

Views of Pre-service Primary School Teachers About the Integration of Children's Literature in Mathematics Teaching*

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Abstract

This study aims to examine the views of preservice primary school teachers about the integration of children's literature in mathematics teaching. The views of the participants were collected before and after the use of a course outline based on the integration of mathematics with children's literature. The study had a qualitative research design, and the opinions of the preservice teachers were evaluated extensively through the case study. The data were obtained through mathematics lesson plans and open-ended questionnaires developed about children's literature. The items in the first form were concerned with the experiences of the pre-service teachers about the integration of children's literature in mathematics, their views on the selection process of children's books, and their expectations and evaluations regarding the practice. The second form was aimed to share their experiences following the implementation and to get their opinions about the teaching process which reflected the relationship between children's literature and mathematics. According to the findings, the views of the participants are grouped into the following four dimensions: book selection criteria and process, pedagogical effect, integration process, possible barriers, and limitations. It is found that the participants have difficulty in choosing children's books that provide opportunities for learning mathematics to the children. Following the implementation, they emphasized the pedagogical benefits of the practice such as increasing children's motivation and interests in learning mathematics. During the integration process, they mostly made use of the context of the books. Some of them employed books to teach mathematical concepts and skills. However, the books were mostly used to get attraction, make courses more fun, and increase student motivation. To use children's books as an effective tool to support conceptual understanding in the mathematics teaching process, pre-service and in-service teachers should be provided with necessary training and experience.

Keywords: Children's Literature, Teaching Mathematics, Pre-Service Primary School Teachers

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INTRODUCTION

Researchers have been studying on the importance of children's literature in strengthening the relationship between mathematics and literacy from an early age for more than 40 years (Cotti & Schiro, 2004; Jennings, Jennings, Richey & Dixon-Krauss, 1992; Moyer, 2000; Shatzer, 2008; Whitin, 1992; Whitin & Wilde, 1992). Research suggests that if mathematical knowledge is given in a context teaching mathematics would be both more productive and easier to comprehend (Casey, Erkut, Ceder & Young, 2008). Therefore, when mathematical concepts are given in a context, it contributes to communicating the usage of mathematical language (Moyer, 2000; Whitin & Wilde, 1992). It also makes it clear for children to recognize how mathematical knowledge can be employed in daily life (Kurz & Bartholomew, 2012). In other words, it contributes to make abstract mathematical concepts much clearer and to connect these concepts with daily life. Many research findings are indicating that mathematics courses supported by children's literature improve the students' mathematical skills (McAndrew, Morris & Fennel, 2017; Jennings et. al., 1992; Van den Heuvel-Panhuizen & Elia, 2008).

Although the integration of mathematics with children's literature has many pedagogical benefits, many factors are thought to be effective in achieving this integration (Prendergast, Harbison, Miller & Trakulphadetkrai, 2018). One such factor is teacher views about this integration. The teacher's perspective, knowledge, attitude, beliefs, and willingness about this integration are important factors in how such an integration can be done effectively (Rogers, Cooper, Nesmith & Purdum-Cassidy, 2015). There are studies on the beliefs, opinions, practices, and experiences of pre-service and in-service teachers about the use of children's literature in mathematics classes (Edelman, 2017; Harding, Hbaci, Loyd & Hamilton, 2017; Jett, 2018; Purdum-Cassidy, Nesmith, Meyer & Cooper, 2015; Prendergast et. al., 2018; Rogers et. al., 2015; Wilburne & Napoli; 2008). For instance, in the study conducted by Wilburne and Napoli (2008), the beliefs and knowledge of pre-service teachers were examined about the integration of literature in mathematics teaching. In the study, it was found that the beliefs and interests of the participants who designed and implemented mathematics lessons based on the literature were all significantly improved. The participants stated that the use of literature in mathematics lessons motivates the students, provides them with an opportunity to make mathematics more meaningful, helps to establish mathematical connections, and supports students to learn mathematics much more easily. Jett (2018) analyzed how the use of children's literature in mathematics lessons affects the pre-service early childhood mathematics teachers' views on mathematics teaching and learning. The use of children's literature was found to arouse the excitement about mathematics among pre-service teachers, increased their self-efficacy, and motivated them to plan innovative mathematics lessons. Trakulphadetkrai (2017) analyzed the beliefs of 109 pre-service primary school teachers about the integration of children's literature in the process of mathematics learning and teaching. The study produced nine dimensions about the beliefs of the participants, and the participants mostly emphasized the pedagogical benefits of such an integration. Pre-service teachers mostly stated that their awareness of books containing mathematical topics was insufficient. Prendergast et. al. (2018) examined the perceptions of Irish pre-service teachers and in-service teachers about positive and negative dimensions of the integration of children's literature into mathematics teaching. The participants reported problems such as lack of resources, time constraints, lack of pedagogical knowledge and self-efficacy, doubts about output expectations, and limitation of social norms. However, they also reported that the integration of children's literature in mathematics has pedagogical benefits and increase engagement and enjoyment in mathematics learning. In short, pre-service and in-service teachers, in general, have positive perceptions on the use of children's literature in mathematics lessons, but also have opinions on potential difficulties.

