Matematik Öğretmenleri İnanç Ölçeğinin Türkçeye Uyarlanması: Geçerlik ve Güvenirlik Çalışması

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Öz

Bu araştırmanın amacı Xie ve Cai (2021) tarafından geliştirilen Matematik Öğretmenleri İnanç Ölçeğinin Türk kültürüne ve Türkçeye uyarlanmasına yönelik geçerlik ve güvenirlik analizlerini yapmaktır. Çalışma nitel ve nicel yöntemlerin birlikte kullanıldığı karma desen olarak tasarlanmıştır. Çalışma grubu Türkiye'nin çeşitli illerinde görev yapan 431 matematik öğretmeninden oluşmaktadır. Ölçeğin orijinali 5 faktör altında 26 maddeden oluşup 4'lü likert tipi bir ölçektir. İlk olarak, ölçeğin dil geçerliğine yönelik olarak çeviri çalışmaları yapılmıştır. Daha sonra elde edilen veri seti ile açımlayıcı faktör analizi yapılmıştır. Analizler sonucunda ölçeğin orijinal halindeki yapının korunduğu belirlenmiştir. Doğrulayıcı faktör analizi sonucunda ise ölçek yapısının iyi ya da kabul edilebilir uyum indekslerine sahip olduğu sonucuna ulaşılmıştır. Ayrıca madde toplam korelasyon katsayıları ile %27'lik alt ve üst grup ortalamalarının karşılaştırılmasına yönelik t değerleri de ölçek yapısına ilişkin veriler sunmaktadır. Güvenirliğe ilişkin ise Cronbach alpha ve Spearman Brown iki yarı test güvenirlik katsayıları ölçeğin güvenilir bir yapıya sahip olduğu göstermiştir. Analizler sonucunda Türkçeye uyarlaması yapılan ölçeğin geçerli ve güvenilir bir yapıya sahip olduğuna yönelik olarak yeterli kanıtlara ulaşılmıştır.

Anahtar Kelimeler: inanç, matematik öğretmeni, matematik öğretmenleri inanç ölçeği, ölçek uyarlama

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GENİŞ ÖZET

Giriş

Matematik öğretiminde inançlar da önemli bir yere sahiptir (Breiteig vd., 2005; Thompson, 1992). Matematiksel inançların kişisel deneyimlerle oluşturulan kişisel yapılar olduğu (Hannula, 2010), öğretmenlerin yaşamları süresince eğitimleri ve deneyimlerinin matematiğe yönelik inançlarını etkilediği (Lasley, 1980; Pajares, 1992a) düşünüldüğünde öğretmenlerin matematiğe yönelik inançları ders süresince almış oldukları kararları da önemli düzeyde etkilediği söylenebilir (Ambrose vd., 2004). Bu kapsamda Raymond (1997), öğretmenlerin matematiğe yönelik inançlarının matematik öğretimine yönelik inançlarından daha etkili olduğunu vurgulamıştır. Ayrıca öğretmenlerin sınıf içi uygulamalarda deneyimlerinden yola çıkarak etkinlikler yaptıkları (Raymond, 1997) göz önüne alındığında, öğretmenlerin matematiğe yönelik inançları öğrenme ve öğretmen sürecini oldukça fazla etkilediği söylenebilir (Philippou ve Christou, 1999).

Matematiksel inancı öğretmen bağlamında değerlendiren Ernest (1989b), matematik öğretmenlerin matematiğe yönelik inançlarını 3 başlık altında incelemiştir: matematiği öğretmeye yönelik inançlar, matematiğin öğrenilmesine yönelik inançlar ve matematiğin doğasına yönelik inançlar. Bu kapsamda ilgili çalışmada öğretmenlerin, eğitim ve matematiğin doğası üzerindeki inançları üzerinde durulduğu anlaşılmaktadır. Bunun yanında yapılan çalışmalarda öğretmenlerin öğrenciler ve öğretmenlerin kendileri hakkındaki inançlarının da belirlenmesine ihtiyaç duyulduğu ifade edilmiştir (Barkatsas & Malone, 2005; Pajares, 1992a; Yu, 2009). Bu ihtiyacı göz önünde bulunduran Xie ve Cai (2021) ise bu alt başlıklara öğretmenlerin öğrenciler ve öğretmenler hakkındaki inançları boyutlarını da eklemişlerdir.

Xie ve Cai (2021), öğretmenlerin matematiğe yönelik inançlarını daha kapsamlı bir şekilde belirlemek amacıyla Matematik Öğretmenleri İnanç Ölçeğini geliştirmişlerdir. Oluşturmuş oldukları ölçek; *matematik*, *matematik öğrenimi*, *matematik öğretimi*, *öğrenciler* ve *öğretmenler* olarak 5 alt boyuttan ve 26 maddeden oluşmaktadır. Ölçeğin alt boyutlarından ilki öğretmenlerin matematik hakkındaki inançları olarak ifade edilmiştir. Matematiğin doğası (Di Martino ve Zan, 2010), araçsal ve yapısal özellikleri (Ernest, 1989a) dikkate alınarak bunların bütünleştirilmesiyle öğretmenlerin matematiğe yönelik inançlarını belirlemek üzere bu alt boyut hazırlanmıştır. Öğretmenlerin matematiği öğrenme alt boyutuna yönelik inançları, öğrencilerin matematiği öğrenmesiyle sahip olmaları gereken özellikler (Xie ve Cai, 2021) olarak ifade edilmiştir. Matematik öğretimi üzerine inançlar alt boyutunda ise öğretmenlerin etkili öğretimin doğası ve sınıf öğretim ilkeleri üzerine inançlarını (Xie ve Cai, 2021) kapsamaktadır. Öğretmenlerin öğrencilere ve kendilerine yönelik inançları da ölçeğin odak noktası olarak belirlenmiştir. Öğretmenlerin öğrencilerin yönelik inançları ile yapılan etkinliklerdeki öğrencilerin başarıları arasında pozitif yönde ilişkili bulunması (Carpenter ve Fennema, 1992) göz önüne alındığında bu alt boyut da önemli konuma gelmektedir.

Çalışmanın Amacı

Matematik öğretmelerinin öğretim sürecine yönelik inançlarını belirlemeye amacıyla güncel bir ölçeğin Türkçeye uyarlanmasının literatüre katkı sağlayacağı düşünülmektedir. Uyarlanması amaçlanan bu ölçeğin öğretmenlerin matematik, öğrenme, öğretim, öğrenci ve öğretmenlerle ilgili alt boyutlardan oluşması nedeniyle öğretim süreci üzerinde öğretmenlerin genel inancını ortaya koyması açısından önemlidir. Böylelikle matematik öğretmenlerinin

inançlarının belirlenmesiyle eğitim öğretim sürecinin daha etkin bir şekilde uygulanması planlanmaktadır.

Yöntem

Araştırmada farklı bir kültür ve dilde geliştirilmiş olan bir ölçeğin Türk kültürüne ve Türkçeye uyarlanması amaçlandığından, çalışma nitel ve nicel yöntemlerin birlikte kullanıldığı karma desen olarak tasarlanmıştır. Çalışmanın örneklemini Türkiye'nin çeşitli illerinde görev yapan 431 matematik öğretmeni oluşturmaktadır. Araştırmanın verileri 2021-2022 bahar döneminde elde edilmiştir. Araştırma iki farklı çalışma grubu ile gerçekleştirilmiştir. Çalışma grubunda yer alan 216 öğretmen birinci çalışma grubu olarak ifade edilmiş ve bu grupla açımlayıcı faktör analizi (AFA) yapılmıştır. 215 matematik öğretmeni ise ikinci çalışma grubu olarak ifade edilip bu grupla da doğrulayıcı faktör analizi (DFA) gerçekleştirilmiştir. Çalışmada matematik öğretmenlerinin matematiğe yönelik inançlarını belirlemek üzere Xie ve Cai (2021) tarafından geliştirilen Matematik Öğretmenleri İnanç Ölçeği kullanılmıştır. Ölçeğin yapı geçerliğine yönelik AFA ve DFA yapılmıştır. Daha sonra ölçeğin güvenirliğine yönelik Cronbach alfa ve Spearman-Brown iki yarı test güvenirlik katsayıları, maddelerinin madde toplam korelasyonları ve %27'lik alt ve üst grup ortalamalarının incelenmesine ilişkin t değerleri hesaplanarak ölçeğin güvenirliği belirlenmiştir.

