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Eğitim Fakültesi Öğrencilerinin Epistemolojik İnançlarının Bazı Değişkenlere Göre İncelenmesi

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Özet – Bu araştırmada, Eğitim Fakültesi İlköğretim Matematik, Fen Bilgisi ve Ortaöğretim Bölümlerinde öğrenim gören 1004 öğretmen adayının epistemolojik inançları ve bu inançların cinsiyet, öğrenme stili, akademik başarı, sınıf ve bölüme göre değişiklik gösterip göstermediğinin belirlenmesi amaçlanmıştır. Veri toplamak amacıyla Epistemolojik İnanç Ölçeği ve Kolb Öğrenme Stili Ölçeği kullanılmıştır. Analiz sonuçları incelendiğinde, cinsiyete göre epistemolojik inançlarda farklılıklar görülmüştür. Ayrıca, öğrenme stilleri ile epistemolojik inançları arasında negatif bir ilişki bulunmuştur. Analiz sonuçlarına göre, öğretmen adaylarının, öğrenmenin çabaya bağlı olduğuna inanç ile ilgili inançlarının daha gelişmiş tek bir doğrunun var olduğu ile ilgili inançlarının daha az gelişmiş düzeyde olduğu, epistemolojik inançlarında her bir boyutta sınıf düzeylerine göre anlamlı farklılıklar olduğu ve kızların erkeklere göre epistemolojik inançlarının daha gelişmiş olduğu belirlenmiştir.

Anahtar kelimeler: Epistemolojik inançlar, öğretmen adayları, öğrenme stilleri.

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Geniş Özet

Giriş

Epistemolojik inanç, bireylerin bilginin ne olduğu, bilme ve öğrenmenin nasıl gerçekleştiği ile ilgili öznel inançları olarak tanımlamaktadır (Schommer ve diğ., 2005). Bireyler bu inançlara sahip olma bakımından "gelişmemiş" ve "gelişmiş" şeklinde

sınıflandırılmaktadır. "Gelişmemiş" epistemolojik inançlara sahip bireyler, bilginin basit olduğuna, mutlak olgulardan oluştuğuna ve bir otorite tarafından aktarıldığına inanırken, gelişmiş inançlara sahip bireyler, bilginin daha karmaşık ve göreceli olduğuna, doğruluğunun değişebildiğine, bir otoritenin aktardığı olgular yığını olmadığına ve sürekli değişen bir yapıya sahip olduğuna inanma eğilimindedir (Bromme, Pieschl ve Stahl, 2010: akt: Sapancı, 2012). Gelişmiş epistemolojik inançlara sahip öğretmen ve öğrenciler eğitim alanında çok başarılı olurlar (Brownlee ve diğ., 2011). Bu nedenle öğretmen olacak öğrencilerin epistemolojik inançlarını, inançları etkileyen faktörleri ve epistemolojik inançlarıyla ilgili görüşlerini öğrenmek önemlidir. Bu amaçla, aşağıdaki sorulara cevap aranmıştır;

1. Eğitim fakültesi öğrencilerinin epistemolojik inançları ne düzeydedir?
2. Eğitim fakültesi öğrencilerinin epistemolojik inançları çeşitli değişkenler açısından farklılık göstermekte midir?

Yöntem

Bu araştırmada, öğretmen adaylarının epistemolojik inançlarının bölüm, cinsiyet, akademik ortalama, sınıf düzeyi ve öğrenme stiline göre incelenmesi amaçlanmaktadır. Araştırmanın örneklemini, Fen Bilgisi Eğitimi (267), İlköğretim Matematik Eğitimi (286), Biyoloji Eğitimi (98), Fizik Eğitimi (121), Kimya Eğitimi (110) ve Ortaöğretim Matematik Eğitimi (122) bölümlerinde öğrenim gören toplam 1004 öğretmen adayı oluşturmaktadır. Araştırmada Epistemolojik İnançlar Ölçeği (Schommer, 1990; Deryakulu ve Büyüköztürk, 2002) ve Kolb'ün Öğrenme Stilleri Testi (Aşkar ve Akkoyunlu, 1993) kullanılmıştır. Veriler, varyans analizi, Pearson korelasyon analizi ve Skewnes-Kurtosis Testi ile analiz edilmiştir.

Bulgular

Epistemolojik inançlar ölçeği verilerinin Cronbach Alfa güvenirlik katsayıları, Faktör 1 için .78, Faktör 2 için.76, Faktör 3 için .58 ve ölçeğin bütünü için .77 olduğu belirlenmiştir. Faktör 1 alt boyutunda en düşük ortalamanın kızlarda Biyoloji Eğitimi, erkeklerde ise Fizik Eğitimi, toplamda ise Biyoloji Eğitiminde olduğu görülmektedir. Faktör 2 alt boyutunda en düşük ortalamanın kızlarda Fizik Eğitimi, erkeklerde ise Kimya Eğitimi, toplamda ise Fizik Eğitiminde olduğu görülmektedir. Faktör 3 alt boyutuna ilişkin en düşük ortalamanın kızlarda Orta Öğretim Matematik Eğitimi, erkeklerde ise Kimya Eğitimi, toplamda ise Orta Öğretim Matematik Eğitiminde olduğu görülmektedir. Bölümlere göre bağımlı değişkenlerde farklılık görülmüştür (Wilk's Lambda=,954; F(15-2733), $p<0,05$). Faktör 1 ($F=1,06$, $p>0,05$) ile ilgili elde edilen değerler anlamlı olmayıp, Faktör 2 ($F=4,76$, $p<0,05$) ve Faktör 3 ($F=2,54$, $p<0,05$) değişkenleri için elde edilen değerler anlamlıdır. Analiz sonucunda cinsiyete göre

