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Research Article

Examination of Preschool Teachers' Views on Mathematics Efficacy

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Abstract – This study aims to examine preschool teachers' views on mathematics self-efficacy, mathematics teaching self-efficacy, and factors affecting mathematics efficacy. The study was conducted with 10 preschool teachers working at public schools in a province (Mersin) in the Mediterranean Region of Turkey in the 2022-2023 academic year. In the study where case study was adopted, the participants were teachers from different school types and with different professional experiences. The results of the study revealed that preschool teachers consider mathematics efficacy in the context of mathematics self-efficacy and mathematics teaching self-efficacy. However, they stated that internal and external factors were effective on mathematics efficacy. In addition, different parameters played a role in whether they found themselves competent in mathematics efficacy. Depending on the results of the study, various suggestions were presented that would lead to research on mathematics efficacy.

Key words: preschool teachers, mathematical efficacy, mathematics self-efficacy, mathematics teaching self-efficacy, teachers' views

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Introduction

Efficacy can be evaluated in the broadest sense as the capacity a person has. Demirtaş et al. (2011) defined efficacy as the level of having the necessary equipment to perform a certain task. In this context, mathematics efficacy can be expressed as the knowledge, skill, or belief (perception) required in the mathematics learning-teaching process. Mathematics efficacy, which begins to form in the preschool period when individuals actively participate in learning,

plays an important role in their mathematics life (Sarama & Clement, 2009). Fear of mathematics, loving mathematics, being excited about mathematics learning, and developing a positive attitude towards mathematics at school are associated with mathematics efficacy (Aytaç, 2020; Oktay, 2000). Individuals construct mathematics at school through the experiences their teachers convey to them. In other words, teachers make sense of mathematics through their teaching, so they can use their mathematical skills (matching, comparison, classification, ordering, pattern, estimation, etc.) in problem-solving (Tran et al., 2012). Therefore, teachers' knowledge, skills, or beliefs about mathematics not only affect their thoughts but also their interactions in the classroom, the materials they use, the activities they implement, and the teaching they perform (Sweeting, 2011).

Teachers' mathematics efficacy can be considered as a concept that can be evaluated according to both individual and teacher roles. In other words, the teacher's mathematics efficacy can be evaluated not only as having professional knowledge and skills but also as belief in the ability to put them into action. Bandura (2006) claimed that efficacy is the belief or perception that a person has according to the knowledge, skills, and roles he has, and explained this with the concept of self-efficacy. Therefore, we can define teachers' mathematics efficacy as the combination of both their personal belief in their ability to successfully plan and carry out teaching goals in mathematics (mathematics self-efficacy (Ferla et al., 2015)) and their perception of their ability to fulfill their mathematics teaching tasks (mathematics teaching self-efficacy (Zuya et al., 2016)).

Gavora (2010) stated that higher mathematics self-efficacy of teachers enables them to use their professional knowledge and skills successfully. This may mean that low mathematics self-efficacy may prevent the use of professional knowledge and skills, thus negatively affecting children's learning. This shows that the mathematics self-efficacy of teachers is important not only for them but also for the children. Achurra and Villardon (2013) pointed out that the sense of self-efficacy is associated with positive teaching behavior and stated that teachers with high self-efficacy are more likely to use effective methods in their teaching. However, Kahle (2008) stated that individual differences in teacher effectiveness are a result of mathematics teaching self-efficacy and emphasized that mathematics teaching self-efficacy should also be considered as an important variable when evaluating a teacher's mathematics efficacy.

When studies on mathematics efficacy are examined in the literature, it is recommended that mathematics self-efficacy and mathematics teaching self-efficacy be examined together to understand teachers' beliefs or perceptions about their abilities (Pajares, 1992) and to show how these affect the learning environment in the classroom (Kahle, 2008). Siegle and McCoach (2007) and Kahle (2008) stated that the teacher's mathematics efficacy affects the choice of teaching method, which in turn affects the student's mathematics self-efficacy. This means that students' learning of mathematics may be positively or negatively affected depending on whether the teacher's perception of both mathematics self-efficacy and mathematics teaching self-efficacy are high or low. However, when the studies on mathematics efficacy were examined, it was determined that some of them focused on the factors affecting teachers' mathematics efficacy. Ay (2005), in his study examining which variables affect classroom teachers' self-efficacy in teaching mathematics, stated that gender, length of service, and field of graduation do not affect the self-efficacy level. Şeker (2013) and Bülbül (2016) stated in their studies that preschool teachers' self-efficacy levels regarding mathematics education were high and emphasized that teachers' mathematics self-efficacy did not differ according to the variables of age, professional seniority, and having taken a mathematics course. It was observed that some studies focus on the relationship between teachers' mathematics self-efficacy and mathematics teaching self-efficacy. Schillinger's (2016) studies with kindergarten teachers and Ünlü and Ertekin's (2013) studies with primary school mathematics teachers revealed a positive significant relationship between mathematics teaching and self-efficacy. Finally, it could be argued that some studies focus on the relationships between mathematics efficacy and success. In a study conducted by Siegle and McCoach (2007) to increase students' mathematics self-efficacy, it was determined that there was a significant relationship between mathematics self-efficacy and mathematics success.

