



An Evaluation of the Preservice-Teacher Training for Children's Literature and Mathematics Integration*

Matematik ve Çocuk Edebiyatını Bütünleştirmeye Yönelik Hizmetöncesi Bir Öğretmen Eğitiminin Değerlendirilmesi

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ABSTRACT: This study aims to examine the change in intentions and views about the integration, mathematics teaching self-efficacy, and mathematical literacy self-efficacy after an online education about mathematics and children's literature to pre-service pre-school, primary school, and elementary mathematics teachers. The research participants consisted of fifty-four pre-service teachers who were selected by convenient sampling. A weak experimental pre-test and post-test design without control group was used. The data collection tools were the belief scale for the integration of mathematics, and children's literature, mathematics teaching self-efficacy belief, mathematics literacy self-efficacy scales and an open-ended question. The study findings revealed that the training enabled the pre-service teachers to gain positive inputs within the context of all the variables. Besides, the pre-service teachers' scores varied across their branches. A significant difference was identified between pre-service elementary mathematics teachers, and primary school and pre-school teachers in terms of the difference scores on intentions about integration. There are statistical differences between mathematics teaching self-efficacy and mathematical literacy self-efficacy pre-test and post-test scores. For further studies, various studies such as face-to-face, experimental studies on a single branch basis, may be conducted to examine the changes in beliefs and competences of pre-service teachers about mathematics and children's literature integration.

Keywords: Beliefs, children's literature, mathematics education, teacher training.

ÖZ: Bu çalışmada okul öncesi, sınıf ve ilköğretim matematik öğretmen adaylarına verilen matematik öğretimi ve çocuk edebiyatı bütünleştirmesine yönelik bir çevrimiçi eğitim sonrasında öğretmen adaylarının bütünleştirme niyetleri ile görüşlerinde, matematik öğretimi özyeterliklerinde ve matematiksel okuryazarlık özyeterliklerinde meydana gelen değişimin incelenmesi amaçlanmıştır. Araştırmanın katılımcıları uygun örnekleme ile belirlenen 54 öğretmen adaydır. Araştırmanın deseni ön test son test kontrol grupsuz zayıf deneysel desendir. Veri toplama araçları matematik öğretimi ve çocuk edebiyatı bütünleştirmesine yönelik inanç, matematik öğretimi özyeterlik inanç ile matematik okuryazarlığı özyeterlik ölçekleri ve açık uçlu bir sorudur. Bulgulara göre verilen eğitim, öğretmen adaylarının araştırma kapsamında incelenen tüm değişkenler bağlamında olumlu yönde kazanımlar elde etmelerini sağlamıştır. Ayrıca öğretmen adaylarının ölçeklerden elde ettikleri fark puanlarının alanlara göre değişiklik gösterdiği görülmüştür. Buna göre ilköğretim matematik öğretmeni adaylarının bütünleştirme niyetine ilişkin inançlarının sınıf ve okul öncesi öğretmeni adayları ile istatistiksel olarak anlamlı bir farklılık gösterdiği belirlenmiştir. Matematik öğretimi özyeterliği ile matematiksel okuryazarlık özyeterliği ölçeklerinden elde edilen ön test son test puanları arasında istatistiksel olarak anlamlı bir farklılık bulunmuştur. İleride yapılacak araştırmalar için daha uzun süreye yayılmış bir eğitimle, tek bir alan bazında, yüz yüze ve tam deneysel çalışmaların gerçekleştirilmesi ve öğretmen adaylarının matematik ve çocuk edebiyatını bütünleştirmeye yönelik inançları ile yeterliklerinde meydana gelen değişimin incelenmesi önerilebilir.

Anahtar kelimeler: Çocuk edebiyatı, inançlar, matematik eğitimi, öğretmen eğitimi.

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The integration of children's literature and mathematics is an approach in which literary products are used in mathematics teaching (Forbringer, 2004). This approach allows considering individual differences in mathematics teaching by using children's books (Forbringer et al., 2016). Considered as teaching mathematics through children's books in the relevant literature, this approach benefits teachers and students in various ways (Edelman et al., 2019; Ginsburg & Uschianowski, 2017; Jett, 2018; Young & Marroquin, 2006). The integration of mathematics teaching and children's literature contributes to the connection of mathematical concepts with each other and with daily life (Columba et al., 2005), the introduction of mathematical concepts (Wallace et al., 2006), the concretization of abstract concepts (Barone, 2011), the development of mathematical language (Hassinger-Das et al., 2015), relieving mathematics anxiety through methods such as bibliotherapy (Furner, 2018; Green, 2013), increasing students' interest in mathematics (Luedtke & Sorvaag, 2018), changing the students' attitudes positively (Mink & Fraser, 2005), presenting a natural context for mathematical language (McDuffie & Young, 2003), developing problem-solving skills (Cankoy, 2011), differentiating teaching depending on students' needs (Forbringer, 2004; Forbringer et al., 2016), diagnosing and eliminating misconceptions (Courtade et al., 2013; Skoumpourdi & Mpakopoulou, 2011), and increasing academic achievement (Capraro & Capraro, 2006; Lemonidis & Kaiafa, 2019).

Along with all its contributions, how this integration is made, which can be used as a rich teaching approach in mathematics classes, affects the learning outcomes in various aspects. All the actions such as the selection of appropriate books and the ways of integration along with personal characteristics of the practitioners who are eager to integrating their lessons with children's literature play a decisive role in this (Durmaz et al., 2022). Therefore, one of the remarkable issues influencing the quality of the integration process is the practitioner's intentions which are shaped by their beliefs about applying the integration in the classroom. As in many other behaviors, teachers' beliefs are also effective in their behaviors to transform their content knowledge into teaching (Ajzen, 2020; Kutaka et al., 2018). That is also the case for the integration of children's literature in mathematics teaching. Therefore, practitioners' beliefs about integration affect not only their instructional decisions (Staub & Stern, 2002) but also the frequency and manner of transferring this practice to their classrooms (Edelman, 2017). While this situation is a facilitator for the benefits and gains that can be obtained from the integration process, it sometimes becomes much more difficult (Prendergast et al., 2019).

Literature Review

Children's Literature and Mathematics Integration

The idea of integrating mathematics lessons with stories or children's books, which is becoming increasingly significant in mathematics education, is not a new practice (Koellner et al., 2009). However, the related literature indicates that it is still unlikely to draw the definite boundaries of a good integration (Luedtke & Sorvaag, 2018). One of the most crucial issues for the integrated courses to reach their purpose is the quality and appropriateness of the selected books. Because an unqualified book containing mistakes or misconceptions may harm students in numerous ways (Columba

et al., 2005; Flevares & Schiff, 2014; Nurnberger-Haag, 2017). However, choosing a high-quality book does not always warrant a perfect integration process (Edelman, 2017; Flevares & Schiff, 2014). Therefore, what the practitioners do in the process is as critical as the books chosen for integration in achieving the purpose of integration and being effective for instruction (Edelman, 2017). Hence, teacher competences have a key role in this process.

The related literature has discussed various ways of integrating mathematics teaching and children's literature. Some are mentioned as follows: providing meaningful contexts for learning mathematics, modeling mathematical experiences, creating problems, introducing materials related to the book, preparing or developing the teaching of a mathematical concept or skill, measurement, and evaluation, and showing the use of mathematics in different fields and daily life as well as introducing mathematical words to students (Hong, 1996; Welchman-Tischler, 1992). Integrating mathematics with children's literature has some benefits for mathematics education, such as mathematics and geometry success (Capraro & Capraro, 2006; Durmaz & Miçooğulları, 2021; Lemonidis & Kaiafa, 2019), motivation and attitudes (Mink & Fraser, 2005; Munro, 2013), and mathematics anxiety (Green, 2013).