bağımlı değişkenlerde farklılık görülmüştür (Wilk'sLambda=,984; F(3-990), p<0,05). Faktör 1 (F=8,86, p<0,05) ve Faktör 2 (F=8,59, p<0,05) değişkenleri için elde edilen değerler anlamlıdır. Faktör 3 (F=1,16, p>0,05) değişkeni için elde edilen değerler anlamlı değildir. Not ortalaması yüksek olan öğretmen adaylarının düşük olanlara göre daha gelişmiş epistemolojik inançlara sahip oldukları görülmektedir. Analiz sonucunda, akademik ortalamalara göre, Faktör 1 (F=1.658, p>0,05), Faktör 2 (F=1.377, p>0,05) ve Faktör 3 (F=.730, p>0,05) bağımlı değişken puanlarının anlamlı olarak farklılık göstermediği belirlenmiştir (Wilk'sLambda=,992; F(6-1738), p>0,05). Sınıf düzeylerine göre bağımlı değişkenlerde farklılık görülmüştür (Wilk'sLambda=.960; F(12-2299), p<0,05). Faktör 1 (F=1.300, p>0,05) ile ilgili elde edilen değerler anlamlı olmayıp, Faktör 2 (F=4.262, p<0,05) ve Faktör 3 (F=4.396, p<0,05) değişkenleri için elde edilen değerler anlamlıdır. Uygulanan Scheffe testine göre, 2.sınıfların Faktör 2 ile ilgili inançlarının 4. ve 5. sınıflara göre daha az gelişmiş olduğu belirlenmiştir. Araştırmada, Kolb'ün Öğrenme Stilleri Testi'nden elde edilen verilere göre, adayların en çok "özümseyen" öğrenme stiline sahip oldukları en az ise "yerleştiren" öğrenme stiline sahip oldukları tespit edilmiştir. Faktör 1 alt boyutu ile ilgili ortalamalarda "Yerleştiren" öğrenme stiline sahip adaylar, Faktör 2 ve Faktör 3 alt boyutları ile ilgili ortalamalarında "Ayrıştıran" öğrenme stiline sahip adaylar en düşük ortalamaya sahip olup epistemolojik inançları gelişmiş/olgunlaşmış düzeydedir. Yapılan varyans analizine göre, Faktör 1 (F3-997=5.9 ,p<0.05) alt boyutu ile Faktör 2 (F3-997=8.9,p<0.05) alt boyutunda öğrenme stilleri açısından anlamlı bir farklılık olduğu belirlenmiştir. Buna karşın Faktör 3 (F3997=2.2,p>0.05) alt boyutunda öğrenme stillerine göre anlamlı bir farklılık olmadığı tespit edilmiştir.

Sonuç ve Tartışma

Araştırmada öğretmen adaylarının, öğrenmenin çabaya bağlı olduğuna inanç ile ilgili düşünceleri daha gelişmiş düzeydedir. Bu durum alan yazındaki diğer çalışmaların çoğunluğu ile paralellik arz etmektedir (Aypay, 2011; Büyüköztürk & Deryakulu, 2002; Deryakulu, 2004).

Araştırmada bölümlere göre, "Öğrenmenin çabaya bağlı olduğu inanç" boyutunda Biyoloji Eğitimi, "Öğrenmenin yeteneğe bağlı olduğu inanç" boyutunda Fizik Eğitimi ve "Tek bir doğrunun var olduğuna inanç" boyutunda Orta Öğretim Matematik Eğitimi adaylarının inançlarının en gelişmiş düzeyde olduğu belirlenmiştir. Araştırmada, Epistemolojik İnançlar Ölçeğinin alt faktör ortalamaları cinsiyet değişkenine göre incelendiğinde kızların her üç faktörde de erkeklere göre daha gelişmiş inançlara sahip

oldukları ilgi çekici sonuçlardan biridir. Bu durum alan yazındaki diğer çalışmalarla benzerlik arz etmektedir (Biçer, Er & Özel, 2013; Deryakulu & Büyüköztürk, 2005; Enman & Lupart, 2000; Oğuz, 2008). Diğer bir sonuç ise öğretmen adaylarının akademik ortalamalarına göre Epistemolojik inançlarının alt faktör ortalamaları incelendiğinde elde edilmiştir. Buna göre akademik ortalaması yüksek olan adayların düşük olanlara göre daha gelişmiş epistemolojik inançlara sahip oldukları görülmektedir. Bu durum, akademik ortalaması yüksek olan adayların öğrenmenin çabaya bağlı olduğuna daha çok inandıklarını, öğrenme yeteneğinin doğuştan getirilmediğine sonradan geliştirilebileceğine daha çok inandıkları ve bilginin kesin ve mutlak olmadığına daha çok inandıklarını göstermektedir. Literatürdeki bazı çalışmalarda farklı sonuçlarda elde edilmiştir. Tümkaya (2012), çalışmasında üniversite öğrencilerinin akademik başarıları ile epistemolojik inançları arasında anlamlı düzeyde farklılık tespit etmemiştir. Araştırmanın bir diğer sonucu öğretmen adaylarının Epistemolojik İnançlar Ölçeğinin alt faktör ortalamaları sınıf değişkenine göre incelendiğinde; birinci sınıflardan üst sınıflara doğru gidildiğinde epistemolojik inançlarının genel olarak daha gelişmiş olduğu yönündedir. Bu durum üniversite öğrencilerinin sınıf düzeyi arttıkça epistemolojik inançlarının geliştiğini göstermektedir. Bu durum alan yazınla uyum göstermektedir (Schommer, 1998 akt: Biçer, Er & Özel, 2013). Araştırmada ayrıca, Kolb'ün Öğrenme Stilleri Testi ile öğretmen adaylarının sahip oldukları öğrenme stilleri belirlenmiştir. Testten elde edilen verilere göre adaylar, en çok "özümseyen" öğrenme stiline sahip olup en az ise "yerleştiren" öğrenme stiline sahiptirler. Varyans analizine göre Faktör 1 alt boyutu ile Faktör 2 alt boyutunda öğrenme stilleri açısından anlamlı bir farklılık olduğu, buna karşın Faktör 3 alt boyutunda öğrenme stillerine göre anlamlı bir farklılık olmadığı tespit edilmiştir. Faktör 1 alt boyutu ile ilgili ortalamalarda "Yerleştiren" öğrenme stiline sahip adaylar, Faktör 2 alt boyutları ile ilgili ortalamalarında ise "Ayrıştıran" öğrenme stiline sahip adaylar en gelişmiş/olgunlaşmış düzeydedirler. Bu durum diğer araştırmalarla benzerlik göstermektedir (Tümkaya, 2012).

Öneriler

Bu araştırmada sayısal bölümlerde öğrenim gören öğretmen adayları ile çalışılmıştır. Daha sonraki çalışmalarda, sosyal (Tarih, Türkçe, Edebiyat vb.) ve sayısal bölümlerde öğrenim gören öğretmen adaylarının epistemolojik inançları belirlenerek bölüm değişkeni açısından epistemolojik inançları karşılaştırılabilir. Ayrıca bu araştırmalar karma araştırma yöntemleri ile gerçekleştirilerek öğretmen adaylarının epistemolojik inançları hakkında ayrıntılı ve derinlemesine bilgi elde edilebilir.