Bulgular

Ölçeğin yapı geçerliğini belirlemek amacıyla öncelikle öğretmenlerden elde edilen veri setinin yapılacak analiz için uygunluğu incelenmiştir. Veri setinin uygunluğu için veri setinden uç ve kayıp değerlerin çıkarılması, veri setinin normal dağılması, örneklem büyüklüğünün uygunluğu ve örneklemin yeterliliği (KMO ve Barlett Küresellik Testi) gibi ölçütler bulunmaktadır (Field, 2013; Pallant, 2011). Bu doğrultuda uç değerlere sahip olan 12 satır veri setinden silinmiştir. Uç değerler veri setinden çıkarıldıktan sonra kalan 204 verinin çarpıklık ve basıklık değerleri hesaplanmıştır. Bu şekilde 204 veriden elde edilen veri setinin normal dağılıma uygun olduğunu belirlenmiştir.

Daha sonra veri setinin AFA'ya uygun olup olmadığını belirlemek amacıyla Barlett Küresellik testi ve KMO istatistiği incelenmiştir. Yapılan analizler sonucunda veri setinin analizler için uygun olduğu belirlenmiştir (Barlett Küresellik Testi sonuçları: $\chi 2=2722.693$; $sd=325$; $p=.000<.05$; $KMO=.844$). AFA'da temel bileşenler analizi kullanılmıştır. Yapılan analizler sonucunda özdeğeri 1.00'dan büyük olan 5 faktörlü bir yapıya sahip olduğu belirlenmiştir (1. Faktör: 4.385; 2. Faktör: 3.636; 3. Faktör: 2.953; 4. Faktör: 2.902; 5. Faktör: 2.165). Ayrıca çizgi grafiğindeki birikinti noktaları da dikkate alındığında 5 faktörlü yapının desteklendiği görülmüştür. Ölçeğin tamamının toplam varyansın %61.699'unu açıkladığı tespit edilmiştir. AFA sonucunda .434 ile .845 arasında değişen faktör yüklerine sahip ve .424 ile .766 arasında değişen ortak faktör yüküne sahip 26 maddelik bir ölçek elde edilmiştir.

AFA ile belirlenen 5 faktörlü ölçek yapısını doğrulamak için ayrı bir veri setiyle DFA yapılmıştır. Veri setinin normalliğinin belirlenmesi amacıyla çarpıklık ve basıklık değerleri incelenmiştir. Çarpıklık değerlerinin -1.101 ile .888 arasında, basıklık değerlerinin ise -1.462 ile .185 değerleri arasında yer aldığı belirlenmiştir. Daha sonra beş faktörlü yapının uyum indeksleri incelenmiştir. Analizler sonucunda çeşitli modifikasyon önerileri ortaya çıkmıştır. Buna göre 1-5, 8-9, 8-10, 12-17 ve 14-15 maddeleri arasında ilişkilendirmeler belirlenmiştir. Bu değişiklikler sonucunda $\chi 2$değerinde anlamlı bir düşüş gözlenmiştir ($\chi 2/df=1,752$; $p=0,000$).

Veri setinin uyum indeksleri incelendiğinde yapılan modifikasyonlar sonucunda önerilen modelin genel olarak kabul edilebilir düzeyde olduğu belirlenmiştir (χ2/df=1.752, RMSEA=.061, RMR=.054, SRMR=.069, GFI=.848, NNFI=.903, CFI=.915). Bu değerlerden χ2/df değerinin iyi uyuma, diğer değerlerin ise kabul edilebilir düzeyde olduğu görülmektedir. Ölçek yapısının standardize edilmiş faktör üklerinin 1'in altında olduğu (.49 ile .93 arasında) belirlenmiştir. Standartlaştırılmış faktör yüklerinin karesinin (R^2) ise .24 ile .87 arasında olduğu görülmüştür. Belirlenen bu veriler ölçeğin yapı geçerliğinin sağlandığının göstergesidir.

Ölçeğin güvenirliğine yönelik iç tutarlığı incelendiğinde ölçeğin tamamına yönelik olarak cronbach alpha değeri .911 olarak bulunmuştur. Ölçek alt faktörlerine yönelik cronbach alpha değerleri ise sırasıyla .887, .775, .817, .823 ve .766 olarak elde edilmiştir. Ölçeğin tamamının Spearman Brown iki yarı yöntemiyle güvenirliği incelendiğinde .933 değeri elde edilmiştir. Alt faktörlerde ise sırasıyla .806, .836, .832, .776, ve .837 değerleri bulunmuştur. Ölçek maddelerinin madde toplam korelasyonları incelendiğinde değerlerin .308 ile .708 arasında değiştiği belirlenmiştir. Maddelerin %27'lik alt ve üst gruplarına yönelik madde puanlarına ilişkin *t* değerleri incelendiğinde ise bütün madde puanlarının anlamlı olduğu belirlenmiştir (p<.001). Bu değerler ölçeğin genel olarak güvenilir bir yapıya sahip olduğunu göstermektedir.

Tartışma ve Yorum

Bu çalışmada matematik öğretmenlerinin inançlarını ölçmek üzere Xie ve Cai (2021) tarafından geliştirilen "Matematik Öğretmenleri İnanç Ölçeği"nin Türkçeye uyarlanmasının yapılması amaçlanmıştır. Bu kapsamda öncelikle ölçek Türkçeye çevrilmiş ve geri çevirisi de yapılarak dil geçerliği sağlanmıştır. Uzman görüşleri de alınarak ölçek formuna son şekli verilmiş ve analizlere geçilmiştir. Ölçeğin yapı geçerliğini belirlemek için farklı çalışma gruplarından elde edilen verilerle AFA ve DFA yapılmıştır. AFA ile ölçeğin orijinal formunda yer aldığı gibi ölçek yapısının 5 alt faktörden oluştuğu belirlenmiştir. Elde edilen 5 faktörlü yapı DFA ile uyum indeksleri incelenmiştir. Analizler sonucunda ölçeğin kabul edilebilir uyum indekslerine sahip olduğu belirlenmiştir.

Analizleri yapılan ölçeğin alt faktörlerinden "Matematik" olarak adlandırılan boyutta 5 madde bulunmaktadır ve bu alt faktör öğretmenlerin matematiğin genel yapısına yönelik inançlarını belirlemeye amaçlayan maddeler içermektedir. "Matematik Öğrenimi" olarak adlandırılan ikinci alt faktörde 5 madde yer almakta ve öğretmenlerin matematik öğrenimi üzerine maddeler bulunmaktadır. "Matematik Öğretimi" alt faktöründe 9 madde ile öğretmenlerin matematiğin öğretiminde nelerin etkili olacağına yönelik maddeler yer almaktadır. 3 maddeden oluşan "Öğrenciler" alt boyutunda öğrencilerin öğrenimlerine yönelik inançlar belirlenmeye çalışılırken, 4 maddeden oluşan "Öğretmenler" alt boyutunda da öğretmenlerin kendi öğretimlerine yönelik maddeler bulunmaktadır. Matematiksel inancın; kişilerin matematik öğrenme ve öğretmeleri ile ilgili inançları, matematiğin doğası, kişisel yargılara (Raymond, 1997), matematiksel kavramlara yönelik deneyimlere (Raymond, 1997; Thompson, 1984), öğrenme ortamındaki etkileşime (Op't Eynde ve DeCorte, 2004) yönelik olduğu dikkate alındığında bu faktör yapıları ve isimlendirmelerin matematik inancını yansıtmada yeterli boyutta olduğu söylenebilir.

