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PRE-SCHOOL TEACHERS' OPINIONS ON THE USE OF OUT-OF-SCHOOL LEARNING ENVIRONMENTS IN THE MATHEMATICS TEACHING

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Abstract

This research was conducted to examine the views of preschool teachers regarding out-of-school learning environments for mathematics activities and their usage of these environments. The research was conducted out using a phenomenological design, one of the qualitative research methods. The study group consisted of 42 preschool teachers working in preschool education institutions affiliated with the Ministry of National Education, determined on a voluntary basis. The research data were collected through a semi-structured interview form created by the researchers. The analysis of the obtained data was done by content analysis method. The research results revealed that preschool teachers have sufficient knowledge about out-of-school learning environments where mathematics activities can be implemented and that they use various out-of-school learning environments. The preschool teachers participating in the research stated that they found out-of-school learning environments beneficial for math activities but faced various difficulties during the implementation process. Positive teacher opinions were found regarding out-of-school learning environments increasing children's interest in mathematics and developing their problem-solving skills. It was revealed that teachers use these environments most often for reasons such as connecting with daily life (making it concrete), learning by doing and experiencing, permanent learning, and being engaging.

Keywords: Preschool, mathematics, activity, out-of-school learning.

INTRODUCTION

The preschool period is a critical time for children, marked by accelerated cognitive, linguistic, social, and emotional development, alongside intense brain development. Children exhibit a natural inclination towards learning during this stage, and the skills they acquire during this time serve as the foundation for their future academic success and lifelong learning (Magnuson et al., 2004). High-quality preschool education programs are instrumental in fostering children's creativity, problem-solving skills, and critical thinking abilities, while simultaneously supporting their social and emotional development (Barnett, 2008; Yoshikawa et al., 2013). Therefore, investments in preschool education hold immense significance for the future of individuals and societies. Creating a stimulating environment rich in learning opportunities that cater to all developmental domains is crucial for nurturing a positive attitude towards learning in children (Yazlık & Öngören, 2018). Mathematics activities are a key component of preschool education programs, supporting all developmental areas, especially cognitive development. In early childhood, these activities not only bolster cognitive growth but also cultivate essential skills such as problem-solving, analytical thinking, and number sense. Research on number and counting skills demonstrates that the mathematical foundations laid during these formative years pave the way for understanding more complex mathematical concepts later on (Oktay & Unutkan, 2003). Furthermore, mathematics activities are known to enhance children's learning motivation and facilitate

easier comprehension of mathematical concepts. For instance, play-based mathematics activities provide valuable opportunities for developing both academic and daily life skills. The diversity of methods employed by teachers in mathematics activities plays a vital role in structuring children's mathematical thinking. Therefore, collaboration between teachers and curriculum developers in developing research-based and practical activities is essential for effective preschool education (Björklund et al., 2020). Play-based mathematics activities, in particular, are highly effective in supporting children's understanding of key mathematical concepts and developing their problem-solving skills (Ginsburg & Golbeck, 2004). Research on early mathematical thinking and learning highlights the important role teachers play in supporting children's mathematical development (Björklund et al., 2020). In this context, it is imperative for teachers to employ effective strategies in mathematics instruction and support the development of children's mathematical thinking skills (Ginsburg & Golbeck, 2004).

Teachers enrich learning environments in preschools by assessing children's mathematical knowledge and skills and utilizing appropriate methods and techniques in their activities. Creating a classroom environment and selecting materials that encourage exploration and hands-on experiences is crucial in this process (Clements & Sarama, 2020). Children should be exposed to a wide range of methods and materials and provided with ample opportunities for free exploration. Limiting mathematics activities to traditional methods can hinder children's interaction with the world around them and impede their understanding of concepts (Björklund et al., 2020). Therefore, teachers should not confine their mathematics activities to the classroom but also leverage out-of-school learning environments. Out-of-school learning environments are described as "Places where educational activities are carried out to enable students to discover the production, culture, art, and geographical capacity of their own regions in line with the subjects and achievements within the scope of education/training programs; to get to know plant and animal species, local characteristics, games, and folklore; and to learn by doing and experiencing as an integrated or extracurricular activity" (MoNE, 2019, p.4).