In some studies, pre-service teachers' and in-service teachers' designing and implementing process was examined about the integration of children's literature in mathematics lessons. For instance, in the study carried out by Alazzi (2006) three children's books related to geometry were read to the pre-service teachers, and they were asked to write down their reflections concerning the books and the potential integration of these books into mathematics courses. The pre-service teachers predicted how children would react to these books. They described the mathematical content covered

in the books and associated these books with the teaching methods they could use when they became teachers. Rogers et. al. (2015) analyzed how pre-service teachers integrated children's literature books to mathematics courses. It was found that the participants mostly used the context of the books for review. It is noteworthy that no lesson plans included creative experiences like writing students' own mathematical stories. In the study conducted by Edelman (2017), the pre-service teachers' planning and implementation processes related to the integration of children's literature books into mathematics courses were examined. In the study, the following points were analyzed: their approaches to the use of children's literature in mathematics courses, how they plan and prepare mathematical activities related to children's literature, and the mathematical content of the activities. The analysis was conducted in the framework of the mathematical knowledge for teaching (knowledge of content and students, knowledge of content and teaching, knowledge of content and curriculum) developed by Ball, Thames, and Phelps (2008). The findings indicated that the use of children's books may pose a risk if the teachers' content knowledge is insufficient. However, it is possible to change students' beliefs about the nature of mathematics by enabling them to develop alternative solutions that may be supported by the use of children's books (Edelman, 2017). In a study by Harding et. al. (2017) pre-service teachers were asked to plan and implement mathematics lessons using children's books that include topics on multiculturalism and mathematics. According to the participants, the books enabled the students to learn, created a structure for mathematical concepts, and motivated them. The major challenge for the participants was the problem of classroom management and time constraints. In the study conducted by Purdum-Cassidy et al. (2015), the questions used by pre-service teachers in the integration of literature and mathematics were examined. It was found that most of the questions focused on mathematics, only a few questions were about the relation between mathematics and the text used. In addition, the questions were not clear enough and contained incorrect mathematical concepts. In the studies related to the use of the books in mathematics, it is reported that pre-service and in-service teachers had some problems in integrating books that would support conceptual learning in mathematics. It is thought that preservice teachers will need the opportunity to have experience in providing children's literature and mathematics integration in different ways (Rogers et. al. 2015).

Studies about the relationships between mathematics and children's literature carry out in Turkey mostly focus on book reviews and preschool education dimension (Dedeoğlu, Özer & Can, 2016, 2018; Hacısalihoğlu & Karadeniz, 2016, 2018; Öçal, Öçal & Şimşek, 2015; Öztürk Samur, İnal Kızıltepe & Uyanık, 2017; Yılmaz Genç, Akıncı Coşkun & Pala, 2017). The study by İnal Kızıltepe, Öztürk Samur and Tekin (2018) reviewed the previous studies on the acquisition of mathematical skills through children's books. They found that studies on how mathematical concepts and skills can be developed through children's books are limited in Turkey. In a study in which teachers developed plans on how to realize the integration process their skills such as differentiation of the education programs were analyzed (Durmaz, 2019). There is no study about the beliefs, opinions, and experiences of the pre-service and in-service teachers on the integration of children's literature with mathematics courses. In short, the studies carried out in Turkey seem not to deal with the activities towards the integration of children's literature with mathematics courses.

Significance

The studies reveal the pedagogical benefits of the use of children's literature for the effective teaching of mathematics (Van den Heuvel-Panhuizen, Elia & Robitzsch, 2016). On the other hand, it was observed that teachers do not use children's literature at all or use such products very little in mathematics classes (Prendergast et. al. 2018). Researchers emphasize that for teachers, to use children's literature when teaching mathematics, they must experience this process before becoming a teacher, and should be given opportunities to discover the fact that children's literature can be transformed into a powerful instructional strategy in many different ways (Rogers et. al, 2015; Wilburne & Napoli, 2008). Providing pre-service teachers with an opportunity to employ the integration of children's literature and mathematics in teaching activities may encourage and motivate

them to employ skills such as reading, writing, and mathematical communication while teaching mathematics (Ward, 2005; Wilburne & Napoli, 2008).

Although there are studies that provide pre-service and in-service teachers with experience in the integration of children's literature and mathematics and therefore, enable them to share their experiences, such studies are very limited (Cotti & Schiro, 2004; Edelman, 2017; Harding et. al., 2017; Prendergast et. al., 2018; Purdum-Cassidy et. al., 2015; Rogers et. al., 2015; Trakulphadetkrai, 2017; Wilburne & Napoli, 2008). Some studies are carried out within the scope of mathematics teaching methods courses given at teacher training programs, and children's books (containing implicit or explicit mathematical content) are introduced to pre-service teachers before developing and implementing lesson plans. In addition, the ways of integrating such books into mathematics courses are introduced to them. This process informed the pre-service teachers about book selection criteria and ways of integration (Harding et. al., 2017; Purdum-Cassidy et. al., 2015; Rogers et. al., 2015).

In Turkey, the implementation and evaluation of using children's literature in mathematics teaching and learning are quite limited. In this study, it is aimed to examine the views of pre-service teachers about the use of children's books in mathematics teaching before and after experiencing such an activity. Introducing a perspective on the integration of children's literature in mathematics teaching and learning in relation to the Turkish education system (curriculum, lesson hours, teaching approach, children's books, etc.) will significantly contribute to the literature. The problem statement of the study is "What are the views of the pre-service primary school teachers about the use of children's literature in the process of mathematics teaching?". The sub-problems of the study are as follows:

1. What are the views of the pre-service primary school teachers about the book selection process and book selection criteria before and after the implementation?
2. What are the views of the pre-service primary school teachers about the pedagogical effects of the use of children's books in teaching mathematics before and after the implementation?
3. What are the views of the preservice primary school teachers about the potential ways of integrating children's literature in teaching mathematics before and after the implementation?
4. What are the views of the preservice primary school teachers about the potential barriers in integrating children's literature in teaching mathematics before and after the implementation?

METHOD

Design

In the study pre-service primary teachers' lesson plans developed for the integration of children's literature and mathematics and their views about the effects of this integration on the learning-teaching process were examined. Their views were analyzed before and after the implementation. The participants were not given any training on the integration of children's literature and mathematics teaching, so there was no external intervention. The study was conducted in qualitative research design, and the views of the pre-service teachers were evaluated extensively through case studies. Yıldırım & Şimşek (2013) stated that in a qualitative case study, which aims to produce conclusions about a particular situation, the situation is examined in depth adopting a holistic approach and also, the factors such as environment, individuals, events, processes which affect the situation and how it is affected from the situation are all investigated.

