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Preservice Preschool Teachers' Mathematics Activity Plans and Their Views on the Planning Process

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ABSTRACT

This study examines the consistency between preservice preschool teachers' views on planning mathematics activities and the activity plans they prepare. The study was conducted with 42 preservice teachers enrolled in a preschool education program at a public university in the Western Mediterranean region of Türkiye. Data were collected through semi-structured interviews and an examination of the participants' mathematics activity plans. The findings show that preservice teachers generally found the planning process enjoyable and instructive, though they experienced difficulties at certain stages. An analysis of the activity plans revealed that they frequently incorporated concrete materials, hands-on learning, and child-centered approaches. However, the range of mathematical content was limited, and the assessment components of the plans were not sufficiently elaborated. These findings suggest that teacher education programs should provide more opportunities for practice-based learning and offer stronger guidance, particularly in developing assessment processes within mathematics activity planning.

KEYWORDS

Early mathematics education; preservice teachers; mathematics activity planning; preschool education.

INTRODUCTION

The preschool years are a vital time for young children, as it is when they start to develop the building blocks of mathematical thinking. During this period, their minds begin to form the cognitive structures that will support their future academic learning (Liu et al., 2025). Research shows that early math skills strongly predict children's future success in mathematics and other academic areas, such as reading (Duncan et al., 2007; Jordan et al., 2009). The foundational ideas of early number sense, counting, and understanding quantities lay the groundwork for more advanced math skills and problem-solving abilities later. These early concepts help children develop the confidence and skills they'll need as they tackle more complex arithmetic in the future (Starr et al., 2013). Within early childhood education, mathematical development is therefore not viewed merely as a domain in which specific learning outcomes are taught. Rather, it is considered a key developmental area that influences how later learning is organized and built upon. Evidence from a large-scale meta-analysis of 54 longitudinal studies involving more than 58,000 students demonstrates that numerical skills assessed in early childhood are strongly related to later mathematical performance and serve as meaningful long-term predictors of mathematical development (Liu et al., 2025). For this reason, the nature of the mathematical learning opportunities provided during early childhood and the structure of instructional processes have become important topics of research.

Research examining mathematics interventions in early childhood suggests that planned instructional practices implemented during this period can meaningfully support children's mathematical development. A meta-analytic review including 29 experimental and quasi-experimental studies conducted in preschool and kindergarten settings reported that early mathematics programs demonstrate moderate to large effect sizes on children's mathematical skills (Wang et al., 2016). These findings indicate that early mathematics instruction constitutes a developmentally appropriate and educationally effective area of learning. However, research on classroom practices indicates that the time spent on mathematics activities in preschool settings is quite limited. Classroom observations reveal that children spend only a small portion of their day on math activities, while literacy-related activities take up a much larger portion of the schedule. This imbalance highlights the need for greater focus on math in the classroom (Early et al., 2010). This challenge goes beyond perceptions of math's importance. It often hinges on teachers' understanding of the subject, their confidence, and their ability to create engaging lessons for young learners. By addressing these areas, we can significantly enhance the quality of early math instruction, making it a more enriching experience for students and fostering a lifelong appreciation for the subject (Lee & Ginsburg, 2009). Teachers' knowledge of mathematics, pedagogical orientations, and affective dispositions can directly shape the quality of classroom interactions and the organization of learning environments (Jenßen et al., 2022). For this reason, the nature of mathematical learning opportunities in early childhood education settings and the ways instructional processes are structured have become important areas of research.

Learning mathematics in early childhood is not just about teaching children facts and figures; it's also about creating a supportive environment and fostering meaningful interactions. Both elements play a crucial role in enhancing the quality of their learning experience. Research indicates that in play-based learning, social interactions, teacher support, and the arrangement of materials greatly influence children's understanding of math. When children construct complex structures with blocks, engage in collaborative problem-solving with peers, and use mathematical language, these behaviors often emerge from intentionally designed learning environments (Trawick-Smith et al., 2016). Such findings suggest that the quality of early mathematics instruction is closely tied to teachers' planning decisions. During the planning process, teachers determine which learning outcomes will be emphasized, which materials will be introduced, how interaction will be facilitated during learning activities, and how children's learning will be assessed. Within this process, teachers' classroom interactions and forms of guidance play a particularly important role. Studies show that teachers' questioning strategies that prompt mathematical reasoning, as well as their use of mathematical discourse, can significantly influence children's learning processes (Gonulates & Gilbert, 2023). Effective mathematics instruction often emerges from deliberate instructional planning, requiring teachers to organize learning goals, materials, and interaction patterns purposefully (Clements & Sarama, 2014).

Research shows that teachers' mathematical content knowledge influences how they design and implement instruction (Konca & Özçakır, 2021). However, this knowledge does not always translate directly into students' mathematics achievement (Hill et al., 2005). Effective mathematics teaching is not only about what teachers know, but also about how they structure and use this knowledge in the classroom. For this reason, pedagogical knowledge and the planning of the learning process need to be considered together (Li, 2020). In early childhood mathematics education, teachers' pedagogical content knowledge and their understanding of how to teach mathematics play an important role in shaping the learning environment and process (Ortiz Padilla et al., 2023; Taşkın & Sezer, 2022). One study in the literature shows that although teachers are aware of the importance of early mathematics, they often feel inadequate in terms of pedagogical content knowledge and structuring the teaching process (Demir, 2025). In this respect, how teachers reflect their pedagogical knowledge in classroom practices has become an important research focus.