Out-of-school learning environments are gaining increasing importance within the Turkish education system, particularly in the context of innovative practices. This is evident in the goals set by the Ministry of National Education (MoNE) in its 2023 Education Vision for both primary and secondary education levels. Following this vision, the MoNE prepared the "Out-of-School Learning Environments Guide." This guide aims to help teachers and students in preschool, primary, and secondary schools affiliated with the MoNE to more effectively utilize out-of-school learning environments such as museums, science centers, art centers, historical and cultural sites, libraries, natural protected areas and archaeological sites, technoparks, industrial facilities open to visitors, and universities, by linking them to educational programs. It also aims to familiarize them with these environments and contribute to students' learning by doing and experiencing (MoNE, 2019).

In out-of-school learning environments, students actively participate in activities involving real-life situations. Research indicates that natural environments offer unique opportunities for developing children's mathematical thinking skills (Björklund et al., 2020; Yıldız, 2022). Implementing math activities in out-of-school environments during preschool allows children to experience mathematical concepts in a more concrete and meaningful way. For example, observations made in a park or measurement and classification activities carried out in a garden facilitate children's acquisition of basic mathematical skills such as shape recognition, measurement, and comparison (Björklund et al., 2020; Yıldız, 2022). Moreover, out-of-school learning environments enable children to establish connections between mathematics and daily life, making learning more permanent (Kelton, 2015). For instance, having children count different types of leaves during a nature walk or asking questions related to symmetry and patterns during a museum visit deepens their mathematical understanding. Research also indicates that out-of-school learning environments have positive impacts on areas such as problem-solving, self-confidence development, and self-care skills, and that such experiences positively influence children's attitudes towards mathematics and help them better understand mathematical concepts (Yıldız, 2022). Extending math activities beyond the classroom increases children's learning

motivation and allows them to connect mathematics with their surroundings in a more meaningful way (Buchholtz, 2023). Research shows that while teachers believe out-of-school learning activities are important in preschool education, teaching primarily takes place in classroom settings (Ernst, 2014; McClintic & Petty, 2015). Ernst (2014) noted that preschool teachers recognize the positive impacts of using natural outdoor spaces as learning environments on children's environmental awareness and problem-solving skills, but logistical obstacles, time constraints, and safety concerns limit the implementation of such activities. Similarly, McClintic and Petty (2015) state that while teachers believe outdoor play and out-of-school learning activities are essential for children's social and emotional development, they often prefer classroom activities due to planning and implementation challenges.

Similar findings have been observed in studies conducted in Turkey. While teachers express positive views regarding the importance of out-of-school learning environments in preschool education, it has been determined that children do not experience these environments frequently enough (Karakuş & Aktın, 2023; İnce & Akcanca, 2021). Yıldız (2022) found that preschool teachers use out-of-school learning environments less frequently due to insufficient financial resources and transportation options, difficulties in classroom management, unfavorable weather conditions, and lack of parental permission. Likewise, a study by Karakuş and Aktın (2023) indicated that teachers' frequency of using out-of-school learning environments is low, and the main reasons for this include lack of time, safety concerns, and the complexity of official procedures.

Despite this situation, there are limited studies in Turkey that examine teachers' views on the usage of out-of-school learning environments and identify the related problems (Ay, Anagün & Demir, 2015; Ocak & Korkmaz, 2018; Yazlık & Öngören, 2018; Dere & Çifçi, 2022; Yıldız, 2022; Ergin Aydoğdu, Aydoğdu & Aktaş, 2023). Moreover, although there are studies in national and international literature on preschool teachers' views and practices regarding the implementation of math activities (Thiel, 2010; Baki & Hacısalihoğlu Karadeniz, 2013; Pekince & Avcı, 2016; Koç, 2017; Orçan-Kaçan & Karayol, 2017; Hsieh & McCollum, 2018; Kılıç & Özcan, 2020; Tantekin Erden & Tonga, 2020; Li, 2021; Karakuş and Aktın, 2023; Ata Doğan & Akman, 2023), there is very limited research on the use of out-of-school learning environments in mathematics teaching. Recognizing the limited research in this area, the current study aims to make significant contributions to the field of preschool education. By systematically examining preschool teachers' views on the use of out-of-school learning environments in mathematics teaching, this research seeks to provide valuable insights. These insights can guide the design of more effective pedagogical approaches, enrich teacher training programs, and inform the development of curricula that better incorporate real-world contexts into early mathematics learning. Ultimately, understanding teachers' experiences and perspectives is crucial for fostering an educational environment where out-of-school settings are utilized more effectively and frequently to enhance young children's mathematical understanding and engagement, thereby strengthening the overall quality of preschool mathematics education. Therefore, this research aimed to investigate preschool teachers' views on their knowledge levels regarding out-of-school learning environments for math activities, their usage of these environments, and the challenges they encounter in using them. Within this scope, the research sub-problems are as follows:

1. What are the knowledge levels of preschool teachers regarding out-of-school learning environments for math activities?
2. What are the views of preschool teachers on the usage of out-of-school learning environments where math activities can be conducted?
3. What challenges do preschool teachers face while conducting math activities in out-of-school learning environments?