The Adaptation of the Mathematics Teachers' Beliefs Scale into Turkish: Validity and Reliability Study

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Öz

The purpose of this research is to analyze the validity and reliability of the Mathematics Teachers Belief Scale developed by Xie and Cai (2021) for its adaptation to Turkish culture and Turkish language. The study was designed as a mixed pattern. The study group consisted of 431 teachers of mathematics working in various cities of Turkey. The original scale is a 4-point Likert scale. It consists of 26 items in 5 subscales. Translation studies were carried out for the language validity of the scale. Then, exploratory factor analysis was performed with the examined data set. Analysis of the results showed that the original structure of the scale was preserved. Confirmatory factor analysis results, it was concluded that the scale structure had good or acceptable fit indexes. In addition, the t-values for the comparison of the item-total correlation coefficients and the 27% lower/upper group averages also provide data on the scale structure. Regarding reliability, Cronbach Alpha and Spearman-Brown two-half test reliability coefficients showed that the scale had a reliable structure. Result of analysis, sufficient evidence was obtained that the scale, which was adapted into Turkish, has a valid and reliable structure.

Keywords: belief, mathematical belief, mathematics teacher, mathematics teachers' beliefs scale, scale adaptation

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The Adaptation of The Mathematics Teachers' Beliefs Scale into Turkish: Validity and Reliability Study

Beliefs play an important role in mathematics teaching (Breiteig et al., 2005; Thompson, 1992). Considering that mathematical beliefs are personal structures formed by personal experiences (Hannula, 2010), teachers' education and experiences throughout their lives have an impact on their beliefs about mathematics (Lasley, 1980; Pajares, 1992b). In addition, teachers' beliefs about mathematics also affect their decisions during the lesson significantly (Ambrose et al., 2004). Therefore, Raymond (1997) emphasized that mathematics beliefs of teachers are more effective than their beliefs about how to teach mathematics. In addition, considering that teachers do activities based on their experiences in classroom practices (Raymond, 1997), it can be said that mathematics beliefs of teachers greatly affect the teaching and learning process (Philippou & Christou, 1999).

The effectiveness of teaching depends on the teachers' feelings, approaches, and beliefs towards the teaching phase, as well as their skills (Zakaria & Musiran, 2010). The attitudes, behaviors, decisions, perceptions, and actions of teachers during mathematics education are shaped by their beliefs (Pajares, 1992a). This also affects the mathematical activities teachers conduct for their students (Tokgöz, 2006). In addition, it was found that mathematics teachers' experiences as students are among the factors affecting their activities and beliefs (Demirsoy, 2008).

Teachers' beliefs have been a focus of study in mathematics education, in recent years (Aydın, 2010). Thompson (1992) also emphasized that it is very important to discuss teachers' beliefs regarding the teaching, learning, and nature of mathematics. In parallel, studies have shown that the beliefs of the teachers a very active role in how they teach (Dougherty, 1990; Thompson, 1984; Thompson, 1992; Wilkins, 2008). Hence, various studies have been conducted on the beliefs of mathematics teachers (Barkatsas, & Malone, 2005; Peterson et al., 1989; Yu, 2009). There are also various scale-development studies (Kloosterman & Stage, 1992; Platas, 2015; Yıldız & Çiftçi, 2020). In studies on the use of scales in determining mathematical beliefs, the Beliefs about Mathematical Problem Solving scale (Kloosterman & Stage, 1992) was adapted into Turkish by Delice et al. (2016), and Hacıömeroğlu (2011). In addition, the Mathematical Development Beliefs Scale (Platas, 2015) was adapted into Turkish by Karakuş et al. (2018). Yıldız and Çiftçi (2020); however, developed a Likert-type scale consisting of four subscales to investigate the mathematics belief of secondary school students. These scales were generally developed to determine students' beliefs. However, in planning and implementing an effective educational approach, the identification of teachers' beliefs plays a crucial role. For this reason, it is believed that adapting a current scale, which aims to identify the beliefs of those who teach mathematics, to Turkish culture and Turkish will contribute to the literature. Therefore, this research aims to adapt the Mathematics Teachers' Beliefs Scale, which was developed by Xie and Cai (2021).

Mathematics Teachers' Beliefs Scale

Many definitions have been made in the literature on belief (Pajares, 1992a; Raymond, 1997; Richardson, 2003; Schoenfeld, 2013). Pajares (1992b) explained belief as a state that occurs in individuals as a result of emotional experiences. Richardson (2003) defines it as situations that are visualized in the mind and thought to be correct in the face of any event.

Raymond (1997), on the other hand, expressed belief as personal value judgments formed from the experiences of individuals. The diversity in the definition of belief is also reflected in the definition of mathematical belief. Therefore, researchers have made various definitions with regard to mathematical belief (Ernest, 1989a; Raymond, 1997; Schoenfeld, 1992). According to Ernest (1989b), mathematical belief is one's ideas, tendencies, values, and understandings of mathematics. On the one hand, Raymond (1997) explains mathematical belief as one's value judgments about mathematics, including one's experiences with mathematics, the learning and teaching of mathematics, and the nature of mathematics. Schoenfeld (1992), on the other hand, defines mathematical belief as the feeling and understanding one has as a result of dealing with mathematics. In this context, mathematical beliefs can be expressed as a subjective situation in which thoughts are explained depending on learning at school (Mason & Scrivani, 2004).

Examining the mathematical belief on the basis of the teacher, Ernest (1989b) examined the beliefs of mathematics teachers in relation to mathematics under three headings: learning and teaching mathematics, the nature of mathematics and the principles of education. In this context, it is understood that in his study, teachers focused on their beliefs on the nature of education and mathematics. In addition, it was stated in the studies that there is a need to determine the teachers themselves and their students' beliefs (Pajares, 1992b). In this context, Xie and Cai (2021) added to these dimensions the dimensions of teachers' of students' and teachers' beliefs.

Xie and Cai (2021) developed the Mathematics Teachers' Beliefs Scale in order to more comprehensively determine teachers' beliefs about mathematics. Their scale consists of 5 subscales and 26 items. The first subscale was teachers' beliefs about mathematics. Taking into account the nature of mathematics (Di Martino & Zan, 2010), and instrumental and structural features (Ernest, 1989a), this subscale was developed to determine teachers' beliefs about mathematics by integrating them. The second subscale, learning mathematics, refers to the characteristics that students should have by learning mathematics (Xie & Cai, 2021). The teaching mathematics is the third subscale and includes teachers' beliefs on the nature of effective teaching and classroom teaching principles (Xie & Cai, 2021). The last subscale are teachers' beliefs towards students and themselves. Considering that teachers' beliefs about students and students' success in activities are positively related (Carpenter & Fennema, 1992), this subscale can be regarded important.

The Aim of the Study

Although there have been several studies on the beliefs of mathematics teachers (Barkatsas & Malone, 2005; Peterson et al., 1989; Yu, 2009), there is a lack of scale that examine the beliefs of mathematics teachers, which is an important gap. It is very important to examine the mathematics teachers' beliefs towards mathematics in order to plan and implement an effective mathematics teaching. In this context, it is thought that adapting an up-to-date scale to identify the beliefs of mathematics teachers in Turkish will contribute to the literature. This scale is significant in revealing teachers' beliefs on the teaching process because it consists of subscales related to mathematics, learning, teaching, students, and teachers. Thus, it is planned to implement the education and training process more effectively by determining the beliefs of mathematics teachers.

Method

Since the purpose of the research was the adaptation of a scale developed in another culture and language to Turkish culture and Turkish, the study was designed as a mixed design, using quantitative and qualitative methods together. The mixed design is generally used in scale development and scale adaptation studies. In mixed design, the research starts with a qualitative study and moves on to the quantitative study based on the findings obtained in the qualitative part (Creswell & Clark, 2011). In this study, first, translation studies have been carried out in order to ensure the linguistic validity of the items of the scale. Then, the quantitative part was conducted to test the psychometric features of the Turkish version of the scale.