Participants

The views of the pre-service teachers on the use of children's literature in the mathematics teaching process were analyzed before and after experiencing this process. Therefore, 4th-grade students, who completed the Mathematics Teaching I-II courses delivered at the 3rd grade of the undergraduate program and attended the “Teaching Practice” course, were included in the study. The study group was determined by an appropriate sampling method, and it consisted of 105 pre-service teachers who were studying in the last year of a teacher training program at a public university. The data collected from seven participants were excluded since these data were incomplete or invalid. In addition, the participants were asked whether they experienced any integrated teaching approach between mathematics and children's literature during their earlier education. All of the participants stated that they had no experience in such a teaching approach.

The pre-service teachers in the fourth grade did not receive any training on how to carry out the integration of children's literature in mathematics courses. The third-year Mathematics Teaching-I and Mathematics Teaching-II courses were given by one of the authors. Within the scope of these courses, the importance of the use of children's books in mathematics courses, the information regarding the appropriate books, and how they can structure a course was given to the candidates. However, the implementation process was not carried out. The participants are expected to structure the implementation process and share the positive and negative factors they have experienced in this process by considering the information they acquired in the third grade. To describe the current situation, no intervention process was adopted during the teaching process.

Data collection tools

The data of the study were collected through mathematics lesson plans developed with the integration of children's literature in the mathematics teaching process and open-ended questionnaires. Two different open-ended questionnaires were developed to get the views of the pre-service teachers before and after the development and implementation of the lesson plan. The items in the first form were concerned with their views on the selection process of children's books and their expectations and evaluations regarding the implementation. The items in the second form aimed to provide an opportunity for the participants to share their experiences following the implementation and to get their opinions about the teaching process that reflected the relationship between children's literature and mathematics. The dimensions of the items in both forms are as follows:

Table 1. Themes covered in the items

Before the implementation	After the implementation
1. Book selection criteria	1. Book selection criteria and the process of book selection
2. Pedagogical effects	2. Pedagogical effects
3. Potential barriers and limitations to reduce the effectiveness of children's literature-based mathematics practice	3. Integration process
	4. Potential barriers and limitations to reduce the effectiveness of children's literature-based mathematics practice

The items were identified based on the previous studies (Jett, 2018; Prendergast et. al., 2018; Trakulphadetkrai, 2017), the views of the pre-service teachers, and the experience of the authors. Following the review of the related studies, the pre-service teachers were asked to write down essays on their views about the use of children's books in mathematics courses. Also, the outcomes from a project that was implemented by the authors on the use of children's books in mathematics courses (Durmaz, 2018) and from the related seminars. The forms were developed on these findings.

Data analysis

The data obtained in the study were analyzed by descriptive data analysis. Yıldırım and Şimşek (2013) stated that in the descriptive analysis, the data were summarized and interpreted based on the predetermined themes and that the data could be presented by considering the questions or dimensions used in the interviews and during the observation process.

FINDINGS

The pre-service teachers' lesson plans were examined by the authors, and their views about the use of children's literature in mathematics lessons were obtained before they experienced the teaching process. Then, the participants were asked to develop and implement mathematics lesson plans based on the use of children's literature. Their views reflecting their experiences and evaluations regarding the implementation process were taken after the implementation. The findings of the research are presented below according to the emerging themes. The frequency values given in tables do not represent the number of participants, but the frequency of that view. Similar views were grouped under a single item, and the frequency of the views was given in the frequency section. For example, in relation to the book selection criteria, some participants stated that the books chosen should be appropriate to the level of the student while others stated that such books should be suitable for their age. Similar views were grouped under a single item, and the frequency of the views was given in the frequency section. As stated earlier the frequency shows the number of expressions of the views.

Book selection process and criteria

The pre-service teachers were asked to provide their views about the book selection criteria in relation to mathematics teaching before the implementation. After the implementation, they were asked to develop a list of book selection criteria and explain the book selection process. Table 2 shows the views of the participants concerning the book selection criteria.

Table 2. Book selection criteria

Criteria	Before the implementation (f)	After the implementation (f)
1. Content-based criteria		
Appropriate for the age, grade level, and readiness	82	56
Existence of subject integrity and main idea in the story covered in the book	16	-
The relevance of the content of the book in terms of values/lack of negative expression and behavior (slang, violence, sexuality, etc.)	9	-
Appropriateness in terms of content features (suitability in terms of theme, subject, character, plan, language-style, etc.)	33	3
Attractive literary content	38	16
The relevance of the context in the book to the daily life of children	19	2
2. Physical features		
The suitability of physical features (paper type, font, size, page layout, spelling rules and punctuation marks, and book cover)	25	-
The suitability of number of pages for the level of the age group	7	3
3. Visual features		
Ensuring the text-visual balance, including visuals of appropriate size and ratio	13	5
Support of the book content through visuals	10	10
Attractive visuals	15	-
4. Mathematical features		
Relevant to mathematical concepts and mathematical concepts to be covered in the course/relevance to mathematical outcomes	46	73
Supporting the mathematical concepts to be taught	3	-
Appropriate content of the book to support with materials, activities and other methods and techniques (e.g. drama)	9	11

Appropriate mathematics content to student level	6	-
No wrong, incomplete information, free from misconceptions and errors	4	-
Inclusion of clear mathematical concepts and topics	8	2
Inclusion of mathematical activities and items	2	3
Inclusion of mathematics in an entertaining way	-	10
Relevant visuals on the book cover to the content of the book	6	11
Supporting the mathematical terms and concepts through visuals	-	5
Supporting the mathematical concepts in a concrete way	-	6
Relevant mathematical topics to daily life	-	11
Being mathematically instructive	4	-
Balance of literary and mathematical aspects in the book	4	-
<hr/>		
5. Others		
Cost-effective book price	4	-