METHOD

Research Model

In the study, since it was aimed to determine the views of preschool teachers on the out-of-school learning environments used in preschool education in terms of mathematics activities and the use of these environments, phenomenology (phenomenology) design, one of the qualitative research methods, was preferred. This method provides an in-depth examination to understand individuals' perceptions, feelings, and thoughts about a phenomenon (Creswell & Poth, 2018). In the phenomenological design, as a result of the interviews with the participants, their experiences about the phenomena emerge (Moustakas, 1994). These phenomena include events, situations, experiences, perceptions, orientations or concepts that participants encounter in daily life (Yıldırım & Şimşek, 2013).

Participants

The study group of the research consists of 42 preschool teachers who work in different institutions in various districts of Izmir, Türkiye Province and who voluntarily agreed to participate in the research. The participants were selected by the convenience sampling method, which is among the purposeful sampling techniques. Convenience sampling involves researchers working on a situation or sample by reaching the most accessible participants (Büyüköztürk et al., 2019). Twelve of the participants were male and 30 were female. In addition, the professional experience of the teachers participating in the study ranged between 5 years and 27 years.

Data Collection and Analysis

The data of the study were obtained through a semi-structured interview form consisting of 18 questions (10 questions measuring demographic features) prepared by the researchers to determine the views of preschool teachers on the out-of-school learning environments used in preschool education in terms of mathematics activities and the usage status of these environments. The interview form consists of three parts; the first part of the form includes demographic questions describing the personal characteristics of preschool teachers, the second part includes short-answer and open-ended questions prepared to determine the views of preschool teachers on the out-of-school learning environments used in mathematics activities and the use of these environments. In the third part of the form, there are questions about the difficulties that preschool teachers face in out-of-school learning environments. The prepared questions were presented to three expert researchers. As a result of the expert opinions, the number of questions was changed. Using the final version of the form, interviews were conducted with five teachers to check the comprehensibility of the questions. The questions that were not clearly understood through the pilot application were revised and semantic corrections were made. Thus, the interview form was finalized.

A semi-structured interview form was used to collect the data obtained in the study. The questions in the form were prepared by the researchers by reviewing the literature on out-of-school learning environments and the experiences of the researchers on this subject. There are 8 open-ended questions in the interview form and these questions are given below:

1. What are the out-of-school learning environments where mathematics activities can be carried out?
2. What are the characteristics of out-of-school learning environments where mathematics activities can be carried out? What do you think these environments contribute to students?
3. Do you use out-of-school learning environments in mathematics activities? If so, what are your reasons for using these environments?
4. What are the out-of-school learning environments you use in activities related to mathematics course? How often do you use out-of-school learning environments?
5. What kind of mathematics activities do you perform in out-of-school learning environments?
6. What can be done to make out-of-school learning environments more efficient in terms of mathematics activities?

7. What are the difficulties you encounter while performing mathematics activities in out-of-school learning environments?
8. What are your suggestions for solutions to these difficulties?

In the study, content analysis was used to determine teachers' views on out-of-school learning environments in terms of mathematics activities. The numerical values of the categories obtained in the analysis of the data are given in the tables, and in order to support the data, the answers given by the participants in the study were also included directly.

Teachers' opinions were given with direct quotations and the findings were interpreted. The aim is to present the findings to the reader in an organized and interpreted form and to increase the consistency of the research. After the end of the implementation process of the research, the interview recordings were listened to by the researchers and turned into a written document. Codes were created by two researchers using the common answers given by the teachers and the teacher responses were categorized according to these codes. For reliability, the coder reliability suggested by Miles and Huberman (1994) was examined. Accordingly, when the consensus correlation coefficient was calculated with the formula of (Consensus/(Consensus+Disagreement))×100, it was seen that the resulting value was 92.4%. The fact that this value is more than 80% indicates that reliable results were obtained. In this study, internal validity was ensured by making use of expert opinions at the stages of preparing the interview questions and analyzing the data. In addition, care was taken to ensure external validity by expressing the research design, data collection tools and data analysis process in a clear and understandable way. In order to protect ethical principles in the research, teachers were coded as T1, T2, ..., T42.