Preservice preschool teachers constitute an important group, as they are at the beginning of their professional development. Research shows that teacher candidates generally hold positive attitudes toward mathematics teaching. However, these positive attitudes can coexist with mathematics anxiety and limited conceptual understanding (Gresham & Burleigh, 2019; Lavidas et al., 2023). When prior learning experiences in mathematics are mostly procedural, opportunities to develop conceptual understanding may remain limited. This situation may also increase anxiety related to teaching mathematics (Devine et al., 2012; Osana et al., 2006). In addition, preservice teachers' perceptions of self-efficacy do not always align

with their pedagogical content knowledge. Their level of conceptual understanding can directly influence the quality of the instructional plans they prepare (Ball et al., 2005; Chen et al., 2014).

Research has shown that preservice teachers' experiences in preparing lesson plans can be more effective than theoretical learning (Kablan, 2012). Studies focusing on the planning process indicate that the decisions made during planning directly influence the quality of the resulting activity plans. For instance, when the plans prepared by preservice teachers who demonstrate high performance in the planning process are examined, it is observed that instructional processes targeting cognitive outcomes and evaluation components tend to be of higher quality (Aşiroğlu & Koç Akran, 2018). However, the literature also emphasizes that the evaluation component in many activity plans is often insufficiently elaborated and needs to be more clearly aligned with learning outcomes (Suurtamm et al., 2016). Similarly, studies have shown that preschool teachers often feel less competent in planning mathematics activities and conducting evaluations, and experience various difficulties in these areas (Aydın, 2009; Tarım & Bulut, 2006). Although these studies provide important insights into preservice teachers' planning processes, research that simultaneously examines the relationship between preservice teachers' views on planning and the activity plans they prepare remains limited. Therefore, the present study aims to contribute to the literature by addressing these two dimensions together. In this context, the relationship between planning processes and instructional practices emerges as an important area of discussion.

Research in mathematics education suggests that there may be differences between teachers' beliefs and what they express, and their actual classroom practices. Studies have shown that teachers' knowledge about teaching does not always align with their classroom practices, and that instructional processes can be influenced by various contextual factors (Thompson, 1992). For this reason, studies examining the consistency between teachers' views and their practices often consider lesson plans as an important source of data (Hiebert et al., 2007). In this respect, the lesson plans prepared by preservice teachers provide valuable insight into how they organize instructional processes and how they translate their views on mathematics teaching into practice.

This study focuses on the consistency between preservice preschool teachers' views on planning mathematics activities and the activity plans they prepare. Examining how these views are reflected in the plans they design may help better understand the planning dimension of early mathematics instruction. Based on this, the study addresses the following research questions:

1. How do preservice preschool teachers describe the process of planning mathematics activities?
2. What are preservice teachers' perceptions of their self-efficacy in planning mathematics activities?
3. How are learning outcomes selected in the mathematics activity plans prepared by preservice teachers?

4. What is the nature of the mathematical concepts included in the activity plans?
5. How is the learning process structured within the activity plans?
6. What characteristics are reflected in the evaluation sections of the activity plans?
7. To what extent is there consistency between preservice teachers' views on mathematics activity planning and the activity plans they prepare?

METHOD

Research Design

This study was designed as a qualitative case study to examine the consistency between preservice preschool teachers' views on mathematics activity planning and the mathematics activity plans they prepared. Case study research enables the in-depth exploration of a bounded phenomenon within its natural context. The preservice teachers included in the study group had completed the Early Childhood Mathematics Education course and had previously prepared a mathematics activity plan. These criteria ensured that the study was conducted within a specific context and shared experience, thereby providing the basis for adopting a case study design. Within this approach, researchers aim to develop a comprehensive understanding of a particular situation by drawing on multiple data sources. The use of various data sources, including interviews and documents, is a defining characteristic of case study research (Yin, 2018). This study was a case study examining the consistency between preservice preschool teachers' views on planning mathematics activities and the mathematics activity plans they prepared. It focuses on how these views are reflected in the plans they design.

Participants

The participants in the study were 42 preservice preschool teachers enrolled in the second year of a preschool teacher education program at a public university in the Western Mediterranean region of Türkiye who volunteered. The study group was selected through criterion sampling, a purposive sampling strategy. In criterion sampling, individuals are deliberately selected according to predefined criteria to examine a particular phenomenon in depth (Creswell, 2015). Within the scope of this study, the criteria used for participant selection were as follows: having completed the Early Childhood Mathematics Education course and having previously prepared a mathematics activity plan. The demographic characteristics of the 42 preservice preschool teachers who participated in the study are presented in Table 1.

Table 1.

Demographic Characteristics of the Preservice Teachers

Characteristic	Category	n
Age	18-20	23
	21-23	17
	24 and above	2
Gender	Female	34
	Male	8
Previous experience in a preschool institution	Yes	8
	No	34

Table 1 shows that most participants were between 18 and 20 years old (n = 23), followed by those aged 21–23 (n = 17). Only two participants were 24 or older. In terms of gender, the sample was predominantly female (n = 34), with a smaller number of male participants (n = 8). A similar pattern was observed for prior preschool experience: most participants (n = 34) had no preschool experience, while only a few (n = 8) reported having it.