Examination of The Epistemological Beliefs of The Teacher Candidates According to Some Variables

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Abstract – This study aimed to determine the epistemological beliefs of 1004 teacher candidates studying at the Education Faculty, Secondary Grade Science and Mathematics Education departments, and the teacher candidates attending the Primary Grade Mathematics and Science Education departments and to examine whether these epistemological beliefs differ on the basis of gender, learning style, academic average, class level and department. The study made use of the Epistemological Beliefs Inventory and the Kolb Learning Styles Questionnaire. According to the analysis results, there were differences seen in dependent variables based on gender. Also, there was a negative relationship found between the learning styles and epistemological beliefs. The analysis results suggest that the teacher candidates mostly possess a strong belief that learning is dependent on effort and that they possess a weak belief that there is only one truth that epistemological beliefs of the candidates show meaningful differences on the basis of each dimension and class levels and that females possess more developed beliefs than males.

Key words: Epistemological beliefs, teacher candidates, learning styles.

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Introduction

Epistemology is defined as the discipline in which knowledge's nature, source, limitation, truth, reliability and validity as well as the ways it can be transferred are examined, investigated and questioned (Terzi, 2005). According to Schommer (1990), epistemological beliefs are individuals' beliefs about knowledge and learning. These beliefs are more sophisticated in some people than others. Dweck (1988) indicated that the students who think that learning is an inborn ability tend to demonstrate incompetent behaviors when they are asked to work on a difficult task, while the students who think that learning ability can be

improved in time and through experience are observed to try to learn through different strategies when they encounter a difficult task (cited: Schommer-Aikins, Duell & Hutter, 2005). The students using deep studying systems possess sophisticated epistemological beliefs and students' epistemological beliefs affect their learning approaches and study systems (Rodriguez & Cano, 2006). There is a relationship between high school students' epistemological beliefs and mathematic problem-solving beliefs. According to Schommer et al. (2005), students' general epistemological beliefs affected their mathematic beliefs and abilities, and the most powerful epistemological belief among students was the belief in learning fast. Additionally, the researchers emphasized that the students study without any aims and they perceive success as an outcome of chance rather than due to a strategy. Because it is important for a person's epistemological beliefs, Schommer (1993) developed the "Epistemological Beliefs Scale" to determine the level of development of the epistemological beliefs of persons. This scale consists of 4 factors. The first factor is "Innate ability", the second is "Quick learning", the third is "Simple knowledge" and the fourth is "Certain knowledge". The high score from each factor indicates that the person with that factor has naïve beliefs and the low score indicates that the person has sophisticated beliefs.

There have been numerous researches about students' epistemological beliefs. Lots of these researches are examining the effects of gender, class level, academic performance and refutational texts on students' epistemological beliefs (Aydın & Gür, 2017; Biçer, Er & Özel, 2013; Deryakulu & Büyüköztürk, 2005; Enman & Lupart, 2000; Er, 2013; Eroğlu & Güven, 2006; Oğuz, 2008; Sadıç, Çam & Topçu, 2012; Schommer, 1990; Schommer, 1993; Schommer-Aikins, Duell & Hutter, 2005; Terzi, 2005; Tümkaya, 2012). The majority of these studies reported that when compared to males, female students attributed learning to effort rather than ability and as the class level increases, epistemological beliefs of students improve and the students with sophisticated epistemological beliefs also have higher academic performance. However, some researches in the literature reached different results on this issue. For example, Tümkaya (2012) did not determine significant differences between university students' academic success and epistemological beliefs. In his study with university students, Schommer (1990) indicated that students' epistemological beliefs had separate effects on understanding and learning, and that both students' and their families' educational backgrounds affected the students' epistemological beliefs. He also emphasized that to improve students epistemological beliefs, the families should give them more responsibilities and provide them with suitable environments in which they can comprise their own ideas and thoughts. Eroğlu and Güven (2006) revealed that the least sophisticated belief

among first and final year students at the education faculty was that there is only one truth, females attributed success to effort while males believed that ability is the source of success, and there were no significant differences in students' epistemological beliefs in terms of class levels and students' departments. However, Sadıç, Çam and Topçu (2012) reported that males possessed more sophisticated epistemological beliefs than females concerning the source of knowledge, inability to change and justification knowledge. Er (2013) in his study, explored the epistemological beliefs of teacher candidates in terms of various variables (gender, department, teaching type, faculty). Er (2013) revealed that epistemological belief levels exhibited significant differences in terms of departments and teaching types and epistemological belief levels differed significantly in terms of genders. In his study, it was found that like Sadıç et al. (2012) male students believed that learning is more dependent on effort rather than ability more than females. Many studies in the literacy generally females possessed more sophisticated epistemological beliefs than males. For example in their study comparing high school and university students' epistemological belief levels on the basis of gender, Enman & Lupart (2000) reported that females possessed more sophisticated beliefs than males. In this sense, in their studies Deryakulu and Büyüköztürk (2005), Enman and Lupart (2000) expressed that females and possess more sophisticated epistemological beliefs than males than those studying sciences. Oğuz (2008), Deryakulu and Büyüköztürk (2005), Biçer, Er and Özel (2013) thought that female students believed more strongly that learning depends on making an effort rather than ability than male students. In his study examining the effects of epistemological beliefs of high school students on their academic performances (Schommer, 1993) revealed that females believed that learning happens spontaneously and that it is a stable and inherent ability, less than males, and it was also reported that the beliefs related to simple knowledge, precise knowledge and learning fast decreases as the class levels rise. It was found that the students believing that learning does not take place fast and requires effort demonstrate higher levels of academic performance. A similar finding was encountered in the study of Aksan and Sözer (2007) concerning the relationship between Educational Faculty and Faculty of Science and Arts students' epistemological beliefs and their problem solving skills. In that study, the students with naïve epistemological beliefs were observed not to think over and strive to solve complicated and challenging problems, which are shown as a reason for their low levels of academic success. In their studies, Schommer and Walker (1997) underscored that most of the high school students believed that learning can be improved in time and that these high school students develop more positive attitudes towards

education. Enman and Lupart (2000) and Terzi (2005) revealed that students studying social sciences department possess more sophisticated epistemological beliefs than studying science department.