Study Groups

The study sample consisted of 431 mathematics teachers from different cities in Turkey. The data were obtained in the spring term of 2021-2022. The study has been conducted with two different groups: EFA Group and CFA Group. EFA group on which exploratory factor analysis (EFA) was conducted consisted of 216 teachers. A confirmatory factor analysis (CFA) was carried out with 215 mathematics teachers in the CFA group. Descriptive statistics for the groups are presented in Table 1. The distribution of the groups by city is shown in Figure 1.

Table 1.

Descriptive statistics of study groups

Variables	Categories	EFA Group		CFA Group	
		N	%	N	%
Gender	Female	132	61	138	64
	Male	84	39	77	36
Type of School	State School	183	85	192	89
	Private School	33	15	23	11
Age	20-30	82	38	78	36
	31-40	96	44	109	51
	41-50	38	18	28	13
Education Status	Bachelor's Degree	156	72	165	77
	Master Degree	49	23	43	20
	Doctorate	11	5	7	3
Work Experience	0-5 year	70	32	62	29
	6-10 year	54	25	66	31
	11-15 year	45	21	38	18
	16-20 year	30	14	29	13
	21 years and above	17	8	20	9
	TOTAL	216	100	215	100

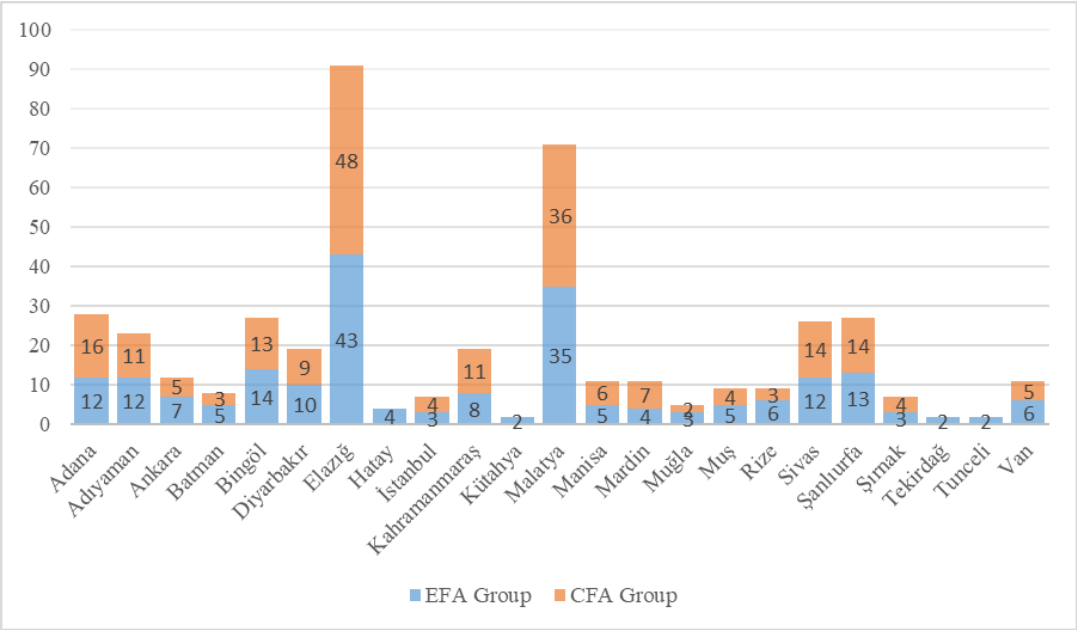

Figure 1. D*istribution of the study group by cities*

Data Collection Tool

In the study, the Mathematics Teachers' Beliefs Scale (MTBS), designed by Xie and Cai (2021), was used to determine the mathematics teachers' beliefs towards mathematics. The purpose of this scale is to investigate teachers' beliefs in mathematics under five dimensions. First of all, they developed 81-item draft scale items. The pilot study was applied to 108 mathematics teachers. After conducting the pilot study, some items were either removed or changed. After removing 21 items, the remaining items were administered to another 184 mathematics teachers, and EFA was performed using the data from this application.

The findings revealed a 26-item scale with 5 factors. The scale is 4-point Likert, from 1 (strongly disagree) to 4 (strongly agree). The reliability internal consistency coefficients of the subscales ranged from .56 to .85. The overall coefficient of internal consistency of the scale was calculated to be .87. Following CFA, goodness of fit indices were calculated as $\chi 2(294, n=184)=531.140$, $\chi 2/df=1.807<2$, $p<.001$, RMSEA=.066<.08, NFI=.877, NNFI=.934>.9, CFI=.940 >.9, GFI=.817.

The first subscale, "Mathematics", focuses on the beliefs about mathematics and consists of 5 items (Items 1, 2, 3, 4, 5). The second subscale is related to beliefs about mathematics learning and is named as "Mathematics Learning" and is expressed with 5 items (Items 6, 7, 8, 9, 10). The third subscale was defined as "Mathematics Teaching" and consists of 9 items (Items 11, 12, 13, 14, 15, 16, 17, 18, 19). The fourth subscale is about determining the beliefs of teachers towards students, named as "Students" and expressed with 3 items (Items 20, 21, 22). The fifth subscale is about teachers' beliefs about themselves and is defined as "Teachers" and consists of 4 items (Items 23, 24, 25, 26). The Turkish form of the MTBS is given in Appendix A.

Data Collection Process

For the Turkish adaptation of the MTBS, the first of the researchers who developed the scale was contacted by e-mail and the necessary permissions for the Turkish adaptation of the scale were obtained. Four linguists fluent in English and Turkish translated the scale items into Turkish. Then, two experts in mathematics education reviewed the English and Turkish versions of these items and examined their suitability for mathematical concepts. The scale items were revised by English language experts who made the necessary adjustments to the items. Linguists were asked to examine the items and indicate their suggestions if any. The prepared items were then shown to a Turkish Language expert and asked to examine the items for the target group of the scale. In this context, Turkish Language expert was expected to examine the understanding of the items, their clarity and intelligibility, and conceptual and semantic aspects. After the corrections, the Turkish version of the items of the scale was sent to English language experts for back-translation. After the translation, the original version of the scale items was compared with the final version. The tests showed no semantic difference between the items. Thus, the Turkish version of the items was given its final form. The scale was then applied to 431 mathematics teachers and the analyzes were made for the construct validity and reliability of the scale.

Data Analysis

The scale was administered to 431 mathematics teachers to test the construct validity of the scale. EFA was conducted with the data obtained from 216 teachers. The CFA was performed with another 215 mathematics teachers to determine whether the structure obtained in EFA was valid. The number of participants in each group meets the assumption in the literature (Çokluk et al., 2010) that a data set with a size of 5 times the number of items is sufficient for analysis. Afterward, the reliability of the scale was determined by calculating Cronbach's alpha and Spearman-Brown two-half test reliability coefficients, the item-total correlations of the items, and the t values for examining the 27% lower and upper group averages.

Research Ethics

Ethics committee approval was obtained after the necessary documents were prepared for the study. Documents have been submitted to the Social and Human Sciences Research Ethics Committee of Firat University.

Findings

Construct Validity Findings

The scale's construct validity was tested using EFA and CFA. The results regarding these are as follows.

Exploratory Factor Analysis (EFA) Findings

First of all, the suitability of the data set was examined for construct validity analysis of the scale. To examine the suitability of the data set, various criteria are taken into account in the literature. These criteria include removing extreme and missing values from the data set, checking normal distribution of the data set, the suitability of the sample size, and the

adequacy of the sample (KMO and Barlett's Sphericity Test) (Field, 2013; Pallant, 2011). For EFA, the normality assumptions of the data of 216 teachers were examined based on the criteria of ±3.29 range of z scores (Field, 2013). Accordingly, 12 participants were excluded due to extreme values. Skewness and kurtosis values were calculated for the remaining 204 data. The values of skewness and kurtosis should be between ±1.96 (Can, 2014). The analyzes showed that the kurtosis and skewness values of data set were met these criteria. Accordingly, the data set was considered as normally distributed.