Almost all of the studies mentioned in the literature above are relational/descriptive studies. However, in most of these studies, teachers' mathematics efficacy was interpreted mainly with the information obtained through quantitative data collection tools (surveys, scales with Likert-type items, etc.). In this study, preschool teachers' mathematics efficacy was evaluated through interviews with the methods adopted by qualitative approaches. Thus, it was tried to collect opinions of preschool teachers regarding sub-dimensions such as mathematics self-efficacy and mathematics teaching self-efficacy, along with mathematics efficacy. In addition, preschool teachers' views on the factors affecting their mathematics efficacy and their mathematics efficacy levels were also focused on. The fact that qualitative

studies examining mathematics efficacy of preschool teachers are rare in the literature also increases the importance of this study. In summary, the aim of this study, which focused on the mathematics efficacy of preschool teachers, was to shed light on teachers' knowledge, skills, and beliefs about their potential for mathematics self-efficacy, mathematics teaching self-efficacy, factors affecting mathematics efficacy, and their efficacy levels. Thus, it was aimed to contribute to the literature by revealing what preschool teachers care about while teaching mathematics, from their perspectives. This may provide an opportunity for the field to increase the efficiency of learning/teaching mathematics directly or indirectly in preschool.

The research questions of the study were:

- What are the preschool teachers' views on mathematics efficacy (mathematics self-efficacy and mathematics teaching self-efficacy)?
- What are the preschool teachers' views on the factors affecting their mathematics efficacy?
- What are the preschool teachers' views on their mathematics efficacy levels?

Method

In this study, case study among the qualitative research approaches was preferred to reveal preschool teachers' opinions about mathematics efficacy in detail. In addition, the study was designed as a case study (Yin, 2011) to reach a deeper understanding of preschool teachers' mathematics self-efficacy, mathematics teaching self-efficacy, factors affecting efficacy, and efficacy level. The purpose of such case studies is not to produce general theories or to generalize the findings to a larger sample, but to examine a particular group in a multifaceted, systematic, and in-depth context within its real-life context (Baxter & Jack, 2008).

Participants

The study was carried out with the participation of 10 preschool teachers working at different schools in a province (Mersin) in the Mediterranean Region of Turkey in the 2022-2023 academic year. Maximum variation sampling was used in the study. This type of sampling is very common in qualitative research and involves the selection of highly diverse sites or participants. The aim is to increase the possibility of reflecting different perspectives (Creswell, 2012). In this context, attention was paid to the fact that the participants worked in different types of schools and different regions in terms of socio-economic environment. It

was also taken into account that the participants had different professional experiences. Participants were shown with letters T1, T2, T3, ..., and T10 to keep their identities confidential. Demographic characteristics of the participants is presented in Table 1.

Table 1 Demographic characteristics of the participants

Participants	Professional experience	High school graduation	Teaching group	Type of school	School location	Family interest
T1	14 years	Mathematics-Science	48-60 months	Primary school kindergarten	Village	Low
T2	11 years	Mathematics-Science	60-72 months	Independent kindergarten	Town	Low
T3	16 years	Mathematics-Science	48 months	Independent kindergarten	City	High
T4	16 years	Social studies	48-60 months	Independent kindergarten	City	High
T5	17 years	Mathematics-Science	72 months	Primary school kindergarten	Town	Medium
T6	4 years	Social studies	60 months	Secondary school kindergarten	Village	Low
T7	15 years	Vocational	60 months	Primary school kindergarten	Village	Low
T8	12 years	Mathematics-Science	48-60 months	Secondary school kindergarten	Town	Low
T9	2 years	Vocational	48 months	Primary school kindergarten	Village	Low
T10	5 years	Mathematics-Science	48 months	Independent kindergarten	Village	Low