Data Collection

Data were collected through a semi-structured interview form and an analysis form for a mathematics activity plan. Semi-structured interviews are a data collection technique that allows participants' views, experiences, and evaluations regarding a particular topic to be explored in detail. While this type of interview proceeds through a set of predetermined questions, it also provides the researcher with the flexibility to ask follow-up questions and request clarification when necessary (DeJonckheere & Vaughn, 2019; Kallio et al., 2016). The semi-structured interview form developed by the researchers consisted of 12 open-ended questions designed to explore preservice teachers' perceptions of the planning process, the aspects they focus on during planning, the areas in which they feel competent, and the dimensions they find challenging.

To evaluate the mathematics activity plans prepared by the preservice teachers, a plan analysis form developed by the researchers was used, drawing on the Preschool Education Program of the Ministry of National Education (MoNE, 2024) as a reference framework. The form included criteria for alignment with learning outcomes and indicators, the mathematical concepts addressed, the structure of the teaching–learning process, the use of materials, and the evaluation component.

In this study, mathematics activities are conceptualized as structured learning experiences that support the holistic development of preschool children. These activities are based on the Preschool Education Program of the Ministry of National Education (MoNE, 2024) and include domains such as counting and number sense, ordering, classification, comparison, measurement, and geometry. Activity plans are defined as written instructional documents prepared in line with learning outcomes and mathematical concepts. These plans are considered key data sources reflecting how preservice teachers organize mathematics instruction and support children's learning.

To examine the activity plans, the researchers used a plan analysis form developed based on the MoNE (2024) Preschool Education Program. This form was structured to enable systematic, comparable analysis of the data. During its development, the learning outcomes and indicators included in the program, along with the dimensions of the learning process and evaluation, were considered. This framework was further integrated with mathematical process skills emphasized in the early childhood mathematics education literature, including problem-solving, reasoning, and making connections.

The developed form was designed to evaluate both the alignment of the activity plans with the curriculum and their mathematical and pedagogical quality. In this context, the analysis

considered the alignment of the plans with learning outcomes and indicators, their appropriateness for the target age group, the accuracy and depth of the mathematical concepts, the structuring of the learning process, the quality of the methods and materials used, and the functionality of the evaluation component. To ensure content validity, both the interview form and the plan analysis form were reviewed by experts in early childhood education. Based on their feedback, necessary revisions were made, and the data collection tools were finalized.

Data Collection Process and Analysis

Data for this study were collected in two stages. In the first stage, preservice teachers were asked to prepare a mathematics activity plan. After collecting the activity plans, semi-structured interviews were conducted in the second stage to explore their views on planning mathematics activities. During the interviews, a total of 12 open-ended questions were asked, including: "How did you experience the process of preparing a mathematics activity in general?" "What did you pay attention to first when planning a mathematics activity?" "In which part of planning a mathematics activity did you feel most competent?", and "Which part did you find most challenging and why?". Each interview lasted approximately 25–30 minutes. Using multiple data sources in qualitative research supports a more comprehensive understanding of the phenomenon under study (Yin, 2018).

The data obtained within the scope of the study were analyzed using a content analysis approach. Interview data and mathematics activity plans were considered together; however, the units of analysis were defined separately for each data type. In the interview data, the unit of analysis was determined as meaningful expressions reflecting participants' experiences and evaluations. At the same time, in the activity plans, it was defined as the plan's structural components.

Both deductive and inductive approaches were employed during the analysis process. The activity plans were examined through document analysis using the plan analysis form developed by the researchers as a framework (Yıldırım & Şimşek, 2013). The plans were analyzed with respect to their alignment with learning outcomes and indicators, the nature of the mathematical concepts, the structure of the teaching–learning process, the use of materials, and the evaluation component. For the interview data, an initial coding framework based on the research questions was established and expanded as codes emerged.

During the coding process, the data were examined in detail, and meaningful expressions were coded based on their content and grouped according to similarities. The resulting codes were organized into sub-themes, and sub-themes were further developed into overarching themes. This thematic structure facilitated the systematic identification of patterns of meaning within the data and supported the transparent presentation of the analysis (Elo et al., 2014; Nowell et al., 2017). Both interview data and activity plans were analyzed within the same dimensions and evaluated comparatively. In this way, the consistency between preservice teachers' expressed views and the content of the plans they prepared was examined. Finally,

the data were coded independently by the researchers, and agreement was reached through comparison, thereby enhancing the reliability of the analysis process.

Validity and Reliability of the Study

In this study, several steps were taken during the data collection and analysis processes to enhance validity and reliability. In this context, data from semi-structured interviews with preservice teachers and the mathematics activity plans they prepared were examined together to ensure data triangulation. The interview form and the activity plan analysis form were developed based on the relevant literature and the Preschool Education Program of the Ministry of National Education (MoNE, 2024) and revised in line with expert feedback. During the analysis, coding and theme development were carried out systematically, and the findings were grounded in the data sources (Bowen, 2009; Nowell et al., 2017).

