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OKUL ÖNCESI ÖĞRETMEN ADAYLARININ MATEMATİKSEL GELİŞİM İNANÇLARI VE MATEMATİK ÖĞRETME KAYGI DÜZEYLERİ ARASINDAKI İLİŞKİ[3]

THE RELATIONSHIP BETWEEN PROSPECTIVE PRESCHOOL TEACHERS' MATHEMATICAL DEVELOPMENT BELIEFS AND MATHEMATICS TEACHING ANXIETY LEVELS

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ÖZ: Bu ilişkisel araştırma, okul öncesi öğretmen adaylarının matematik öğretimi kaygı düzeylerini ve matematiksel gelişim inançlarını belirlemeyi ve bu iki kavram arasındaki ilişkiyi ortaya çıkarmayı amaçlamaktadır. 200 okul öncesi öğretmen adayından "'Sınıf Öğretmenlerine Yönelik Matematik Öğretimi Kaygı Ölçeği" ve "Matematiksel Gelişim İnanç Ölçeği" kullanılarak veriler toplanmıştır. Sonuçlar, öğretmen adaylarının matematik öğretme kaygılarının ve matematiksel gelişim inançlarının orta düzeyde olduğunu göstermektedir. Okul öncesi öğretmen adaylarının genel matematiksel gelişim inançları ile matematik öğretme kaygısı ölçekleri arasında anlamlı bir ilişki olmadığı görülmektedir. Ancak alt ölçekler arasında anlamlı ilişkiler bulunmuştur. Alt ölçeğe dayalı ilişkiler dikkate alındığında, okul öncesi öğretmen adaylarının matematiksel gelişim inançlarının yüksek olmasının, matematik öğretimi konusunda daha kaygılı hale gelebilmelerine neden olduğu sonucuna varma mümkündür. Bir diğer deyişle, öğrencilerin matematiğe yönelik artan inançlarının, "daha iyiye ulaşma" kaygılarını artırdığı söylenebilir. Bu çalışmada elde edilen sonuçlardan hareketle, öğretmen adaylarının matematik alan bilgisine ilişkin bilgi ve deneyimlerini artıracak içerik ve uygulamalar geliştirilerek matematiksel gelişim inançlarının üst bir konuma taşınması ve ayrıca bu yüksek seviyelerin kaygı seviyeleri üzerinde çok yüksek bir etkiye sahip olmasını önleyecek uygulamalara yer verilmesi önerilebilir.

Anahtar sözcükler: Matematik öğretme kaygısı, Matematiksel gelişim inancı, Okul öncesi öğretmen adayları

ABSTRACT: This correlational study aims to determine the mathematics teaching anxiety levels and mathematical development beliefs of prospective preschool teachers, and to find out the relationship between these two concepts. Data were collected through the usage of 'Mathematics Teaching Anxiety Scale for Classroom Teachers' and 'Mathematical Development Belief Scale' from 200 prospective preschool teachers. The results show that prospective teachers' mathematics teaching anxiety and mathematical development beliefs were found to be moderate level. No significant relationship between the overall mathematical development beliefs and the mathematics teaching anxiety scales of the prospective preschool teachers is seen. However, there were significant correlations between the sub-scale. Considering the relationships based on the sub-scale, it is possible to conclude that the high mathematical development beliefs of prospective preschool teachers may make them more anxious about mathematics teaching. This can lead to the interpretation that increased beliefs of students about mathematics escalate their anxiety about 'achieving better'. Based on the results obtained in the current study, it can be recommend that content and applications that will increase the knowledge and experience of prospective teachers regarding their field knowledge of mathematics can be developed to move the levels of their mathematical development beliefs to a high position and also to prevent these high levels from having a very high effect on their anxiety levels.

Keywords: Mathematics teaching anxiety, Mathematical development beliefs, Prospective preschool teachers

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GENİŞLETİLMİŞ ÖZET

Giriş

Matematik, geçmişten günümüze bireylerin yaşantılarında yer edinmiş ve edinmeye devam edecek önemli bilim dallarından biri olarak karşımıza çıkmaktadır. Geçmişi yontma taş devrinde temel sayılar sisteminin oluşturulmasıyla başlayan matematik bilimi (Struik, 1987), günümüzde birçok karmaşık problemin çözümünde ve teknolojik gelişmelerin temelinde yer alarak günlük yaşamı kolaylaştırmaya devam etmektedir. Yalnızca bilimsel kavramların çözümlenmesinde değil hayatın her alanında matematiğin kullanıldığı bilinen bir gerçektir. Ancak yaşamın her alanında sıklıkla kullanılmasına ve ihtiyaç duyulmasına rağmen birçok bireyde matematiğe ilişkin ön yargı, kaygı ve korkular meydana gelebilmektedir. Matematik eğitiminin sağlıklı bir biçimde yürütülmesi, öğrencilerin matematiğe yönelik kaygılarının en aza indirilmesini ve olumlu tutumlar geliştirmelerini sağlayacaktır. Umay'a (1996) göre öğrencilerin ön yargı, kaygı ve korkularının üstesinden gelinebilmesi adına daha okula geldikleri ilk günlerden itibaren günlük yaşamla bağlantısı kurulmuş bir matematik eğitimi anlayışıyla karşılaştırılmaları gerekmektedir. Öğretmenin matematiğe karşı tutumunun öğrenci başarısı ve tutumu üzerinde etkiye sahip olduğu yapılan araştırmalarla da gözler önüne serilmiştir (Mensah, Okyere ve Kuranchie, 2013). Tersi durum düşünüldüğünde, öğretmenin matematiğe ilişkin kaygısının öğrencilerinin matematik kaygısı geliştirmelerine neden olması da beklenen bir durumdur (Bekdemir, 2010). Carey, Devine, Hill, Dowker, McLellan ve Szucs (2019) yayınladıkları raporda, matematik kaygısına sebep olabilecek birçok neden arasında öğretmen özelliklerini de sıralamışlar ve öğretmenlerin kaygı düzeylerinin öğrencilerini de etkileyebileceğinin farkında olunması gerektiğini vurgulamışlardır.