The Barlett's Sphericity test and KMO statistics were then used to test the suitability of the dataset for EFA. Following analysis, the dataset was found to be suitable for analysis (Barlett's Test of Sphericity: $\chi 2=2722.693$; sd=325; p=.000<.05; KMO=.844). Here, a KMO value greater than .70 indicates that the dataset is large enough to allow factoring (Bryman & Cramer, 1999) and the data set is adequate for multivariate normal distribution criteria according to the result of Barlett's Sphericity test.

Principal component analysis was used in EFA. Rotation techniques were used in factor analysis (Tabachnick & Fidell, 2013). In order to examine scale structures with two or more factors, the items were rotated with the varimax vertical rotation technique, since the varimax vertical rotation technique is a more frequently used method (Büyüköztürk, 2019). The lower cut-off points of the calculated factor loads were set as .40 (Hatcher, 1996) and the common factor variance was as .40 (Costello & Osborne, 2005). In addition, attention was paid to ensuring that the load differences between the different subscales of the item loads were at least .10 (Menard, 2002). However, although the differences between the load values of some items (Items 7, 13) under different factors were less than .10, it was decided not to exclude them in order not to reduce the content validity of the scale. As a result, the scale was found to have a 5-factor structure with eigenvalues greater than 1.00 (1. Factor: 4.385; 2. Factor: 3.636; 3. Factor: 2.953; 4. Factor: 2.902; 5. Factor: 2.165). Furthermore, considering the accumulation points in the scree plot, it was seen that the 5-factor structure was confirmed (Figure 2). In this way, it was determined that the 26-item 5-factor 4-point Likert-type scale met the anticipated conditions without removing any items in the original scale.

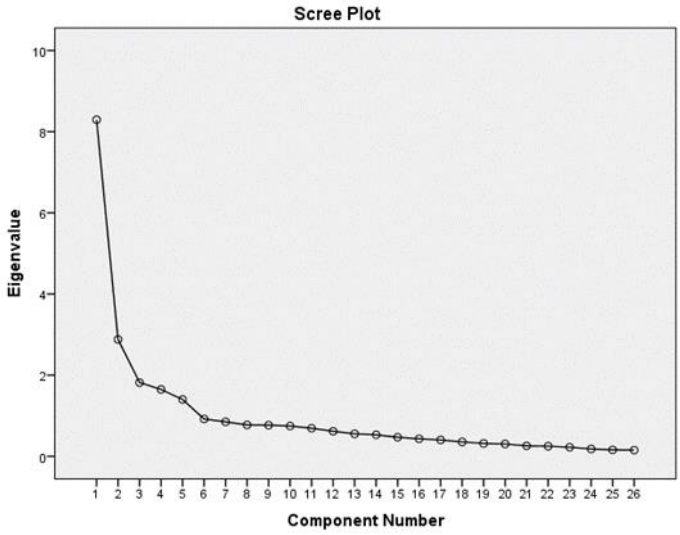

Figure 2. *Scree plot*

It was found that the total scale explained 61.699% of the total variance. Accordingly, the “Mathematics Teaching” subscale consisting of 9 items accounted for 16.866% of the total variance; The “Mathematics” subscale consisting of 5 items accounted for 13.986% of the total variance; The “Teachers” subscale consisting of 4 items accounted for 11.357% of the total variance; The “Mathematics Learning” subscale consisting of 5 items accounted for 11.163% of the total variance; and the “Students” subscale consisting of 3 items explained 8.326% of the total variance. The factor load values of the items and the communalities values are given in the Table 2.

Table 2.

Factor loads and communalities of items

Items	Communalities	1. Factor (Mathematics Teaching)	2. Factor (Mathematics)	3. Factor (Teachers)	4. Factor (Mathematics Learning)	5. Factor (Students)
Item 12	.676	.771				
Item 14	.666	.726				
Item 15	.571	.719				
Item 17	.548	.694				
Item 19	.707	.668				
Item 11	.601	.599				
Item 13	.578	.575				
Item 18	.633	.563				
Item 16	.428	.502				
Item 3	.678		.804			
Item 1	.512		.685			
Item 4	.517		.662			
Item 2	.539		.635			
Item 5	.424		.434			
Item 24	.721			.824		
Item 23	.688			.787		
Item 26	.654			.768		
Item 25	.497			.682		
Item 8	.640				.759	
Item 9	.699				.753	
Item 10	.642				.715	
Item 7	.729				.593	
Item 6	.609				.556	
Item 20	.766					.845
Item 21	.761					.802
Item 22	.556					.719
KMO=.844						
Bartlett's Test of Sphericity =2722.693						
Eigenvalues		4.385	3.636	.953	2.902	2.165
Percentage of Variance Explained (%)		16.866	13.986	11.357	11.163	8.326

The examination of the factor loadings values of the scale showed that the factor loads varied between .502 and .771 in the 1st subscale, .434 and .804 in the 2nd subscale, .682 and .824 in the 3rd subscale, .556 and .759 in the 4th subscale, .719 and .845 in the 5th subscale. The communalities values of the scale indicated that communality factor loads varied between .428 and .707 in the 1st subscale, .424 to .678 in the 2nd subscale, .497 to .721 in the third subscale, .609 to .729 in the 4th subscale and .556 and .766 in the 5th subscale. As a result of

EFA, a 26-item scale with factor loads ranging from .434 to .845 and communalities ranging from .424 to .766 was obtained.

Confirmatory Factor Analysis (CFA) Findings

To verify the 5-factor scale structure determined by EFA, CFA was performed using a separate data set. For this reason, the accuracy of the structure was examined through CFA using the data obtained from another 215 mathematics teachers. First, data with missing information were excluded from the analysis. Then, skewness and kurtosis values were calculated in order to examine the normality of the data set. The skewness values were between -1.101 and .888, and the kurtosis values were between -1.462 and .185. Mahalanobis distance values (p<.001) were also calculated to ensure multiple normalities (Tabachnick & Fidell, 2013). As a result, 11 extreme values were identified and removed from the data set. Accordingly, the data set was found to be normally distributed.

Then, the fit indexes of the five-factor structure were examined. The analysis suggested a number of modifications. Accordingly, correlations were determined between Items 1-5, 8-9, 8-10, 12-17, and 14-15. As a result, a significant decrease in χ2 value was observed (χ2/df=1.752; p=0.000). Accordingly, the fit indexes of the scale, that are χ2/df, Root Mean Square Error of Approximation (RMSEA), Root Mean Square Residual (RMR), Adjusted Goodness of Fit Index (AGFI), Goodness of Fit Index (GFI), Comparative Fit Index (CFI), Standardized Root Mean Square Residual (SRMR), and Tucker-Lewis Index (TLI) are shown in Table 3.

Table 3.

Fit indexes obtained from CFA

Fit Indexes	Perfect	Acceptable	Recommended Model
χ2/df[1]	<2	2-5	1.752
RMSEA[2]	<.05	<.08	.061
RMR[3]	<.05	<.08	.054
SRMR[4]	<.05	<.08	.069
GFI[5]	>.95	.90-.95	.848
AGFI[6]	>.95	.90-.95	.812
TLI[7]	>.95	.90-.95	.903
CFI[8]	>.95	.90-.95	.915

([1] Brown, 2006; [2] Tabachnick & Fidel, 2013; [3] Brown, 2006; Kline, 2011; [4] Brown, 2006; [5] Hu & Bentler, 1999; [6] Hu & Bentler, 1999; [7] Hu & Bentler, 1999; [8] Kline, 2011; Brown, 2006)

The fit indexes of the data set revealed that the proposed model was generally at an acceptable level after the modifications (χ2/df=1.752, RMSEA=.061, RMR=.054, SRMR=.069, GFI=.848, NNFI=.903, CFI =.915). Among the values, it was found that the χ2/df value had a perfectly good fit and the other values were at an acceptable level. The standardized analysis values for the factor structure and correlations between factors of the scale revealed by CFA is given in Figure 3. The values in the figure are shown in Table 4.