Brownlee, Purdie and Boulton-Lewis (2011) revealed that the students and teachers who possess sophisticated epistemological beliefs become more successful in education. For this reason students', teacher candidates' and teachers' epistemological beliefs are very important for effective learning. Researchers should start by identifying the epistemological beliefs of their students. In the light of these knowledge, in this study answers to the following questions were sought:

- Which levels of epistemological beliefs do the teacher candidates possess?
- Do the epistemological beliefs of the teacher candidates differ based on different variables?

Methodology

This study aimed to determine the epistemological beliefs of teacher candidates studying at the Education Faculty, Secondary Grade Science and Mathematics Education departments, and the teacher candidates attending the Primary Grade Mathematics and Science Education departments and to examine whether these epistemological beliefs differ on the basis of gender, learning style, academic average, class level and department. In this study relational survey was used. Relational survey is a descriptive research method which describes the relationships among the variables (Karasar, 2005).

Sample

The sample of the study consisted of 1004 teacher candidates studying at the Science Education department (267), Primary Grade Mathematics Education department (286), Biology Education department (98), Physics Education department (121), Chemistry Education department (110) and Secondary Grade Mathematics Education department (122).

Table 1. Teacher Candidates Distributions Based on Gender and Departments

Departments	Female(N)	Female(%)	Male(N)	Male(%)	Total	Percent
Science Education	219	82.02	48	17.98	267	26.6
Primary Grade Math. Ed.	223	77.97	63	22.03	286	28.5
Biology Ed.	86	87.76	12	12.24	98	9.8
Physics Ed.	72	59.50	49	40.50	121	12.0
Chemistry Ed.	72	65.46	38	34.54	110	10.9
Secondary Grade Math Ed.	83	68.03	39	31.97	122	12.1
Total	755	75.1	249	24.8	1004	100

The age averages of the teacher candidates range between 17 and 27 and with a 43.5% rate, the majority is at the age of 21-22. 38.1% of the participants graduated from general high schools while 33.5% graduated from Anatolian high schools. Additionally, it was revealed that most of the parents were primary school graduates, and the teacher candidates' fathers' educational status were higher than their mothers'.

Instruments and Data Analysis

The study made use of the Epistemological Beliefs Questionnaire and Kolb's Learning Styles Inventory. With the aim of determining teacher candidates' epistemological beliefs, the study made use of the Epistemological Beliefs Questionnaire which was developed by Schommer (1990), and its adaptation into Turkish, validity and reliability studies were conducted by Deryakulu and Büyüköztürk (2002). The instrument consists of 4 factors and 63 items. In a study with 595 students, the 3-factor and five-point Likert scale consisting of 35 items was then transformed into a three-factor and 34-item scale (Deryakulu and Büyüköztürk, 2005). The scale includes three factors: *Learning is dependent on effort, Learning is dependent on ability* and *There is only one truth.* In the first factor, there are 17 items all of which are negatively coded, in the second, there are 8 items and in the third factor there are 9 items all of which are coded positively. The scale scores are measured out of each factor rather than total scores. A high score obtained from each factor indicates unsophisticated beliefs related to that factor while low scores indicate sophisticated beliefs (Öngen, 2003). The Cronbach Alpha reliability values for Factor 1 were .84, for Factor 2, it was .69 and for Factor 3, it was measured as .64. The total Cronbach Alpha reliability value of the scale was .81 (Deryakulu & Büyüköztürk, 2005). For the current study, the Cronbach Alpha reliability values were found to be .78 for Factor 1, .76 for Factor 2 and .58 for Factor 3. The Cronbach Alpha reliability value for the total scale was .77 in the study. In this context, the scale data can be said to be within reliable ranges. In the study, with the aim to see the participants' learning styles, a learning style inventory, which was developed by Kolb, was used. The scores of learning style inventory reveal individuals' various preferences from concrete to abstract, from active to reflective. There are 12 items in the scale, each of which includes four statements. Kolb's Learning Styles Inventory was adapted into Turkish by Aşkar and Akkoyunlu (1993). The scores an individual obtained from the learning styles inventory indicate which learning style the individual possesses. These learning styles are *diverging, assimilating, converging* and *accommodating* learning styles.

In data analysis process, the data obtained from the Epistemological Beliefs Questionnaire and beliefs scores from the three Factors were calculated. The learning styles of the participants were determined with the Learning Styles Test. Variance analysis was conducted to see if teacher candidates' epistemological beliefs differ in terms of their learning styles, genders, departments and class levels. The Tukey test was applied to determine how significant the differences are according to the variance analysis results. And with the aim of determining the relationship between the academic averages and epistemological beliefs, the Pearson correlation analysis was conducted. To reveal whether the Epistemological Beliefs Scale data presented a normal distribution, the Skewnes-Kurtosis Test was applied. And lastly, in order to determine the descriptive values related to the Epistemological Beliefs Scale's sub dimensions and gender and departments variables, and to measure the significance level between teacher candidates' academic averages and sub factor score averages on the basis of their class level, the MANOVA test was applied.

Results and Findings

In the study, teacher candidates' epistemological beliefs and the effective factors on these beliefs comprise. These factors are gender, learning style, academic average, class level and department. According to the Skewness-Kurtosis test results which was conducted to see whether Factor 1, Factor 2 and Factor 3 scores obtained from the Epistemological Beliefs Scale, the total scores and the scores from the Learning Styles Test show a normal distribution, the average, median and mode values were found to be quite close to each other, and coefficients of Skewness and Kurtosis were between -1.96 and +1.96 (Table 2), which indicates that the data obtained from both instruments demonstrate a normal distribution (Can, 2014). The correlation between sub dimensions and learning styles were also checked in the study, and the Pearson correlation coefficients and significance levels among dimensions and learning styles were also described.