The book selection criteria developed by the participants are grouped under five dimensions. Three of them refer to the general selection criteria of children's books (i.e., content, physical features, and visuals). In terms of content characteristics, the criterion most emphasized by the participants is the suitability of the selected book to the level of age, grade level, and readiness of the students. The criteria that the participants draw attention to before the implementation is that the book should be suitable for the student in terms of content features, physical properties, and visual characteristics. After the implementation, the frequency of specifying the criteria evaluating the book in terms of mathematical properties are observed to increase. The most emphasized criterion is the relevance of the book to the subject of mathematics, mathematical concepts, and learning outcomes. Following the implementation those criteria that were frequently expressed by the participants include the support of the content of the book by other methods and techniques, reflecting mathematics in the book in a fun way, visuals in the book supporting mathematical concepts, books' content to make mathematical concepts much more concrete and associating them with daily life. Under the category of other criteria, the price of the book was expressed by a few participants.

The participants reported that they had some difficulty in selecting the appropriate book. They had particular difficulty in obtaining information about the age group of the students that the book was suitable for and the subject of mathematics covered in the book. During the book selection process, the participants were not assigned with any titles of children's books related to mathematics and were asked to find these books themselves. However, a list of children's books prepared by the authors was given to the participants. The list contained only the title of the book, its author/s, and publisher. The participants were expected to manage the process of selecting a children's book that is relevant to the mathematics level and appropriateness for the level of children. The participants stated that they generally make use of the explanations and comments about the children's books on the web ($f=36$). Some of the participants guessed that the book may be related to mathematics topics based on the title of the book and after ordering and receiving it they could manage to decide whether or not it was appropriate. For instance, the participant coded P35 explained this process as follows:

The book selection process was difficult for me in that I don't know very well the contents of the children's books. I first started by searching the contents of the children's books on the web and tried to find out what level it was suitable for them. But I couldn't get the contents of each book as much as I wanted. I got help from my friends. Finally based on the title I bought the book entitled 7x9 Eyvah. And I thought the book was about multiplication.

Pedagogical effect

The participants' views about the pedagogical effects of supporting the mathematics teaching process through children's books were analyzed based on before and after the implementation of their lesson plans. The views of the participants concerning the pedagogical contributions of the integration of children's literature into mathematics courses are given in Table 3.

Table 3. Views of the participants concerning the pedagogical contributions of the integration of children's literature into mathematics courses

Views about pedagogical contributions	Before the implementation (f)	After the implementation (f)
1. Affective dimensions		
It makes children develop a positive attitude towards mathematics.	9	2
It increases students' interest in mathematics.	6	1
It makes it possible for students to enjoy mathematics courses./It may eliminate students' bias against mathematics.	7	2
It makes mathematics lessons fun.	28	9
It supports the social and emotional development of the students.	2	1
It may improve students' imagination and creativity.	17	2
It may improve students' artistic and aesthetic tendencies.	2	1
2. Contributions of the mathematics teaching process		
It makes classroom management much easier.	1	1
It supports the use of different teaching methods and techniques.	6	5
It diversifies the teaching process for students learning at a different pace.	5	2
It functions as teaching material.	3	2
It may provide visual support for mathematical topics.	3	-
3. Contributions of the mathematics learning process		
It makes mathematics more interesting/remarkable, motivates students, and arouses curiosity among them.	38	43
It helps to learn topics that are difficult to learn, makes mathematics easier to understand.	38	2
It makes permanent learning possible.	25	6
It makes it possible for students to be part of the active learning process.	6	2
It contributes to the conceptual development of mathematics and supports meaningful learning.	6	15
It makes mathematical topics concrete.	51	11
It makes it possible to develop a connection between mathematics and daily life.	25	11
It makes it possible to connect mathematics with other courses/disciplines.	3	-
It improves students' skills of problem-solving and problem posing.	5	-
4. Contributions to reading and comprehension skills		
The book gives children the habit of reading./It improves their reading comprehension skills.	8	2

Before the implementation, it was seen that the views of the participants about the use of children's books in mathematics classes increased in terms of improving the student interest in the lesson, easier and permanent learning, concrete mathematical subjects, connections with daily life, and making mathematics courses enjoyable. After the implementation, the participants' views increased in relation to the use of children's books in mathematics courses to improve the student interest in the lesson and student motivation whereas their views on other topics decreased. For instance, before the implementation the number of the views who reported that the use of children's books would make it easier to teach more difficult mathematical topics is thirty-eight, but it became just two following it. After the implementation, the frequency of the participants' views was decreased in regard to the points such as improving the creativity of students, making mathematical topics much more concrete and fun, and helping to connect mathematics with daily life. The views centered around this expression "*The use of books in mathematics courses makes mathematics more interesting/remarkable, motivates students, and arouses curiosity among them.*" are at the highest level before and after the implementation. It suggests that the participants focused on the dimension of attracting student attention through the use of children's books without paying importance to other pedagogical effects of this activity. In general, the participants reported that for their students the reading a book in mathematics courses was a different activity and that their reactions were like the following statements "*Aren't we supposed to do math? You have a book to read?*" The participant coded P14 reported before the implementation that their students would focus on the story and the hero/es in it, so they would not concentrate on mathematical topics in the courses. In other words, the participants argued that the use of children's books might have negative effects on the acquisition of mathematical skills. One of the participant's view on the implementation is as follows: "*The lesson with children's books became more attractive for the students. They both repeated the subject and there was no time for them to get bored. The fact that they put themselves in the place of hero in the book amused them.*" It was observed with other participants in that their views were mostly about the

significant effects of children’s books as a method in attracting student attention. However, it was seen that the participants did not focus enough on how children’s books may support the learning process.