Matematik eğitiminde kaygının yanı sıra matematiğe ilişkin inançların da büyük bir role sahip olduğunu söylemek mümkündür. Nitekim matematiğe ilişkin sahip olunan inançlar, yalnızca öğretmen ve öğrenci ile sınırlı kalmamakta, bütün bir eğitim programını ve eğitim sürecini etkileyebilmektedir (Goldin, Rösken ve Törner, 2009). Bu nedenle öğrencilerin (Fardin, Alamolhodaei ve Radmehr, 2011;Jones, Wilkins, Long ve Wang, 2012; Mason ve Scrivani, 2004;), öğretmen ve öğretmen adaylarının (Handal, 2003; Kaiser, 2006; Philipp, 2007; Szydlik, Szydlik ve Benson, 2003), hatta velilerin (Leedy, La Londe ve Runk, 2003; Missall, Hojnoski, Caskie ve Repasky, 2015) matematik inançları ortaya konularak matematik öğretimine ilişkin ipuçları elde edilmeye çalışılmaktadır. Öğretmen inançları genel çerçevede öğretmenlerin bakış açılarından matematiğin ne olduğu, matematik öğrenim ve öğretiminin gerçekte nasıl olduğu ve ideal anlamda nasıl olması gerektiğine ilişkin inançları kapsamaktadır (Ernest, 1989). Okul öncesi dönemde öğretmenlik yapan öğretmenlerin matematiğe ilişkin algı, tutum ve görüşlerinin belirlenmesi, matematiğin öğrencilere tanıtıldığı ilk örgün eğitim düzeyi olması nedeniyle büyük önem taşımaktadır. Okul öncesi öğretmenlerinin, çocukların okul öncesi dönemde matematik eğitimine ihtiyaç duyup duymadıklarına ilişkin inançları ve matematik öğretimine yönelik kaygılarının farkında olmaları, kendi öğretim süreçlerini planlamaları ve matematik öğretimini bu sürece dahil etmeleri açısından önemli olduğunu söylemek mümkündür. Bu durum öğretmen adayları için de geçerlidir. Bu sayede matematiksel gelişim inancı yüksek, matematik kaygısı düşük bireyler yetiştirilecek ve ileride öğretmen olarak göreve başlayacak öğretmen adayları öğrencilerine bu konuda fayda sağlayacaktır.

Bu araştırmanın amacı, okul öncesi öğretmen adaylarının matematik öğretme kaygı düzeyleri ve matematiksel gelişim inançları arasındaki ilişkiyi tespit etmek olarak belirlenmiştir. Bu amaçla aşağıda belirtilen sorulara cevap aranmaktadır:

1. Okulöncesi öğretmen adaylarının matematik öğretme kaygıları ne düzeydedir?
2. Okulöncesi öğretmen adaylarının matematiksel gelişim inancı ne düzeydedir?
3. Okulöncesi öğretmen adaylarının matematik öğretme kaygıları ile matematiksel gelişim inançları arasında anlamlı bir ilişki var mıdır?

Yöntem

Araştırmada ilişkisel tarama yöntemi benimsenmiştir. Araştırmanın katılımcılarını 2019-2020 öğretim yılında Türkiye'de Orta Karadeniz Bölgesinde bir ilde yer alan üniversitenin Eğitim Fakültesi Okul Öncesi Öğretmenliği Programında eğitim gören ve uygun örnekleme yöntemi ile seçilen okul öncesi öğretmen adayları oluşturmaktadır. Söz konusu programda toplam öğrenci sayısı 260 olup bu

öğrencilerin 200'ü formu doldurmayı kabul etmiştir. Katılımcıların 172'si kız, 28'i erkek öğrencilerden oluşmaktadır. Katılımcıların %31'i 1. Sınıf (n=62), %24'ü 2. Sınıf (n=48), %28'i 3. sınıf (n=56) ve %17'si 4. Sınıfta (n=34) öğrenim görmektedirler.
Araştırmada veri toplama aracı üç bölümden oluşmaktadır. İlk bölümde öğrencilerin yaş, cinsiyet ve sınıf seviyelerinin yer aldığı kişisel bilgiler kısmı bulunmaktadır. İkinci bölümde veri toplama araçlarından ilki olan 'Sınıf Öğretmenlerine Yönelik Matematik Öğretimi Kaygı Ölçeği' (Sarı, 2014), üçüncü bölümde ise 'Matematiksel Gelişim İnanç Ölçeği' (Karakuş, Akman ve Ergene, 2018) yer almaktadır.
Araştırmada elde edilen veriler üzerinde betimsel istatistik ve Pearson korelasyon testleri yapılmıştır. Verilerin analizleri için SPSS 22.0 paket programı kullanılmıştır.