Table 2. The Normality Tests Results of Scores

	Fac.1	**Fac.2**	**Fac.3**	**Fac.1Avg**	**Fac.2 Avg.**	**Fac.3 Avg.**	**Tot. Fac.**	**Learning Style**
N Valid	1004	1004	1004	1004	1004	1004	1004	1001
Mean	31.98	17.60	27.08	**1.8809**	**1.9555**	**3.3847**	76.65	2.41
Median	32.00	17.00	27.00	1.8824	1.8889	3.3750	77.00	2.00
Mode	31	16	26	1.82	1.78	3.25	75	2
Std.Deviation	5.427	4.393	4.683	.31925	.48807	.58532	9.091	.867

Skewness	.134	.149	.048	.134	.149	.048	-.009	.118
Std.Er.Skewn	.077	.077	.077	.077	.077	.077	.077	.077
Kurtosis	-.074	.298	-.157	-.074	.298	-.157	.036	-.305
Std.Er.Kurto.	.154	.154	.154	.154	.154	.154	.154	.154

In terms of the relationships among the sub dimensions of the Epistemological Beliefs Inventory, as seen in Table 3, there is a 0.05 significance level and a negative relationship between Factor 1 and Factor 3 (r=-.076, p<0.05), and there is a positive meaningful relationship between Factor 1 and Factor 2 (r=.109, p<0.01), and Factor 2 and Factor 3(r=.259, p<0.01). Also, there was a negative relationship found between the Learning Styles and Epistemological Beliefs Inventory total factors (r=-.117, p<0.01).

Table 3. The Correlation Between Epistemological Beliefs Inventory Sub Dimensions and Learning Styles

		Fac.1	**Fac. 2**	**Fac. 3**	**Total Factors**	**Learning Styles**
Factor 1(Learning is dependent on effort)	Pearson Correl.	1	.109**	-.076*	.610**	-.073*
Factor 2 (Learning is dependent on ability)	Sig. (2-tailed)	.001	-.076*	.016	.000	.022
Factor 3 (There is only one truth)	Pearson Correl.	.016	.610**	.259**	.682**	-.095**
Factor Total	Sig. (2-tailed)	.000	-.073*	.000	.000	.003
Learning Style	Pearson Correl.	.022		1	.594**	-.054

*p<0.05 ; **p<0.01

Considering the correlation values, the MANOVA test was applied to the variables, and descriptive values in terms of gender and departments, and the Epistemological Beliefs Inventory sub dimensions were revealed. According to Box's M statistics (Box's M: 85.343; F=1.258, p>0.05), the equality of covariance's was accepted. Also, following the Levene Test, it was found that variance errors were the same for Factor 1 (F=1.358, p=.187), Factor 2 (F=.728 p=.712) and Factor 3 (F=1.594 p=.095).

Table 4. The Averages and Standard Deviations of the Epistemological Beliefs Inventory Sub Dimensions Based on Gender and Departments

Factors	**Departments**	**Female**			**Male**		
		Avg.	**Sd.**	**N**	**Avg.**	**Sd.**	**N**
Factor 1	Sci. Ed.	1.8378	.32728	219	1.9436	.28944	48
(Learning is dependent on effort)	Pri. Math. Ed.	1.9074	.30567	223	1.9010	.28326	63
General Total: Avg.:1.8809	Bio. Ed.	**1.8071**	.32778	86	1.9461	.31871	12
(Bio.Ed.: Avg.: 1.8241)	Phy. Ed.	1.8489	.28848	72	**1.8788**	.30997	49
(Female Avg.:1.866; MaleAvg.:1.929)	Chem. Ed.	1.8211	.29806	72	1.9737	.43693	38

	Math. Ed.	1.9298	.32989	83	1.9834	.30742	39
Factor 2	Sci. Ed.	1.9137	.49428	219	1.9954	.48565	48
(Learning is dependent on ability)	Pri. Math. Ed.	2.0339	.45893	223	2.1340	.47484	63
General Total: Avg: 1.9555	Bio. Ed.	1.9457	.54266	86	2.0556	.47496	12
(Phys.Ed.:Avg: 1.8219)	Phy. Ed.	**1.7377**	.47956	72	1.9456	.51626	49
(Female Avg:1.929; Male Avg:2.024)	Chem. Ed.	1.8781	.44294	72	**1.8860**	.42486	38
	Math. Ed.	1.9116	.44402	83	2.1140	.54522	39
Factor 3	Sci. Ed.	3.4669	.61323	219	3.5208	.66910	48
(There is only one truth)	Pri. Math. Ed.	3.3402	.49482	223	3.3095	.52883	63
General Total: Avg: 3.3847	Bio. Ed.	3.3488	.60910	86	3.6875	.61814	12
(Mat.Ed.: Avg: 3.2613)	Phy. Ed.	3.4236	.53961	72	3.3980	.67973	49
(Female Avg:3.383; Male Avg:3.427)	Chem. Ed.	3.4688	.66335	72	**3.2566**	.59342	38
	Math Ed	**3.2003**	.54798	83	3.3910	.58432	39

The lowest averages related to the Factor 1 sub dimension belonged to the teacher candidates at the Biology Education Department among females (XAvg=1.81) while for males it belonged to Physics Education teacher candidates (XAvg=1.88). And in total, the lowest scores belonged to the teacher candidates at the Biology Education Department (XAvg=1.82). Regarding the Factor 2 sub dimension, the lowest averages belonged to Physics Education teacher candidates among females (XAvg=1.74) while it belonged to Chemistry Education teacher candidates among males (XAvg=1.89). In total, the lowest averages were observed among Physics Education (XAvg=1.82). In relation to the Factor 3 sub dimension, the lowest averages among females were found in Secondary Grade Mathematic Education Department teacher candidates (XAvg=3.20) while for males, it was found in Chemistry Education Department teacher candidates (XAvg=3.26). And in total, it was measured to belong to Secondary Grade Mathematic Education Department teacher candidates (XAvg=3.26). Additionally, based on teacher candidates' genders and departments, whether there are meaningful differences between sub factors and score averages was determined.