The process of integrating children's books into mathematics

The preservice teachers were asked to plan a mathematics lesson integrated with children's books and to implement it at the schools where they made field experience under the course of Teaching Practice. Their lesson plans were analyzed based on the following points: grade level, learning domain, sub-learning domain, and part of the lesson. It is found that twenty-five participants developed mathematics lesson outlines for the first grade, thirty-seven participants for the second grade, seventeen participants for the third grade, and nineteen participants for the fourth grade. It is found that the participants developed lesson plans for different parts of the courses: twenty-three participants for introduction part, thirty-nine participants for both introduction and practice, twenty-eight participants for practice, three participants for introduction and evaluation, and one participant for evaluation. In addition, in four lesson plans, there were no specific references to the lesson part. In short, the participants used the children’s books for mostly introduction and practice parts of the mathematics lessons (f=39).

The distribution of the lesson plans developed by the participants based on the learning domains is found as follows: thirty-one lesson plans on “numbers and operations”, seventeen lesson plans on “geometry”, forty-two lesson plans on “measurement” and six lesson plans on “data processing”. The lesson plans are found to focus on the following learning domains: measurement, and numbers and operations. The participants were expected to develop a lesson plan in line with the topics covered at the schools they went to within the scope of Teaching Practice course. Therefore, it is thought that these two frequent learning domains were the results of the topics covered at the schools. Some of the participants contacted with the teachers to develop lesson plans in order to repeat the topics that had been taught before. Another reason for it can be that the participants found the children’s books on measurement much more easily. The ways proposed by the participants on the integration of children's books into mathematics lesson plans were examined which are given in Table 4.

Table 4. Ways to integrate children's books into mathematics

Suggested integration ways	Frequency
Use of the context of the book throughout the practices and activities	39
Preparation for teaching mathematical concepts or skills	26
Improving a mathematical concept or skill	20
Using the book to create different problems	10
Not clear	3

During the implementation process, some of the pre-service teachers used the book directly at the appropriate grade level, while others adapted the book to higher or lower grade levels. In this process, which part of the lesson was designed based on the book and how the participants used it to provide some insights about the participants’ ways to integrate it into the lesson. As seen in Table 4, thirty-nine participants employed the book to provide a context for the mathematics lessons. In other words, they designed the lesson based on the context given in the book and made a connection between this context and the mathematics teaching process. For instance, the participant P16 put forward the problem with mathematical content and started to find a solution to the problem given in the book, and the students sought a solution. On the other hand, twenty-six participants used the book as a preparation to teach a concept or a skill. For instance, after reading the book the participant P8 wrote the length measurements on the blackboard and discussed the subject later in this chapter. Another participant P10 first made the students read the book and asked the students to find the visuals in the book about the mathematical concepts that would be taught. Twenty participants used the book to improve the understanding of a mathematical concept or a skill. For instance, to give the concepts related to spatial relations, the participant P3 used the visuals covered in the book and

carried out a process of teaching concepts aligned with the book. On the other hand, ten participants employed the book to pose problems. For instance, the participants P5 developed problems related to division by using the context of the book and asked the students to solve these questions. Another participant coded P27 adapted a book that she thought it was not suitable for the first grade and posed the problems by using the book during the practice part of the course. In general, it is seen that the participants found the use of books more suitable for the repetition and reinforcement of a subject taught.

Possible barriers and limitations that may reduce the effectiveness of the integration of children's books in mathematics courses

Most of the participants reported that the integration of children's books in mathematics courses is a very influential method. However, some of them also reported potential barriers and limitations that may reduce the effectiveness of this activity. Table 5 presents the views of the participants about the potential barriers and limitations that may reduce the effectiveness of this integration. The views of the pre-service teachers about this theme were not asked directly. The frequencies are given in Table 5, therefore, contain the views of a limited number of the participants. These views reflect the views of the participants who needed to express their difficulties in this process.

Table 5. Participants' views on potential barriers and limitations

IEWS	Before the implementation f	After the implementation f
1. Teaching and learning process		
Planning the lesson is time-consuming.	-	4
During the lessons, books may be out of the context of mathematics or the topic of the book may be more focused on other issues than mathematics.	-	2
Inadequate understanding of mathematics with the one-book activities (After explaining the subject, it may be more appropriate to use it as additional work.)	3	4
The possibility that course becomes confusing when the appropriate books are not selected	1	-
Boring to read the book as a whole	-	1
2. Book selection		
Shortage of finding qualified books suitable for every subject or learning outcomes in mathematics	10	11
Some sections of the book are appropriate for the acquisition of knowledge and skills, but not all sections	-	2
Lack of the opportunity to search for qualified books suitable for subject or acquisition of knowledge and skills	-	1
The perception that the mathematical aspect of the book is weak as the literary aspect of the book increases.	-	1
High costs of books		1
3. Students		
Students focus on the event flow in the book and ignore the mathematical content	2	
4. Teacher		
Lack of teachers' prior experience and education on the use of children's literature in mathematics teaching	3	2
The effect of the activities depends on the competence of the teacher	1	-

As can be seen in Table 5 the participants have the most difficulty in finding children's books that are proper for the mathematics topics or the mathematics learning outcomes. They also stated that they had significant problems due to the lack of resources to investigate the books that are suitable for the subject or acquisition of mathematical skills. Moreover, the high cost of children's books constitutes another important limitation of the book selection process. The participants are concerned that the literary aspect of the children's books is too emphasized, making the subject of mathematics

to be taught secondary. In general, the participants stated that there was not enough time for the preparation and implementation of children's books and mathematics integration, that it would be boring to read longer children's books, that the student would be distracted from the mathematics subject to be taught, and that there would be limitations in the teaching of a novel mathematics subject. The participant coded P25 reported that the effectiveness of children's literature and mathematics integration depends on whether the mathematical learning outcomes is complex or not and that it may work for some the mathematical learning outcomes, but for the others, it may not be functional. More specifically, it is argued that the use of the children's books may be useful for verbal topics in mathematics courses, but it may not be preferred for the topics involving algorithm and complex gains.