In addition, ethical principles were observed throughout the research process. Participants were informed in detail about the study's purpose and procedures, and their consent was obtained voluntarily. The confidentiality of the collected data was also ensured. To protect the identities of the preservice teachers participating in the study, participants were assigned codes such as “PT1, PT2, …, PT42”, and direct quotations in the findings section are presented using these codes.

FINDINGS

The findings are presented within the framework of themes and sub-themes, based on data from semi-structured interviews with preservice teachers and on document analysis of the mathematics activity plans they prepared.

Preservice Teachers’ Views on Mathematics Activity Planning

This section presents the findings from the semi-structured interviews with preservice teachers. The data were analyzed under five main themes reflecting participants’ views on their experiences in mathematics activity planning, the selection of mathematical content and concepts, the structuring of the learning process, and the evaluation process.

The analysis of the interviews revealed that preservice teachers made 184 statements (n = 184) on experiences related to the mathematics activity planning process, organized into three sub-themes. Findings related to the first research question, “How do preservice preschool teachers describe the process of planning mathematics activities?”, are presented in Table 2 based on interviews with participants.

When the sub-theme mathematics activity planning process, which reflects preservice teachers’ views about the planning experience, is examined, it becomes clear that the process involved a range of different experiences. A considerable number of participants described the activity planning process as enjoyable (n = 26) and instructive (n = 11). For instance, PT5 expressed this by stating, “It was an instructive and enjoyable experience.” In addition, several preservice teachers reported that they gradually gained self-confidence during the process (n = 12). PT8 explained this as follows: “After completing the activity, I felt satisfied, gained

confidence in myself, and my belief in my ability to do it increased." At the same time, some participants also emphasized that the process could be challenging (n = 10) and stressful (n = 7). Regarding this aspect, PT7 noted: "When I first started preparing the activity, I felt very stressed and found it difficult."

Table 2.

Experiences Related to the Mathematics Activity Planning Process

Sub-theme	Code	n
Mathematics activity planning process	Enjoyable	26
	Gaining self-confidence	12
	Instructive	11
	Challenging	10
	Stressful	7
	Peer learning	2
Considerations when planning mathematics activities	Alignment with learning outcomes	18
	Developmentally appropriate	16
	Planning the process	12
	Clear instructions	8
	Enjoyable	7
	Instructive	7
	Evaluation component	1
Developing mathematics activity planning skills	Opportunities for practice	23
	Using creativity	9
	Planning activities	8
	Preparing materials	7

Within the sub-theme considerations when planning mathematics activities, preservice teachers most frequently referred to alignment with learning outcomes (n = 18) and developmental appropriateness (n = 16). For example, PT29 stated, "I paid attention to whether the activity addressed the developmental areas and learning outcomes that I aimed to support in children." In addition, other aspects highlighted included planning the activity process (n = 12), ensuring that instructions were clear and understandable (n = 8), and designing the activity to be both enjoyable (n = 7) and instructive (n = 7). PT16 referred to the importance of structuring the process and giving clear instructions by saying, "I tried to prepare a plan in which I would use fewer instructions during the teaching–learning process and take on more of a guiding role alongside the children." Similarly, PT13 emphasized the importance of the activity being enjoyable and instructive, stating, "I made sure that my instructions were clear and that the process was not boring but instead instructive."

Under the sub-theme developing mathematics activity planning skills, preservice teachers most frequently stated that they needed more opportunities for practice (n = 23). In this regard, PT5 remarked, "I think I need more practice." Participants also indicated that they needed to further develop skills related to creativity (n = 9), activity planning (n = 8), and

material preparation (n = 7). PT10 described the need to enhance creativity by stating, “I think I need to come up with more creative ideas.” PT38 expressed the need to improve activity planning skills by noting, “I may need to design more activities.” Similarly, PT33 referred to material preparation by saying, “I think I need to improve my use of tools and materials during preparation and be clearer about the materials that will be used.”

Under the theme mathematical content and concept selection, preservice teachers expressed a total of 89 statements (n = 89) across two sub-themes. Preservice teachers’ views on the criteria used to determine mathematical content and concepts during the planning process are presented in Table 3.

Table 3.

Mathematical Content and Concept Selection

Sub-theme	Code	n
Determining learning outcomes and indicators	2024 ECE Curriculum	13
	Developmental appropriateness	7
	Teaching–learning process	6
	Selecting outcomes appropriate to the topic	6
	Alignment with materials	6
	Supporting children’s development	4
	Internal consistency of outcomes	4
Determining concepts	Relevance to the topic	19
	Research	7
	Developmental appropriateness	7
	ECE curriculum	5
	Alignment with learning outcomes and indicators	5

When the sub-theme determining learning outcomes and indicators was examined, it was found that preservice teachers primarily referred to the 2024 ECE Curriculum when selecting the learning outcomes and indicators included in their mathematics activity plans (n = 13). For example, PT27 explained this as follows: “I determined them according to the preschool education program and the children’s developmental levels, considering their relevance to the topic.” Some preservice teachers also reported considering criteria such as developmental appropriateness (n = 7), the structure of the teaching–learning process (n = 6), and selecting outcomes appropriate to the topic (n = 6) when making their selections. PT4 expressed this by stating, “I decided according to the teaching–learning process.”