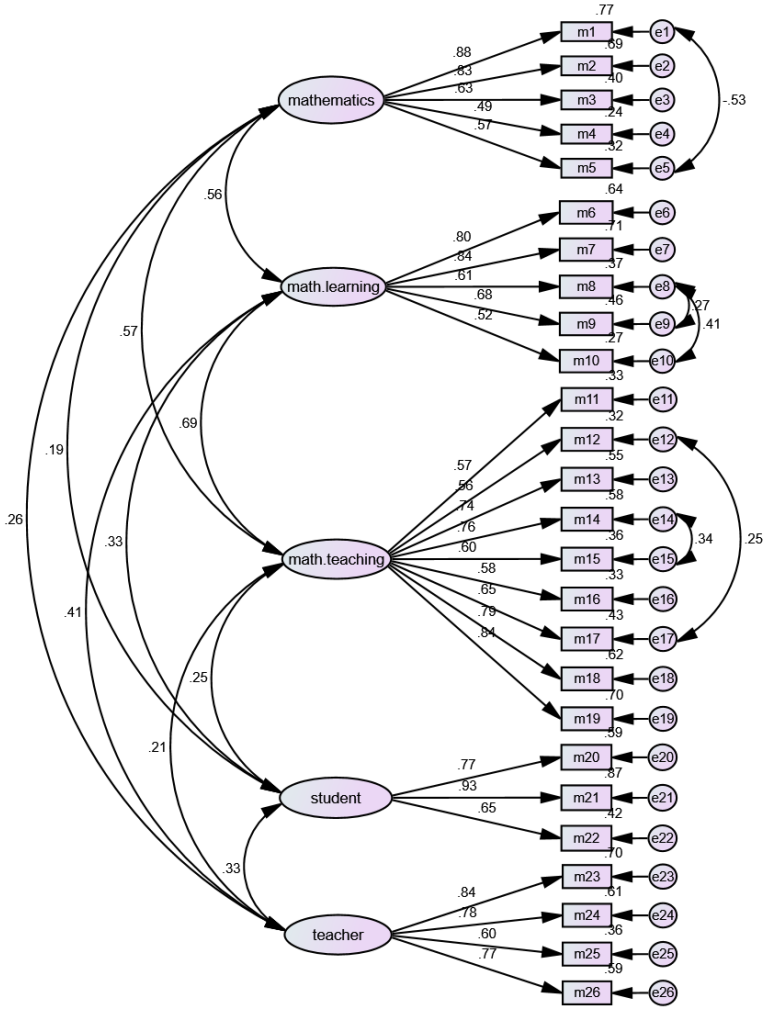

Figure 3. *Standardized analysis values for the factor structure of MTBS*

Table 4.

Standardized loadings and R^2 values

Item	Standardized loadings	R^2	Item	Standardized loadings	R^2
1	.88	.77	**14**	.76	.58
2	.83	.69	**15**	.60	.36
3	.63	.40	**16**	.58	.33
4	.49	.24	**17**	.65	.43
5	.57	.32	**18**	.79	.62
6	.80	.64	**19**	.84	.70
7	.84	.71	**20**	.77	.59
8	.61	.37	**21**	.93	.87
9	.68	.46	**22**	.65	.42
10	.52	.27	**23**	.84	.70
11	.57	.33	**24**	.78	.61
12	.56	.32	**25**	.60	.36
13	.74	.55	**26**	.77	.59

It was found that standardized factor loads were between .49 and .88 in the "Mathematics" factor, between .52 and .84 in the "Mathematics Learning" factor, between .56 and .84 in the "Mathematics Teaching" factor, between .65 and .93 in the "Students" factor and between .60 and .84 in the "Teachers" factor. It was found that the correlation values

between the factors varied between .19 and .69 and the factor loads were below 1 (between .49 and .93). The square of the standardized factor loads (R^2) was found to be between .24 and .87. These data indicated that the scale had construct validity.

Results on the Reliability of the Scale

Cronbach's Alpha and Spearman-Brown two half methods were used to examine the reliability of the scale, and these values are shown in Table 5.

Table 5.

Data for reliability

Subscale	Cronbach Alpha	Spearman-Brown (Two-Half)
Mathematics	.887	.806
Mathematics Learning	.775	.836
Mathematics Teaching	.817	.832
Students	.823	.776
Teachers	.766	.837
Total Scale	.911	.933

The examination of the internal consistency for the reliability of the scale showed that The Cronbach's Alpha for the total scale was .911. Cronbach's alpha for the subscales were calculated as .887, .775, .817, .823, and .766, respectively. the Spearman-Brown two-half method analysis indicated a value of .933 for the total scale and .806, .836, .832, .776, and .837 for the subscales, respectively. It should be noted that a reliability coefficient of .70 and above is an indication that the scale has a reliable structure (Kline, 2011), it was concluded that the scale had a reliable structure. The item-total correlation values of the scale with *t*-values for the comparison of the 27% lower and upper group averages are given in Table 6.

Table 6.

Item-total correlations and t values for the comparison of the 27% lower and upper group averages

Item	Item-total correlations	*t*	Item	Item-total correlations	*t*
1	.447	7.187*	14	.660	11.210*
2	.586	10.651*	15	.530	7.416*
3	.485	9.206*	16	.554	8.527*
4	.483	10.060*	17	.580	8.880*
5	.548	11.476*	18	.661	11.334*
6	.678	11.296*	19	.708	10.746*
7	.689	12.268*	20	.338	4.553*
8	.515	9.203*	21	.332	4.984*
9	.586	11.211*	22	.308	3.900*
10	.313	4.690*	23	.381	5.786*
11	.555	9.835*	24	.336	4.819*
12	.540	7.899*	25	.314	3.962*
13	.594	8.213*	26	.345	4.996*

*p<.001

The item-total correlations of the scale items showed that the values varied between .308 and .708. It is stated that the item-total correlations above .30 measure the anticipated feature of the item (Pallant, 2011). In this respect, it can be said that the scale items measured the anticipated feature. The *t* values of the item scores for the 27% lower and upper groups of

the items were examined, it was found that all item scores were significant (p<.001). These values show that the scale had a generally reliable structure.

Discussion and Conclusion

This research aimed to adapt the "Mathematics Teachers' Beliefs Scale" developed by Xie and Cai (2021) to Turkish in order to measure the beliefs of mathematics teachers. In this context, first, the scale has been translated into Turkish and back-translated to ensure linguistic validity. The final form was given to the scale by obtaining expert opinions and the analysis stage started. EFA and CFA were performed on the data obtained from different study groups to determine the scale's construct validity. EFA revealed that the scale structure consisted of 5 subscales, which were similar to the original scale. The obtained 5-factor structure and fit indexes were examined using CFA. Result of the analysis, the scale was found to have acceptable fit indices.

Cronbach Alpha and Spearman-Brown two-half test values were used to examine the reliability of the scale. It was concluded that the Cronbach's Alpha value for the overall scale was at a good level (α=.911). Similarly, subscales (Mathematics=.887; Mathematics learning=.775; Mathematics teaching=.817; Students=.823; Teachers=.766) were found to be at a good level. Spearman Brown's two-half test values were calculated as .933 for the total scale. It was found that the subscales also had good values (Mathematics=.806; Mathematics learning=.836; Mathematics teaching=.832; Students=.776; Teachers=.837). The analysis revealed that the scale had a valid and reliable structure.

In sum, it was concluded that the 5-factor structure consisting of 26 items met the required conditions without removing any item from the scale. In the first subscale, "Mathematics", there are 5 items to examine teachers' beliefs about the general structure of mathematics. In the second subscale, "Mathematics Learning", there are 5 items to examine teachers' mathematics learning. In the third subscale, "Mathematics Teaching", there are 9 items about what will be effective in the teaching of mathematics. In the fourth subscale, "Students", there are 3 items to examine the beliefs about the learning of students, and in the fifth subscale, "Teachers", there are 4 items to examine teachers' teaching styles. Considering that people's beliefs regarding mathematics learning and teaching, the nature of mathematics, personal judgments (Raymond, 1997), experiences with mathematical concepts (Raymond, 1997; Thompson, 1984), interaction in the learning environment (Op't Eynde & DeCorte, 2004) play an important role in mathematics teaching, it can be said that these factor structures are sufficient to reflect the belief in mathematics.