Table 5. Multidimensional Variance Analysis Related to Factors in Epistemological Beliefs Scale based on Gender and Departments

Effect	**Dependent Variable**	**df**	**F**	**Sig.**	**η^2**
	Factor1 (Learning is dependent on effort)	1	8.862	.003	.009
Gender	Factor2 (Learning is dependent on ability)	1	8.598	.003	.009
	Factor3 (There is only one truth)	1	1.160	.282	.001
	Factor1 (Learning is dependent on effort)	5	1.063	.379	.005
Department	Factor2 (Learning is dependent on ability)	5	4.757	.000	.023
	Factor3 (There is only one truth)	5	2.540	.027	.013
	Factor1 (Learning is dependent on effort)	5	1.202	.306	.006
*Gender*Department*	Factor2 (Learning is dependent on ability)	5	.686	.634	.003
	Factor3 (There is only one truth)	5	2.022	.073	.010

According to the analysis results, there were differences seen in dependent variables based on gender (Wilk's Lambda=.984; F(3-990), $p<0.05$). The obtained values for Factor 1

(F=8.86, p<0.05) and Factor 2 (F=8.59, p<0.05) were statistically meaningful while for Factor 3 (F=1.16, p>0.05) variable it did not present statistically significant values. In terms of teacher candidates' departments, there were significant differences found among dependent variables (Wilk's Lambda=.954; F(15-2733), p<0.05). For Factor 1 (F=1.06, p>0.05), the obtained values were not statistically meaningful while for Factor 2 (F=4.76, p<0.05) and Factor 3 (F=2.54, p<0.05), the values were found to be meaningful. According to the Scheffe test results, Physics education teacher candidates' beliefs in relation to Factor 2 were more sophisticated than those belonging to Primary Grade Mathematics Education teacher candidates. In other words, physics education teacher candidates believe that learning is dependent on making an effort more than Primary Grade Mathematics Education teacher candidates. Additionally, it was observed that Secondary Grade Mathematics Education teacher candidates' beliefs in relation to the existence of only one truth were more sophisticated than the beliefs of Science Education teacher candidates. In this sense, Science Education teacher candidates believe in the existence of only one truth more than Secondary Grade Mathematics Education teacher candidates.

Table 6. Scheffe Test Results

Dependent Variable	Depart.	Depart.	MeanDif.	StdError	Sig.
Factor 2	Physics	Pri. Math.	-.2341*	.05219	**.001**
Factor 3	Mat.	Scie.Edu.	-.2153*	.06352	**.043**

In the study, the relationships between sub factor averages that the teacher candidates scored in Epistemological Beliefs Inventory, their academic grade averages, and class levels, were examined. In this sense, the MANOVA Test was applied to grade averages and class levels variables. To the Box's M statistics results (Box's M:53.421; F=.958, p>0.05), the equality of the covariance's' were accepted. And following the Levene Test, the results suggested the equality of variance errors for Factor 1 (F=.764, p=.676), Factor 2 (F=1.656 p=.079) and Factor 3 (F= .946 p=.495).

In terms of the Factor 1 sub dimension, the lowest averages were found to belong to a third year teacher candidates whose academic average was also low (XAvg=1.64), to belong to a fourth year student whose academic average was intermediate (XAvg=1.84), and to a first year student whose academic average was high (XAvg=1.79). All in all the lowest averages generally belonged to fourth year teacher candidates (XAvg=1.82). Regarding Factor 2 sub dimension, the lowest averages belonged to a third year student whose academic average was low (XAvg=1.78), to a fourth year student with medium level of academic

average (XAvg=1.81), and to fifth year teacher candidates whose academic averages were high (XAvg=1.70). In general, the lowest scores were found among fifth year teacher candidates (XAvg=1.77). In relation to Factor 3 sub dimension, the lowest averages belonged to a first year teacher candidate whose academic average was low (XAvg=3.25), to fifth year students whose academic averages were medium and high, and totally, the lowest averages were found to belong to fifth year teacher candidates (XAvg=3.11).

Table 7. Averages and Standard Deviation Values of Epistemological Beliefs Sub Scales based on Averages and Class Levels (N:883)

Factors	**Aca. Avg.: 0-2.49**				**Aca. Avg.: 2.5-4**			
	Class	***Fac. Avg.***	***Ss***	***N***	***Class***	***Fac. Avg.***	***Sd***	***N***
Factor 1 (Learning is dependent on effort) ***Factor1Avg.:1.8807***	1	1.9374	.3372	93	1	**1.7956**	.3077	122
	2	1.9254	.3394	56	2	**1.9068**	.3368	149
	3	1.9213	.3081	68	3	**1.9040**	.3148	174
	4	1.8444	.2841	45	4	**1.8220**	.3006	113
	5	1.9346	.3595	9	5	**1.8747**	.3533	54
	Total	**1,9089**	-	**271**	**Total**	**1.8631**	-	**612**
Factor 2 (Learning is dependent on ability) ***Factor2Avg.: 1.9607***	1	1.9164	.4893	93	1	1.9973	.5029	122
	2	2.1151	.4905	56	2	2.0611	.5057	149
	3	1.9803	.5055	68	3	1.9540	.4541	174
	4	**1.8049**	.4661	45	4	1.9145	.4859	113
	5	2.1852	.2357	9	5	**1.7037**	.3533	54
	Total	**1.9694**	-	**271**	**Total**	**1.9553**	-	**612**
Factor 3 (There is only one truth) ***Factor3Avg.:3.3837***	1	3.4314	.6393	93	1	3.5871	.5271	122
	2	3.5491	.5842	56	2	3.3649	.5775	149
	3	3.4209	.5529	68	3	3.4073	.5353	174
	4	3.3500	.6563	45	4	3.2013	.5528	113
	5	**3.2222**	.5331	9	5	**3.1065**	.5277	54
	Total	**3.4291**	-	**271**	**Total**	**3.3636**	-	**612**

In a review of teacher candidates' academic averages based on their sub factor averages from Epistemological Beliefs Sub scales, it was found that the teacher candidates with less than 2.5 averages (N:271) possessed 1.9089 as Factor 1 average; 1.9694 as Factor 2 average, and 3.4291 as Factor 3 average. On the other hand, among the teacher candidates whose academic averages were 2.5 and more (N:612), Factor 1 average was found 1.8631; Factor 2 average was 1.9553, and Factor 3 average was 3.3636. It can be inferred that the teacher candidates with high academic averages possess more sophisticated epistemological beliefs than those with lower academic averages. In addition to the analysis above, the MANOVA test was conducted to see the significance level among sub factor score averages based on teacher candidates' academic averages and class levels.