When the sub-theme determining mathematical concepts to be included in the activity was examined, it was observed that the most frequently emphasized criterion in concept selection was relevance to the topic (n = 19). For example, PT22 explained this by saying, “I selected the concepts according to the topic I determined and the relevant learning outcomes.” In addition, some participants reported considering factors such as conducting research (n = 7) and developmental appropriateness (n = 7) when identifying the mathematical concepts to be

included in their activities. PT3 described this process as follows: "I tried to create something original by doing a lot of research and reviewing many activities." Similarly, PT13 emphasized the importance of children's developmental level by stating, "Since I learned that concepts should be explained to children step by step, I organized them according to their level, moving from simple to more complex concepts."

Under the theme structuring the learning process, preservice teachers expressed a total of 152 statements (n = 152) across three sub-themes. Preservice teachers' pedagogical approaches to structuring the learning process and incorporating mathematical concepts into their plans are presented in Table 4.

Table 4.

Structuring the Learning Process

Sub-themes	Code	n
Reflecting mathematical concepts in activity plans	Through integrated activities	13
	Concretization	11
	Play	9
	Materials	7
	Relating to real life	7
Views on structuring the learning process	Clarity	16
	Active participation	13
	Developmental appropriateness	12
	Alignment with learning outcomes and indicators	11
	Engaging	10
Use of concrete materials	Use of senses	24
	Age group	15
	Relating to real life	4

When the sub-theme reflecting mathematical concepts in activity plans was examined, it was observed that concepts were most often incorporated into the plans through integrated activities (n = 13). PT8 explained this by stating, "I tried to reflect them by integrating them into my activity." In addition, preservice teachers reported using concretization (n = 11) and game-based practices (n = 9) so that children could understand the concepts more easily. For example, PT18 described the concretization process by saying, "I used real objects." Similarly, PT24 explained the use of game-based practices as follows: "I reflected it through gamification, playing with music, and activities involving the use of the senses." Furthermore, approaches such as the use of materials (n = 7) and relating concepts to daily life (n = 7) were also mentioned as ways of integrating mathematical concepts into activity plans. PT13 described this approach by stating, "I tried to reflect it by connecting it with daily life and helping children experience it through materials."

When the sub-theme views on structuring the learning process was examined, it was found that preservice teachers particularly emphasized factors such as clear instructions (n = 16), active participation of children (n = 13), and developmental appropriateness (n = 12). For

instance, PT9 stated, “I paid attention to whether children could understand it and whether it was appropriate for them.” Likewise, PT20 expressed this view by saying, “I wanted to act only as a guide during the learning process and allow children to learn through doing and experiencing. I thought I should not give too many instructions.” In addition, ensuring that activities were aligned with learning outcomes and indicators (n = 11) and captured children’s interest (n = 10) were also identified as important considerations when planning the learning process. PT4 explained alignment with outcomes and indicators by stating, “I considered whether the activity aligned with the learning outcomes and indicators and whether children could learn actively.” Similarly, PT3 emphasized the importance of engagement by saying, “I paid attention to attracting children’s interest, exciting them, and drawing them into the activity.”

When the sub-theme use of concrete materials in mathematics activities was examined, most preservice teachers emphasized that materials were important because they allow children to use multiple senses during learning (n = 24). For example, PT30 explained this as follows: “Children remember objects that they can see and touch more easily.” In addition, some participants highlighted the importance of using concrete materials in terms of age appropriateness (n = 15) and relating mathematical concepts to daily life (n = 4). Regarding age appropriateness, PT29 stated, “I think activities using concrete materials always provide more lasting learning for children aged 0–6.” Likewise, PT16 referred to linking mathematics with daily life by saying, “Children can connect objects they encounter in daily life with mathematics and develop analytical thinking skills.”

Table 5.

Views on the Evaluation and Implementation Process

Sub-themes	**Code**	**n**
Views on the evaluation process	Asking activity-related questions	37
	Observation	6
	Product creation	2
Views on the activity planning process	Designing materials	20
	Writing the learning process	11
	Teaching through enjoyment	4
Challenges experienced during the activity planning process	Planning	12
	Designing materials	8
	Giving instructions	8
	Evaluation	5
	Introduction to the activity	4
Views on the implementation process	Matching	7
	Patterns	5
	Maintaining focus	3
	Activities being abstract	2

Under the theme views on the evaluation and implementation process, preservice teachers expressed a total of 134 statements (n = 134) across four sub-themes. Preservice teachers' perceptions of self-efficacy in the planning process and their perspectives on evaluation and implementation are presented under common themes in Table 5.

Preservice teachers' views on how children's learning would be assessed at the end of mathematics activities are presented under the sub-theme views on the evaluation process. An examination of this sub-theme shows that the most frequently preferred approach for evaluation was asking questions related to the activity (n = 37). For example, PT42 explained this by stating, "I thought I would evaluate it by asking questions related to the topic and the activity I presented." The areas in which preservice teachers felt most competent during the mathematics activity planning process are presented under the sub-theme views on the activity planning process. An examination of this sub-theme revealed that the majority considered themselves most competent in designing materials (n = 20). PT23, for instance, stated, "I think I am good at designing materials."