This scale includes a comprehensive assessment of mathematics teachers' beliefs regarding mathematics education, mathematics learning and teaching, and the roles of students and teachers in the teaching process. For this reason, it can be said that it will make an important contribution to the literature in determining the beliefs of teachers. In this way, studies with larger study groups can contribute to the validity and reliability of the scale. In addition, the data to be obtained from the scale can be supported by conducting qualitative studies to determine teachers' beliefs.

Conflict of Interest

No conflict of interest is declared by the author.

Information on Financial Support

The author did not receive any financial support for research, authorship, and / or publication of this article.

Statements of publication ethics

The author stated that the study was approved by the Social and Human Sciences Research Ethics Committee of Firat University on May 27, 2022 (Document date and number: 31.05.2022-8694).

References

Ambrose, R., Clement, L., Philipp, R., & Chauvot, J. (2004). Assessing prospective elementary school teachers' beliefs about mathematics and mathematics learning: Rationale and development of a constructed-response-format belief survey. *School Science and Mathematics Journal*, *104*(2), 56-69. https://doi.org/10.1111/j.1949-8594.2004.tb17983.x

Aydın, M. (2010). *Examining changes in mathematics teachers' beliefs towards mathematics education*. Unpublished Master's Dissertation, Karadeniz Teknik University.

Barkatsas, A. T., & Malone, J. (2005). A typology of mathematics teachers' beliefs about teaching and learning mathematics and instructional practices. *Mathematics Education Research Journal*, *17*(2), 69-90. https://doi.org/10.1007/BF03217416

Breiteig, T., Grevholm, B., & Kislenko, K. (2005). *Beliefs and attitudes in mathematics teaching and learning*. In Nordisk konferanse i matematikkdidaktikk ved NTNU: 15/11/2004-16/11/2004 (pp. 129-138). Department of Geography, Norwegian University of Science and Technology.

Brown, T. A. (2006). *Confirmatory factor analysis for applied research*. New York & London: Guilford Press.

Bryman, A., & Cramer, D. (1999). *Quantitative data analysis with SPSS release 8 for Windows: A guide for social scientist*. London: Routledge.

Büyüköztürk, Ş. (2019). *Data analysis handbook for social sciences: Statistics, research design, SPSS applications and interpretation (25th ed.)*. Ankara: Pegem Academy.

Can, A. (2014). *Quantitative data analysis with SPSS.* Ankara: Pegem Academy.

Carpenter, T. P., & Fennema, E. (1992). Cognitively guided instruction: Building on the knowledge of students and teachers. *International Journal of Educational Research*, *17*(5), 457–470. https://doi.org/10.1016/S0883-0355(05)80005-9

Costello, A. B., & Osborne J. W. (2005). Best practices in exploratory factor analysis: Four recommendations for getting the most from your analysis. *Practical Assessment, Research & Evaluation*, *10*(7), 1-9.

Creswell, J. W., & Clark, V. L. P. (2011). *Designing and conducting mixed methods research (2nd edition)*. Thousand Oaks, CA: Sage Publications.

Çokluk, Ö., Şekercioğlu, G., & Büyüköztürk, Ş. (2010). *Multivariate statistics for social sciences. SPSS and LISREL applications*. Ankara: Pegem Academy.

Delice, A., Erden, S., Yılmaz, K. & Sevimli, E. (2016). Adaptation of mathematics beliefs scale to Turkish: Validity and reliability studies. *Kastamonu Education Journal*, *24*(2), 737-754.

Demirsoy, N. H. (2008). *Elementary mathematics teachers? beliefs about mathematics and their practice and relationship between them*. Unpublished Master's Dissertation, Abant İzzet Baysal University.

Di Martino, P., & Zan, R. (2010). 'Me and maths': Towards a definition of attitude grounded on students' narratives. *Journal of Mathematics Teacher Education*, *13*(1), 27–48. https://doi.org/10.1007/s10857-009-9134-z

Dougherty, B. J. (1990). *Influences of teacher cognitive/conceptual levels on problem-solving instruction*. In G. Booker et al. (Eds.), Proceedings of the Fourteenth International Conference for the Psychology of Mathematics Education (pp. 119-126). Oaxtepec, Mexico: International Group for the Psychology of Mathematics Education.

Ernest, P. (1989a). *The impact of beliefs on the teaching of mathematics*. In P. Ernest (Ed.), Mathematics teaching: The state of the art (pp. 249–254). New York, NY: The Flamer Press.

Ernest, P. (1989b). The knowledge, beliefs and attitudes of the mathematics teacher: a model. Journal of Education for Teaching, 15(1), 13-33. https://doi.org/10.1080/0260747890150102

Field, A. (2013). *Discovering statistics using SPSS statistics* (Third Edition). Sage.

Hacıömeroğlu, G. (2011). Turkish adaptation of beliefs about mathematical problem solving instrument. *Dicle Üniversitesi Ziya Gökalp Eğitim Fakültesi Dergisi*, *17*, 119-132.

Hannula, M. S. (2010). The effect of achievement, gender and classroom context on upper secondary students' mathematıcal beliefs. CERME 6–Working Group, 34.

Hatcher, L. (1996). A Step-by-step approach to using the SAS™ system for factor analysis and structural equation modeling, *Technometrics*, *38*(3), 296-297. https://doi.org/10.1080/00401706.1996.10484524

Hu, L. T., & Bentler, P. M. (1999). Cutoff criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives. *Structural Equation Modeling: A Multidisciplinary Journal*, *6*(1), 1-55. https://doi.org/10.1080/10705519909540118

Karakuş, H., Akman, B., & Ergene, Ö. (2018). The Turkish adaptation study of the mathematical development beliefs scale. *Pegem Journal of Education and Instruction*, *8*(2), 211-228. https://doi.org/10.14527/pegegog.2018.009

Kline, R. B. (2011). *Principles and practice of structural equation modeling* (3rd ed.). New York London: The Guilford Press.

Kloosterman, P., & Stage, F. K. (1992). Measuring beliefs about mathematical problem solving. *School science and mathematics*, *92*(3), 109-115. https://doi.org/10.1111/j.1949-8594.1992.tb12154.x

Lasley, T. S. (1980). Pre-service teacher beliefs about teaching. *Journal of Teacher Education*, *31*(4), 38-41. https://doi.org/10.1177/002248718003100410

Mason, L., & Scrivani, L. (2004). Enhancing Students' Mathematical Beliefs: An İntervention Study. *Learning and Instruction*, *14*, 153–176. https://doi.org/10.1016/j.learninstruc.2004.01.002

Menard, S. (2002). *Applied logistic regression analysis*. Thousand Oaks, CA: Sage. https://doi.org/10.4135/9781412983433

Op't Eynde, P., & De Corte, E. (2004). *Junior high school students' mathematics-related belief systems: Their internal structure and external relations*. Paper presented in the Topic Study Group at the10th International Congress on Mathematical Education, Copenhagen, Denmark.

Pajares, M. F. (1992a). Preservice teachers' beliefs: A focus for teacher education. *Action in Teacher Education*, *15*(2), 45-54. https://doi.org/10.1080/01626620.1993.10734409

Pajares, M. F. (1992b). Teachers' beliefs and educational research: Cleaning up a messy construct. *Review of Educational Research*, *62*(3), 307-332. https://doi.org/10.3102/00346543062003307

Pallant, J. (2011). *SPSS Survival manual: A step by step guide to data analysis using SPSS for Windows* (4th edition). McGraw Hill: Open University Press.

Peterson, P. L., Fennema, E., Carpenter, T., & Loef, M. (1989). Teachers' pedagogical content beliefs in mathematics. *Cognition and Instruction*, *6*, 1-40. https://doi.org/10.1207/s1532690xci0601_1

Philippou, G., & Christou, C. (1999). *Efficacy beliefs with respect to mathematics teaching*. Paper presented at the Mathematical Beliefs and their Impact on Teaching and Learning of Mathematics Conference at Mathematisches Forschungsinstitut Oberwolfach, Germany.