Data collection

In this study, a semi-structured interview form consisting of 5 open-ended questions was used as a data collection tool to reveal the opinions of preschool teachers about mathematics efficacy. During the preparation process of the interview form, the questions in the interview form were examined by two experts, one in preschool education and the other in mathematics education, and it was decided that the questions were appropriate. Because two of the 7 open-ended questions created at the beginning were comprehensive, they were removed from the interview form in line with the suggestion of experts to remove them, and some questions were corrected in terms of language. Afterward, it was tested whether the questions prepared at the pre-interviews with three preschool teachers who did not participate in the current study were understood. After this process, partial corrections were made in some expressions of the interview questions. The first question in the interview form was aimed at understanding how the participants related mathematics efficacy with mathematics self-efficacy and mathematics teaching self-efficacy. The second and third questions were

aimed at understanding how the factors affecting the development of efficacy were evaluated. The last two questions were for assessing their mathematics efficacy levels. The questions in the interview form were as follows:

1. What do you think is mathematical efficacy?
- What do you think is mathematics self-efficacy?
- What do you think is mathematics teaching self-efficacy?
2. What are the factors affecting mathematical efficacy?
3. Is it possible to develop mathematics efficacy? If possible, what does this development depend on?
4. Do you think you are competent to teach mathematics?
5. What are the advantages of mathematics efficacy?

Before the actual interview, the participants were pre-interviewed and informed about the study. A suitable day and time were agreed upon with the participants for the main interview. The interviews took place face-to-face with the participants and lasted approximately 25-35 minutes. All of the interviews were recorded with a voice recorder with the permission of the participants and notes were taken during the interviews. The interviews were based on voluntary participation.

Data Analysis

The data obtained in the study were analyzed by content analysis method. In this process, the first step is coding the data, followed by creating the categories that best explain these codes by classifying the obtained codes, and organizing and interpreting the data according to the determined codes and categories (Yıldırım & Şimşek, 2005). The answers to each question posed to the participants were examined in depth. Each answer was examined repeatedly, and the inductive analysis method was adopted in the analysis process. This method provides an important advantage and convenience for organizing qualitative data (Biklen & Casella, 2007). During the coding process, the data obtained were analyzed, and divided into meaningful sections, and the meaning of each section was labeled using a word or a sentence. The categories that had common aspects based on the codes obtained were brought together. A mathematics education specialist participated in the coding of the data together with the researcher. To resolve the disagreements in the codes and reach a consensus, the differences between the codes were discussed and the codes approved by both mathematics education specialist and researcher were included in the study. On the other hand, Miles and Huberman's

(1994) formula (reliability=consensus/(consensus + opinion)) was used to ensure coding reliability. The reliability of the coding done independently by the coders was calculated as 0.92. Since it is recommended to quote directly from the data in terms of the reliability of the study in qualitative studies (Yin, 2011), some participant views were also directly reflected in the study.

Findings

According to the analysis of the data obtained, the findings were collected under three headings: the views of preschool teachers on mathematics efficacy, their views on the factors affecting mathematics efficacy, and their views on whether they found themselves competent in terms of mathematics efficacy.

Preschool teachers' views on mathematics efficacy

In this section, general thoughts of preschool teachers about mathematics efficacy were given. The codes, categories, and themes obtained as a result of the analysis were shown in Table 2.

Table 2 Codes, categories, and themes of preschool teachers' views on mathematics efficacy

Participants	Codes	Categories	Themes
T2, T3	• Desire to improve myself	Affective	Mathematics self-efficacy
T5, T4, T8	• Love, social balance, power to cope with difficulties		
T9	• It is assimilation	Cognitive	
T10	• Reasoning and using logic		
T6	• Problem-solving		
T1, T5	• To be able to give and explain mathematical concepts (numbers, patterns, shapes)	Transfer	Mathematics teaching self-efficacy
T3, T9	• To gamify, to be fun	Level	
T10	• Make it in a way that the student can understand		
T7	• to produce solutions for children	Skill	
T6	• to make children think		
T8, T2	• to concretize		

Preschool teachers' views on mathematics efficacy were grouped into two themes: mathematics self-efficacy and mathematics teaching self-efficacy. In the mathematics self-efficacy theme, two categories were determined as cognitive and affective. In the affective

category, participants defined mathematics self-efficacy as desire, social stability, and coping power. The statements of the participants are presented below.