Even though its benefits, the studies conducted with teachers pointed out that teachers rarely considered practices such as writing students' own mathematical stories in collaboration with role-playing or games, with hands-on or outdoor activities that can be used in addition to these integration ways (Larkin & Trakulphadetkrai, 2019). Regrettably, both pre-service and in-service teachers make use of integration superficially. To exemplify, pre-service teachers benefit from integration as reinforcement, while teachers for the introduction or evaluation part of the lesson (Can et al., 2020; Rogers et al., 2015). Such practices, conducted without aligning the entire course, can be considered ineffective integration (Rogers et al., 2015). Another ineffective practice is focusing on the subject rather than the quality of the books during the integration process, which is frequently encountered (Can et al., 2020; Cooper et al., 2020). Besides, both pre-service and in-service teachers attached less importance to the contributions of integration in terms of the cognitive domain by prioritizing the affective domain; moreover, they indicated that this practice is more suitable for younger children and basic mathematical skills (Farrugia & Trakulphadetkrai, 2020; Larkin & Trakulphadetkrai, 2019). Such erroneous thoughts or beliefs may dwindle the potential contribution of integration and integration intentions. Because both pre-service and in-service teachers are concerned about the possibility of moving away from the focus of the mathematics course in integrated courses where mathematics and literature are integrated (Durmaz, 2018; Prendergast et al., 2019) even though they have positive views on integration, which will increase students' interest, motivation, etc. (Can & Durmaz, 2022; Can et al., 2020). Therefore, the study results addressing these points also ensure to understand the beliefs behind the actions/intentions of teachers as the tasks presented in the instructional processes are influenced by the teacher's knowledge, attitudes, beliefs, goals, aims, and obstacles related to these tasks (Sullivan et al., 2012).

Similar (Sullivan et al., 2012), studies confirmed that although teachers believe in the positive contributions of integrating children's literature in mathematics teaching, they do not use it in their classes too much (Farrugia & Trakulphadetkrai, 2020). The role of the beliefs is considered significant among the various factors that lead to the

emergence of this situation and the intentions of integration. The studies analyzed the underlying factors behind the behaviors of in-service or pre-service teachers for integrating literature in mathematics lessons within the context of Theory of Planned Behavior (Ajzen, 2020; Farrugia & Trakulphadetkrai, 2020; Larkin & Trakulphadetkrai, 2019; Prendergast et al., 2019).

Theoretical Background

Theory of Planned Behavior (TPB)

For investigating behaviors there are some useful theoretical frameworks. One of them, which is especially practical and important for examining teacher behaviors, is the theory of planned behavior (Dunn et al., 2018). This theory was used so many times to explain teacher intentions about children's literature and mathematics integration in the literature (ex. Can & Durmaz, 2022; Farrugia & Trakulphadetkrai, 2020; Yang et al., 2021). To this theory, teachers' behavioral intentions are shaped by attitudes towards the behaviors, subjective norms about these behaviors, and perceived behavioral control (Ajzen, 2020). According to this theory, there is a strong relation between intention and the behavior.

The perceived barriers to the integration of children's literature in mathematics teaching mentioned within the framework of TPB were classified as attitude towards behavior, social norms, and perceived behavioral control. These barriers preventing teachers from the integration are the selection of appropriate books for the integration process, the teaching methods, the lack of sufficient books for each grade and mathematics skill, the hesitation to break away from the focus of mathematics lessons, and the possibility of hindering students from discovering mathematics on their own (Whitin, 2002). Teachers' misconception about the suitability of this integration for younger children and basic mathematical concepts is an example of their attitudes towards integration. However, this practice is an effective way for teaching levels except the pre-school period and for teaching complex concepts, and even for students of all ages and grades, including those with reading and comprehension difficulties (Ibarra et al., 2019; Miller, 1998; Moore, 2008; Movshovitz-Hadar & Shriki, 2009). The perceived barrier in terms of social norms is that teachers' attempt to integrate children's literature into mathematics teaching might not be received positively by parents or the school's senior administration (Farrugia & Trakulphadetkrai, 2020). This may negatively affect teachers' intention to perform the behavior. Barriers in terms of perceived behavioral control are the limited time for integration, anxiety about keeping up with the curriculum, a lot of time to prepare and implement lesson plans, and the feeling of inadequacy in pedagogical knowledge and confidence. Many issues within the scope of the perceived behavioral control also play a key role in teachers' acquisition of a new skill or incorporating any innovative approach in their classrooms (Smith et al., 2016; Xie & Cai, 2021) because teachers need to overcome the barriers of accessing to resources and developing appropriate beliefs (Smith et al., 2016). When evaluated in terms of access to resources, which also refers to access to information, teachers believe that their awareness, experience, and knowledge about children's literature required for integration is insufficient (Farrugia & Trakulphadetkrai, 2020;

Trakulphadetkrai, 2017). Such thoughts and beliefs may cause teachers to be ambiguous about integrating literature in their mathematics classrooms.

Perceived enablers of the integration process are examined under the categories of attitude towards behavior, subjective norms, and perceived behavioral control. Teachers' views on integration are mostly focused on its affective contributions in terms of attitude towards behavior. Subjective norms include teachers' expectations that they are validated for integrating practices. On the other hand, perceived behavioral control defines teachers' intentions to receive training on integrating children's literature in mathematics teaching (Farrugia & Trakulphadetkrai, 2020). As seen from the theory and the literature, teacher competences are also important for effective mathematics and children's literature integration.

Teacher Competences

Like all approaches, teachers need to have some competences in the content area to teach effectively. From this point of view, Edelman (2017) examined pre-service teachers' practices for the integration of mathematics teaching and children's literature and presented a competency framework. The factors influencing the integration process are explained within the context of pedagogical content knowledge. Accordingly, knowledge of content and student refers to skills such as being able to listen to student responses and being aware of misconceptions; knowledge of content and teaching indicates such skills as knowing how teaching can be planned; knowledge of content and curriculum includes the ability to critically analyze lesson plans and literary texts. With this framework, Edelman (2017) drew attention to the fact that no matter how qualified books are chosen for the integration of children's literature in mathematics teaching, they cannot save the process alone if the teacher's content knowledge is insufficient. Studies conducted in the context of competences revealed that both in-service and pre-service teachers used integration as an introductory activity to attract more attention, so they need more practice and guidance on different and rich ways of integration (Can et al., 2020; Edelman, 2017; Edelman et al., 2019; Farrugia & Trakulphadetkrai, 2020; Rogers et al., 2015). Thus, it is recommended to model different ways of integration in teacher education programs, to conduct discussions on them, and offer the opportunity to observe an integrated mathematics lesson by asking pre-service teachers to prepare lesson plans in which they use different ways of integration (Rogers et al., 2015). For this reason, it is important for both pre-service and in-service teachers to facilitate the integration of children's literature in mathematics lessons (Prendergast et al., 2019). In this study, the online training content is shaped according to this framework and TPB components. Also, teachers' awareness levels about mathematics content in the children's books and the ability to find mathematics in the context are also important for the sake of this integration. So, it is thought that pre-service teachers' mathematics teaching self-efficacy and mathematics literacy self-efficacy may be developed through the training because they would attend a training which is focused on these competences about integration.

Mathematics Teaching Self-Efficacy

A strong self-efficacy supports teachers in overcoming difficulties they face (Smith, 1996). While integrating mathematics and children's literature, teachers face a lot of problems such as finding appropriate books, support from school administration

and parents, etc. (Prendergast et al., 2019). In the literature, there are many studies about teacher beliefs and self-efficacy (Sezgin-Memnun & Katrancı, 2012; Zehir et al., 2019). These are focused especially on the related variables with self-efficacy and are designed as a survey model. The literature shows that integrated lessons support not only students but also teachers. Studies revealed that teachers' self-efficacy towards mathematics increases by virtue of integrated mathematics lessons, they are motivated to use innovative approaches to mathematics lessons, and their mathematics teaching anxiety decreases (Ginsburg & Uscianowski, 2017; Jett, 2018). But it is not very clear that an integration focused instruction's effect on pre-service teachers' mathematics teaching self-efficacy. So, in this study, one of the variables is mathematics teaching self-efficacy because teacher competences play a crucial role in mathematics and children's literature integration and behavior intentions.