Platas, L. M. (2015). The mathematical development beliefs survey: Validity and reliability of a measure of preschool teacher' beliefs about the learning and teaching of early mathematics. *Journal of Early Childhood Research*, *13*(3), 295-310. https://doi.org/10.1177/1476718X14523746

Raymond, A. M. (1997). Inconsistency between a beginning elementary school teacher's mathematics beliefs and teaching practice, *Journal for Research in Mathematics Education*, *28*(5), 550-576. https://doi.org/10.5951/jresematheduc.28.5.0550

Richardson, V. (2003). *Pre-service teachers' beliefs*. In J. Raths, & A. C. McAninch. (Eds.), Teacher beliefs and classroom performance: The impact of teacher education (pp.1-22)

Schoenfeld, A. H. (2013). Reflections on problem solving theory and practice. *The Mathematics Enthusiast*, *10*(1), 9-34. https://doi.org/10.54870/1551-3440.1258

Schoenfeld, A. H. (1992). *Learning to think mathematically: problem solving, metacognition, and sense making in mathematics*. In D.A. Grouws (Ed.), Handbook of research on mathematics learning and teaching (pp. 334–370). New York: Macmillan.

Tabachnick, B. G., & Fidell, L. S. (2013). *Using multivariate statistics* (6th edition). Boston, MA: Pearson.

Thompson, A. G. (1984). The relationship of teachers' conceptions of mathematics and mathematics teaching to instructional practice. *Educational Studies in Mathematics*, *15*(2), 105-127. https://doi.org/10.1007/BF00305892

Thompson, A. G. (1992). *Teachers' beliefs and conceptions: A synthesis of the research*. In D. A. Grouws (Ed.), Handbook of research on mathematics teaching and learning (pp. 127-146). New York: Macmillan.

Tokgöz, B. (2006). *The attitudes of preschool teachers about early methematics education and their point of view concerningto their efficacies.* Unpublished Master's Dissertation, Gazi University.

Xie, S., & Cai, J. (2021). Teachers' beliefs about mathematics, learning, teaching, students, and teachers: perspectives from chinese high school in-service mathematics teachers. *International Journal of Science and Mathematics Education*, *19*(4), 747-769. https://doi.org/10.1007/s10763-020-10074-w

Wilkins, J. L. M. (2008). The relationship among elementary teachers' content knowledge, attitudes, beliefs, and practices. *J Math Teacher Education*, *11*, 139-164. https://doi.org/10.1007/s10857-007-9068-2

Yıldız, P., & Çiftçi, S. K. (2020). Mathematics belief scale: Construct validity and reliability analyzes. *Mehmet Akif Ersoy Üniversitesi Eğitim Fakültesi Dergisi*, *56*, 121-138.

Yu, H. (2009). A comparison of mathematics teachers' beliefs between England and China. *Research in Mathematics Education*, *11*(1), 83-84. https://doi.org/10.1080/14794800902732282

Zakaria, E., & Musiran, N. (2010). Beliefs about the nature of mathematics, mathematics teaching and learning among trainee teachers. *The Social Sciences*, *5*(4), 346-351. https://doi.org/10.3923/sscience.2010.346.351

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Appendix A. Turkish form of the scale

	Matematik Öğretmenleri İnanç Ölçeği	Kesinlikle Katılmıyorum	Katılmıyorum	Katılıyorum	Kesinlikle Katılıyorum
1	Matematik bilgisi, sadece matematikçiler tarafından üretilir.	◯	◯	◯	◯
2	Matematiksel bir teori bir kez geliştirildikten sonra, mutlak yasa haline gelir.	◯	◯	◯	◯
3	Matematik bilgisi durağan ve değişmezdir.	◯	◯	◯	◯
4	Matematik bilgisi sadece üretime, yaşamsal faaliyetlere ve diğer bilimlere yardımcı olduğu için değerlidir.	◯	◯	◯	◯
5	Matematiksel bilginin gerçek değeri, kişinin düşünme becerilerini geliştirme yeteneğini somutlaştırmasıdır. Örneğin, matematik öğrenmenin sizi daha zeki yapması gibi.	◯	◯	◯	◯
6	Matematik öğreniminin temeli, bilgiyi öğrencinin zihnine aktarmaktır.	◯	◯	◯	◯
7	Matematikte uzmanlaşmak; formülleri, teoremleri ve işlem kurallarını hatırlamak ve bunları matematiksel problemleri çözmek amacıyla kullanmak demektir.	◯	◯	◯	◯
8	Alıştırma en mükemmel yoldur. Örneğin, alıştırma yapmak matematiği öğrenmenin en önemli yöntemidir.	◯	◯	◯	◯
9	Matematik öğrenimi mümkün olduğunca hızlı ve yoğun olmalıdır. Bazıları her şeyi o an anlayamasa da öğrenciler fikirleri daha sonra da benimseyebilir.	◯	◯	◯	◯
10	Öğrencilerin motivasyon, tutum, sosyal ilişki ve azim gibi eğilimleri matematik öğreniminde belirleyici bir rol oynamaktadır.	◯	◯	◯	◯
11	Öğretmenler matematik öğretiminde sonuçları her zaman kanıtlamalıdır.	◯	◯	◯	◯
12	Matematik öğretiminde, önermeleri kanıtlamak ya da çıkarımlarda bulunmak için temel olarak deneysel yöntemler kullanılmalıdır.	◯	◯	◯	◯
13	Matematik önceden tasarlanmış amaç ve prosedürlere sıkı sıkıya bağlı kalarak öğretilmelidir.	◯	◯	◯	◯
14	Matematik öğretiminin en önemli noktası, öğrencilerin bilgiyi edinmelerine yardımcı olmaktır. Bilgi üretim sürecini anlayıp anlamadıkları çok da önemli değildir.	◯	◯	◯	◯
15	Matematiksel kavramlar öğretilirken, öğrencilerin çeşitli örneklerin gözlem ve analizi yoluyla ortak özellikleri genelleştirmelerine izin verilmelidir.	◯	◯	◯	◯
16	Matematiksel önermeler önce öğrencilere doğrudan sunulmalıdır. Ardından öğrenciler öğretmenin rehberliğinde bunları analiz edip ispatlayabilir.	◯	◯	◯	◯
17	Matematiksel problem çözmeyi öğretmek esasen öğrencilerin olabildiğince fazla problem çözme modelinde uzmanlaşmasına yardımcı olmakla ilgilidir.	◯	◯	◯	◯
18	Matematik dersinde öğretmen tek otorite ya da hakem olmalıdır.	◯	◯	◯	◯
19	Sınav sonuçları, öğretim kalitesini değerlendirmek için en etkili ölçüttür.	◯	◯	◯	◯
20	Öğrencilerin matematiksel düşünme becerileri kademeli olarak aşamalar halinde gelişir.	◯	◯	◯	◯
21	Öğrencilerin motivasyon, tutum, sosyal ilişki ve azim gibi eğilimleri çalışma ile geliştirilebilir.	◯	◯	◯	◯
22	Öğrencilerin matematik öğrenme becerilerinde bireysel farklılıklar vardır. Matematik bazı öğrenciler için zor olabilir.	◯	◯	◯	◯
23	Bir sınıfta öğretim konusunda kendime güvendiğimde, genellikle daha iyi sonuçlar alırım.	◯	◯	◯	◯
24	Öğretmenlerin kariyerleri boyunca yaptıkları öz yansıtmaları, öğretimi geliştirmeleri hususunda üniversitede aldıkları eğitimden daha faydalıdır.	◯	◯	◯	◯
25	Her matematik öğretmeninin kendi öğretim tarzı vardır.	◯	◯	◯	◯
26	Başarılı matematik öğretmenleri sınıflarında demokratik olma eğilimindedir.	◯	◯	◯	◯