T2; "*As a preschool teacher, I can say that mathematics efficacy is my desire to improve myself in mathematics and my desire to use different methods…I spend a lot of time on this…*" (Code: Desire to improve myself/Category: Affective)

T4; "*I think we have the power to deal with challenges and affect our way of looking at things. The education we received at the university remained purely theoretical. It was an education that made you feel like you knew nothing when you entered the classroom… I think everything starts after you enter the classroom. I have always worked in public schools with limited means... I had to deal with a lot of problems, from the math materials we wanted to use in the classroom environment to the struggle to bring the students to school. Perhaps being able to balance all of these and cope with difficulties shows my mathematics efficacy*." (Code: Love, social balance, power to cope with difficulties/Category: Affective)

It was observed that the statements in this category were made by teachers working in independent kindergartens and having a lot of professional experience. This situation strengthens the assumption that teachers' professional experiences and the types of schools they work in are related with the affective side of mathematics self-efficacy.

The other category that emerged in the mathematics self-efficacy category was cognitive. In this category, it was observed that the participants evaluated their mathematics self-efficacy as assimilation, reasoning, and problem-solving. The statements of the participants are presented below.

T9; "*Actually, I don't need a very high level of knowledge in the field of mathematics, it is my ability to make them assimilate the mathematical knowledge that we have and that we need to give to children*" (Code: It is assimilation /Category: Cognitive)

T10; *"… I think it's more a matter of logic, more of the ability to create things and solve problems…*" (Code: Reasoning and using logic /Category: Cognitive)

T6; "*Because I feel that we have to use mathematics in many problems that we think are not related to mathematics*" (Code: Problem-solving/Category: Cognitive)

Participants who evaluated mathematics self-efficacy cognitively had less professional experience compared to other participants. This showed that preschool teachers, who were in

the first years of the profession, evaluated mathematics self-efficacy according to the cognitive domain.

Another theme that emerged according to the analysis of the data obtained from the opinions of preschool teachers was mathematics teaching self-efficacy. This theme consisted of three categories: transfer, skill, and level. In the transfer category, the participants interpreted mathematics efficacy more as being able to explain concepts. The statements of the participants are presented below.

T1; "…*it is the ability to give and transfer mathematics to the child*." (Code: To be able to give and explain mathematical concepts /Category: Transfer)

T5; "*I think that mathematical efficacy shows the mathematical efficacy of the teacher, in whatever way he/she can teach mathematics to children in the flow of daily life...*" (Code: To be able to give and explain mathematical concepts /Category: Transfer)

Pre-school teachers in this theme graduated from high school mathematics-science field and used behavioral descriptions in their teaching. This situation showed that the type of high school graduates was effective in evaluating the mathematics teaching self-efficacy of preschool teachers.

In the level category, especially game teaching and student level came to the fore. The statements of the participants are presented below.

T9; "*I teach 48-month-olds and we can teach them anything through play. For example, they do not like to write numbers we teach primary school students, but they can reach a certain point in writing numbers. In the second semester, they have a little more interest, but at this age they have problems, and they may feel incompetent in this regard. I need to overcome this*" (Code: To gamify, to be fun /Category: Level)

T10; "*We teach mathematics dependent on the curriculum. This affects us and sometimes hinders us. Outdoor teaching contributes to concretization in 48-month-old children. This makes it easier for children (48 months old) to grasp. Therefore, in my opinion, mathematics can be taught more easily through gamification and concretely in open space.*" (Code: Make it in a way that the student can understand /Category: Level)

These teachers especially work with children aged 48 months. It was determined that the preschool teachers working with this group were concerned about not being able to reach the children's level while evaluating the mathematics efficacy, and therefore it could be

thought that they evaluate the efficacy according to the constructivist point of view (in terms of play and concretization).

In the skill category, the participants defined mathematics teaching self-efficacy as generalizing, prompting, and directing. The statements of the participants are presented below.

T6; "*To what extent can I direct children to mathematics in daily life…*" (Code: is to make children think /Category: Skill)

T7; "*When I encounter a problem, I see it as the ability to use numerical data and solve it. I can say that it is the ability to reason, reach a conclusion, and solve that problem by using different techniques.*" (Code: to produce solutions with children/Category: Skill)

T8; "*Actually, my ability to generalize by making mathematics concrete…I think it starts in the family…and I need their support…*" (Code: make concrete/Category: Skill)

The common aspects of preschool teachers in this category were that they were working in schools where family interest was low, and they complained about family indifference. These teachers considered teaching as a skill. And they saw mathematics teaching self-efficacy as a phenomenon that should be supported by the family.

