropriate for pre-schoolers. *Current Research in Education*, 1(2), 58-69.
- Ozen Uyar, R. & Yılmaz Genç, M. M. (2016). MEB 2013 Okul Öncesi Eğitim Programının Bilimsel Süreci Becerileri Açısından Analizi, 3.Uluslararası Avrasya Eğitim Araştırmaları Kongresi (Sözlü bildiri), 1-3 Haziran, Muğla.
- Powell, S. R., & Nurnberger-Haag, J. (2015). Everybody counts, but usually just to 10! A systematic analysis of number representations in children's books. *Early Education and Development*, 26(3), 377-398.

- Radebaugh, M. R. (1981). Using children's literature to teach mathematics. *The Reading Teacher*, 34(8), 902-906.
- Shatzer, J. (2008). Picture book power: Connecting children's literature and mathematics. *The Reading Teacher*, 61(8), 649-653.
- Shih, J. C., & Giorgis, C. (2004). Mathematics and Literature Connection. *Teaching Children Mathematics*, 329.
- Thatcher, D. H. (2001). Reading in the math class: selecting and using picture books for math investigations. *Young Children*, 56(4), 20- 26.
- Turgut, M. F., & Baykul, Y. (2013). *Eğitimde ölçme ve değerlendirme*. Ankara: Pegem Akademi.
- van den Heuvel-Panhuizen, M., van den Boogaard, S., & Doig, B. (2009). Picture books stimulate the learning of mathematics. *Australian Journal of Early Childhood*, 34(3), 30-39.
- van den Heuvel-Panhuizen, M., & Elia, I. (2011). Kindergartners' performance in length measurement and the effect of picture book reading. *ZDM*, 43(5), 621-635.
- Yıldırım Hacıbrahimoglu, B. (2016). Ölçme. In B. Akman, (Ed.), *Okul öncesi dönemde matematik* (5.Baskı), (pp. 148-157) Ankara: Pegem Akademi.

## Özet

### Resimli Çocuk Kitaplarında Yer Alan Matematiksel İçeriğin İncelenmesi

#### Atıf:

Yılmaz-Genç, M.M., Akıncı-Coşkun, A., & Pala, Ş. (2017). A study of mathematical content provided in illustrated children's books. *Eurasian Journal of Educational Research*, 69, 159-175. <http://dx.doi.org/10.14689/ejer.2017.69.9>

*Problem Durumu:* Okul öncesi dönem, gerçek yaşam koşulları ve ileriki akademik süreç için gerekli olan matematiksel düşünmenin, matematik kavram ve becerilerinin temelini hazırladığı evredir. Bu dönemde, çocuklara matematiğin bir bağlam çerçevesinde sunulması, anlamlı matematik deneyimleri bakımından oldukça önemlidir. Okul öncesi eğitimde sıklıkla kullanılan resimli çocuk kitapları, barındırdığı matematik kavram ve becerilerini gerçek yaşam durumları ile ilişkilendirerek, sözü edilen bağlamsal temeli sağlamaktadır. Alan yazın incelendiğinde yapılan çalışmaların çoğunlukla, matematik eğitiminde kullanılacak nitelikli kitap isimleri önerisine yoğunlaştığı görülmektedir. Diğer taraftan, resimli çocuk kitaplarının okul öncesi matematik eğitiminde kullanımının, çocukların matematiği anlamaları üzerinde pozitif bir etkisi olduğu belirtilmektedir. Ayrıca yalnızca okul etkinliklerinin değil, aile katılımlı kitap okuma çalışmalarının da