When the sub-theme challenges experienced during the mathematics activity planning process was examined, it was found that participants most frequently emphasized difficulties related to the planning process itself (n = 12). For example, PT23 explained: "I found it difficult when planning the activity because children have individual differences, and it is challenging to plan according to each child's level of readiness." In addition, designing materials (n = 8) and giving instructions (n = 8) were also mentioned among the areas in which preservice teachers experienced difficulties. PT11 stated, "I had difficulty designing materials suitable for the activity." Similarly, PT23 noted, "Explaining the instructions to the children was difficult for me." When the sub-theme views on the implementation process were examined, preservice teachers indicated that certain mathematical concepts might be more challenging for children during classroom implementation of the activities. They emphasized matching (n = 7) and patterns (n = 5) as concepts that children might find difficult. Regarding matching, PT20 stated, "They might struggle most with the matching part because it could be confusing." Similarly, PT14 noted patterns: "They might have difficulty when creating patterns."

Examination of the Mathematics Activity Plans

The preservice teachers' mathematics activity plans were examined through document analysis. The analysis revealed four main themes: the structural characteristics of the activity plans, the treatment of mathematical content, the features of the learning process, and the evaluation components. The findings are presented within the framework of these themes.

Under the theme structural characteristics of the mathematics activity plans, a total of 144 codes (n = 144) were identified across two sub-themes. The general structural characteristics of the mathematics activity plans prepared by preservice teachers, including activity type and age group, are presented in Table 6.

Table 6.

Structural Characteristics of the Activity Plans

Sub-theme	Code	n
Type of activity	Mathematics	39
	Play	8
	Turkish language activity	6
	Drama	3
	Science	2
	Music	2
	Movement	2
Age groups	3 years	1
	4 years	17
	5 years	36
	6 years	28

When the sub-theme structural characteristics of the mathematics activity plans was examined, it was found that most of the plans were designed as mathematics activities (n = 39). However, some activities were also integrated with other types of activities, including games (n = 8), Turkish language activities (n = 6), drama (n = 3), science (n = 2), music (n = 2), and movement activities (n = 2).

Table 7.

Mathematical Content Included in the Activity Plans

Sub-themes	Code	n
Learning outcomes	Counts objects	18
	Matches objects or entities according to their attributes	18
	Compares the attributes of objects or entities	18
	Pays attention to an object/event/situation	13
	Orders objects or entities according to their attributes	11
	Demonstrates number awareness	10
Mathematical concepts	Number and counting	18
	Comparison	15
	Ordering	15
	Patterns	10
	Matching	6
	Measurement	5
	Estimation	4
	Geometry	4
	Classification	3
	Addition–subtraction	3

An examination of the sub-theme target age groups in the activity plans showed that most plans were prepared for five-year-old children (n = 36). Fewer activity plans targeted four-year-old children (n = 17), and only a small number were prepared for three-year-old children

(n = 1). Under the theme mathematical content included in the activity plans, a total of 171 codes (n = 171) were identified across two sub-themes. The selection of learning outcomes and the diversity and quality of the mathematical concepts addressed in the activity plans are presented in Table 7.

When the mathematical content included in the activity plans was examined, it was observed that preservice teachers incorporated a range of different mathematical learning outcomes and indicators into their plans. Among these, the most frequently selected outcomes were counting objects, matching, and comparison (n = 18).

An examination of the mathematical concepts addressed in the activity plans showed that the most used concepts were number and counting (n = 18), comparison (n = 15), and ordering (n = 15).

Under the theme learning process features of the mathematics activity plans, a total of 146 findings (n = 146) were identified in the plans prepared by the preservice teachers. The pedagogical principles and methods guiding the structuring of the learning process in the activity plans (e.g., use of concrete materials, active participation) are presented in Table 8.

An examination of the learning process features of the activity plans indicates that preservice teachers most frequently incorporated the use of concrete materials in their mathematics activities (n = 37). In addition, a large proportion of the activities were designed in accordance with a learning-by-doing and experiencing approach (n = 34). The findings also show that the question–answer technique (n = 27) and the principle of developmental appropriateness (n = 19) were commonly considered in structuring the learning process.

Table 8.

Learning Process Features

Theme	Code	n
Learning process features	Use of concrete materials	37
	Learning by doing and experiencing	34
	Question–answer technique	27
	Developmental appropriateness	19
	Child-centered approach	16
	Teacher guidance/facilitation	13

Furthermore, pedagogical features such as a child-centered approach (n = 16) and teacher guidance (n = 13) were also included in the activity plans. These findings suggest that preservice teachers tended to structure mathematics activities in ways that emphasize active participation and concrete learning experiences.

Under the theme evaluation features of the activity plans, a total of 91 findings (n = 91) were identified in the plans prepared by the preservice teachers. The characteristics of the evaluation sections in the activity plans and the types of questions used are presented in Table 9.

Table 9.

Evaluation Features

Theme	Code	n
Evaluation features	Descriptive questions	31
	Closed-ended questions	22
	Open-ended questions	21
	Alignment with learning outcomes and indicators	11
	Questions relating to daily life	6

When the theme evaluation features of the activity plans were examined, it was observed that preservice teachers most frequently included descriptive questions in their evaluations (n = 31). In addition, closed-ended questions (n = 22) and open-ended questions (n = 21) were among the evaluation approaches used in the activity plans.