Preschool teachers' views on the factors affecting mathematics efficacy

In this section, the views of preschool teachers on the factors affecting mathematics efficacy were given. The codes, categories, and themes obtained as a result of the analysis are shown in Table 3.

Table 3 Codes, categories, and themes of preschool teachers' thoughts on the factors affecting mathematics efficacy

Participants	Codes	Categories	Themes
T7, T6, T4	• Experiences related to mathematics	Experience	Internal
T9	• Perspective on mathematics	Attitude	
T1, T10	• Education received at university	University	External
T2	• Predominance of rote understanding	Education system	
T5, T2	• Updating the curriculum		
T1	• Large classes (Class size)	Class facilities	
T9	• Access to materials		
T7	• Family interest	Family	
T10, T9	• Readiness	Student	
T8, T7, T9	• Development Level		

When the views of preschool teachers on the factors affecting mathematics efficacy were examined, the two themes that were determined were internal and external. In the internal theme, two categories were formed: experience and attitude. In the experience category, the participants drew attention to their past experiences related to mathematics. The statements of the participants are presented below.

T7; "*For years, I have dreaded mathematics and even mathematics teachers, saying what kind of people these are, how special people are, how can they understand it. Frankly, I attribute this to not getting a good enough education. Because, as I said, there is a production that loves to learn, but unfortunately this fear could not be overcome in time, so I feel that I cannot always do it. For example, I dreamed of being able to solve very difficult questions in geometry in the past, but unfortunately, I could not achieve this goal. Maybe because I graduated from vocational high school, we rarely encountered courses related to mathematics. That is why our vocational courses were more intense, but I always envied those who could solve mathematics. I used to like it very much, but unfortunately, this remained as a shortcoming. I am currently deficient (laughs). And I cannot do anything to make up for this shortcoming…"* (Code: Experiences related to mathematics /Category: Experience)

T6; "*I add a lot of interpretation to the events and sometimes I do not perceive that I have to look at the events from one place. I do not see that problems can sometimes be solved in one way. My mother and brother sometimes looked at this from different angles. I was very impressed with them about mathematics."* (Code: Experiences related to mathematics /Category: Experience)

Another category that emerged in the internal category was attitude. Participants stated that another factor affecting their mathematics efficacy was their attitudes toward mathematics. The statements of the participants are presented below.

T9; "*Sometimes I experience learned helplessness, unfortunately, when I cannot do it . Of course, a person cannot overcome the fact of not being able to do it, unfortunately, he cannot move on to the next stage. Even though I try to understand, that negative attitude always hinders me. For example, when I took the school management exam, there were also math questions. Since I could not overcome this prejudice, I felt that I had difficulty even in simple problems…*" (Code: Perspective on mathematics /Category: Attitude)

It was observed that the statements in this category were made by teachers who graduated from the social studies and vocational fields in high school. This situation shows

that the mathematics efficacy of preschool teachers is affected by the type of high school they graduated from.

The other theme that emerged according to the analysis of the data obtained was related to external effects. This theme consisted of five categories. The education received at the university, education system, classroom opportunities, family interests, and students. Statements of the participants in the university category are as follows:

T1; "*The education received at the university is also effective. After all, at university we learn how to teach mathematics to children aged 36-72 months. The more productive this training is, the better it is for us.*" (Code: Education received at university /Category: University)

These teachers graduated from mathematics and science in high school and stated that information about teaching was important. It could be argued that they were worried about the lack of pedagogical courses.

In the education system category, the opinions of the dominance of rote understanding and the inability to follow the changes related to updating came to the fore. The statements of the participants are presented below.

T2; "*We need to use concrete materials when teaching mathematics to children. In other words, instead of drawing the dotted forms of the numbers on the paper and saying let us combine them, we need to make them more concrete and draw their attention. We need to focus on this issue a little more. This is because our education system is rote-learned, the priority is for the child to be able to write the number. He can falter when he moves to other classes.*" (Code: Predominance of rote understanding /Category: Education system)

T5; "*There are constant changes, even in the writing of numbers. It changes every year, and we do not know about it. The child moves to the next grade, but sometimes we do not know how to continue.*" (Code: Updating the curriculum /Category: Education system)

These teachers especially taught 72-month-old children. Since they were worried about primary school, they stated that the education system was a factor affecting proficiency. Therefore, they brought this to the forefront as a factor affecting teacher efficacy.

In the classroom facilities category, the participants generally stated that the class size and access to materials affect proficiency. The statements of the participants are presented below.