CONCLUSIONS, DISCUSSION, AND SUGGESTIONS

Book selection criteria and the process of book selection

It is found that the pre-service teachers do not know the children's books related to mathematics adequately and that they do not have any knowledge about the content, level, and mathematical content of these books. Although the participants were given a list of children's books related to mathematics, they reported that they had the biggest difficulty in the book selection process. For them, the most important reasons for this difficulty are insufficient information about the book, the children's books which are appropriate age group not involving necessary factors such as not being able to provide detailed information about the mathematical subject. This finding is consistent with the previous studies. Edelman (2017) conducted a study with pre-service teachers and concluded that being aware of children's literature products with a mathematical context or using such products in the classrooms is not an effective method alone, and pre-service teachers have difficulties in book selection and integration process even though they are specifically educated for such an integration. LeSage (2013) emphasizing the importance of teachers' assessment in the use of qualified children's books on counting in mathematics education argued that despite the widespread use of children's books in mathematics teaching, there is no comprehensive assessment scale to guide primary school teachers in defining the quality of these books which is very necessary to have an efficient integration.

One of the selection criteria for mathematics-related children's books is its relevance to mathematical subjects to be taught (van den Heuvel-Panhuizen & Elia, 2012). In this study, it is found that the participants emphasized the significance of the relevance of children's books to mathematical subjects and concepts to be taught. In assessing such relevance, the focus should be on the mathematical content covered in the children's books to assure that the books involve these contents correctly and completely (Hunsader, 2004; Whitin & Whitin, 2004). However, only four of the participants in the current study argued that the children's books to be used in the courses should not contain incomplete or incorrect information and should be free from misconceptions and errors. The participants do not sufficiently emphasize this criterion seems to be an indication that they do not tend to critically look at the mathematical content covered in children's books. This finding is consistent with the previous findings suggesting that the pre-service teachers have incompetence in this regard (Edelman, 2017). Pre-service teachers should be informed about the accuracy, precision, and misconceptions of mathematical knowledge included in children's books. In addition, they should be informed about this issue through book review studies which should be conducted to support their capacity to deal with misconceptions, incomplete, and incorrect information.

Children's books should also provide children with an opportunity for the use of mathematics in real-life situations (van den Heuvel-Panhuizen & Elia, 2012; Whitin & Whitin, 2004). In addition, these books should enable students to relate mathematics with their own experiences, other learning domains, and other mathematical ideas (Hunsader, 2004; Marston, 2010; Schiro, 1997; van den Heuvel-Panhuizen & Elia, 2012). When the criteria list developed the participants for the book selection process was examined, it is found that the criterion to associate mathematics with daily life was not mentioned by any participants before the implementation. However, it was reported by eleven participants following the implementation. This shows that the idea that books can be a tool for

linking mathematics to real-life situations is noticed by very few pre-service teachers after the implementation. Practical examples should be presented to pre-service teachers so that they can relate to real-life situations while teaching mathematics and use the book as a tool for it. None of the pre-service teachers included such a feature in their criteria list in relation to other disciplines and other math subjects when selecting mathematics-related children's books. This finding is consistent with the findings reported in the study by Trakulphadetkrai (2017).

There is no large number of bookstores where pre-service teachers can search for and examine different children's books in the city where their faculty is. Therefore, the participants generally preferred to order children's books online. This situation caused them to buy the book without examining its contents, and when they got the book they ordered, they recognized that it was not suitable for the lesson plan. This situation caused a financial burden and difficulty in terms of time constraints for the participants. Given that these pre-service primary teachers will be possibly assigned to village schools, it is very likely that they will experience similar difficulties in the future (ordering children's books online, financial burden, etc.). For this reason, it is suggested that pre-service teachers should be presented with examples of children's books with mathematical content during their teacher training, and opportunities should be provided for the candidates to examine such books, and to understand which books contain which mathematics subjects, mathematical concepts and appropriate for their future students' age group. The preparation of a list of children's books containing information such as mathematics subject, mathematical concepts, students' age group, and the related learning domains together with pre-service teachers can provide them important resource support when they will start teaching.

Pedagogical effects

The findings of the study indicate that the integration of children's literature in mathematics lessons has many valuable contributions to mathematics in that it makes such courses more interesting, motivating, and arousing curiosity among students. The findings are consistent with the previous findings suggesting that majority of the teachers who employed the children's books in mathematics teaching consider such activity as making mathematics much more interesting and fun (Prendergast et. al. 2018). The participants took a course entitled "Children's Literature" at the second year of the teaching training program. Within the scope of this course, they experienced a teaching process about the general quality of children's literature. However, there is no practical and applied course about how to use the children's books in the mathematics teaching process. It is argued that in teacher education or other professional development programs focusing only on children's literature is not sufficient (Jett, 2018). On the other hand, it is suggested that teachers are expected to include literary texts in mathematics teaching activities (Purdum-Cassidy et. al. 2015). Therefore, practical training and courses should be added to teacher education programs and in-service training in order to increase the awareness of pre-service and in-service teachers about the pedagogical effects of children's literature and mathematics integration on students, and enable them to experience this process.

Pre-service teachers should be offered sample activities that show how the mathematics learning-teaching process integrated with children's literature should be organized to improve students' capacity to make sense of mathematical concepts and their conceptual knowledge. The lesson plans developed by the pre-service teachers should be revised, and the implementation of these revised plans should be observed and examined during the teaching process. Teacher educators should provide pre-service teachers with the necessary support to teach the various ways in which they can relate children's literature to mathematics lessons (Jett, 2018; Rogers et. al. 2015).