Furthermore, in some plans, the evaluation questions aligned with the learning outcomes and indicators (n = 11), and questions about daily life were also included (n = 6). These findings suggest that preservice teachers primarily relied on question-based approaches when evaluating mathematics activities.

When the views expressed by preservice teachers in the interviews were combined with the findings from the document analysis of the activity plans, a noticeable level of alignment emerged between the two data sources. During the interviews, preservice teachers highlighted several pedagogical preferences, including the use of sensory experiences, the concretization of concepts, and the active participation of children. These preferences were also evident in the activity plans, which incorporated concrete materials, experiential learning activities, and child-centered approaches.

At the same time, some differences between expressed views and written plans were also observed. Although preservice teachers preferred integrating mathematics with other learning areas, most activity plans were designed primarily as standalone mathematics activities. Similarly, while preservice teachers reported considering various factors when selecting mathematical concepts, the activity plans tended to focus mainly on a limited number of commonly used concepts. In addition, although different assessment approaches were mentioned during the interviews, the evaluation sections of the plans were largely based on question-oriented strategies.

DISCUSSION

The findings of the study indicate that there is generally a meaningful alignment between preservice teachers' expressed views on the planning process and the structural characteristics of the activity plans they prepared. In their responses, preservice teachers emphasized principles such as developmental appropriateness, alignment with learning outcomes, clear instructions, and engaging learning processes. These emphases are consistent with findings reported in recent studies. For example, Elmalı (2025) notes that preschool teachers are aware

of the importance of developmental appropriateness and gamification principles when planning mathematics instruction. Such approaches not only strengthen cognitive learning but also influence affective learning processes, support academic achievement, and increase classroom participation and motivation by fostering positive emotional responses (Bolkan, 2017; Titsworth et al., 2015).

The study's findings also show that preservice teachers placed considerable emphasis on the use of concrete materials, learning by doing and experiencing, and a child-centered approach in their activity plans. Given children's cognitive developmental characteristics in early childhood, it is well known that they require concrete experiences involving sensory engagement, such as touch and sight, to make sense of abstract mathematical concepts. In this context, many studies highlight that construction and exploration activities carried out with concrete objects support meaningful learning (Verdine et al., 2019; Wolfgang et al., 2001) and contribute positively to children's mathematical development (Babur, 2016; Clements, 2000; Sarama & Clements, 2009).

Manipulative materials used in mathematics instruction are considered to provide sensory learning opportunities that support students' mathematical thinking (Swan & Marshall, 2010). However, the literature also suggests that teachers do not always fully recognize or utilize the potential contributions of real objects in the learning process (Topbaş Tat & Bulut, 2010). From this perspective, the frequent use of concrete materials in the activity plans prepared by preservice teachers may indicate that they have developed an important pedagogical awareness of the role of active participation in early childhood learning.

Another noteworthy finding is that preservice teachers did not limit their plans to the use of materials alone; rather, they addressed mathematical concepts through integrated practices, such as game-based activities, Turkish language activities, and connections to daily life. Kesicioğlu (2021) notes that preservice teachers frequently integrate mathematics through gamification, while Ginsburg and Seo (1999) emphasize the importance of organizing these processes in ways that are motivating for children. Similarly, the National Council of Teachers of Mathematics (2000) states that creating appropriate learning environments is a fundamental responsibility of preschool teachers.

The literature also frequently highlights that teachers' educational orientations are among the most important factors shaping the quality of learning environments (Ortiz Padilla et al., 2023; Jenßen et al., 2022). In this regard, preservice teachers' tendency to design child-centered, play-based, and interdisciplinary activities can be considered a strong indicator of their professional readiness. Indeed, Figueiredo et al. (2018) suggest that teachers with well-developed mathematical content knowledge can translate theoretical concepts into practical activities appropriate for children's cognitive levels. As emphasized by Kirova and Bhargava (2002) and Aktaş Arnas (2009), designing activities that align with children's developmental levels is also fully consistent with the learning trajectories approach in early mathematics (Clements & Sarama, 2020).

The findings also indicate that the mathematical content included in the activity plans prepared by preservice teachers was largely concentrated on more visible and commonly used concepts, such as counting, comparison, ordering, and patterns. Similarly, the literature suggests that preschool teachers and preservice teachers tend to focus primarily on numbers and basic arithmetic skills in mathematics activities (Aslan et al., 2006; Hachey, 2013). Some mathematical concepts, such as geometry, measurement, estimation, time, and classification, seem to receive less attention in activity plans. This pattern may suggest that preservice teachers tend to associate early mathematics mainly with a set of core numerical skills.

However, mathematics education in early childhood encompasses a much broader conceptual structure, including number, classification, comparison, ordering, geometry, and measurement (Charlesworth & Lind, 2007). Moreover, early developments in quantity understanding and number sense are considered essential foundations for children's later mathematical thinking and problem-solving skills (Starr et al., 2013). For this reason, researchers emphasize that teachers should move beyond narrow approaches that limit mathematics to simple number-related activities (Lee & Ginsburg, 2009) and instead address mathematical concepts within a more comprehensive and intentional instructional framework (Clements & Sarama, 2014). In this respect, the findings of the present study point to the importance of supporting preservice teachers' theoretical learning with practice-based experiences so that they can develop greater conceptual diversity in the mathematics activities they design (Alat, 2019).