T1; "*sometimes class size affects our efficacy because it limits the activities you want to do…*" (Code: Large classes (Class size)/Category: Class facilities)

T9; "*The lack of materials in the classroom, or vice versa, makes it difficult/easier to teach mathematics.*" (Code: Access to materials /Category: Class facilities)

In the family category, the participants stated that family attention affects their efficacy. When the statements of the participants in this area are examined;

T7; "*I also guide families on this issue, for example, When emptying a dishwasher, I give advice such as sorting spoons and forks from larger to smaller. For counting, for example, give me five walnuts, let us eat two, let us see how many are left, or I want attention to be paid to the materials that the child touches to gain mathematical skills. I think this seems to me to be the most beautiful mathematics teaching technique. In other words, I prefer to use these methods with the help of family to gain skills.*" (Code: Family interest /Category: Family)

In the student category, the participants generally stated that their readiness and development level affect their mathematics efficacy. The statements of the participants are presented below.

T8; "*The readiness level of children is important. I think this is the most important. So are, of course, their interests and needs. For example, if I give an example from my current students, their mathematical skills are very secondary. We are now in the second semester. Generally, in the first semester, there are concepts such as feeling simple arithmetic operations, recognizing mathematical concepts and geometric shapes superficially, and showing objects as much as the number shown and the number said. I would like to do simple mathematical operations in the second semester, but I observed that they are not ready for this at the moment. For children who are in the first six months of six years of age, we show them more self-care, social skills, and more games. That is why readiness levels and children's attention needs are very effective when teaching mathematics to children. Of course, my being ready for that subject and knowing the child well are also effective. For example, sometimes the language we speak is not effective.*" (Code: Development level /Category: Student)

The common aspects of the teachers who commented in the last three categories should be working in primary school kindergarten and secondary school kindergarten within the village. These teachers saw the socio-cultural structure of the school as a factor affecting mathematics efficacy.

Preschool teachers' view on whether they find themselves competent in terms of mathematics efficacy

In this section, the opinions of preschool teachers about whether they find themselves sufficient in terms of mathematics efficacy were given. The codes, categories, and themes obtained as a result of the analysis are shown in Table 4.

Table 4 Codes, categories, and themes of preschool teachers' views on the level of mathematics efficacy

Participants	Codes	Categories	Themes
T5, T4	• I am competent because I can motivate and attract attention	Competent	Positive
T1	• not 100%	Indecisive	
T2	• I should update		
T3, T8, T10	• Even if I use different teaching methods, I don't know	Indecisive	Negative
T7	• I don't think I can	Incompetent	
T6, T9	• Being nervous while teaching		
T6	• Not being able to prepare activities		

When the opinions of preschool teachers about the levels of mathematics efficacy were examined, two themes were determined: positive and negative. Two categories emerged in the positive theme: competent and indecisive. In the competent category, participants stated that they could motivate and arouse interest in mathematics. The statements of the participants are presented below.

T5; *"... am I competent? Yes, I am competent because I think I make children interested in mathematics. I think I motivate them. I also influence their behavior. So, mathematics is a very different field. But I find this sufficient for our level.*" (Code: I am competent because I can motivate and attract attention /Category: Sufficient)

It was observed that the statements in this category were made by teachers working in schools with medium and high family interest.

In the indecisive category, teachers stated that they were not at full capacity in doing mathematics and that they needed to be updated. The statements of the participants are presented below.

T1; "*Well, I cannot say 100% like that, I mean like this: For example, I am having a hard time teaching numbers, maybe it is because families do not support me in this regard, I do not know*." (Code: not 100%/Category: Indecisive)

T2; "*because right now our information is no longer up to date. We can not stop the advancement of technology. Children are too busy with tablets and phones, which is something I am very against. We need to teach with activities that can prevent them from having tablet addiction. Children have communication problems due to tablet addiction, I need to learn more fun methods that can prevent this, teachers need to be updated on this issue.*" (Code: I should update /Category: Indecisive)

The common feature of the teachers who gave their opinions in this category was that they had a lot of professional experience. This situation showed that although teachers had a lot of experience in their profession, they felt the need to be updated in the context of mathematics proficiency over time.

Another theme that emerged according to the analysis of the data obtained was negative. This theme consisted of two categories. The statements of the participants are presented below.

T3; "*I sometimes have trouble using different techniques and methods in teaching mathematics…*" (Code: Even if I use different teaching methods, I don't know /Category: Indecisive)

Teachers who express their opinions in this category graduated from the mathematics science field in high school and were undecided in terms of mathematics efficacy. They stated that they especially had difficulties in using different teaching methods.