Table 8. Multidimensional Variance Analysis Related to Factors in Epistemological Beliefs Scale based on Academic Averages and Class Levels

Effect	Dependent variable	df	F	Sig.	η^2
Academic averages	Factor 1	2	1.658	.191	.004
	Factor 2	2	1.377	.253	.003
	Factor 3	2	.730	.482	.002
Class level	Factor 1	4	1.300	.268	.006
	Factor 2	4	4.262	.002	.019
	Factor 3	4	4.396	.002	.020
*Averages*Class level*	Factor 1	5	1.139	.338	.006
	Factor 2	5	2.370	.038	.013
	Factor 3	5	2.051	.069	.012

At the end of the analysis, it was found that the Factor 1 (F=1.658, p>0.05), Factor 2 (F=1.377, p>0.05) and Factor 3 (F=.730, p>0.05) dependent variables' scores did not present statistically significant differences (Wilk's Lambda=.992; F(6-1738), p>0.05). However, there were meaningful differences seen among dependent variables in terms of class levels (Wilk's Lambda=.960; F(12-2299), p<0.05). Although the values obtained in relation to Factor 1 (F=1.300, p>0.05) was not significant, other values related to Factor 2 (F=4.262, p<0.05) and Factor 3 (F=4.396, p<0.05) were statistically meaningful.

Table 9. Scheffe Test Results

Dependent Variable	Class	Class	Mean Dif.	Std. Error	Sig.
Factor 2 Average	2	4	.1926*	.05062	**.006**
		5	.3034*	.06887	**.001**
Factor 3 Average	5	1	-.3968*	.08107	**.000**
		2	-.2922*	.08152	**.012**
		3	-.2881*	.08004	**.012**
	4	1	-.2761*	.05930	**.000**

According to the Scheffe test, second year teacher candidates' beliefs related to Factor 2 were found to be less sophisticated than those belonging to fourth and fifth year teacher candidates. Also, fifth year teacher candidates' beliefs towards "There is only one truth" were found to be more sophisticated than the beliefs of first, second and third year teacher candidates. In other words, fifth year teacher candidates believe in the existence of only one truth more than other teacher candidates. In the study, the learning styles of the participant teacher candidates were determined via Kolb's Learning Styles Test. According to the test results, the participants mostly possessed the "assimilating" learning style, and possessed the "accommodating" learning style the least.

Table 10. The Distribution of Teacher Candidates' Learning Styles

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	*Diverging*	146	14.5	14.6	14.6
	Assimilating	411	**40.9**	41.1	55.6
	Converging	335	**33.4**	33.5	89.1
	Accommodating	109	10.9	10.9	100.0
	Total	1001	99.7	100.0	

One way variance analysis (ANOVA) was also conducted to see whether there was a meaningful relationship between teacher candidates' learning styles and epistemological beliefs.

Table 11. One Way ANOVA Test Results related to Epistemological Beliefs Sub Factors and Learning Styles

		Factor 1 ($F_{3\text{-}997}$=5.909 ,p<0.05)		**Factor 2 ($F_{3\text{-}997}$=8.889,p<0.05)**		**Factor 3 ($F_{3\text{-}997}$=2.183,p>0.05)**	
		Avg.	Sd.	Avg.	Sd.	Avg.	Sd.
Valid	*Diverging*	1.8550	.31599	2.0784	.56175	3.4991	.59060
	Assimilating	1.9274	.31613	1.9803	.45858	3.3689	.57769
	Converging	1.8569	.31671	**1.8541**	.46818	**3.3593**	.59062
	Accommodating	**1.8068**	.32090	2.0092	.50265	3.3773	.58034

In terms of the Factor 1 averages, the teacher candidates who possessed the "accommodating" learning style and the teacher candidates who possessed "Converging" learning style in Factor 2 and Factor 3 were found to have the lowest averages, which also indicate possession of naïve epistemological beliefs. Additionally, the teacher candidates possessing the "assimilating" learning style in Factor 1, and the teacher candidates possessing the "diverging" learning style in Factor 2, were revealed to have less sophisticated epistemological beliefs than the teacher candidates who possess other kinds of learning styles. According to the variance analysis, there was a meaningful difference between Factor 1 (F3-997=5.9, p<0.05) and Factor 2 (F3-997=8.9, p<0.05) sub dimensions in terms of learning styles. However, no difference was determined in Factor 3 (F3997=2.2, p>0.05) sub dimension in terms of learning styles. The Scheffe test was applied to reveal from which group the meaningful differences between Factor 1 and Factor 2 average scores and learning styles stemmed from.

Table 12. Scheffe Test Results

Dependent Variable	Learning Style	Learning Style	Mean Dif.	Std. Error	Sig.
Factor 1 Avg.	Accommodating	Diverging	-.04816	.04011	.696

		Assimilating	-.12064*	.03413	**.006**
		Converging	-.05009	.03494	.561
		Diverging	-.22432*	.04789	**.000**
Factor 2 Avg.	Converging	Assimilating	-.12620*	.03554	**.002**
		Accommodating	-.15511*	.05325	**.019**

According to Table 12, the source of the meaningful differences between Factor 1 average scores and learning styles was stemming from the participants' averages that possessed the "assimilating" learning style, which is in favor of the participants who possessed "accommodating" learning styles. Also, it was seen that the source of the meaningful differences between Factor 2 average scores and learning styles, was stemming from the participants' averages that possessed "diverging," "assimilating" and "accommodating" learning style, which is in favor of the participants who possessed "converging" learning styles.

Conclusion and Discussion

In this study, teacher candidates' epistemological beliefs and the effective factors on these beliefs were investigated. Following the quantitative analysis of the study, it was revealed that teacher candidates' averages related to the "Learning is dependent on effort" belief was 1.88; "Learning is depended on ability" belief was 1.95; and "There is only one truth" belief was 3.33.

Following the examination of teacher candidates' epistemological beliefs in terms of their departments in the study, it was found that for the "Learning is dependent on effort" belief dimension, the teacher candidates in the Biology department possessed the most sophisticated epistemological beliefs. The same held true for the "Learning is depended on ability" belief dimension for the teacher candidates in the Physics department, and for the "There is only one truth" belief dimension for the teacher candidates at the Secondary Grade Mathematics Education department. To the analysis results, there were meaningful differences between Factor 2 and Factor 3 scores while there was no significant difference found in Factor 1 scores. Regarding Factor 2, there were found meaningful differences between the Physics and Secondary Grade Mathematics Education teacher candidates, which indicated that, compared to Mathematics teacher candidates, the Physics teacher candidates believed that learning is dependent on making effort rather than ability more so. Regarding Factor 3, there were significant differences found between Secondary Grade Mathematics Education and Science Education teacher candidates, which indicates that compared to

Mathematics teacher candidates, the Science education teacher candidates possessed less sophisticated epistemological beliefs, and they were found to believe that there is only one truth more so.