Bulgular

Öğretmen adaylarının matematik kaygı düzeyleri ortalamasının 2.49 olduğu görülmektedir. öğretmen adaylarının matematiksel gelişim inançlarının orta düzeyde olduğu tespit edildiği görülmektedir. Nitekim okul öncesi öğretmen adaylarının matematiksel gelişim inançları matematik öğretiminin yaş uygunluğu alt boyutunda orta ($\bar{X}$=2.55, SS=.80) düzeyde, matematiksel bilgi üretiminin sınıf odağı alt boyutunda orta ($\bar{X}$=2.63, SS=.64) düzeyde, okul öncesi eğitiminin amacı olarak matematiksel gelişim alt boyutunda orta ($\bar{X}$=2.13, SS=.83) düzeyde ve matematik eğitiminde güven alt boyutunda ise orta ($\bar{X}$ =2.40, SS=.82) düzeyde bulunmuştur.
Matematiksel gelişim inancı ile matematik öğretimi kaygısı arasında anlamlı bir ilişki bulunmamaktadır. Ancak matematiksel gelişim inancı ile matematik öğretimi kaygısının alt boyutları arasında anlamlı ilişkiler bulunmaktadır. Matematiksel gelişim inancı ile öğretim süreci ile ilgili yaşanan kaygı arasında negatif yönlü, düşük düzeyde anlamlı bir ilişki bulunmaktadır (r=-.20, p<.01). Matematiksel gelişim inancı ile alan bilgisi ile ilgili yaşanan kaygı arasında pozitif yönlü orta düzeyde bir ilişki bulunmaktadır (r=.32, p<.01). Matematiksel gelişim inancı ile öz-yeterliğe ilişkin yaşanan kaygı arasında pozitif yönlü düşük bir ilişki bulunmaktadır (r=.21, p<.01). Matematik öğretimi kaygısı ile matematiksel gelişim inancının alt boyutları arasında anlamlı bir ilişki bulunmamaktadır.

Öğretim süreci ile ilgili yaşanan kaygı ile matematik öğretiminin yaş uygunluğu ile arasında (r=-.18, p<.01), matematiksel bilgi üretiminin sınıf odağı arasında (r=-.20, p<.01) ve okulöncesi eğitimin başlıca amacı olarak matematiksel gelişim arasında (r=-.22, p<.01) negatif yönlü düşük düzeyde ilişki olduğu gösterilmektedir. Matematiksel yaş uygunluğu ile alan bilgisi ile ilgili yaşanan kaygı arasında (r=.23, p<.01), matematiksel yaş uygunluğu ile öz-yeterliğe ilişkin yaşanan kaygı arasında (r=.14, p<.05) ve okulöncesi eğitimin başlıca amacı olarak matematiksel gelişim ile öz-yeterliğe ilişkin yaşanan kaygı arasında (r=.15, p<.05) pozitif yönlü düşük düzeyde anlamlı bir ilişki bulunmaktadır. Alan bilgisi ile ilgili yaşanan kaygı ile okulöncesi eğitimin başlıca amacı olarak matematiksel gelişim arasında (r=.29, p<.01), alan bilgisi ile ilgili yaşanan kaygı ile matematik eğitimindeki güven arasında (r=.31, p<.01) ve öz-yeterliğe ilişkin yaşanan kaygı ile matematik eğitimindeki güven arasında (r=.32, p<.01) pozitif yönlü orta düzeyde anlamlı bir ilişki bulunmaktadır.

Tartışma ve Sonuç

Araştırmada elde edilen sonuçlardan yola çıkılarak öğretmen adaylarının matematiksel gelişim inanç düzeylerinin yüksek olmasını sağlamak ancak bu durumun kaygı düzeyleri üzerindeki etkisinin çok yüksek olmasına engel olmak adına öğretmen adaylarına yönelik matematiksel alan bilgisini ve öğretim sürecine ilişkin bilgi ve deneyimlerini artıracak içerik ve uygulamalara yer verilmesi önerilebilir. Bu yolla öğretmen adaylarının karşılaşacakları gerçek durumlar artırılarak matematiksel gelişim inançları artırılabileceği gibi aynı zamanda öğretim süreci ile alakalı kendilerine güvenleri artırılıp kaygı düzeyleri düşürülebilir. Gelecekte yapılacak çalışmalarda okul öncesi öğretmenlerinin matematiksel gelişim inançları ve matematik öğretimine yönelik kaygılarının ortaya konmasına yönelik çalışmalar yapılarak öğretmen adaylarıyla karşılaştırma yapılmasının mümkün kılınması önerilebilir. Ayrıca matematiksel gelişim inancına ilişkin görüşler ve matematik öğretimi kaygısına ilişkin sebeplerin ortaya

konulabileceği nitel çalışmalara yer verilmesi de bu konulara ilişkin daha derinlemesine bilgiler elde edilebilmesi açısından önerilebilir.