RESULTS

In this section, the findings obtained from preschool teachers' views on out-of-school learning environments in terms of mathematics activities are presented under sub-problems. The numerical values belonging to the categories obtained in the analysis of the data are given in the tables, and in order to support the data, the answers given by the participants in the research are also included directly.

Results related to the first sub-problem

The findings obtained from the interview questions related to the first sub-problem *"What are the knowledge levels of preschool teachers about out-of-school learning environments in terms of mathematics activities?"* are presented.

Preschool teachers were asked what out-of-school learning environments are and the distribution of the answers given is given in Table 1.

Table 1. Out-of-school learning environments.

Teacher Responses	f
School Playground	24
Playgrounds	20
Nature (Forest, Garden)	16
Mathematics Village	13
Everywhere Outside the Classroom	9
Museums	6
Science Centers	5
Ruins	3
Streets and Alleys	3
Library	2
Home	1
Courses	1

When Table 1 is examined, it is seen that the most frequently mentioned out-of-school learning environment for mathematics teaching is the school garden. Teachers also cited playgrounds, nature, mathematics village, outside the classroom, museums, and science centers as examples of out-of-school learning environments where they could carry out mathematics activities. The least frequently

mentioned out-of-school learning environments were libraries, home environment and courses. This distribution suggests that teachers primarily associate out-of-school mathematics learning with immediately accessible and less formal outdoor spaces like school playgrounds and general playgrounds. The relatively high mention of 'Nature' and 'Mathematics Village' indicates an awareness of more structured or specialized environments, though their practical application might be less frequent compared to school-based outdoor areas. The lower frequencies for environments like libraries or homes might imply that teachers perceive these as either less directly applicable for formal math activities they would lead, or perhaps more within the realm of parental involvement rather than teacher-led excursions.

Teachers were then asked about the characteristics of effective out-of-school learning environments for teaching mathematics. Teachers' responses are given in Table 2.

Table 2. Characteristics of effective out-of-school learning environments for mathematics teaching according to teachers.

Teacher Responses	f
It Should Be Suitable for Learning Goals	19
It Should Be Safe	15
It Should Be Student-Centered	15
It Should Be Suitable for Learning by Gaming	13
It Should Be Suitable for the Age Group	5
It Should Be Attention-Grabbing	4
It Should Support Learning by Doing and Living	4
It Should Provide the Opportunity for Concretization	3
It Should Be Planned	2
It Should Be Suitable for the Use of Technology	2
It Should Be Economical	2

When Table 2 is examined, it is seen that the characteristics of effective out-of-school learning environments in terms of teaching mathematics are most frequently expressed by teachers as “appropriate to learning objectives”, “safe”, “student-centered” and “suitable for learning through gamification”. The least frequently expressed by teachers are “planned”, “suitable for technology use” and “economical”. The opinions of the teachers are given below:

T11: “… The environment that can be created should be equipped with mathematical materials appropriate for the children’s age, and the determined activities should be determined according to the children’s interests and needs…”

T24: “… It should be in line with the learning objectives, it should be planned, it should allow the child to concretize, it should be eye-catching…”

T41: “… It should be safe, it should allow children to learn by playing. It should be student-centered…” These findings indicate that teachers prioritize pedagogical alignment, safety, and child-centric approaches when considering the effectiveness of out-of-school environments. The strong emphasis on 'learning goals' and 'student-centered' learning, coupled with 'safety' and 'gaming,' reflects a modern understanding of early childhood pedagogy. The lower frequency of 'planned' might suggest a preference for flexibility within these less structured settings, or perhaps it reflects the perceived difficulty in detailed pre-planning for such environments. Similarly, 'economical' being less emphasized could imply that while a practical concern, it's not seen as a primary determinant of effectiveness compared to pedagogical suitability and safety.

Then, the teachers were asked about the contributions of out-of-school learning environments to children for teaching mathematics, and the distribution of the answers given is in Table 3.

Table 3. Contributions of preferred out-of-school learning environments for teaching mathematics to students according to teachers.