Mathematics Literacy Self-Efficacy

Mathematics literacy self-efficacy and mathematics teaching self-efficacy have a mixed relation with each other (Dinçer et al., 2016; Karalı, 2022). Some studies show that teachers' mathematics literacy self-efficacy affects mathematics teaching self-efficacy (Karaklı, 2022). Like mathematics teaching self-efficacy, research on mathematics literacy self-efficacy is mostly designed as a survey method and conducted with teachers (ex. Usta et al., 2019). But this variable may also affect the pre-service teachers' integration intentions because it is aligned with teacher competences such as seeing the world with mathematical eyes. Pre-service and in-service teachers need to be good at finding high-quality books and mathematics content in the books etc. These kinds of competences are related to mathematics literacy and mathematics literacy self-efficacy. If pre-service teachers feel that they are enough to teach effectively and find good books for teaching mathematics, then they may utilize this integration. That is why these three variables are taken into consideration together in this work.

Aim and Significance of the Study

Studies showed that both pre-service and in-service teachers faced some barriers in integrating mathematics and literature. The barriers and the beliefs about these barriers affect the intentions of the individual to perform the relevant behavior about this integration (Ajzen, 2020). Therefore, it is of utmost importance to understand the pre-service and in-service teachers' beliefs as intentions' function to ensure their professional development (Qhobela & Moru, 2014). It is also known that teachers' beliefs about teaching might be changed through professionally designed training (Lane & Ríordáin, 2020). Besides, pre-service and in-service teachers encounter similar difficulties in terms of barriers to this integration (Can & Durmaz, 2022; Can et al., 2020; Prendergast et al., 2019), and the development of practitioner competencies regarding integration has become increasingly popular in recent years (Edelman et al., 2019). Upon analyzing the relevant literature, studies mostly focus on the views regarding the integration process, the analysis of the integrated lesson plans prepared without any training, or the effect of the pre-service education integrated into the method lessons of early childhood educators (Can & Durmaz, 2022; Can et al., 2020; Edelman, 2017; Prendergast et al., 2019; Trakulphadetkrai, 2017). No analysis was conducted regarding the change in the variables related to the practitioners' beliefs and

intentions towards integrating mathematics teaching and children's literature after any training. In addition to this, some of the competences of teachers' such as mathematics teaching self-efficacy and mathematics literacy self-efficacy, play a key role in the quality of this integration process. Because teachers need not only intentions but also necessary skills. The relevant studies unveiled those in-service and pre-service teachers gained favor from trainings on integration and would use this practice in their lessons (Edelman, 2017; Mink & Fraser, 2005). But in the literature, these characteristics of the teachers are not investigated together. Also, unlike other studies, this study was conducted with pre-service teachers who would work not only at the early childhood period but also at the middle school level, and a shorter, economical, and online education was carried out rather than covering a whole academic term. Hence, the change in the beliefs and intentions about the integration of pre-service and in-service teachers directly or indirectly related to the integration of children's literature in mathematics teaching will be examined within the context of training on integration practices. Thus, the research question was, "How does online training on the integration of children's literature in mathematics teaching influence the pre-service pre-school, primary and elementary mathematics teachers' beliefs and intentions about integration?." The sub-problems of the study are as follows;

1. What is the change in the pre-school, primary and elementary mathematics pre-service teachers' beliefs/intentions towards the integration of children's literature in mathematics teaching?
2. Does the change in the pre-school, primary, and elementary mathematics pre-service teachers' beliefs/intentions differ across their branches and sub-factors of the belief scale for the integration of mathematics teaching and children's literature?
3. What is the change in the pre-school, primary and elementary mathematics pre-service teachers' mathematics teaching efficacy levels?
4. What is the change in the pre-school, primary and elementary mathematics pre-service teachers' mathematics literacy self-efficacy levels?
5. What is the change in pre-service teachers' views about the advantages and disadvantages of children's literature and mathematics education integration after the instruction?

Method

This section includes information regarding the research design, the participants of the research, data collection tools, and data analysis.

Research Design

This study attempts to analyze the change in the beliefs namely intentions of the senior pre-service teachers receiving preschool, primary and elementary education related to the integration of mathematics teaching and children's literature at the end of an online training on the integration of children's literature in mathematics teaching. Therefore, the study used a weak experimental pretest-posttest design without a control group to test the effect of the training on the variables examined within the scope of the research. Experimental research is used to reveal the effect of a certain intervention process in solving a problem under controlled conditions within a systematic

methodology (Cohen et al., 2018; Fraenkel et al., 2012; Özmen, 2019). However, a weak experimental design was used in the present study since the criteria such as the presence of a control group required by the full experimental design, and random sampling cannot be provided (Fraenkel et al., 2012; Gopalan et al., 2020).

Participants of the Study

The study was conducted with the senior pre-service teachers who received preschool, primary, and elementary mathematics education in undergraduate programs throughout Turkey and who voluntarily applied for an online education on the integration of children's literature in mathematics teaching. The application form and information about training were shared with all universities via official letters and various social media accounts. All the participants attended all the classes and the participants' eagerness to learn a novel approach was important through the process. This may cause the selection bias and could be prevented by considering intent to treatment. Some criteria were used in the selection of the participants for the training. These were to be an active student in the relevant undergraduate programs, to be successful in the courses related to mathematics education, to have a GPA of 3.00 or above, and to have completed the third grade courses and moved up the 4th grade at the university. Those who studied at different universities and who met these criteria were chosen with great care.

The study was carried out with a total of 54 pre-service teachers, 17 of whom were in pre-school, 19 in primary education, and 18 in elementary mathematics education. Convenient sampling was used to determine the participants (Cohen et al., 2018; Etikan et al., 2016; Patton, 2014). This method is especially useful when the researcher has limited resources, time and workforce (Etikan et al., 2016; Patton, 2014). According to the criteria and the focus of the study, the participants were selected among those who would teach from pre-school to elementary (K-8 grades) level. Because both pre-service and in-service teachers have a general misconception that teaching mathematics with children's books is more suitable for younger students. So, this instruction was seen as an opportunity to reduce this misconception. Therefore, one of the objectives of this study is to make pre-service teachers realize that integration is an appropriate instructional approach for all age groups when planned correctly and effectively (Trakulphadetkrai, 2017).

Data Collection Tools

The study deployed four different data collection tools to examine the change in the pre-service teachers' beliefs, intentions, and views related to the integration of children's literature in mathematics teaching with the knowledge and experience they gained from the training they attended. Each data collection tool is explained as follows.

Belief Scale for the Integration of Children's Literature in Mathematics Teaching

"The Belief Scale for the Integration of Children's Literature in Mathematics Teaching" was developed Can and Durmaz (2022). The tool is a 5-point Likert type and includes four factors and 33 items. The factors were identified as (i) positive pedagogical effects of integrating children's literature in mathematics teaching; (ii) the

role of resources influencing the integration process; (iii) teacher competencies complicating the integration process and social norms and (iv) teacher competencies facilitating the integration process. One of the items in the scale is as follows: *“I don’t think there are enough books to support mathematics lessons.”* The measurement reliability of the data obtained from this scale was calculated as .794 for the pre-test and .855 for the post-test. In addition to this, the subfactors’ reliabilities are as follows .899 for factor 1; .659 for factor 2; .648 for factor 3; and .727 for 4. So, the Cronbach Alpha reliability coefficients are at a sufficient level (Can, 2020; Field, 2018; Pallant, 2020).

Mathematics Teaching Self-Efficacy Belief Scale

The second data collection tool of the study was the “Mathematics Teaching Self-Efficacy Belief Scale,” which was adapted into Turkish by Hacıömeroğlu and Taşkın (2010). Although the adaptation of the scale was made especially for primary teachers, many studies indicated that it is a valid and reliable tool for elementary mathematics teachers, preschool teachers, and pre-service teachers (Ex. Zehir et al., 2019). Being a 5-point Likert type, the scale consists of twenty-one items and three factors: personal efficacy, the role of the teacher in effective teaching, and performance related to teaching. One of the items in the scale is as follows: *“When a student does better than usual in mathematics, it is often because the teacher exerted a little extra effort.”* The measurement reliability of the data obtained from this scale was determined as .854 for the pre-test and .773 for the post-test. In addition to this, the subfactors’ reliabilities are as follows .750 for factor 1; .866 for factor 2; and .575 for 3. So, the Cronbach Alpha reliability coefficients are at a sufficient level (Can, 2020; Field, 2018; Pallant, 2020).