INTRODUCTION

Mathematics is one of the important study fields of science existed in the lives of individuals from past to present and will continue. The science of mathematics, which dates back to the formation of the common numeral system in the Paleolithic age (Struik, 1987), keeps on facilitating daily life by taking part in the solution of many complex problems and the basis of technological developments. Mathematics is used not only in the analysis of scientific concepts but also in all areas of life. Nevertheless, although it is frequently used and needed in all areas of life, prejudices, anxieties, and fears related to mathematics can be observed in many individuals. This applies not only to Turkey but also to almost all countries across the world. Therefore, many national and international level studies investigating attitudes, prejudices, fears, and anxiety about mathematics focus on solving this problem (Chaves, Garcia, & Kramer, 2019; Dowker, Sarkar, & Looi, 2016; English & Kirshner, 2016; Levine & Pantoja, 2021; Üstaş ve Sağ, 2021; Westfall, McAuley & Millar, 2021; Yenilmez & Özbey, 2006;). Particularly, the foundations of studies on mathematics anxiety can be observed to have a long history. For example, nearly 50 years ago, Richardson and Suinn (1972) developed a "mathematics anxiety scale". Mathison (1977) mentioned innovations that had been brought and had to be brought to the teaching programs to reduce mathematics anxiety. Dew and Galassi (1983) tried to reveal basic issues related to mathematics anxiety in their study. All of these studies show the extent of importance given to mathematics anxiety years ago. However, despite all these studies, unfortunately, many individuals still have mathematics anxiety today, and the volume of studies on this subject is growing every other day (Alkan, 2018; Klee & Miller, 2019; Ramirez, Shaw, & Maloney, 2018; Sad, Kis, Demir, & Özer, 2016).

Quality mathematics education appropriately will help students to minimize their anxiety about mathematics and develop positive attitudes. According to Umay (1996), for students to overcome their prejudices, anxieties, and fears, they need to be introduced to a mathematics education philosophy that is linked to daily life as of the first day of school. DiMatrino (2019) stated that a positive change was observed in students' attitudes towards mathematics when they were given real life-related mathematics problems. Teachers play the biggest role in introducing students to mathematics problems that they can use in their daily lives, reducing their anxiety about mathematics, and developing positive attitudes towards it. Studies have also revealed that the attitude of the teacher towards mathematics affects student achievement and attitude (Mensah, Okyere, & Kuranchie, 2013). On the other hand, teachers' anxiety about mathematics will cause students to develop mathematics anxiety (Bekdemir, 2010). In their report, Carey, Devine, Hill, Dowker, McLellan, and Szucs (2019) listed teacher characteristics, too, among many reasons that may cause mathematics anxiety and warned that teachers' anxiety levels might affect their students. For teachers, mathematics anxiety can be handled in two dimensions as mathematics learning and mathematics teaching anxiety. Teachers can be said to have some concerns about teaching mathematics as well as learning it. Indeed, many studies on this topic have shown that teachers and prospective teachers develop anxieties about teaching mathematics (Hughes, Swars Auslander, Stinson, & Fortner, 2019; Gresham, 2018; Stoehr, 2017). These anxieties experienced by teachers can affect mathematics learning, anxiety, and attitudes of their students towards mathematics.

Beliefs about mathematics have a significant role in mathematics education as well as anxiety. As a matter of fact, beliefs about mathematics are not only limited to teachers and students, but they can affect an entire education program and education process (Goldin, Rösken & Törner, 2009). For this reason, studies obtain clues about mathematics instruction by laying out the mathematics beliefs of students (Fardin, Alamolhodaei, & Radmehr, 2011; Hamukwaya & Haser, 2021; Jones, Wilkins, Long, & Wang, 2012; Mason & Scrivani, 2004), teachers and prospective teachers (Handal, 2003; Kaiser, 2006; Philipp, 2007; Szydlik, Szydlik, Benson, 2003; Xie & Cai, 2021), and even parents (Leedy, La Londe, & Runk, 2003; Missall, Hojnoski, Caskie, & Repasky, 2015). In a general sense, teachers' beliefs include what mathematics is, what mathematics education and teaching really are, and how it should ideally be from the perspectives of teachers (Ernest, 1989). These beliefs have the potential to determine teachers' perceptions of mathematics and to influence their behaviors (Kajander, 2007). For this reason, determining the beliefs of prospective teachers and teachers has an important place in identifying the

extent to which they include mathematics teaching in their instructional activities and how they carry out or aim to carry out their teaching. Stating that mathematics teaching had an important place in pre-school education and that it was necessary to determine mathematical development beliefs of pre-school teachers and prospective pre-school teachers, Platas (2015) defined the beliefs of preschool teachers about mathematics teaching and learning as mathematical development beliefs. Platas's (2015) definition of mathematical development belief includes "age-appropriateness of mathematics instruction for preschool students", "the beliefs of teachers about their support for the student's learning in the classroom", "the beliefs of teachers about whether mathematics instruction is among the primary goals of preschool education", and "the level of teachers' confidence in providing mathematics instruction". Similarly, Karakuş, Akman, and Ergene (2018) thought that for preschool teachers to be more successful in mathematics instruction, their beliefs about mathematical development needed to be determined.