Teacher Responses	f
Concrete Experience	19
Problem Solving Skills	15
Establishing Cause-Effect Relationships	15
Developing a Positive Attitude Towards Mathematics	13
Questioning Skills	5
Creative Thinking Skills	4
Permanent Learning	4
Communication Skills	3
Research-Analysis Skills	2
Acquiring Motor Skills	2
Self-Confidence Development	2

Some of the teachers' opinions on the contributions of effective out-of-school learning environments for teaching mathematics to students are as follows:

T20: "…It definitely provides students with concrete experiences, and students' problem-solving skills increase. I also think it will make them like mathematics more…"

T33: "…I think it supports children's ability to establish cause-effect relationships, creative thinking and questioning skills…"

T2: "…It reinforces permanent learning because it attracts their attention more than the classroom environment. It allows students to work in communication with each other…"

The data in Table 3 clearly demonstrate that teachers perceive significant cognitive and affective benefits from using out-of-school environments for mathematics. The high emphasis on 'Concrete Experience' underscores the value teachers place on making abstract mathematical concepts tangible for young learners. Furthermore, the strong association with developing 'Problem Solving Skills,' 'Establishing Cause-Effect Relationships,' and fostering a 'Positive Attitude Towards Mathematics' suggests that teachers view these environments as catalysts for deeper conceptual understanding and positive engagement with the subject, going beyond mere content delivery.

Results related the second sub-problem

The findings obtained from the interview questions regarding the second sub-problem, *"What are the views of preschool teachers on the use of out-of-school learning environments where mathematical activities can be carried out?"* are presented in tables in this section. First, the teachers were asked whether they used out-of-school learning environments for mathematical activities and the distribution of the answers given is presented in Table 4.

Table 4. Teachers' use of out-of-school learning environments in mathematics activities.

Teacher Responses	f
Yes, I use it	32
No, I don't use it	10

As seen in Table 4, the majority of teachers stated that they used out-of-school learning environments in mathematics activities. Some of the teachers' opinions are as follows:

T8: "*...I use it as much as it is economical and safe because I know its benefits for students…*"

T37: "*...I don't use it outside of the schoolyard. Dealing with the procedures is tiring…*"

Then, teachers were asked about their reasons for using out-of-school learning environments for mathematics activities. These teachers' opinions are given in Table 5.

Table 5. Reasons for teachers to use out-of-school learning environments in mathematics activities.

Teacher Responses	f
Relating to Daily Life (Concretization)	17
Contributing to the Problem Solving Process	15
Making Teaching Fun	13
Increasing Interest and Motivation in the Course	8
Permanent Learning	5

Some of the teachers' opinions regarding the reasons for using out-of-school learning environments are as follows:

T4: *"...Students learn better outside of school. I think learning is permanent. Students' interest is quite high..."*

T28: *"...It allows the lesson to be associated with daily life. Students solve the problem being worked on more easily..."*

The reasons cited by teachers for using these environments, as shown in Table 5, align closely with established principles of effective early childhood education. The emphasis on 'Relating to Daily Life' and 'Concretization' reinforces the desire to make mathematics relevant and understandable. The focus on 'Problem Solving' and 'Making Teaching Fun' indicates that teachers utilize these settings not just for content delivery but also to foster critical thinking and enhance student engagement and motivation, which are crucial for sustained learning.
Then, teachers were asked which out-of-school settings they use for math activities. The results are shown in Table 6.

Table 6. Out-of-school learning environments used by teachers for mathematics activities.

Teacher Responses	f
School Playground	18
Nature (Forest, park)	12
Library	8
Science Center	4
Museums	2
Ruins	2

Some of the teachers' views on the out-of-school learning environments used by teachers for mathematics activities are as follows:

T19: *"... I use the school yard, both for safety and economic reasons. Also, you don't bother for permission. ..."*

T36: *"...I took my students to the museum. They tried to solve some problems by playing an escape game. But I can't take them too often, the procedures are tiring. ..."*

Table 6 reveals a practical trend in the actual use of out-of-school environments. The 'School Playground' and 'Nature' are the most frequently utilized, likely due to their accessibility, lower logistical demands, and minimal bureaucratic hurdles, as alluded to by teacher T19. The less frequent use of 'Museums' and 'Ruins', despite their potential, probably reflects the challenges associated with organizing such excursions, including permissions and resources, as hinted by teacher T36. This suggests that while teachers may be aware of a broader range of environments (as seen in Table 1), practical considerations heavily dictate their actual choices.

The teachers participating in the study were asked how often they make use of out-of-school learning environments in mathematics lessons and the data obtained are presented in Table 7.

Table 7. Frequency of teachers' use of out-of-school learning environments for mathematics activities.

Teacher Responses	f
2 or 3 times a year	15
1 time per year	13
Rarely	4
Never Used	10

Some teachers' views on the frequency of using out-of-school learning environments for mathematics activities are as follows:

T13: "... I used it once this year. We took the children to the museum ..."

T21: "...Obviously, I find it difficult to complete the lessons, so I do not prefer to use it ..."

Following this question, teachers were asked what kind of mathematics activities they carried out in out-of-school learning environments and the distribution of the answers is shown in Table 8.