Mathematics Literacy Self-Efficacy Scale

The last scale was the “Mathematics Literacy Self-Efficacy Scale” developed by Özgen and Bindak (2008), which contains items that may be paramount during the integration of children’s literature in mathematics teaching. One of the items in the scale, composed of twenty-five items and a single factor, is as follows: *“I can use mathematical language in the expression of mathematical thoughts.”* The measurement reliability of the data was identified as .966 for the pre-test and .965 for the post-test. So, the Cronbach Alpha reliability coefficients are at a sufficient level (Can, 2020; Field, 2018; Pallant, 2020).

Open Ended Question

An open-ended question was used to examine the change in pre-service teachers’ views on integrating children’s literature and mathematics teaching after instruction. The question on the form is: *“What are the changes in your views on the advantages and disadvantages of integrating children’s literature with mathematics education? Please clarify your answer.”* This form aims to support the data obtained through the scales because it is thought that it’s very difficult to make changes in beliefs and intentions in a short-term instruction.

The Course Structure

The participants were provided online training for 6 hours per day for six days. The training content was planned to be 45 minutes for each session based on the data

obtained from the researcher's previous studies and teacher training as well as the studies on the relevant subject (Can et al., 2020; Durmaz, 2018, 2019; Rogers et al., 2015). The researcher investigated children's literature course content, serving only early childhood and primary education graduate programs, and examined the relevant studies (Prendergast et al., 2019; Rogers et al., 2015, Purdum-Cassidy et al., 2015) which are focused on teacher education about the integration of children's literature and mathematics education. Most of the sessions were 45 minutes long each and structured as the I Do-We Do-You Do approach. So firstly, the theoretical lecture (10-15 minutes) was made and then applications on mathematics education of the content was provided. The first day's sessions were mostly theoretical. Table 1 depicts the sessions of the training.

Table 1

The Sessions of the Training

First Day	<ol style="list-style-type: none"> 1. Informing the Participants about the Training Content and Program 2. The Relationship Between Children's Literature and Education 3. Rationale for Integrating Mathematics Teaching and Children's Literature 4. Pre-School Curriculum and Children's Literature 5. Primary and Elementary Mathematics Curriculum and Children's Literature 6. Completion of Evaluation and Learning Logs
Second Day	<ol style="list-style-type: none"> 1. Book Selection Criteria and Ways of Integration 2. During and After Activities of Interactive Read Aloud I 3. During and After Activities of Interactive Read Aloud II 4. Questioning Methods 5. From Stories to Games from Games to Stories 6. Completion of Evaluation and Learning Logs
Third Day	<ol style="list-style-type: none"> 1. Writing in Mathematics Teaching 2. Digital Storytelling Tools 3. Writing Math Poems 4. Problem Solving and Posing 5. Children's Literature, Multiculturalism and Values Education 6. Completion of Evaluation and Learning Logs
Fourth Day	<ol style="list-style-type: none"> 1. Math Anxiety and Bibliotherapy 2. Mathematics through Books with Family Participation 3. Mathematical Talk and Number Sense 4. A Journey to the Cultural History of Mathematics with Books 5. One Book Doesn't Fit All: Creating Activities Suitable for Student Level I (Focused on Slow Learners) 6. Completion of Evaluation and Learning Logs
Fifth Day	<ol style="list-style-type: none"> 1. One Book Doesn't Fit All: Preparing Activities Suitable for Student Level II (Focused on Fast Learners) 2. Numbers and Operations with Children's Books 3. Patterns and Algebra with Children's Books 4. Geometry and Measurement with Children's Books

	5. Data Analysis and Probability with Children's Books
	6. Completion of Evaluation and Learning Logs
Sixth Day	1. Evaluation of Digital Stories with Mathematical Context I
	2. Evaluation of Digital Stories with Mathematical Context II
	3. Evaluation of Integrated Lesson Plans I
	4. Evaluation of Integrated Lesson Plans II
	5. Evaluation of Developed Games and Stories
	6. Completion of Training and Final Evaluations (Performing Post-Tests)

Table 1 displays that the training included various contents associated with children's literature and mathematics teaching. The workflow for each day was briefly explained.

On the first day, the participants were presented information to build the theoretical framework of the integration process regarding how to use children's literature in educational areas except for mathematics; the reasons for integrating mathematics teaching and children's literature; how the learning outcomes of mathematics lessons might be connected with children's literature for the students from pre-school to the 8th grade.

On the second day, the selection criteria of the books, which significantly affected the quality of the integration process, how the books were classified according to their mathematical context and how integration could be made according to this classification were mentioned. On the same day, practical studies were conducted about when and how the questions should be asked by using the interactive read aloud process, which is a functional technique to make the integration throughout the whole class. Finally, the evaluation process was initiated by giving practical examples about the gamification of the story in the book or the storytelling of the games, one of the ways of integration in the related literature (Cutler et al., 2003).

On the third day, studies that would contribute to the creation of mathematical stories by the teachers or students as an alternative solution to the problem of finding suitable books for the purpose (Prendergast et al., 2019), which is a subject that pre-service and in-service teachers often have troubles in the integration process, were discussed. In this regard, poetry writing, which is more unusual than mathematical writing, digital storytelling tools, and other literary genres for mathematics lessons, was included in the training. On the same day, a problem solving and posing session was held as an example of using children's literary products as a useful source of problem solving and posing and allowing them to be connected with daily life (Welchman-Tischler, 1992). Lastly, a session was held on the potential of children's literature for a multicultural and values-based teaching in mathematics lessons.

The fourth day of the training included developmental bibliotherapy applications that teachers could use to relieve mathematics anxiety, studies that families can do to support students' mathematical development, number sense and math talk to support the use of mathematical language, the use of books related to the history of mathematics both to help students value mathematics and to teach mathematics, and finally, adaptation studies on the integration process for students with mathematical learning difficulties or slow learners.

The fifth day covered applied studies on the use of children's literature in the teaching of mathematics lessons, including all content areas in the curriculum such as Numbers and Operations; Patterns and Algebra; Geometry and Measurement, Data Analysis and Probability from pre-school to the 8th grade and integrated lesson plan samples in connection with the content standards defined by the National Council of Mathematics Teachers [NCTM] (2000) for the mathematics course after the adaptations that could be made in the integration process for gifted or advanced/fast learners.

On the sixth day, time was allocated to evaluate the integrated lesson plans prepared by the pre-service teachers in line with the training they received, digital stories with a mathematical context, and the games they developed depending on the book they chose for the integration process, and trainers and other pre-service teachers gave the pre-service teachers feedback.

Each session included scientific studies conducted with the pre-service and in-service teachers in the literature, the characteristics of the lessons integrated with children's literature based upon practical/wise knowledge and experience. Teacher education programs for the integration of mathematics teaching and children's literature recommend to model and discuss different ways of integration, and to offer the opportunity to observe an integrated mathematics lesson by asking pre-service teachers to prepare lesson plans in which they experience different ways of integration (Harding et al., 2017). All studies were conducted within the scope of this study except for the observation of a real class in which the integration was applied. Each session was conducted by expert instructors having academic studies and publications in that field, namely, the pre-service teachers received training from those who train teachers for different education levels. This provides them insight on how to use and adapt the content for different grade levels. These sessions presented information about why and how mathematics teaching and children's literature should be integrated. Besides, pre-service teachers were given the opportunity to experience what problems they might encounter during the integration process and how they could overcome them as they were asked to prepare an integrated lesson plan within the scope of the training. In the evaluation sessions held at the end of each day, the participants were asked to write a reflection based on the Know-Wonder-Learn (KWL) strategy that could also be used in the integration of mathematics teaching and children's literature. Thus, necessary arrangements could be made for the following sessions and the progress of the pre-service teachers could be followed individually day by day.