As it is frequently stated in the literature, too, for teachers to carry out their educational activities appropriately, they must first have positive attitudes towards mathematics, minimize their anxiety about mathematics learning and teaching, and have a belief in the necessity of mathematics instruction. Uysal and Dede (2016) stated that recent studies on mathematics anxiety and mathematical beliefs generally addressed these two variables separately, but that studies that would reveal the relationship between the two variables were also needed. Determining the mathematics-related perceptions, attitudes, and opinions of teachers teaching at the preschool level is of great significance since this is the first formal education level at which mathematics is introduced to students. It is possible to say that the beliefs of preschool teachers about whether children need mathematics instruction in preschool period and their awareness of their anxiety about teaching mathematics are important in terms of planning their own teaching processes and including mathematics instruction in this process. This situation also applies to prospective teachers. Also, institutions training teachers need to know about the levels of these variables and the relationship between them, as well. In this way, individuals who have high mathematical development beliefs and low levels of mathematics anxiety will be grown up, and prospective teachers who will start to work as teachers in the future will benefit their students in this respect. For this reason, the study aimed to determine the relationship between mathematics teaching anxiety levels and mathematical development beliefs of prospective preschool teachers. In the light of this purpose, following questions are asked:

1. What is the mathematics teaching anxiety level of prospective preschool teachers?
2. What is the level of mathematical development belief of prospective preschool teachers?
3. Is there a significant relationship between mathematics teaching anxiety and mathematical development beliefs of prospective preschool teachers?

METHOD

Study Design

This study used the relational screening method. Relational studies investigate whether there is a relationship between two or more variables, and if there is a difference, they try to determine the direction, size, and form of the difference. In these studies, variables are not manipulated; instead, the type of relationships between variables is described as they are (Bordens & Abbott, 2007, p. 99). Thanks to relational studies, if the variables are correlated, the degree of one variable can be estimated based on the other the variable (Jackson, 2009).

Participants

The study sample consisted of prospective preschool teachers selected using the convenience sampling method and enrolled in Preschool Teacher Education Department of a university located in the Central Black Sea Region of Turkey in the 2019-2020 academic year. The convenience sampling method is defined as "sampling [AP1] method in which participants are obtained wherever they can be found and typically wherever is convenient for the researcher" (Jackson, 2009, p. 96). The total number of students in the mentioned department was 260. The forms including the data collection tools were distributed to the students, and they were requested to respond to the form voluntarily. Eventually, 200 out of 260 prospective teachers agreed to fill out the form (77%). To eliminate the disadvantages of the

convenience sampling method, demographic information about prospective teachers are presented in Table 1.

Table 1.
Prospective Preschool Teacher' Demographic Information

Variables		N	%
Gender	Female	172	86
	Male	28	14
Grade level	Freshmen	62	31
	Sophomores	48	24
	Juniors	56	28
	Seniors	34	17
Total		200	100

As seen in Table 1, 172 of the participants were female, and 28 were male students. Also, 31% of the participants were in 1st-year (n = 62), 24% 2nd-year (n = 48), 28% 3rd-year (n = 56), and 17% 4th-year students (n = 17).

Data collection tools

The data collection tool used in the study consists of three parts. The first part is the personal data form aiming to collect information about students' age, gender, and grade levels. The second part includes the "Mathematics Teaching Anxiety Scale for Classroom Teachers", and the third part includes the "Mathematical Development Belief Scale".

One of the data collection tools employed in the study was the "Mathematics Teaching Anxiety Scale for Classroom Teachers" developed by Sarı (2014). This scale includes a 3-factor structure and consists of a total of 23 items. The scale, which has a 5-point Likert type rating structure, consists of 11 items in the "anxiety about the teaching process" dimension, 6 items in the "anxiety about field knowledge" dimension, and 6 items in the "anxiety about self-efficacy" dimension. The internal consistency coefficient for the overall scale is .89. Also, the internal consistency coefficients for the sub-scale are as follows: the "anxiety about the teaching process", .89; the "anxiety about field knowledge", .77; the "anxiety about self-efficacy", .72. High scores obtained from the scale and sub-scale indicate high mathematics teaching anxiety, while low scores show low mathematics teaching anxiety. Model's coherence indexes related to confirmatory factor analysis were as follows: X^2/sd (389.72 / 224) = 1.74, RMSEA= 0.057, RMR= 0.062, GFI= 0.87, CFI= 0.95, and NFI= 0.89. In the current study, the reliability coefficients were found as .91, .77, and .80, respectively. Besides, the reliability coefficient of the entire scale was determined as .88. Other than this, in the confirmatory factor analysis performed in the current study, the values were found as follows: X^2/sd= 2.15, RMSEA=.077, GFI=:70, NFI=.55. It was seen that X^2/sd (Kline, 2005) and RMSEA (Hair et all., 2006; Browne & Cudeck, 1993; Steiger, 1989) values were within acceptable ranges. The high number of items and the relatively low number of participants could be cited as reasons for the other values to be outside the acceptance ranges.