Table 8. Mathematics activities performed by teachers in out-of-school learning environments.

Teacher Responses	f
Game	20
Creating Geometric Shapes	17
Measuring the Length of Shapes	15
Pattern Creation	13
Matching, Sorting, Grouping Activities	10
Addition-Subtraction	8
Observation-Forecast	5
Building with Foundation Blocks	4
Creative Drama	2

As seen in Table 8, teachers stated that they used out-of-school learning environments for teaching mathematics mostly for games, creating geometric shapes, measuring the lengths of shapes and creating patterns, respectively. Some teacher opinions are given below.

T1: *"...I usually use it for game purposes. Playing games that reinforce what we have learned in the school garden provides permanent learning..."*

T18: *"...I make them do activities such as counting leaves in nature, creating patterns according to their colors. They also learn the names of geometric shapes..."*

T22: *"...I make them do environmental and field activities. Sometimes we do addition and subtraction activities with stones or leaves we collect from nature..."*

Table 8 illustrates the types of mathematical engagement teachers facilitate in these settings. The prevalence of 'Game' as an activity underscores the commitment to play-based learning, a cornerstone of early childhood education. Activities such as 'Creating Geometric Shapes,' 'Measuring the Length of Shapes,' and 'Pattern Creation' demonstrate that teachers are applying fundamental mathematical concepts in these environments. This indicates a practical application of early math skills, leveraging the real-world context to make learning more tangible and engaging, as supported by the teacher quotes.

The teachers participating in the study were asked what could be done to make out-of-school learning environments more productive in terms of mathematics activities and the data obtained are given in Table 9.

Table 9. Teachers' opinions and suggestions.

Teacher Responses	f
Organizing School Gardens	21
Dissemination of Mathematics Museums and Workshops	17
Reducing Legal Procedures	16
Budget Provision (Transportation Support, Ruins Entrance Fee)	14
Creating Virtual Museums	7
Providing Training to Teachers	4
Creating Guidebooks for Teachers	2

Some teacher opinions are given below.

T17: *"...First of all, school gardens should be organized. It is both safe and does not require a permit. Apart from that, economic support is absolutely necessary..."*

T26: *"...I believe that legal procedures should be reduced first. Or alternatively, virtual museums can be increased..."*

T40: "...*The number* of mathematics museums and various workshops can be increased. Guidebooks explaining how and in which subjects teachers can benefit from these places can be created..."

The suggestions provided by teachers in Table 9 offer clear directions for enhancing the utility of out-of-school mathematics learning. The strong call for 'Organizing School Gardens' highlights a desire for accessible, well-equipped, and teacher-friendly spaces that minimize logistical burdens. Simultaneously, suggestions for the 'Dissemination of Mathematics Museums and Workshops,' coupled with calls for 'Reducing Legal Procedures' and 'Budget Provision,' point towards a need for both more specialized resources and the removal of systemic barriers that hinder access to more elaborate off-site locations. These suggestions reflect a practical understanding of current limitations and a vision for more robust support structures.

Results related the third sub-problem

The findings obtained from the interview questions related to the third sub-problem, *"What are the difficulties that preschool teachers face while performing mathematics activities in out-of-school learning environments?"* are presented.

Table 10. Challenges faced by teachers.

Teacher Responses	f
Crowded Classrooms	25
Children's Inability to Pay Attention	16
Material Deficiencies	14
Failure to Ensure Children's Safety	9
Loss of Materials	5

Some of the teachers' views on the difficulties encountered during the implementation of the mathematics activity related to out-of-school learning environments are as follows:

T6: *"...The most common difficulty I experience is to keep the children's attention. There are also security concerns. ..."*

T15: *"...Crowded classes are an important problem. It is very difficult to take care of the students, especially if the place (archaeological site, museum) is crowded. Some of our materials were lost in the activities we did in the garden..."*

Table 10 sheds light on the practical impediments teachers face. The most frequently cited challenge, 'Crowded Classrooms,' is a significant structural issue that undoubtedly complicates managing children effectively outside the traditional classroom setting. Difficulties like 'Children's Inability to Pay Attention' and 'Failure to Ensure Children's Safety' are likely exacerbated by larger group sizes and the novel, less controlled nature of out-of-school environments. 'Material Deficiencies' also points to

logistical hurdles. These challenges provide a compelling context for why, despite acknowledging the benefits, teachers may use these environments infrequently (as seen in Table 7).