Data Analysis Procedure

Before the data analysis, negative items in data collection tools were coded in reverse. The data was collected through Google Forms, and answering all items was made mandatory for the pre-service teachers thanks to a feature offered by Google Forms. Because of this feature, pre-service teachers could not skip any question without an answer. Therefore, there is no missing data in the research. Then the researcher examined the distribution of the data within Kolmogorov Smirnov and Shapiro Wilk tests. After the normality tests, Cronbach Alpha reliability coefficients of each scale and sub-factors were calculated. In line with the results of the analysis to test the normality and reliability tests, it was decided which parametric or non-parametric tests would be applied. Then hypothesis tests were performed to answer research problems by

examining assumptions. For this purpose, the scores obtained from the scales were compared with the pre-test and post-test measurements. To compare the two measurements, paired-samples t-test (to identify the effect of the training on mathematics teaching and children's literature integration belief/intention and mathematics literacy self-efficacy), one-way analysis of variance from parametric tests (to examine if there is a difference between scores mathematics teaching and children's literature integration beliefs/intentions according to branches of pre-service teachers), Wilcoxon Signed Ranks (to examine if there is difference between sub-factor scores mathematics teaching and children's literature integration beliefs scale and mathematics teaching self-efficacy according to branches of pre-service teachers), and Kruskal-Wallis from non-parametric tests (to examine difference scores according to branches of pre-service teachers) were used. Other details about the scales and analysis details were given in the results section.

In the analysis of the data obtained through the open-ended question, descriptive analysis and content analysis were used. The data obtained from the pre-service teachers were expressed with themes, codes, and direct quotations about the opinions of the pre-service teachers were included. While presenting the quotations of the pre-service teachers, codes such as PT1, PT2, ..., and PT54 were used for each pre-service teacher. After the data were coded independently by two researchers (the author and another researcher who is an expert in the mathematics education field), a third researcher (a researcher who is an expert in mathematics education and qualitative research approach) was asked to encode 30% of the data to increase the reliability of the data analysis process. Disagreements have also been resolved to ensure consistency between the codes made by the researchers. In case of the author's researcher bias as an instructor in the course, the author asked another researcher who was not in the training or the project team to re-analyze and compare the results of the study.

Ethical Procedures

In this study, the rules specified in the "Higher Education Institutions Scientific Research and Publication Ethics Directive" were followed during the research process; None of the actions specified under the title of "Actions Contrary to Scientific Research and Publication Ethics" were carried out. All necessary permissions were obtained Süleyman Demirel University Social and Human Sciences Ethics Committee with the ethical permission dated 05/24/2021 and 56/4 certificate issue number. All participants were informed about the study and were included in the study on voluntary basis.

Results

The analyzes made based on each data collection tool are presented in order. The normality of the distribution of the pre-test and post-test difference scores was initially examined to identify the tests to be used during data analysis (Can, 2020).

The Integration Intentions and Views About Mathematics Teaching and Children's Literature

The paired samples t-test was used to test the effect of the training as the difference scores obtained from the Belief Scale for the Integration of Mathematics Teaching and Children's Literature demonstrated normal distribution ($K-S_{diff,mclib}=.095$ and $p=.200>.05$). The normality of difference scores of the scale was investigated

because pre-test and post-test scores were not distributed normally, but this is not a problem when the number of participants is above 30 for using the paired samples t test. To overcome this problem, difference scores could be used for the analysis (Green & Salkind, 2005).

Table 2

Paired Samples t-Test Results Related To The Difference Scores Of MTCLIBS

	\bar{X}	<i>N</i>	<i>SD</i>	<i>df</i>	<i>t</i>	<i>p</i>
Pre-test	118.6852	54	8.55575	53	-2.910	.005
Post-test	125.2593	54	14.21823			

Table 2 reveals a significant difference across the pre-service teachers' scores regarding the belief scale for the integration of mathematics teaching and children's literature in favor of post-test [$t_{(53)}=-2.910$, $p<.01$]. The effect size ($d=.40$) indicates that this difference is at a low level (Can, 2020; Field, 2018; Pallant, 2020). The low level of effect may arise from the fact that the training takes place online and in a short period of time. To determine whether the pre-service teachers' scores differed across their branches, the data distribution was firstly tested. One-way analysis of variance was used during data analysis since the distribution of difference scores was normal ($S-W_{diff.mtclibsem}=.971$ and $p=.811>.05$; $S-W_{diff.mtclibsp}=.943$ and $p=.351>.05$; $S-W_{diff.mtclibsce}=.951$ and $p=.404>.05$) the assumption of the homogeneity of variance is met because Levene test result is .041 and $p=.960>.05$. Table 3 displays the results of one-way analysis of variance.

Table 3

One-Way Analysis Of Variance Results

Source of Variance	Sum of Squares	<i>df</i>	Mean of Squares	<i>F</i>	<i>p</i>	Sig. Difference
Between Groups	5897.203	2	2948.602	17.269	<.001	EM-Pre
Within Groups	8708.001	51	170.745			EM-PriE
Total	14605.204	53				

One-way analysis of variance conducted to determine whether the pre-service teachers' difference scores obtained from training on the integration of children's literature in mathematics teaching varied across their branches suggested a statistically significant difference in terms of difference scores [$F_{(2,51)}=17.269$, $p<.01$]. The calculated effect size ($\eta^2=.403>.14$) shows that this difference has a large effect size (Büyüköztürk, 2020; Pallant, 2020). As a result of the Tukey multiple comparison test, which was conducted to analyze which branches led to a statistical difference across the scores, a significant difference was identified between the pre-service elementary mathematics and pre-school teachers; and pre-service elementary mathematics and

primary education teachers. The relevant literature reported that in-service and pre-service teachers believed that the integration of mathematics teaching and children's literature was a more suitable approach for teaching mathematics to young children through more basic mathematical concepts. Therefore, it would be appropriate to examine the pre-service teachers' scores obtained from the factors of the belief scale for the integration of mathematics teaching and children's literature. In this respect, Wilcoxon Signed Ranks test was used to test the effect of the training on the difference scores obtained from the factors since the scores were not normally distributed ($K-S_{diff.mtclibs} 1^{st} factor=.212$ and $p=.000<.05$; $K-S_{diff.mtclibs} 2^{nd} factor=.072$ and $p=.200>.05$; $K-S_{diff.mtclibs} 3^{rd} factor=.129$ and $p=.025<.05$; $K-S_{diff.mtclibs} 4^{th} factor=.140$ and $p=.010<.05$). Table 4 shows test results.

Table 4
Wilcoxon Signed Ranked Test Results

Factor	Post-test Pre-test	N	Mean Rank	Total Rank	z	p
Positive Pedagogical Effects of Integration (PPEI)	Negative Ranks	11	14.50	159.50	-3.668	<.001
	Positive Ranks	31	23.98	743.50		
	No Difference	12				
The Role of Resources Influencing the Integration Process (RRIP)	Negative Ranks	37	27.27	1009.00	-3.246	.001
	Positive Ranks	14	22.64	317.00		
	No Difference	3				
Practitioner Competencies Complicating the Integration Process and Social Norms (PCCIPSN)	Negative Ranks	23	26.54	610.50	-1.139	.255
	Positive Ranks	31	28.21	874.50		
	No Difference	0				
Practitioner Competencies Facilitating the Integration Process (PCFIP)	Negative Ranks	2	3.25	6.50	-6.345	<.001
	Positive Ranks	52	28.43	1478.50		
	No Difference	0				

As seen in Table 4, statistically significant differences were identified across all factors of the scale, except for the factor of practitioner competencies complicating the integration process and social norms [$z_{ppei}=-3.668$, $p<.01$; $z_{rriip}=-3.246$, $p<.01$; $z_{pcfip}=-$

6.345, $p < .01$]. The difference in all factors was found to be in favor of the post-test apart from the factor-the role of resources influencing the integration process. The Kruskal-Wallis test was used to determine whether the pre-service teachers' difference scores varied across branches as the difference scores were not normally distributed. The results are presented in Table 5.