There were found negative relationships between Factors 1 and 3, and positive significant relationships between Factors 1 and 2, and Factors 2 and 3 of epistemological beliefs inventory sub dimensions. In a review of the sub factor averages of participant teacher candidates obtained from the Epistemological Beliefs Inventory on the basis of gender, it was found that females possessed more sophisticated beliefs than males in all three factors, which is a remarkable result. This finding indicates that females have more sophisticated beliefs than males in that they believe learning depends on effort and ability. There were significant differences in the scores of Factor 1 and 2 while no significant results were found in Factor 3. Regarding the dimension "There is only one truth," females had an average of 3.3834 while males showed a 3.3914 average value. This result parallels the findings in the related literature. Indeed, in their study comparing high school and university students' epistemological belief levels on the basis of gender, Enman & Lupart (2000) reported that females possessed more sophisticated beliefs than males. Oğuz (2008), Deryakulu & Büyüköztürk (2005), Biçer, Er and Özel (2013) thought that female students believed more strongly that learning depends on making an effort rather than ability than male students. Similarly, Chai, Khine and Teo (2006) revealed that when compared to females, males are more disposed to believe that ability is inherent and stable, and in a different finding, they also found that females did not question authority knowledge and believed that knowledge is exact and never changes.

Another result of the study was obtained upon examining the teacher candidates' academic averages based on their sub factor averages from the Epistemological Beliefs Inventory. In this sense, the teacher candidates with high academic averages were observed to possess more sophisticated epistemological beliefs than those with lower academic averages. The participant teacher candidates with higher than 2.5 grade point averages had more sophisticated beliefs in all three sub factors than those with less than 2.5 grade point averages which indicates that the teacher candidates with high academic averages mostly tend to believe that learning depends on ability, learning ability is not an inherent feature and it can be improved later, and that knowledge is not certain and absolute. The reasons for these participants' thinking so might be that they spare more time for learning activities, they possess high levels of motivation to study and they raise awareness towards the learning

process. In his study examining the relationships between academic performances and epistemological beliefs of high school students, Schommer (1993) emphasized that sophisticated epistemological beliefs were an important predictor of high school students' academic success, and found that the high school students believing that knowledge is simple and certain, and that learning takes place fast, were seen to have lower academic success.

Another result of the study is related to the teacher candidates' factor averages of the Epistemological Beliefs Inventory on the basis of class level. In this sense, it was found that as the class levels rises, the epistemological beliefs get more sophisticated. The Factor 1 sub dimension average was the highest among fourth year teacher candidates (XAvg=1.8256) while the least sophisticated beliefs belong to second year teacher candidates (XAvg=1.9155) in this factor dimension. For Factor 2 sub dimension, the fifth year teacher candidates had the highest averages (XAvg=1.7700) while the lowest averages belong to the second year teacher candidates (XAvg=2.0764). In terms of Factor 3 averages, the fifth year teacher candidates showed the highest averages (XAvg=3.1267), and first year teacher candidates possessed the lowest averages (XAvg=3.5199). The analysis results revealed significant average differences between Factor 2 and Factor 3 scores. It is also determined that in regards to the learning is dependent on ability dimension, fourth and fifth year teacher candidates possessed more sophisticated beliefs than second year teacher candidates. With regards to the dimension that there is only one truth, fifth year teacher candidates again possessed more sophisticated beliefs than first second and third year teacher candidates, and lastly again in this dimension, fourth year teacher candidates were revealed to possess more sophisticated beliefs than first year teacher candidates. These findings indicate that as the class level of teacher candidates increase, their epistemological beliefs become more sophisticated. Some researchers assert that epistemological beliefs change and become sophisticated during university years, and he emphasized its importance (Biçer, Er & Özel, 2013). Aypay (2011) reported that first second and third year students were disposed to believe that knowledge is certain and never changes, more than fourth and fifth year students. Önen (2011) underscored the finding that as the class level increases, epistemological beliefs become more sophisticated while Öngen (2003) claimed the opposite, in other words, as the class levels increase, students' epistemological beliefs do not become more sophisticated. With the aim of ensuring increased sophisticated beliefs among students, programs need to be supported with courses which concentrate on both theory and practice. From this perspective, the number of the courses which university students take that increase their awareness of learning can be increased as they progress

through university and through course observations and sample lectures they deliver within the curriculum of their final year of school and teaching experience practices, their beliefs concerning learning can be improved.

The study also described teacher candidates' learning styles through Kolb's Learning Styles Inventory. According to the data obtained from the inventory, the participants mostly adopted an "assimilating" learning style and they possessed "accommodating" learning style least. According to the variance analysis, there was a significant difference in the Factor 1 sub dimension and the Factor 2 sub dimension in terms of learning styles while no significant differences were found in the Factor 3 sub dimension. The participants who adopted the "accommodating" learning style in relation to Factor 1 averages and the participants, who possessed a "converging" learning style in relation to Factor 2 averages, were found to have the lowest averages and to be in the sophisticated level. Additionally, when compared to the other participant teacher candidates, the participants possessing the "assimilating" learning style were revealed to be less sophisticated in the Factor 1 sub dimension and the participants possessing a "diverging" learning style were less sophisticated in the Factor 2 sub dimension. These findings show parallels with other study findings in the literature. Tümkaya (2012) examined the relationships between university students' epistemological beliefs and learning styles and reported that the participant university students mostly possessed the "assimilative" learning style, secondly the "converging" and lastly they possessed "accommodating" learning styles. As opposed to the current study's results, in Tümkaya's (2012) study no significant differences in learning styles were found within the Factor 1 sub dimension while there was seen significant differences in the Factor 2 and Factor 3 sub dimensions in favor of the students who adopted the "diverging" learning style. Huglin (2003) concluded that since students possess different epistemological beliefs, they possess different learning styles (cited: Kaleci, 2012). As Kaleci (2012) stated, that teachers' epistemological beliefs and students' epistemological beliefs are in interaction with each other is an undeniable fact. Thus, this interaction can be also reflected in both teachers' and students' learning styles.

Implications

In this study, teacher candidates who have studied in science and mathematics departments have been studied. In following studies, epistemological beliefs of teacher candidates in social (History, Turkish, Literature, etc.) and science and mathematics departments can be determined and their epistemological beliefs can be compared in terms of

departments. In addition, these researches can be carried out with mixed research methods to obtain detailed and in-depth information about the epistemological beliefs of teacher candidates.

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