Based on teachers' opinions, it can be stated that teachers face difficulties in implementing mathematics activities in out-of-school learning environments, particularly in managing groups, maintaining children's attention, and addressing material shortages. Teachers were asked to suggest possible solutions to the challenges they face when implementing mathematics activities in out-of-school learning environments, and the findings obtained from the analysis of their responses are presented in Table 11.

Table 11. Solution suggestions for the difficulties encountered by teachers.

Teacher Responses	f
Reducing Class Sizes	19
School Administration Support	13
Teacher and Parent Support	9
Providing Sufficient Time for Activities	3
Material Support	2

Some teachers' opinions on the solution suggestions are as follows:

T4*: "…It would be good if class sizes were reduced. At least if there is support from the administration and parents when using out-of-school learning environments, the class size could be divided in half. Or, several teachers from the same branch could be hired…"*

T36: *"…The support of the administration is definitely very important. Because security needs to be ensured. In the workshops or museums that are visited, students need to be given enough time because they are young…"*

The solutions proposed by teachers in Table 11 directly address the challenges identified previously. The predominant suggestion, 'Reducing Class Sizes,' underscores its critical importance as a foundational step to make out-of-school learning more manageable and effective. The call for 'School Administration Support' and 'Teacher and Parent Support' highlights the understanding that successful implementation requires a collaborative, systemic approach rather than being solely an individual teacher's burden. These suggestions largely point towards the need for institutional and resource-based changes to facilitate better use of these valuable learning environments.

DISCUSSION, CONCLUSION, and SUGGESTIONS

This research investigated preschool teachers' knowledge levels regarding out-of-school learning environments for math activities, their usage of these environments, and the challenges they face in utilizing them. The first sub-problem of the research addressed preschool teachers' knowledge levels of out-of-school learning environments for math activities. It was observed that teachers listed various spaces with different functions where all kinds of learning can take place as out-of-school learning environments. The research results indicate that preschool teachers have sufficient knowledge about out-of-school learning environments for mathematics teaching. The most frequently mentioned out-of-school learning environment for mathematics teaching by teachers was the schoolyard. Teachers also cited playgrounds, nature, math villages, outside the classroom, museums, and science centers as examples of out-of-school learning environments where they could conduct math activities. The least mentioned out-of-school learning environments by teachers were libraries, home environments, and courses. Similarly, in the study by Kır et al. (2021), it was found that mathematics teachers mostly used environments such as the surrounding area, shopping malls, and historical and cultural places as out-of-school learning environments. Likewise, in the study by Karakuş and Aktın (2023), it was stated that preschool teachers mentioned nature, museums, historical sites, and science centers as out-of-school learning environments. Teachers described the characteristics of effective out-of-school learning environments for mathematics teaching as "suitable for learning objectives," "safe," "student-centered," "suitable for gamified learning," "planned," "suitable for technology use," and "economical." At the

same time, teachers stated the contributions of out-of-school learning environments to students for mathematics teaching as providing concrete experiences, developing problem-solving, research, inquiry, creative thinking, communication, and empathy skills, developing a positive attitude towards mathematics, establishing cause-and-effect relationships, developing motor skills, improving self-confidence, and supporting language development. Therefore, the current research results indicate that preschool teachers are aware of the significant contributions of out-of-school learning environments to children's development in various areas. Supporting the current research findings, various studies have also found that out-of-school learning environments enhance preschool children's cognitive, language, social-emotional, and motor skills (Ata-Doğan & Boz, 2019; Davies & Hamilton, 2016; Çıtak & Arabacı, 2017, Hunter et al., 2020; Jidovtseff et al., 2021; Karamustafaoğlu et al., 2018).