Another scale used in the study was the "Mathematical Development Beliefs Survey" developed by Platas (2015) and adapted to the Turkish context by Karakuş, Akman, and Ergene (2018). The scale consists of 4 sub-scale and 40 items. The sub-scale of the scale are "age-appropriateness of mathematics instruction" (11 items), "classroom locus of the generation of mathematical knowledge" (11 items), "mathematical development as a primary goal of preschool education" (8 items), and "confidence level in providing mathematics instruction" (10 items). The reliability coefficients of the Turkish version of the scale are .88 for the "age-appropriateness of mathematics instruction" sub-dimension, .86 for the "classroom locus of the generation of mathematical knowledge" sub-dimension, .82 for the "mathematical development as a primary goal of preschool education" sub-dimension, and .84 for the "confidence level in providing mathematics instruction" sub-dimension. Model's coherence indexes related to confirmatory factor analysis were as follows: X^2/sd (1832 / 719) = 2.55, RMSEA= 0.08, GFI= 0.94, IFI= .93, NFI= 0.92, NNFI= 0.92 and AGFI= 0.91. These values (Incremental Fit Index (IFI) ≥.90,

Normedit Fit Index (NFI) ≥.90, Goodness of Fit Index (GFI) ≥.90, Adjusted Goodness of Fit Index, AGFI) ≥ .90) shows that the model is acceptable. The reliability coefficients of the sub-scale in the current study were found as .78, .64, .81, and .81, respectively. Also, the reliability coefficient of the overall scale was determined as .87. In the confirmatory factor analysis performed in the current study, the values were found as follows: X^2/sd= 2.88, RMSEA=.097, GFI=:77, NFI=.73. It was seen that X^2/sd (Kline, 2005) and RMSEA (Hair et all., 2006; Browne & Cudeck, 1993; Steiger, 1989) values were within acceptable ranges. Again the high number of items and the relatively low number of participants could be cited as reasons for the other values to be outside the acceptance ranges.

Data analysis

First of all, the data obtained from the participants were analyzed to reveal whether they showed a normal distribution. To determine normal distribution, the Skewness-Kurtosis coefficient, histogram, and Q-Q plot distributions were examined. The Skewness coefficients for the Mathematics Teaching Anxiety Scale ranged between -.14 and .86, and the Kurtosis coefficients ranged between -.59 and .31. Also, the Skewness coefficients for the Mathematical Development Belief Scale varied between -20 and 1.31, and the Kurtosis coefficients varied between .01 and 2.21. According to Kline (2005), data can be accepted to show a normal distribution in cases where the Skewness coefficient is not greater than + 3, and the Kurtosis coefficient is not greater than +10. Besides, histogram and Q-Q plot distributions were found to show a normal distribution. For this reason, parametric tests were administered to the data. Moreover, the data obtained were subjected to descriptive statistics and Pearson correlation tests. SPSS 22.0 statistical software package was used to analyze the study data.

FINDINGS

The first sub-problem of the study was "What is the mathematics teaching anxiety level of prospective preschool teachers?" For this purpose, the mean scores of the prospective teachers obtained from the mathematics teaching anxiety scale and its sub-scale are given in Table 2.

Table 2.
The Mathematics Teaching Anxiety Levels of the Prospective Preschool Teachers

Sub-scale of the Mathematics Teaching Anxiety Scale	$\bar{X}$	SS
Anxiety about the teaching process	3.11	.06
Anxiety about field knowledge	1.82	.05
Anxiety about self-efficacy	2.04	.06
Mathematics Teaching Anxiety	2.49	.62

As seen in Table 2, the mean mathematics teaching anxiety level score of the prospective teachers was found as 2.49. Another finding was that the anxiety of prospective teachers about the teaching process (X = 3.11) was higher compared to the anxiety about field knowledge (X = 1.82) self-efficacy (X = 2.04) sub-scale.

The second sub-problem of the study was "What is the level of mathematical development belief of prospective preschool teachers?" For this purpose, the mean scores of the prospective teachers obtained from the mathematical development belief scale and its sub-scale are given in Table 3.

Table 3.
The Mathematical Development Belief Levels of the Prospective Preschool Teachers

Sub-scale of Mathematical Development Beliefs Survey	$\bar{X}$	SS
Age-appropriateness of mathematics instruction	2.55	.80
Classroom locus of the generation of mathematical knowledge	2.63	.64
Mathematical development as a primary goal of preschool education	2.13	.83
Confidence level in providing mathematics instruction	2.40	.82
Mathematical Development Beliefs	2.45	.55

As seen in Table 3, prospective teachers' mathematical development beliefs were found to be at a moderate level. Also, the level of mathematical development beliefs of prospective preschool teachers was found to be at a moderate level for the "age-appropriateness of mathematics instruction" sub-dimension ($\bar{X}$= 2.55, SS = .80), the "classroom locus of the generation of mathematical knowledge" sub-dimension ($\bar{X}$= 2.63, SS = .64), the "mathematical development as a primary goal of preschool education" sub-dimension ($\bar{X}$=2.13, SS = .83), and the "confidence level in providing mathematics instruction" ($\bar{X}$= 2.40, SS = .82).

The last problem of the study was "Is there a significant relationship between mathematics teaching anxiety and mathematical development beliefs of prospective preschool teachers?" For this purpose, Pearson's Correlation test was done. The findings are given in Table 3.

