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Türkiye'deki 4, 6 ve 8. Sınıf İlköğretim Öğrencilerinin Epistemolojik İnançları

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ÖZ. Bu çalışmanın amacı 4, 6 ve 8. sınıf ilköğretim öğrencilerinin epistemolojik inançlarını belirleme ve bu inançların sınıf düzeyine ve cinsiyete göre nasıl değiştiğinin araştırılmasıdır. Çalışmanın örneklemini 427 ilköğretim öğrencisi oluşturmaktadır. Veri toplamak için Epistemolojik İnançlar Anketi kullanılmıştır. Sınıf düzeyinin ve cinsiyetin epistemolojik inançlara etkisini değerlendirmek için iki yönlü çok değişkenli varyans analizi yapılmıştır. Öğrencilerin epistemolojik inançlarına sınıf düzeyinin etkisi hakkında önceki araştırma bulgularından farklı olarak öğrencilerin sınıf düzeyleri arttıkça bilginin oluşumu ve gerekçelendirilmesi konusuna ait inançlarının daha az gelişmiş olduğu bulunmuştur. Ayrıca kız öğrencilerinin bilginin kaynağı, değişmezliği ve gerekçelendirilmesi hakkındaki inançlarının erkek öğrencilere göre daha gelişmiş olduğu tespit edilmiştir.
Anahtar sözcükler: epistemolojik inançlar, ilköğretim öğrencileri, cinsiyet

ÖZET

Amaç ve Önem: Bu çalışmanın amacı 4, 6 ve 8. sınıf ilköğretim öğrencilerinin epistemolojik inançlarını belirleme ve bu inançların sınıf düzeyine ve cinsiyete göre nasıl değiştiğinin araştırılmasıdır. Öğrencilerin epistemolojik inançları ile öğrenmeleri ve başarıları arasında bir ilişki olduğu literatürde belirtilmiştir. Bu nedenle öğrencilerin epistemolojik inançlarının belirlenmesi öğrencilerin öğrenmelerinin gelişimi açısından önemlidir. Ayrıca ilköğretim öğrencilerinin epistemolojik inançlarının değerlendirilmesine yönelik ülkemizde çalışma az sayıda olduğu belirlenmiştir. Bundan dolayı ilköğretim düzeyinde epistemolojik inançların değerlendirilmesine yönelik çalışmalara ihtiyaç vardır.

Yöntem: Araştırmanın örneklem grubunu Ankara Çankaya'da üç farklı ilköğretim okulunda eğitim gören 427 ilköğretim öğrencisi oluşturmaktadır. Çalışmaya katılan öğrencilerin 147'si 4. sınıf, 160'ı 6. sınıf ve 120'si 8. sınıf öğrencisidir. Veri toplamak için Epistemolojik İnançlar Anketi kullanılmıştır. Bu anket Conley, Pintrich, Vekiri ve Harrison (2004) tarafından geliştirilmiştir. Ölçeğin Türkçe'ye çevrilmesi, geçerlik ve güvenirlik çalışmaları Özkan (2008) tarafından yapılmıştır. Çalışmanın verileri 2009-2010 eğitim öğretim yılı bahar döneminde toplanmıştır. Sınıf düzeyinin ve cinsiyetin epistemolojik inançlara etkisini değerlendirmek için iki yönlü çok değişkenli varyans analizi yapılmıştır.

Bulgular: Literatürdeki çalışmaların bulgularına paralel olarak, yaşı küçük olan öğrencilerin bilginin kaynağı, değişmezliği konusunda daha az gelişmiş inançları olduğu tespit edilmiştir. Önceki araştırmaların bulgularından farklı olarak öğrencilerin sınıf düzeyleri arttıkça bilginin oluşumu ve gerekçelendirilmesi konusuna ait inançlarının daha az gelişmiş olduğu bulunmuştur. Ayrıca kız öğrencilerinin bilginin kaynağı, değişmezliği ve gerekçelendirilmesi hakkındaki inançlarının erkek öğrencilere göre daha gelişmiş olduğu tespit edilmiştir.

Tartışma, Sonuç ve Öneriler: Yaşı küçük olan öğrencilerin bilginin kaynağı, değişmezliği konusunda daha az gelişmiş inançlara sahip olduğu bulgusu literatürdeki çalışmalarla benzerlik göstermektedir. Literatürden farklı olarak öğrencilerin sınıf düzeyleri arttıkça bilginin oluşumu ve gerekçelendirilmesi konusuna ait inançlarının daha az gelişmiş olduğu bulunmuştur. Bir başka deyişle,