The second sub-problem of the research examined preschool teachers' views on the usage of out-of-school learning environments where math activities can be conducted. The results of the current research show that the majority of teachers use out-of-school learning environments in their activities. Teachers specifically stated that they use schoolyards, nature, libraries, science centers, museums, and historical sites. This finding suggests that teachers focus on accessible areas outside the classroom where the subject matter can be applied practically. Similar to the findings of the current study, Ocak and Korkmaz (2018) found that teachers use a wide variety of out-of-school learning environments in their studies. Teachers utilize out-of-school learning environments to connect with daily life, contribute to problem-solving processes, make learning fun, increase interest and motivation in mathematics, and ensure permanent learning. There are studies supporting these findings. Çepni and Aydın (2015) stated that out-of-school learning environments increase the permanence of information and make learning enjoyable. Similarly, Bostan Sarıoğlan and Küçüközer (2017) stated that out-of-school learning activities are effective in permanent learning. When the frequency of preschool teachers' use of out-of-school learning environments was examined, it was found that nearly half of the teachers stated that they use these environments once a year or more. Similar to the result of this research, Yıldız (2022) concluded in their research that the vast majority of preschool teachers actively use these environments and attributed this to the fact that most teachers consider the schoolyard as an out-of-school learning environment. When the math activities carried out by teachers in out-of-school learning environments were examined, it was seen that they conducted activities such as games, creating geometric shapes, measuring length, creating patterns, matching, sequencing, grouping, addition and subtraction operations, observation-estimation, constructing with basic blocks, and creative drama. Similarly, Anders and Rossbach (2015), in their study with preschool teachers in Germany, found that teachers have a high tendency to include mathematical concepts in game activities. Preschool teachers, especially in math activities they conduct in the schoolyard and nature, aimed to contribute to students' learning by utilizing natural materials. Karamustafaoğlu et al. (2018) stated in their studies that teachers conduct math activities in out-of-school learning environments. To make out-of-school learning environments more productive in the context of mathematics lessons, participants argued for the widespread implementation of out-of-school learning environments such as math museums and math workshops. In addition, it was stated that virtual math museums should be created, necessary training on out-of-school learning should be provided to teachers, and guidebooks should be prepared for teachers. The results of this research are consistent with the results of the study conducted by Ergin Aydoğdu, Aydoğdu & Aktaş (2023). Teachers also stated that the schoolyards, which they use most frequently as out-of-school learning environments, should be improved, legal procedures should be reduced, and a budget should be provided for transportation and entrance fees to historical sites. Similarly, other studies conducted with teachers have mentioned problems with time, budget, organization, preparation, and transportation related to out-of-school learning environments (Kır et al., 2021).

The third sub-problem of the research examined the challenges faced by preschool teachers while conducting math activities in out-of-school learning environments. Teachers mentioned overcrowded classrooms, difficulty in keeping children's attention, lack of materials, difficulty ensuring children's safety, and loss of materials. Similar to the findings of the current research, Jidovtseff et al. (2021) revealed in their study that despite having a positive attitude towards out-of-school learning

environments, teachers carry out limited outdoor practices due to class size, organizational constraints, lack of materials, and low supervision rates. Similarly, İnce and Akcanca (2021) stated in their research that problems such as the teacher's inability to attend to each child due to the large number of children in out-of-school learning environments, economic problems, and discipline and control difficulties were experienced. Teachers suggested solutions to prevent these problems, such as reducing class sizes, school administration support, teacher and parent support, providing sufficient time for activities, and material support. In their research, Karamustafaoğlu et al. (2018) revealed that the reasons why preschool teachers do not prefer practices related to out-of-school learning environments stem from restrictive regulations, time constraints, lack of resources, lack of knowledge and confidence, reasons originating from some colleagues, administrators, and parents, especially the lengthy permission process and the challenging situations encountered during this process. Although the teachers participating in the research generally agreed that out-of-school learning environments would contribute positively to math lessons, it was concluded that they conducted their lessons in out-of-school learning environments to a limited extent due to various challenges they faced/would face. Based on the results obtained in the research, it is possible to make some recommendations. Accordingly, considering the contributions of out-of-school learning environments, these environments should be used more frequently and integrated into preschool education. In addition, the chosen out-of-school learning environment should be appropriate for the children's developmental characteristics and the program's learning outcomes. The Ministry of National Education could publish an advisory guide explaining how preschool teachers can conduct math activities in out-of-school learning environments with sample activities. With the support of school administration and parents, necessary conveniences can be provided to teachers regarding the use of out-of-school learning environments. Furthermore, necessary precautions should be taken by relevant institutions to ensure the safe and pedagogically appropriate use of out-of-school learning environments such as math museums and workshops, science centers, and historical sites. This way, teachers' concerns about safety, maintaining student attention, and completing math activities can be addressed. Due to the limited number of studies in the mathematics education literature regarding out-of-school learning, there is a need for in-depth research on this topic. This research was conducted to examine the views of preschool teachers on out-of-school learning environments and their usage for math activities. A similar study can be conducted with parents and students.

Ethics and Conflict of Interest

This research was conducted with the permission obtained from the Ethics Committee of Dokuz Eylül University Legal Counsel, dated 01.04.2024 and numbered E-87347630-659-956012. Furthermore, all publication ethics were adhered to at every stage of the research. The authors declare that they have no conflict of interest.

Author Contribution

All authors contributed equally to the research.

Data availability

The data that support the findings of this study are available on request from the corresponding author.

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