Table 4.
The Correlation between the Mathematics Teaching Anxiety and Mathematical Development Belief Levels of Prospective Preschool Teachers

The Sub-scale of Mathematical Development Beliefs Survey	The Sub-scale of Mathematics Teaching Anxiety Scale			
	Anxiety about the teaching process	Anxiety about field knowledge	Anxiety about self-efficacy	Mathematics Teaching Anxiety
Age-appropriateness of mathematics instruction	-.18**	.23**	.14*	-.01
Classroom locus of the generation of mathematical knowledge	-.20**	.12	-.03	-.11
Mathematical development as a primary goal of preschool education	-.22**	.29**	.15*	-.01
Confidence level in providing mathematics instruction	.00	.31**	.32**	.21**
Mathematical Development Beliefs	-.20**	.32**	.21**	.03

*Correlation is significant at the .05level (2-tailed)
**Correlation is significant at the .001level (2-tailed)

As seen in Table 4, no significant relationship was found between mathematical development belief and mathematics teaching anxiety. However, significant correlations were determined between mathematical development beliefs and the sub-scale of mathematics teaching anxiety. A low level and significant negative relationship was found between "mathematical development beliefs" and "anxiety about the teaching process" ($r = -.20$, $p < .01$). There was a moderate positive relationship between "mathematical development beliefs" and "anxiety about field knowledge" ($r = .32$, $p < .01$). Also, there was a low level and a positive relationship between "mathematical development beliefs" and "anxiety about self-efficacy" ($r = .21$, $p < .01$). There was no significant correlation between "mathematics teaching anxiety" and the sub-scale of "mathematical development beliefs".

A low negative relationship was observed between "anxiety about the teaching process" and "age-appropriateness of mathematics instruction" ($r = -.18$, $p < .01$), "classroom locus of the generation of mathematical knowledge" ($r = -.20$, $p < .01$), and "mathematical development as a primary goal of preschool education" ($r = -.22$, $p < .01$). Also, there was a low level and significant positive relationship between "age-appropriateness of mathematics instruction" and "anxiety about field knowledge" ($r = .23$, $p < .01$), "age-appropriateness of mathematics instruction" and "anxiety about self-efficacy" ($r = .14$, $p < .05$), and "mathematical development as a primary goal of preschool education" and "anxiety about self-efficacy" ($r = .15$, $p < .05$). Besides, a moderate level and significant positive relationship was found between "anxiety about field knowledge" and "mathematical development as a primary goal of preschool education" ($r = .29$, $p < .01$), "anxiety about field knowledge" and "confidence level in providing mathematics instruction" ($r = .31$, $p < .01$), and "anxiety about self-efficacy" and "confidence level in providing mathematics instruction" ($r = .32$, $p < .01$).

DISCUSSION

In this study, which aimed to determine the relationship between prospective preschool teachers' mathematics teaching anxiety levels and mathematical development beliefs, the first finding was that prospective teachers' mathematics teaching anxiety was at a moderate level. According to Peker (2006), mathematics anxiety is a topic that has been studied from the past to the present, and many studies have been conducted on this topic. Studies determining the mathematics teaching anxiety of prospective teachers studying mathematics and classroom teaching have generally found the anxiety levels of the participants as low (Çelik, 2021; Hacıömeroğlu, 2014; Hoşşirin-Elmas, 2010; Tatar, Zengin, & Kağızmanlı, 2016; Ural, 2014). As Çelik (2021) stated in her study, the more the maths teaching anxiety of pre-school prospective teacher decreases, the more their maths teaching competencies increase. For this reason, the low or moderate levels of prospective teachers' mathematics teaching anxiety can be considered as a positive finding considering the potential to increase their success in teaching mathematics while carrying out the teaching profession.

Another finding regarding prospective teachers' mathematics teaching anxiety levels was that their levels of anxiety about the teaching process were higher than their anxiety levels about field knowledge and self-efficacy. In other words, prospective teachers felt more confident in terms of acquiring knowledge of mathematics and self-efficacy in mathematics teaching compared to the teaching process. This might have been because they did not have enough information about the situations they were likely to encounter during the teaching process. Also, when the curriculum of preschool teacher education programs in Turkey is examined, it can be seen that there are courses in the program about mathematics teaching in the preschool period (Higher Education Council, 2018). The presence of such courses in the program suggests that students can see themselves competent about field knowledge, but that their anxiety levels about how to carry out the teaching process increase as there are no applied in-class instruction. In summary, prospective teachers can have field knowledge of mathematics teaching thanks to the courses they take, and this increases their belief that they can carry out mathematics teaching. However, since they do not have enough application areas, they may have anxiety about what they can do along the teaching process. Similarly, in their study on primary and secondary school prospective mathematics teachers, Tatar, Zengin, & Kağızmanlı (2016) concluded that the differences between the anxiety levels of the groups may have been the results of whether these prospective teachers took pedagogical courses and teaching practice/field instruction courses. Based on these results, it is thought that increasing the number of applied teaching courses may play a role in

reducing anxiety about the teaching process by providing prospective teachers with more experience of teaching.