Table 5

Kruskal-Wallis Test Results

Factor	Branch	N	Mean Rank	df	X^2	p	Sig. Difference
Positive Pedagogical Effects of Integration (PPEI)	Elementary Mathematics	18	22.28	2	4.067	.131	-
	Pre-school	17	32.91				
	Primary Education	19	27.61				
The Role of Resources Influencing the Integration Process (RRIIP)	Elementary Mathematics	18	15.17	2	16.859	<.001	EM-Pre-S EM-PriE
	Pre-school	17	34.97				
	Primary Education	19	32.50				
Practitioner Competencies Complicating the Integration Process and Social Norms (PCCIPSN)	Elementary Mathematics	18	16.92	2	12.876	.002	EM-Pre-S EM-PriE
	Pre-school	17	34.94				
	Primary Education	19	30.87				
Practitioner Competencies Facilitating the Integration Process (PCFIP)	Elementary Mathematics	18	24.44	2	1.411	.494	-
	Pre-school	17	30.74				
	Primary Education	19	27.50				

A statistically significant difference was determined across the scores of some factors in terms of pre-service teachers' branches ($X_{rriip}^2=16.859$, $p < .01$; $X_{pccipsn}^2=12.876$, $p < .01$). Mann-Whitney U test results and Bonferroni correction ($p=.05/3=.017$ and $p_{ppei}=.054 > .017$; $p_{rriip}=.000 < .017$; $p_{pccipsn}=.001 < .017$; $p_{pcfip}=.273 > .017$) indicated that this difference was between elementary mathematics teachers and preschool and primary teachers.

The Mathematics Literacy Self-Efficacy

The paired samples t-test was used to identify the effect of the training as the difference scores obtained from the Mathematical Literacy Self-Efficacy Scale were

normally distributed ($K-S_{diff.literacy} = .066$ and $p = .200 > .05$). The results are presented in Table 6.

Table 6
Paired-Sample t-Test Results

	\bar{X}	N	SD	df	t	p
Pre-test	89.3704	54	18.54042	53	-4.836	<.001
Post-test	98.5556	54	18.05826			

According to Table 6, a significant difference was determined across the pre-service teachers' scores obtained from the mathematics literacy self-efficacy belief scale in favor of the post-test [$t_{(53)} = -4.836$, $p < .01$]. The effect size ($d = .66$) shows a medium level of difference (Can, 2020; Pallant, 2020). One-way analysis of variance was performed to determine whether the pre-service teachers' difference scores differed across their branches. In addition, the distribution of the difference scores showed normal distribution ($S-W_{diff.literacyem} = .969$ and $p = .777 > .05$; $S-W_{diff.literacyps} = .950$ and $p = .457 > .05$; $S-W_{diff.literacyct} = .971$ and $p = .798 > .05$). The results of one-way analysis of variance are presented in Table 7.

Table 7
One-Way Analysis Of Variance Test Results

Source of Variance	Sum of Squares	df	Mean of Squares	F	p	Sig. Difference
Between Groups	823.226	2	411.613	2.209	.120	-
Within Groups	9502.923	51	186.332			
Total	10326.148	53				

Table 7 implied no statistically significant difference across the pre-service teachers' scores in terms of their branches [$F_{(2,51)} = 2.209$, $p > .05$].

The Mathematics Teaching Self-Efficacy

The Wilcoxon Signed Rank test was used to test the effect of the training since the difference scores obtained from the Mathematics Teaching Self-Efficacy Scale were not normally distributed ($K-S_{diff.teaching} = .126$ and $p = .031 < .05$). Table 8 depicts test results.

Table 8
Wilcoxon Signed Rank Test Results

Post-test	<i>N</i>	Mean Rank	Total Rank	<i>z</i>	<i>p</i>
Pre-test					
Negative Ranks	10	16.15	161.50	-4.809	<.001
Positive Ranks	42	28.96	1216.50		
No significance	2				

* Based on negative ranks

As observed in Table 8, a significant difference was found between the pre-test and post-test scores of the pre-service teachers [$z_{teaching}=-4.809$, $p<.01$]. The emergence of difference in favor of the post-test indicates that training has a significant effect on the pre-service teachers' mathematics teaching self-efficacy levels.

Lastly, the author asked the pre-service teachers' views about integration via an open-ended questions to support findings from the scales.

The Advantages and Disadvantages of Integrating Children's Literature with Mathematics Education

The themes and codes related to the change in the views of pre-service teachers about the advantages and disadvantages of integrating children's literature with mathematics education are given in Table 9.

Table 9
Pre-Service Teachers' Views on CL And Mathematics Integration After the Instruction

Theme	Codes	<i>f</i>	Theme	Codes	<i>f</i>
Positive Views	Reduce math prejudice/anxiety	14	Negative Views	Having difficulty finding appropriate books	15
	Teaching fun	13		The possibility of not attracting every student's interest	14
	Intriguing/engaging	13		Time-consuming	13
	Acquisition of positive attitudes	9		Planning and implementation require time and effort	14
	Supporting recall	9		Moving away from the focus of the topic	6
	Effective teaching	5		Cost of the books/Accessibility problems	6
	Attracting attention	4		Integration requires expertise (in terms of adapting the book and seeking mathematical content in it)	6
	Connecting mathematics with daily life	4		Integration is not appropriate for every topic	5
Increase success	4	Lack of appropriate books for	4		

		every subject	
Interdisciplinary teaching	4	Negative reactions of parents and school administration	3
Active participation	4	Lack of number of books	2
Applying a constructivist approach /student-centered teaching	3	Not every lesson may be productive with integration	2
Ensuring concreteness	3	Integration is not suitable for all ages	2
Supporting social and emotional development	2		
Gaining reading habits/skills	2		
Teaching concepts	2		
Reducing misconceptions	2		
Facilitating learning	2		
Grasping students' interest who are not interested in mathematics	2		
Sharing experiences with both teachers and students	2		
Reinforcement of concepts	1		
Possibility to create different activities	1		
Allows the use of all kinds of books	1		
Increased motivation for teachers and students	1		
Reduce mathematics teaching anxiety	1		
Ability to handle multiple acquisitions	1		
Supporting creative thinking	1		
Facilitating classroom management	1		
Suitable for all learning areas	1		
Even though there are some limitations, I can overcome them	9		

When the views of pre-service teachers on integration after the instruction are examined, it is seen that their positive views spread to more diverse areas and, in relation to negative opinions, they focus on issues such as mathematics teaching and children's literature integration belief scale's sub-factors such as access to resources and social norms. Although pre-service teachers are aware of the limitations of integration,

they think that they are able to overcome these problems ($f=9$). Pre-service teachers think they have acquired the necessary skills for integration within the instruction. This can be evaluated as an indicator of the integration intentions that are aimed to be measured with the belief scale. The views of some pre-service teachers about the limitations of integration and the change in their knowledge levels within the instruction are as follows:

PT52: ... *not much has changed in my thoughts, but the fact that I can use any book made me feel comfortable...*

PT49: *The biggest limitation is that there is not much material (book) in this area. Here it is up to the teachers. They would either integrate existing books with activities or create their own material using digital story applications.*

PT48: ... *I did not even have such a thought. Now I am excited to use what I've learned...*

PT46: ... *I thought that not every children's literary product could be integrated with mathematics. But since mathematics is involved in our daily life, I found out that we can even use mathematical context embedded books.*

PT41: *We use mathematics in our environment all the time, and almost all of the books have mathematics. Before the project, I was not that aware of them... Before it, combining books and mathematics was not very important and I had not seen many examples of it.*

PT40: ... *At first, I was like, these fields are unrelated... Now I am planning to destroy/change perception in the child's mind like my own.*

PT39: ...*I am looking for ways to integrate it into the lesson.*

PT36: *At first, I thought a lot about whether such a thing was possible, and I started to find mathematical terms in every book I got ... A book can be found or created for any subject desired to be covered...*

PT35: *I had no idea about this before and thought it would not fit, but now I am looking forward to the implementation.*

PT34: ... *I had no idea before the project... I will definitely use it to ensure interdisciplinary connections...*

PT32: ... *But if we can design the process correctly, we can use time effectively in the classroom.*

PT30: *I, who had never thought about literature and mathematics together, have now evolved to look for the answer to the question of how I can benefit from this context... I will definitely use it in my teaching life.*

PT24: *I am thinking of including children's literature in my lessons in some subjects, if not in every subject.*

PT23: ... *I could not trust myself too much. I can say that it has made a meaningful contribution to my lesson plan integrations related to mathematics at this point...*

PT12: *When I applied for this project, I really could not reconcile children's literature with mathematics education at all... now my perspective has changed... I will definitely try to add my storybooks to my lesson in the future.*

PT6: *Since I am a preschool teacher candidate, I was always saying how this age group child will learn mathematics. Now I can teach.*

PT5: *... Even if it is no longer intended to teach mathematics, I will wonder if there is mathematics in a book.*

PT4: *... I do not think it is too hard to relate two fields anymore.*

PT3: *The maximum limitation is the time constraint. That is what I thought before the instruction. But I think it can be overcome in various ways.*

It can be inferred that the intentions of the pre-service teachers to make integration changed positively after the instruction (PT48, PT39, PT35, PT34, PT30, PT24, PT12), that they were aware of the limitations of integration and that they believed that solutions could be found for them (PT49, PT46, PT36, PT32, PT24, PT5, PT3), that they thought that they improved in terms of mathematics teaching after education (PT52, PT36, PT23, PT6, PT4), that they thought that they were more aware of the mathematics contexts in the books (PT52, PT46, PT41, PT36, PT5). As a result, it can be concluded that pre-service teachers have improved through books, albeit indirectly, in terms of their self-efficacy in teaching mathematics, and their intention to apply integration and mathematical literacy self-efficacy after the training.