çocukların matematiksel kavram gelişiminde etkili olduğu sonucuna ulaşılmıştır. Resimli çocuk kitaplarının Türkiye'deki durumunu ortaya koymak üzere; içerik ve fiziksel özellikler, cinsiyet rolleri, şiddet öğeleri, değerler, mizahi ve coğrafi unsurlar alanlarında çalışmalar yapılmıştır. Ancak resimli çocuk kitaplarında yer alan matematik içeriğini incelemeye yönelik sınırlı sayıda çalışmaya rastlanmıştır. Okul öncesi dönem matematik eğitiminde resimli çocuk kitapları kullanılmasının önemli olduğu belirtilmektedir. Fakat odağı matematik olan resimli çocuk kitaplarında, kavram ve becerilerin yer almasına ilişkin mevcut durumun bilinmediği görülmektedir. Bu bağlamda, okul öncesi matematik eğitiminde kullanılmak üzere hazırlanan resimli çocuk kitaplarının, matematiksel içerik durumlarının incelenerek eksikliklerin belirlenmesine ihtiyaç duyulmaktadır.

*Araştırmanın Amacı:* Bu çalışma ile NCTM (National Council of Teachers of Mathematics) tarafından okul öncesi döneme yönelik belirlenen matematik öğretimi içerik standartları arasında gösterilen "Sayma ve İşlem, Cebir, Geometri, Ölçme, Veri Analizi ve Olasılık" standartlarının resimli çocuk kitaplarında yer alma durumlarının incelenmesi amaçlanmıştır.

*Araştırmanın Yöntemi:* Okul öncesi döneme yönelik resimli çocuk kitaplarının matematiksel içerik açısından incelendiği bu çalışma, betimsel nitelikte olup tarama modeli ile gerçekleştirilmiştir. Çalışma kapsamında, Adana ve Ankara illerindeki kitapevlerinde satışa sunulan ve akademisyenlerin özel kütüphanelerinde bulunan 174 adet resimli çocuk kitabı incelenmiştir. Bu inceleme neticesinde, ölçütleri karşıladığına karar verilen 52 adet resimli çocuk kitabı, araştırmanın çalışma grubunu oluşturmuştur. Araştırma verilerinin toplanması sürecinde doküman analizi gerçekleştirilmiştir. Çalışma grubunu oluşturan resimli çocuk kitaplarının matematiksel içerik bakımından incelenmesi amacıyla "İçerik Kontrol Listesi" oluşturulmuştur. Bu listenin oluşturulma aşamasında, uluslararası düzeyde kabul gören ve matematik eğitiminde temel olan başlıkları ayrıntılı bir şekilde kapsayan NCTM içerik standartlarından yararlanılmıştır. Bu standartlar arasında gösterilen; "sayı ve işlem, cebir, geometri, ölçme, veri analizi ve olasılık" alanları ise oluşturulan kontrol listesinin alt boyutları arasında yer almaktadır. Çalışmada veri analiz birimi olarak kitaplarda yer verilen matematiksel ifadeler alınmış ve oluşturulan içerik kontrol listesine paralel olarak analiz edilmiştir. Çalışma grubuna alınan kitaplar arasında, üç araştırmacı tarafından ortak olarak incelenmek üzere yedi kitap seçilmiştir. Bu kitaplarda yer aldığı düşünülen matematiksel ifadeler not edilmiş ve bu ifadelerin hangi matematiksel içerikleri kapsadığı konusunda ortak karar alınarak kontrol listesine işaretleme yapılmıştır. Kalan 45 kitapta yer alan matematiksel ifadeler ise üç araştırmacı tarafından bağımsız olarak değerlendirilmiştir. İncelemeler tamamlandığında, araştırmacılar arası uyum katsayısı hesaplanmıştır. İçerik Kontrol Listesi'ni oluşturan her alt boyut için ayrı ayrı yüzdeler tespit edilmiş ve uyum yüzdeleri; sayı ve işlem için 0.82; cebir için; 0.86; geometri için 0.86; ölçme için 0.78; veri analizi ve olasılık için ise 0.84 bulunmuştur.