In the incompetent category, teachers stated that they were especially anxious about teaching some mathematical concepts and did not know what to do. The statements of the participants are presented below.

T6; "*I did not have any special studies or activity planning, especially on some mathematics subjects. It does not work, I do not have time for this, nor do I have enough materials. Nor do I think the children are ready for this*." (Code: Not being able to prepare activities /Category: Insufficient)

T7; "*I experience learned helplessness in some concepts; unfortunately, when a person cannot overcome the fact of not being able to do it, he cannot move on to the next stage. Even*

though I try, those learned helplessness always follow me, the fact that I cannot do this. For example, I feel like I have difficulty even when working on some problems in class..." (Code: I don't think I can /Category: Insufficient)

Teachers who expressed their opinions in this category were working especially in schools in villages where family interest was low.

Conclusions and Suggestions

In this study, which aimed to reveal the opinions of preschool teachers about mathematics efficacy, the participants evaluated their mathematics self-efficacy in terms of affective and cognitive dimensions. Preschool teachers with a lot of professional experience expressed mathematics self-efficacy as the desire to improve themselves in mathematics and the power to cope with difficulties in mathematics. These views showed that teachers' desire for mathematics was increasing over time, and they found the strength to cope with the difficulty to do mathematics. In addition, teachers who wanted to improve themselves in mathematics stated that they did not hesitate to try different teaching methods and they spend time on this subject. This situation could be considered as an opportunity for the development of different mathematical skills of students. The development of early mathematics skills is mostly related to the beliefs of preschool teachers towards mathematics. During this period, frequent and different activities should be done to enable children to acquire mathematical skills (Çelik, 2017). Therefore, the desire to improve oneself in mathematics could be a driving force for students' mathematical skills. On the other hand, teachers with little professional experience expressed their mathematics efficacy in terms of assimilation, reasoning, and problem-solving. The preschool period is a stage where mathematical reasoning is important (Aytaç, 2020). Contrary to experienced teachers, the fact that teachers who were in the first years of the profession cognitively evaluated mathematics self-efficacy showed that they evaluate efficacy only as teaching. Although this provides an opportunity to focus on mathematics, it may limit the usability of different methods. Therefore, it can create a disadvantage for students with different learning styles. Therefore, teachers' perspectives on mathematics self-efficacy (affective/cognitive) should be considered in studies on mathematics efficacy.

Preschool teachers who expressed their opinions about mathematics efficacy evaluated mathematics teaching self-efficacy in terms of transfer, level, and skill. Pre-school teachers who graduated from high school in the field of mathematics science stated that mathematics

was a transfer. This showed that they evaluated their mathematics teaching self-efficacy according to behavioral approaches. On the other hand, preschool teachers teaching 48-month-old children groups perceived mathematics as level. This showed that they cared about children's mathematical perceptions and gave importance to concretizing them with activities such as games. Some teachers approach mathematics efficacy as a skill. Preschool teachers with this view stated that their mathematics teaching efficacy should be supported by families. Thus, they thought that it would contribute to the generalizability of mathematics in daily life. Henson (2001) stated that teachers with high self-efficacy in teaching mathematics are always ready to accept new ideas and are willing to adopt innovations, Brouwers and Tomic (2003) believe that teachers with high self-efficacy in teaching mathematics are less likely to experience stress and believe more in students' freedom, Ross and Bruce (2007) indicated that teachers with high self-efficacy in teaching mathematics showed more interest in low-ability students. The views on mathematics teaching self-efficacy showed that mathematics efficacy was affected by different parameters. The results of this study showed that parameters such as high school graduation area, teaching group, and family may be important for studies on mathematics teaching self-efficacy. Considering the field of high school graduation as a variable related to the teacher's mathematics background, it should not be surprising that this variable affected the mathematics teaching of preschool teachers. In addition, age range was a determining factor in the mental and social development of preschool children. Therefore, it could be considered as a natural result that preschool teachers consider teaching groups when teaching mathematics. However, the role of the family as an external resource that helps the teacher in mathematics teaching should be emphasized in detail in studies to be carried out in pre-school. It is thought that the empirical level of the child's experiences in the family before encountering school mathematics may have an impact on the emergence of this result.