Discussion and Conclusion

This study examined the change in the pre-service teachers' intentions about integration through online training provided for the pre-service teachers who continue their education in the field of elementary mathematics, pre-school, and primary education to gain knowledge and skills about teaching mathematics and integrating children's literature. Thus, the change in pre-service teachers' intentions/beliefs about integrating children's literature in field education could be examined within the context of different developmental stages related to integration. The training program taught the pre-service teachers how to use children's literature in mathematics teaching. They also experienced the selection process of the appropriate book for the integration of these two fields. When they chose the book that was suitable for integration, they prepared an integrated lesson plan based on this book (Binns et al., 2020). The study results revealed that pre-service teachers achieved certain gains based on all the variables examined within the scope of the study. Namely, a statistically significant difference between the post-test and pre-test scores obtained from the pre-service teachers' beliefs about integrating mathematics teaching and children's literature, mathematics teaching self-efficacy belief and mathematics literacy self-efficacy belief scales was found to be in favor of the post-test. This paved the way for the fact that the short-dated training had a positive effect on the pre-service teachers' beliefs despite being conducted on an online platform. It is known that in-service and pre-service teachers increased the integration competencies after proper instruction (Wilburne & Napoli, 2008). But the findings obtained based on the scales were discussed respectively in line with the relevant literature.

The pre-service teachers' scores obtained from the scale of beliefs about integrating mathematics teaching and children's literature demonstrated that the training had a positive effect on beliefs namely integration intentions, albeit at a low level. Regardless of the branches, a positive change emerged in the pre-service teachers' beliefs towards integration after the training. This finding is convenient with the

literature. Teachers' planned behavior about the integration of children's literature and mathematics education was investigated by lots of detailed qualitative studies. In these studies, researchers found that teachers were hesitant about the benefits of this integration because of their lack of pedagogical knowledge (Farrugia & Trakulphadetkrai, 2020; Livy et al., 2021; Prendergast et al., 2019). So, with the training provided in this study, pre-service teachers may gain new insights into the integration process. However, a significant difference was identified between pre-service elementary mathematics teachers and primary education and pre-school teachers in terms of the difference scores. Pre-service elementary mathematics teachers may have experienced a different process of change compared to those in the field of pre-school and primary education since they did not experience such a process before. Because studies conducted with the pre-service and in-service teachers who ensured integration in their classrooms suggested that practitioners believed the inappropriateness of this approach for all age groups (Farrugia & Trakulphadetkrai, 2020; Larkin & Trakulphadetkrai, 2019; Trakulphadetkrai, 2017). In addition, research on this topic is mostly focused on the early childhood education period (Edelman et al., 2019). Pre-service elementary mathematics teachers may think that such a practice is not functional for older students, which is a general misconception about the integration in the literature (Larkin & Trakulphadetkrai, 2019). When compared to other participants, such a situation may be since they did not take the courses related to children's literature and that did not prepare an integrated lesson plan, which requires considering other disciplines. That the pre-service pre-school and primary teachers were free from such a difference supports this situation. Because the pre-service teachers who receive teacher education in both fields have experience on how this field can be used in the teaching of other fields/lessons by taking the children's literature course, and they may have more positive beliefs before the training thanks to their experiences as they teach different disciplines (Ministry of National Education [MoNE], 2013). The study results also suggested that pre-school teachers' beliefs on integration were more positive than other teachers (Can & Durmaz, 2022). Unlike this study, no statistically significant difference was determined across the primary and elementary mathematics teachers' beliefs in the related study. This may be due to the interdisciplinary connections in the Pre-School Education Curriculum (MoNE, 2013) and the emphasis on children's book-based activities. Besides, children's literature courses available in undergraduate programs do not focus much on how to use children's literature in the teaching of other disciplines (Kanat, 2020). In addition, pre-school teachers did not use different strategies except questioning while reading children's books in their classrooms (Adak-Özdemir et al., 2019).

Considering the pre-service teachers' scores obtained from the factors of the belief scale for the integration of mathematics teaching and children's literature, a significant difference was identified across all factors except for the practitioner competencies complicating the integration process and social norms. In other words, significant changes were observed in teachers' belief difference scores in terms of the positive pedagogical effects of the integration process, the role of the resources influencing the integration process, and the practitioner competencies that facilitate the integration process. However, the difference emerging in the factor of the role of resources influencing the integration process was in favor of the pre-test. Based upon

these findings, the following can be mentioned: After the online training they received, the pre-service teachers' beliefs in terms of the pedagogical contributions of integrating mathematics teaching and children's literature changed positively since they had the opportunity to evaluate the contribution of digital stories on mathematics to their students through their first-hand experiences with the integrated lesson plans, they have prepared. This may have had a positive effect on their beliefs because pre-service teachers could prepare effective integrated lesson plans when they are supported by their mentees, like relevant literature (An et al., 2019). Similar issues occurred in the factor of practitioner competencies facilitating the integration process.

Pre-service teachers may understand the importance of practitioner competencies as they observed that a qualified integration requires a lot of effort and time, such as choosing a book and preparing a detailed lesson plan, as well as successfully implementing this plan. These findings of the study are convenient with the literature because in most of the studies, in-service and pre-service teachers both underlined the time constraint and the limited resources such as books that are appropriate for mathematics education as barriers to the integration (Can et al., 2020; Farrugia & Trakulphadetkrai, 2020; Livy et al., 2021; Prendergast et al., 2019). With this training, they could see the potential of the other children's books that are not directly linked with mathematics. We can conclude that they learned to look at these books with a "mathematical lens" (Trakulphadetkrai, 2018), so they did not feel weak about finding appropriate books and needed much more time for planning an integrated lesson compared to the beginning. In addition, the factor of the role of resources influencing the integration process in the belief scale included negative items about accessing the books to be used in the process. It is noteworthy that the pre-service teachers' beliefs changed in favor of the post-test as they assumed that one of the biggest barriers to integration was the lack of books suitable for each topic and learning outcome/goal (Can et al., 2020; Prendergast et al., 2019). However, as I mentioned before, each book has an aspect that can be used in mathematics teaching when viewed with a careful eye and "mathematical lens" (Trakulphadetkrai, 2018).

Unlike the studies in the literature, the pre-service teachers were found to have more positive beliefs after the training they received than before the training in terms of access to resources, which is regarded as one of the important barriers to integration by practitioners. Various factors may have led to the emergence of this finding. To exemplify, the pre-service teachers were able to examine the samples of all types of books classified differently in terms of their mathematical context (explicit, embedded, and non-mathematical contexts) (Marston, 2010), and they had the opportunity to think about how these books could be integrated into mathematics teaching. As an output of the training, each pre-service teacher was requested to prepare a lesson plan for one of the content areas (numbers and operations; algebra and patterns; geometry and measurement; data analysis and probability) within the scope of the training. However, they were divided into groups of three and produced ideas as a group on a book with different levels of mathematical context that could be associated with the relevant content area. Thus, group members working together for the same content area determined how different types of books by means of mathematical content could be used in integration according to their mathematical context, advantages, and disadvantages.