Another important finding of the study is that preservice teachers reported feeling most competent in designing materials, while indicating greater difficulty in pedagogical decision-making processes such as structuring the teaching process, considering children's levels of readiness, and formulating clear instructions. This pattern suggests that preservice teachers feel more confident in developing concrete products yet have comparatively limited experience in planning the pedagogical dimensions of instructional processes. In early childhood mathematics education, learning effectiveness is not determined solely by the availability of materials. Equally important is the teacher's ability to ask questions that reveal children's thinking and support mathematical discourse (Klibanoff et al., 2006). From this perspective, enhancing preservice teachers' ability to effectively structure the teaching process seems to be a crucial area for further development.

The findings regarding the evaluation dimension of the study similarly point to a limited range of assessment practices. Both the interview data and the activity plans indicate that the evaluation process was largely carried out through question-based methods. The use of descriptive and open-ended questions is positive; however, alternative assessment methods like structured observation, process-based assessment, and portfolios were used only minimally in the plans.

However, in early childhood education, assessment is expected to go beyond simple question–answer exchanges and to incorporate a variety of approaches, including structured

observation, portfolios, and process-oriented assessment methods (National Association for the Education of Young Children, 2020; Wortham et al., 2017). These findings suggest that preservice teachers may tend to perceive evaluation primarily as a final stage for checking learning outcomes at the end of an activity, and that their practical experience with alternative assessment approaches may remain limited.

Finally, it is noteworthy that preservice teachers generally described the planning process as an enjoyable and instructive experience, while some also characterized it as challenging and stressful. This finding suggests that positive attitudes toward mathematics teaching do not always correspond to strong pedagogical competence in practice (Gresham & Burleigh, 2019; Taşkın & Sezer, 2022). Similarly, previous research has shown that teachers may not always feel sufficiently competent in implementing mathematics education during the preschool years (Avci & Akman, 2023; Güven & Çolak, 2019). Some studies further indicate that teachers may feel inadequately prepared to teach mathematics and therefore include mathematics activities in classroom practice only to a limited extent (Orçan Kaçan & Karayol, 2017; Takunyacı, 2014). In addition, the literature suggests that teachers' expressed beliefs and classroom practices do not always align; although teachers may acknowledge the importance of mathematics education, they may still lack confidence in implementing it in practice (Chen et al., 2014).

In the present study, however, the presence of a certain level of alignment between preservice teachers' expressed views and the activity plans they prepared indicates that their pedagogical beliefs about mathematics teaching can be reflected in the planning process. This finding suggests that preservice teachers are able, at least to some extent, to translate the instructional perspectives they adopt at the theoretical level into their planning practices.

CONCLUSION

This study examined the relationship between preservice preschool teachers' views on planning mathematics activities, and the activity plans they prepared and identified a certain level of meaningful alignment in several aspects. Preservice teachers emphasized pedagogical principles such as developmental appropriateness, outcome-based planning, clear instructions, concretization, and active participation in their expressed views. Similarly, the activity plans they developed frequently incorporated concrete materials, hands-on learning, and a child-centered approach. While preservice teachers were able to reflect on some fundamental pedagogical principles of early childhood mathematics teaching during their planning, they appeared to require additional support, particularly in terms of conceptual depth in instruction and the evaluation dimension.

The findings also suggest that practice-based experiences play a significant role in the development of preservice teachers' planning skills. Opportunities to engage in practical settings appear important for enabling preservice teachers to connect their planning

competencies in early mathematics instruction with real classroom contexts and to design plans that are appropriate to children's developmental levels.

Another finding of the study is that preservice teachers demonstrated more limited practices in the evaluation phase of activities. To strengthen their practical experience with alternative assessment approaches, preschool teacher education programs may benefit from introducing measurement and evaluation courses earlier in undergraduate training.

Limitations and Suggestions for Future Research

One limitation of this study is that it was conducted with a limited number of preservice teachers from a single university, which may restrict the generalizability of the findings to other institutions. The autonomy of universities in designing their own teacher education curricula may lead to differences across programs. For this reason, similar studies could be conducted with preservice preschool teachers studying at different universities. Such studies may provide a more comprehensive understanding of early mathematics teaching. Another limitation of the study is that only a limited number of activity plans prepared by preservice teachers were examined. Analyzing plans prepared at different points in time and examining changes throughout the process may offer a more holistic view of the development of planning skills. A further limitation is that only plans prepared in accordance with the 2024 Preschool Education Program of the Ministry of National Education were examined. Given that the Türkiye Century Maarif Model (2024) has recently begun to be implemented in schools, it would be valuable to examine planning skills grounded in this model as well.

The primary focus of this study was to examine the consistency between preservice teachers' views, and the activity plans they prepared. Since the participants did not have the opportunity to implement these plans in actual classroom settings, how the plans would be reflected in real classroom practice remained beyond the scope of this research. Therefore, future studies could investigate how preservice teachers' planning processes are translated into classroom implementation.

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