Integration process

The findings of the study indicate that the participants generally employ the context of the children's books in mathematics courses. It is observed that the participants benefit from the context

of the books rather than supporting the mathematical process. Because the participants focus on drawing attention based on the hero or event covered in the books. This finding is consistent with the previous findings suggesting that pre-service teachers integrate the children's book in the mathematics teaching process through the use of the context of the books (Rogers et. al., 2015). Although this type of integration is seen as a logical and practical approach to mathematics teaching, pre-service and in-service teachers should understand in many different ways the fact that children's literature is an important instructional strategy. It is suggested that the integration of mathematics with children's literature should also support creativity among students (Welcman-Tischler, 1992). However, none of the participants are found to use the children's books in the mathematics teaching process to improve the students' creativity which is consistent with the previous findings (Rogers et. al. 2015). However, students writing their own mathematical stories is an important approach to develop their creativity which enables them to use mathematical language. Teacher trainers should inform pre-service teachers about the different techniques to relate the children's book with mathematics courses, and pre-service teachers should be given opportunities to experience such an integration which should be followed by discussions about the integration process and implementation.

Potential barriers and limitations

The findings of the study indicate that the participants have the most serious problems in finding quality children's books that are proper for the mathematical topics to be taught or the learning outcomes. Previous findings that are consistent with this finding of the study indicate that both pre-service and in-service teachers have difficulty in finding proper children's books for specific mathematical concepts (Prendergast et. al., 2018). This can be explained by the fact that pre-service and in-service teachers are not aware of those children's books that do not explicitly include mathematical concepts but have the potential to include mathematical concepts in a context (Prendergast et. al., 2018).

The participants stated that they had problems due to the insufficient lesson hours while using children's literature books in mathematics courses. A similar finding is also reported in a previous study (Prendergast et. al., 2018). Time constraint is also experienced by the participants during the book selection process, and as a result, some participants received the book by order although they did not have sufficient information about the content of the books. In addition, if they recognized that the book was ineligible for mathematics teaching, they had to search for it again. Such situations caused time management difficulties both in the book selection process and in the implementation process for the participants. To avoid this problem and make it possible to provide convenience and practical solutions, Turkey-based web pages may be developed to provide them with an opportunity to get information about proper children's books. Besides, collaborating with librarians on the classification of children's books based on their themes and students' age group may facilitate access to mathematical content for students, teachers, and parents (Prendergast et. al. 2018).

Limitations

In this study, the pre-service teachers' views were collected through the open-ended questionnaires. Although it helped to collect more data, the inability to investigate in depth the participants' views and the lack of further research on the emerging themes are among the limitations of the research. In this study, there are no video recordings or observations by the authors about the process of implementing the lesson plans developed by the participants. To eliminate this limitation, the micro-teaching technique can be used in other studies, video recording of the course may be requested, or observations can be made.

REFERENCES

- Alazzi, K. F. (2006). Perceptions of preservice teachers toward children's literature. *Essays in Education, 18*, 1-16.
- Ball, D. L., Thames, M. H., & Phelps, G. (2008). Content knowledge for teaching: what makes it special? *Journal of Teacher Education, 59*(5), 389-407. DOI:10.1177/0022487108324554
- 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*, 29-48.
- Cotti, R. & Schiro, M. (2004). Connecting teacher beliefs to the use of children's literature in the teaching of mathematics. *Journal of Mathematics Teacher Education, 7*, 329-356.
- Dedeoğlu, H., Can, D., & Özer, A. (2018). Eric Carle'in kitaplarının matematiksel kavramlar açısından incelenmesi ve 1. sınıf matematik derslerinde kullanımına yönelik etkinlik tasarımı. 17. Uluslararası Sınıf Öğretmenliği Sempozyumu (USOS 2018). 11-14 Nisan 2018. Ankara.
- Dedeoğlu, H., Özer, A., & Can, D. (2016). Okulöncesine yönelik çocuk kitaplarının matematiksel kavramlar açısından incelenmesi. VIII. Uluslararası Eğitim Araştırmaları Kongresi: 5-8 Mayıs 2016. Çanakkale.
- Dedeoğlu, H., Özer, A., & Can, D. (2018). Matematik öğretiminde çocuk kitaplarının kullanımı ve örnek uygulamalar. 27. Uluslararası Eğitim Bilimleri Kongresi: 18-22 Nisan 2018. Antalya
- Durmaz, B. (2018). Matematik öğretiminde çocuk edebiyatının kullanımı ve örnek uygulamalar (Proje ID:118B153), TÜBİTAK 4005 Bilim ve Toplum Yenilikçi Eğitim Uygulamaları Destekleme Programı kapsamında desteklenen proje, 25 Haziran-2 Temmuz 2018, Antalya.
- Edelman, J. (2017). How preservice teachers use children's literature to teach mathematical concepts: focus on mathematical knowledge for teaching. *International Electronic Journal of Elementary Education, 9*(4), 741-752.
- Hacısalıhoğlu Karadeniz, M. (2016). "Sör Çepçevre'nin Matematik Maceraları" Adlı Masal Kitaplarının Türk Matematik Öğretim Programına Uyumluluğu, International Conference on Education in Mathematics, Science & Technology (ICEMST), pp:1070-1081, ISBN: 978-605-66950-3-2.
- Hacısalıhoğlu Karadeniz, M. (2018). "Kraliçeyi Kurtarmak" adlı hikaye kitabında yer alan bilmecelerin problem çözme stratejileri bağlamında incelenmesi, IV. INES Education and Social Science Conference (ESS) Tam Metin Kitabı, Sayfa 77-89, Çizgi Kitabevi, ISBN: 978-605-196-226-9.
- Harding, J., Hbaci, İ., Loyd, S. & Hamilton, B. (2017). Integrating Multicultural Children's Math Books into Kindergarten Through Sixth-Grade Classrooms: Preservice Teachers' Reflections *the Teacher Educator. 52*(4), 386-407.
- Hunsader, P.D. (2004). Mathematics trade books: Establishing their value and assessing their quality. *The Reading Teacher, 57*(7), 618-629.
- İnal Kızıltepe, G., Öztürk Samur, A., & Tekin H. (2018). Çocuk Kitapları Yoluyla Matematik Becerilerinin Kazandırılmasına Yönelik Yapılmış Araştırmaların İncelenmesi. *Adnan Menderes Üniversitesi Sosyal Bilimler Enstitüsü Dergisi, 5*(1), 106-123.