The analysis of the mathematical development beliefs of prospective preschool teachers, which is the second sub-problem of the study, indicated that the mathematical development beliefs of prospective teachers with all its sub-scale were at a moderate level. When the sub-scale were considered, the prospective teachers' beliefs that the age of the preschool students was appropriate for mathematics learning, teachers should provide support during mathematics teaching in the classroom, one of the aims of preschool education is mathematical development, and that their self-confidence in mathematics teaching has an impact on their mathematical development were observed to be at a moderate level. In fact, when the preschool programs are examined, learning outcomes in mathematics instruction are found to be close to those of other skills; in other words, mathematics instruction has a considerable place in preschool education (Ministry of Education, 2013). As it is known, teachers' beliefs about a subject have an important place in guiding and teaching their students about that subject (Lui & Bonner, 2016; Smith, Swars, Smith, Hart, & Haardörfer, 2012; Voss, Kleickmann, Kunter, & Hachfeld, 2013). These beliefs can be influenced by the knowledge and personal experience of teachers as well as the teaching and learning experiences they receive in undergraduate education (Richardson, 1996). As a matter of fact, Haser and Doğan (2012) concluded that the "Special Teaching Methods" course taken by students of the Department of Primary School Mathematics Teaching in the 3rd year affected their beliefs about mathematics. Increasing the mathematical development beliefs of prospective teachers will have an important place in terms of their beliefs in the necessity of mathematics teaching while performing the teaching profession and planning and implementing the teaching. To ensure that teachers' beliefs are at higher levels, in the courses given regarding the mathematics instruction in the preschool period, prospective teachers should be made to adopt the view that mathematics is highly important in the future school years of preschool students and the importance and necessity that students should be given mathematics instruction in the preschool period.

The findings of the current study showed that there was no significant relationship between the overall "mathematical development beliefs survey" and the "mathematics teaching anxiety scale" of the prospective preschool teachers. However, there were significant correlations between the sub-scales. First of all, a low level and negative relationship was determined between "mathematical development beliefs" and the "anxiety about the teaching process". Besides, there was a moderate and low positive correlation between "mathematical development beliefs" and "anxiety about field knowledge" and "anxiety about self-efficacy", respectively. Also, a low negative relationship was found between "anxiety about the teaching process" and "age appropriateness of mathematics instruction", "classroom locus of the generation of mathematical knowledge", and "mathematical development as the primary goal of preschool education". However, there was a low and significant positive relationship between "mathematical age-appropriateness" and "anxiety about field knowledge", "mathematical age-appropriateness" and "anxiety about self-efficacy", and "mathematical development as the primary goal of preschool education" and "anxiety about self-efficacy". Moreover, there was a moderate and significant positive relationship between "anxiety about field knowledge" and "mathematical development as the primary goal of preschool education", "anxiety about field knowledge" and "confidence level in providing mathematics instruction", and "anxiety about self-efficacy" and "confidence level in providing mathematics instruction".

Considering the relationships based on the sub-scale, it is possible to conclude that the high mathematical development beliefs of prospective preschool teachers may make them more anxious about mathematics teaching. This can lead to the interpretation that increased beliefs of students about mathematics escalate their anxiety about 'achieving better'. Indeed, as the level of belief that something should be achieved increases, the individual is greatly likely to feel more pressure and more increased anxiety. Classifying concerns about the teaching profession as self-centered, task-centered, and student-centered concerns, Parsons and Fuller (1974) stated that job-centered concerns included concerns about 'being a good teacher'. The results obtained in the present study led to the interpretation that prospective teachers needed to improve themselves on being a good teacher in teaching mathematics and that their task-centered anxiety about these issues may increase as they believed that mathematics teaching was necessary for the preschool period. Anxiety also has stimulating, protective, and motivating impacts on individuals. If anxiety leads the individual to work harder due to the fear of failure, it can be said to have a motivating effect (Akgün, Gönen, & Aydın, 2007). Based on these findings, it is also possible to think

that anxiety may have a supportive aspect in motivating prospective teachers to improve and to learn as long as their anxiety stemming from their beliefs remains at a moderate level. However, a high level of anxiety can negatively affect the achievement of educational goals and student achievement (Bekdemir, 2010; Carey, Devine, Hill, Dowker, McLellan, & Szucs, 2019; Gabriel, 2022; Mensah, Okyere, & Kuranchie, 2013; Ural, 2014). For this reason, precautions should be taken to prevent teachers' anxiety levels from getting high.

Based on the results obtained in the current study, we can recommend that content and applications that will increase the knowledge and experience of prospective teachers regarding their field knowledge of mathematics can be developed to move the levels of their mathematical development beliefs to a high position and also to prevent these high levels from having a very high effect on their anxiety levels. In this way, the mathematical development beliefs of prospective teachers can be increased by augmenting the real situations that they will meet, and at the same time, their anxiety levels can be decreased by increasing their self-confidence related to the teaching process. We also recommend that future studies should reveal prospective preschool teachers' mathematical development beliefs and their anxiety about mathematics teaching to compare them to those of other prospective teachers. Furthermore, qualitative studies on the mathematical development beliefs and the reasons for mathematics teaching anxiety should be carried out to obtain more in-depth insights into these issues.

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