It was determined that internal factors such as life and attitude and external factors such as education system, university, classroom opportunities, family, and students were effective in the views of preschool teachers on the factors affecting mathematics efficacy. Preschool teachers who graduated from high school in social studies and vocational fields stated that internal factors affect mathematics proficiency. They stated that their past experiences (such as scarcity of mathematics courses, fear of mathematics, etc.) affected their perspectives on mathematics. Contrary to Ay (2005), this situation showed that internal factors such as experience and attitude were important in preschool teachers' mathematics efficacy. On the other hand, teachers who graduated from the field of mathematics science emphasized that the

pedagogical education received at the university was effective in mathematics efficacy. In particular, teachers who teach 72-month-old children stated that the education system encourages memorization and that preschool should be integrated with primary school, so the system should be updated in terms of the efficiency of their mathematical competencies. Preschool teachers, who stated that factors such as classroom opportunities, and family and student readiness affect mathematics efficacy, were found to work in schools that were more socio-culturally inadequate. Therefore, it could be argued that these variables were important in the evaluation of the factors affecting mathematics efficacy. The results of the study differed from the literature (Şeker, 2013; Bülbül, 2016) and it was determined that the mathematics efficacy of preschool teachers differed according to variables such as professional experience, the field from which they graduated from high school, the type of school they work in, family, and the group in which they are taught. This result showed that these variables should be taken into account in studies on the mathematics efficacy of preschool teachers. In particular, qualitative studies on each of these parameters could be considered important in terms of revealing how much these variables were predicted on mathematical efficacy. Therefore, qualitative research covering these parameters could be conducted moving forward.

Preschool teachers expressed their opinions on two themes regarding whether they found themselves competent in mathematics efficacy. Teachers who find themselves efficient in the positive theme were mostly teachers who worked in schools where family interest was medium and high. This showed that the family interest was effective in teachers' finding themselves competent in mathematics. In addition, these teachers stated that they were generally open to new ideas and did not hesitate to try different teaching methods. Teachers who were positive, but undecided had a lot of professional experience, but their desire to be updated over time dominated. Therefore, it could be argued that teachers with high mathematics efficacy showed more interest and commitment to teaching. Tschannen-Moran and Hoy (2001) stated that these teachers were more likely to remain in the teaching profession. The undecided teachers in the negative theme were those who graduated from high school in the field of mathematics and science, and they stated that they had difficulty using different teaching methods, therefore they did not find themselves competent. It was determined that teachers who found themselves inadequate in terms of mathematics efficacy worked in places where village and family interest was low. This showed that the socio-

cultural structure of the school was effective in the teacher's perception of her/himself as incompetent in mathematics efficacy.

Compliance with Ethical Standards

Disclosure of potential conflicts of interest

No conflict of interest.

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CRediT author statement

The study was single authored and the whole process was carried out by the corresponding author.

Research involving Human Participants and/or Animals

The study involves human participants. Ethics committee permission (Date: September 26, 2023; Number: 207) was obtained from Mersin University, Social and Human Sciences Research Ethics Committee.

Okul Öncesi Öğretmenlerinin Matematik Yeterliğiyle İlgili Görüşlerinin İncelenmesi

Özet:

Bu çalışmanın amacı okul öncesi öğretmenlerin matematik yeterliliği bağlamında matematik öz-yeterliğine, matematik öğretme öz-yeterliliğine ve yeterliliği etkileyen faktörlere yönelik görüşlerini incelemektir. Çalışma 2022-2023 öğretim yılında Türkiye'nin Akdeniz Bölgesi'nde bulunan Mersin ilindeki resmi okullarda görev yapan 10 okul öncesi öğretmeni ile gerçekleştirilmiştir. Özel durum yaklaşımı ile yürütülen çalışmada katılımcılar farklı okul türlerinde ve farklı mesleki deneyime sahip öğretmenlerden oluşturulmuştur. Betimsel yöntemlerle yapılan analizler sonucu öğretmenlerin görüşleri belli temalar altında toplanmıştır. Çalışmanın sonuçları okul öncesi öğretmenlerinin matematik yeterliliğini matematik öz-yeterliliği ve matematik öğretme öz-yeterliliğini bağlamında ele aldıkları, içsel ve dışsal faktörlerin yeterlilik üzerinde etkili olduklarını ve kendilerini yeterli bulup bulmadıkları üzerinde de değişik parametrelere göre değerlendirdiklerini ifade etmişlerdir. Bu bağlamda matematik yeterliliği üzerine yapılacak araştırmalara öncülük edecek öneriler sunulmuştur.

Anahtar kelimeler: okul öncesi öğretmenleri, matematiksel yeterlilik, matematik öz-yeterliliği, matematik öğretme öz-yeterliliği, öğretmen görüşleri

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