*Araştırmanın Bulguları:* Okul öncesi matematik eğitiminde kullanılmak üzere hazırlanan resimli çocuk kitaplarındaki matematik içeriğinin incelenmesi amacıyla yapılan bu araştırmadan elde edilen bulgular; incelenen kitaplarda en fazla sayı ve işlem (%44,7) kategorisine yer verildiğini göstermektedir. Bunu sırasıyla; geometri (%30,0), ölçme (%21,5), cebir (%3,1) ile veri analizi ve olasılık (%0,5) kategorilerinin takip ettiği belirlenmiştir. Kitaplarda en az ele alınan kategori olan veri analizi ve olasılık genel kategorisine ait özel alt kategorilerden yalnızca verileri temel olarak çıkarımda bulunma özel alt kategorisine yer verildiği, veri toplama, verileri düzenleme, verileri görselleştirme, verileri tanımlama ve temel olasılık kavramlarını anlama ve uygulama ait özel alt kategorilerine hiç yer verilmediği görülmüştür.

*Araştırmanın Sonuç ve Önerileri:* Araştırma sonuçları genel olarak incelendiğinde, çalışma grubuna alınan resimli çocuk kitaplarında; hesaplamada farklı yöntem ve araçlar kullanma, ayırma, cebir sembolleri ve matematiksel modeller, nicel değişimler, simetri ve öteleme hareketleri, tekrarlı ölçümler, veri toplama, verileri düzenleme, verileri görselleştirme, verileri tanıma ve temel olasılık kavramlarını anlama ve uygulama özel alt kategorilerine hiç yer verilmediği görülmüştür. Araştırma kapsamında elde edilen bu sonuçlar ülkemizde hazırlanan kitapların NCTM matematik standartlarını karşılamada yeterli olmadığını göstermektedir. Çalışma grubunun oluşturulmak üzere incelenen 174 kitabın yalnızca 52 tanesinde matematiğin hikâyenin odağında olduğu ve matematiğin hikâye ile bütünleştirildiği görülmüştür. Bu oranın oldukça yetersiz olduğu düşünülmektedir. Ayrıca, konu bazında bakıldığında, incelenen kitaplar arasında hiç yer verilmeyen veya çok az ele alınan kategoriler olduğu da görülmüştür. Özellikle bu alanlara yönelik kitapların yayınlanmasının gerekli olduğu düşünülmekte ve yayınevleri ve yazarlara bu konular üzerine eğilmeleri önerilmektedir. Zengin görsel sunumlar ve anlamlı bir içerik sayesinde matematiksel kavramların anlaşılmasını kolaylaştıran resimli çocuk kitaplarının okul öncesi dönem matematik etkinliklerinde öğretmenler tarafından sıklıkla kullanılması önerilmektedir. Farklı okuma teknikleri ve uygun müdahaleler ile etkili bir şekilde kullanılan bu hikâye kitaplarının, çocukların matematik etkinliklerine karşı motivasyonlarını artıracığı düşünülmektedir. Okul öncesi öğretmenlerini, matematik etkinliklerinde resimli çocuk kitaplarını kullanma konusunda teşvik etmek amacıyla önerilen resimli çocuk kitapları listesi yayımlanabilir. Bu sayede öğretmenler, uzmanlar tarafından incelenmiş ve doğru içeriğe sahip kitaplara ulaşma fırsatı bulabilir. Bu çalışma, okul öncesi matematik eğitime yönelik resimli çocuk kitaplarının, NCTM tarafından belirlenen matematik içerik standartlarını karşılama durumunu incelemek üzere gerçekleştirilmiştir. İleri çalışmalar için; kitaplarda yer verilen matematik kategorilerinin ele alınış biçimlerinin ayrıntılı olarak incelenmesi veya öğretmenlerin sınıflarında gerçekleştirdikleri matematik etkinliklerine resimli çocuk kitaplarını dâhil etme durumlarının incelenmesi araştırmacılara öneri olarak sunulabilir.

*Anahtar Sözcükler:* Erken çocukluk eğitimi, okul öncesi dönem matematik, NCTM, resimli çocuk kitapları.