- Jennings, C. M., Jennings, J.E., Richey, J., & Dixon- Krauss, J. (1992). Increasing interest and achievement in mathematics through children's literature. *Early Childhood Research Quarterly*, 7, 263-267.
- Jett, C. (2018). The Effects of Children's Literature on Preservice Early Childhood Mathematics Teachers' Thinking. *Journal of the Scholarship of Teaching and Learning*, 18(1), 96-114. <https://doi.org/10.14434/josotl.v18i1.20722>
- Kurz, T. L., & Bartholomew, B. (2012). Supporting Math Skills with Children's Stories. *Kappa Delta Pi Record*, 48(4), 184-188.
- LeSage, A. C. (2013). Don't count on the quality of children's counting books. Paper presented at the 57th International Council on Education for Teaching (ICET) World Assembly, 489-496. Bangkok, Thailand.
- Marston, J. (2010). Developing a framework for the selection of picture books to promote early mathematical development. In L. Sparrow, B. Kissane & C. Hurst (Eds.), *Shaping the Future of Mathematics Education: Proceedings of the 33rd Annual Conference of the Mathematics Education Research Group of Australasia Incorporated*, Vol. 2. Fremantle, WA: MERGA, 383-390.
- McAndrew, E. M., Morris, W. L., & Fennell, F. S. (2017). Geometry-Related Children's Literature Improves the Geometry Achievement and Attitudes of Second-Grade Students. *School Science and Mathematics*, 117(1-2), 34-51.
- Moyer, P. (2000). Communicating mathematically: Children's literature as a natural connection. *Reading Teacher*, 54, 246- 255.
- Öçal, T., Öçal, M., & Şimşek, M. (2015). Okulöncesi öğrencilerine uygun hikâye kitaplarında geçen matematiksel kavram ve becerilerin incelenmesi. *Current Research in Education*, 1(2), 58-69.
- Öztürk Samur, A., İnal Kızıltepe, G., & Uyanık, Ö. (2017). Effects of the story-based number program on the development of the number concept of 60-72-month-old children. *The Turkish Online Journal of Educational Technology*, Special Issue for INTE 2017, 1023-1032.
- Prendergast, M., Harbison, L., Miller, S., & Trakulphadetkrai V. N. (2018). Pre-service and in-service teachers' perceptions on the integration of children's literature in mathematics teaching and learning in Ireland. *Irish Educational Studies*, 1-19. DOI:10.1080/03323315.2018.1484302
- Purdum-Cassidy, B., Nesmith, S., Meyer, R. D., & Cooper, S. (2015). What are they asking? An analysis of the questions planned by prospective teachers when integrating literature in mathematics. *Journal of Mathematics Teacher Education*, 18(1), 79-99.
- Rogers, R. M., Cooper, S., Nesmith, S. M., & Purdum-Cassidy, B. (2015). Ways that Preservice Teachers Integrate Children's Literature into Mathematics Lessons, *The Teacher Educator*, 50(3), 170-186, DOI: 10.1080/08878730.2015.1038493.
- Schiro, M. S. (1997). *Integrating children's literature and mathematics in the classroom: Children as meaning makers, problem solvers, and literary critics*. New York: Teachers College Press.
- Shatzer, J. (2008). Picture book power: connecting children's literature and mathematics. *The Reading Teacher*, 61(8), 649-653

- Trakulphadetkrai, N. V. (2017). The Development of the 'English Pre-Service Primary Teachers' Beliefs concerning the Integration of Children's Literature in Mathematics Learning and Teaching' (EPPTB-ICLMLT) Framework: An Exploratory Study.
- Van den Heuvel-Panhuizen, M., & Elia, I. (2012). Developing a framework for the evaluation of picture books that support kindergartners' learning of mathematics. *Research in Mathematics Education*, 14(1), 17–47.
- Van den Heuvel-Panhuizen, M., & Van den Boogaard, S. (2008). Picture books as an impetus for kindergartners' mathematical thinking. *Mathematical Thinking and Learning*, 10, 341-373.
- Van den Heuvel-Panhuizen, M., Elia, I., & Robitzsch, A. (2016). Effects of reading picture books on kindergartners' mathematics performance. *Educational Psychology*, 36(2), 323-346.
- Ward, R. A. (2005). Using children's literature to inspire K–8 preservice teachers' future mathematics pedagogy. *Reading Teacher*, 59(2), 132–143.
- Whitin, D. J. (1992). Exploring estimation through children's literature. *Arithmetic Teacher*, 41(8), 436-441
- Whitin, D. J., & Wilde, S. (1992). Read any good math lately? Children's books for mathematical learning, K–6. Portsmouth, NH: Heinemann.
- Whitin, D. J., & Whitin, P. (2004). *New visions for linking literature and mathematics*. Urbana, IL: National Council of Teachers of English.
- Wilburne, J. M., & Napoli, M. (2008). Connecting mathematics and literature: An analysis of preservice elementary school teachers' changing beliefs and knowledge. *Issues in the Undergraduate Mathematics Preparation of School Teachers*, 2, 1–10.
- Yıldırım, A., & Şimşek, H. (2013). *Sosyal bilimlerde nitel araştırma yöntemleri*. Seçkin Yayıncılık, Ankara.
- 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.