Contrary to the studies in the related literature, some of the pre-service teachers stated that they experienced more difficulty and felt limited in preparing the lesson plans by using books with explicit mathematical context and purpose-written books (Edelman, 2017). They also found such books dull in a literary sense and that their students would not enjoy it, either. This may be explained by the fact that literary arts lag a little more in books that teach mathematics and that pre-service teachers limited their creativity in preparing lesson plans. It is an important finding because one of the biggest threats to this integration is not balancing these two fields: children's literature and mathematics (Austin, 1998). The cause of the pre-service teachers' approach to the different types of children's books may be that there were a lot of researchers from different fields. It is likely that researchers studying integrating children's literature with fields other than mathematics play a key role in positively changing the pre-service teachers' beliefs through activities modeled on books without a mathematical context. Therefore, more than one expert working together and collaborating in integrated courses where different fields such as mathematics education and children's literature are employed at the same time may have positive results in changing the pre-service teachers' beliefs. In addition, studies may be conducted to gather more detailed data on the books that the pre-service teachers prefer to use during the integration process and to examine the relations between pre-service teachers' book choices and their beliefs about integrating. Both pre-service and in-service teachers can focus on different features of the books they would choose for integration or on those independent from the book such as the book's connection to the subject (Can & Durmaz, 2022; Can et al., 2020; Cooper et al., 2020; Leonard et al., 2014). Both pre-service and in-service teachers stated that they had difficulties in the book selection process and that they mostly used the knowledge that they gained during their university education (Can et al., 2020; Cooper et al., 2020; Kanat, 2020). This may be explained by the fact that the pre-service teachers in the field of elementary mathematics education had more difficulties in this regard. Furthermore, various studies may be carried out to analyze how book choices and beliefs/intentions about integration influence each other.

Upon analyzing the scores obtained from the scale factors in terms of branch, significant differences were identified across the factors, such as the role of the resources influencing the integration process and practitioner competencies complicating the integration process and social norms. Accordingly, a difference was found between the pre-service elementary mathematics and primary teachers and pre-school teachers. This can be explained by the fact that the books used in the integration process may not have been sufficient for pre-service elementary mathematics teachers in terms of quality and quantity, and they do not find themselves sufficient yet in the selection of these books and their integration with the mathematics teaching because the pre-service elementary mathematics teachers stated that they had difficulties in the book selection process and in preparing integrated lesson plans more often than the others. In addition, children's literature or a compulsory course that requires preparing an integrated lesson plan is not included in the undergraduate mathematics curriculum of elementary education (Higher Education Council-HEC, 2018). Moreover, studies highlighted that pre-service elementary mathematics teachers did not believe in the importance of content-area reading skills in mathematics lessons (Spitler, 2011). Still, teaching content-area reading skills is the responsibility of all teachers working closely

with students (Franz & Hopper, 2007). So, it is only possible to eliminate such negative beliefs and change the instructional engagements of pre-service teachers with appropriate pre-service training (Prendergast et al., 2019; Purdum-Cassidy et al., 2015; Spittler, 2011).

Another variable discussed within the scope of the study was mathematics teaching self-efficacy. Various reading strategies such as interactive read-aloud can be used to integrate mathematics teaching and children's literature. Such strategies also contribute to the creation of a classroom climate based upon sociocultural constructivism in mathematics classrooms by employing skills such as mathematical reading, speaking, and writing (Van den Heuvel-Panhuizen & Van den Boogaard, 2008). The quality of interaction and sharing is not independent of the teacher's practices in mathematics lessons, where in-class interaction and sharing are at the forefront. Thus, teacher self-efficacy, which is associated with the average success of the class and the quality of interaction, is of great importance in this respect (Perera & John, 2020). This study revealed that the training had a positive effect on the pre-service teachers' mathematics teaching self-efficacy beliefs. Because they did not only gain knowledge regarding the integration of mathematics teaching and children's literature, but they also endeavored to prepare lesson plans using the books they chose. The lesson planning process became more concrete for them as they received feedback on lesson plans from both groupmates and instructors. Hence, pre-service teachers may have had more positive beliefs in terms of mathematics teaching self-efficacy beliefs. Studies also enlightened those pre-service and in-service teachers' understanding and beliefs regarding training may be changed, their self-efficacy towards mathematics increases, they are more motivated to use innovative approaches for mathematics lessons and their anxiety about teaching mathematics decreases when effectively designed educational content is provided (Ginsburg & Uscianowski, 2017; Jao, 2018; Jett, 2018; Lane & Ríordáin, 2020; Rogers et al., 2015). From this point of view, these kinds of training may be suggested for teacher education to integrate mathematics and children's literature.

The last variable examined within the scope of the study was the mathematical literacy self-efficacy scale. The findings showed that the pre-service teachers' mathematics literacy self-efficacy belief scores were in favor of the post-test and that the training had a medium effect on beliefs. Besides, the difference scores did not differ across branches as in the mathematics teaching self-efficacy scale. The pre-service teachers may be close to each other in terms of the knowledge they gained after the training. The reasons for the absence of the differences across the beliefs about integrating mathematics teaching and children's literature in terms of branches can be explained by the fact that the pre-service teachers had different knowledge and experience.

When the pre-service teachers' views are examined, it can be seen very easily that pre-service teachers have positive opinions about integration. However, they still have some hesitations about this integration's limitations even though they have gone so far in the competences about selecting proper and high-quality books, making effective integrated lesson plans, and overcoming the limitations of children's literature and mathematics integration. This finding is critical for implications and future studies. Even teacher educators take necessary measurements into account, and try to change

teachers' beliefs, so their intentions for performing expected behaviors are not enough. So, in the future, classroom observations and a long period of training may be provided.

The most important implication of this study is that the pre-service teachers had similar beliefs in terms of positive pedagogical effects of integration and practitioner competencies facilitating the integration process. Their beliefs differed in terms of the role of the resources in integration and the practitioner competencies complicating the integration process and social norms. These findings are positive in a way because the pre-service teachers are aware of the benefits of integrating children's literature in mathematics teaching. This can be considered a sign that they are open to professional development in this regard, in conjunction with the studies (Edelman, 2017; Prendergast et al., 2019). Just like the pre-service teachers, in-service teachers also believed that the two biggest barriers to the integration process were their awareness/competence of integration and access to appropriate books (Livy et al., 2021; Prendergast et al., 2019; Trakulphadetkrai, 2017). In this online training, pre-service teachers gained knowledge about the importance of mathematics and children's literature integration, and this allowed them to make connections between theory and practice. They worked on different types of children's books by means of mathematical context. They prepared lesson plans using all kind of these books, examined peers' lesson plans, and found at least one solution to limited and inappropriate book problems by writing their own mathematical digital stories. They all provide some clues to researchers and educators about how to focus on education aiming at changing competencies and beliefs/intentions about mathematics teaching and children's literature implementation.

Implications

There is a growing literature that emphasizes the integration of children's literature and mathematics education and disciplinary/content area reading practices on this topic but very little of these studies are experimental and it's not clear how to prepare teachers for these discipline specific practices (Edelman et al., 2019; Kushner & Phillips, 2020). Pre-service teachers' gains through the training cannot be thought of without the collaboration of researchers from different fields. As noted in the relevant literature (such as Kushner & Phillips, 2020) it may be suggested that teacher educators should consider this situation because without collaboration, this research findings would be different. From this point of view, the study is valuable with some limitations. This training was limited to a very short time and carried out online in the present study. Therefore, it is of utmost significance to examine the changes in the pre-service teachers' beliefs by means of intentions about integration and their behaviors of ensuring integration in their classrooms by longer term and face-to-face. Face-to-face training was impossible due to the pandemic, so this method was used in this study. Yet, this situation, which is a disadvantage, strengthened the project by providing the diversity of participants and trainers. In addition, the study was conducted with the pre-service teachers who were unaware of how the structure and content of mathematics lessons changed during the transition between education levels and who would work at different education levels to get an idea of what mathematical skills and competencies are expected from their students at higher levels. It may be advisable to carry out further studies for specific grade levels or groups. In a nutshell, it is critical for pre-service teachers to carry out studies to understand and develop their beliefs/intentions by

bearing in mind that their practices towards integrating are an indicator of their beliefs and pedagogical content knowledge, and to use innovative approaches for their classrooms to cope with the barriers they may encounter in the integration process such as national exams and curriculum density (Qhobela & Moru, 2014; Rott, 2020; Xie & Cai, 2021).

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Conflicts of Interest

There are no conflicts of interest in this study.

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