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üst sınıfta okuyan öğrenciler, kanıt ve uzman görüşlerin bilginin gerekçelendirilmesinde rolü olduğunu düşünmemekte ve bilimsel görüşlerin değişebilirliğine inanmamaktadır. Beklenenin dışında olan bu durumun açıklaması olarak bazı sebeplerin olabileceği araştırmacılar tarafından belirtilmiştir. Literatürde, öğretmenlerin öğretiminin, öğrencilerin epistemolojik inançlarını etkilediği (Tsai, 1999; Brownlee, 2001), araştırmaya dayalı ve uygulamalı eğitimin öğrencilerin epistemolojik inançlarının gelişimine katkıda bulunduğu (Qian, & Alvermann, 2000; Conley et al, 2004; Kaynar, Tekkaya, & Çakıroğlu, 2009; Kızılgüneş, Tekkaya, & Sungur,2009) belirtilmiştir. Uygulamada olan yapılandırmacı ve sarmal temelli olan Fen ve Teknoloji programı bu tür eğitim yöntemlerini içerdiğinden dolayı öğrencilerin epistemolojik inançlarını geliştirmesi beklenmektedir. Ancak, ilgili literatürde de belirtildiği gibi, Fen ve Teknoloji öğretmenleri hala sınıflarında geleneksel yöntemleri kullanmaya devam etmekte ve dolayısıyla yeni eğitim programı sınıflarda yeterince uygulanamamaktadır (Güven, 2008; Aydın & Çakıroğlu, 2010). Bu durum öğrencilerin epistemolojik inançlarının azalmasına sebep olarak gösterilebilir. Bir diğer sebep olarak Seviye Belirleme Sınavının çoktan seçmeli yapısı ve bu sınava hazırlık amacı ile gidilen özel eğitim kurumlarının (dershane vb.) öğrencileri soru çözme tekniklerini ezberlemeye yönlendirmeleri epistemolojik inançların gelişimini destekleyecek yapıda değildir. Bu sınava 8. sınıf öğrencilerin üç yıl, 6. sınıf öğrencilerinin ise bir yıl hazırlandıkları bilinmektedir. Öğrencilerin epistemolojik inançlarındaki düşüşün sebebi olarak bu sınavın eğitimde önemli derecede ağırlığı olmasından kaynaklanabileceği düşünülmektedir. Ayrıca kız öğrencilerinin bilginin kaynağı, değişmezliği ve gerekçelendirilmesi hakkındaki inançlarının erkek öğrencilere göre daha gelişmiş olduğu tespit edilmiştir. Literatürde epistemolojik inançlar konusunda cinsiyete göre fark bulunan ve fark bulunmayan çalışmalar olup, eğitim durumu, öğrenme yetenekleri, ev-aile değişkenleri gibi değişkenlerin etkisi olabileceğinden kızlara yönelik farkın bu gibi değişkenlerin göz önüne alınarak değerlendirilmesi önerilmiştir.

4th, 6th, and 8th Grade Turkish Elementary Students' Epistemological Beliefs

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ABSTRACT. The purposes of the study were to investigate 4th, 6th, and 8th grade elementary students' epistemological beliefs and how these beliefs change with grade level and gender. The sample of the research included 427 elementary students. Epistemological belief questionnaire (EBQ) was used to collect data. To evaluate the effect of both year and gender on students' epistemological beliefs, two-way MANOVA was conducted. Results showed that different from the previous research findings about the effect of grade level on students' epistemological beliefs, in this study found those students' beliefs became less sophisticated with respect to development and justification of knowledge as they progress through elementary education program. Moreover, female students were found to have sophisticated beliefs about justification, and source/certainty of knowledge.
Key words: epistemological beliefs, elementary students, gender

INTRODUCTION

In recent years, investigation of students' epistemological beliefs, beliefs about knowledge and knowing, has received much attention in science education literature (Roth & Roychoudhury, 1994; Hofer, 2000; Buehl & Alexander, 2001; Conley, Pintrich, Vekiri, & Harrison, 2004; Chai, Khine, &

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Teo, 2006; Yilmaz-Tuzun & Topcu, 2010). Moreover, it has been reported that students' epistemological beliefs have been linked to their learning and achievement (Schommer, 1990; Schraw, Horn, Thorndike-Christ, & Brunning, 1995; Hofer & Pintrich, 1997; Schommer & Walker, 1997; Cano, 2005; Yilmaz-Tuzun & Topcu, 2008). To clarify, students thinking that knowledge are simple, and certain have problems in interpreting tentative information, understanding complex text and they have poor academic achievement (Schommer, 1990; Schommer, Crouse, & Rhodes, 1992; Schommer & Walker, 1997; Lodewyk, 2007). Moreover, epistemological beliefs are linked to students' conceptual change and knowledge construction (Qian & Alverman, 1995; Tsai, 2000; Kienhues, Bromme, & Stahl, 2008). Therefore, it is important to obtain students' epistemological beliefs. In the present study, we will investigate 4th to 8th grade students' epistemological beliefs and how change with the grade level and gender.

THEORETICAL BACKGROUND

Epistemological beliefs refer to the beliefs about the nature of knowledge and knowing (Hofer & Pintrich, 1997). Epistemological beliefs research can be traced back to the study of Perry (1968). He conducted interviews with undergraduate students as they pass through their four-year college education in order to find out students' experiences. Though he was not explicitly interested in exploring students' epistemological beliefs in his study, the analysis of his data revealed information about college students' epistemological beliefs. He concluded that students' beliefs developed in stages from dualism to commitment within relativism. To clarify, first year students believed the unchangeable nature of knowledge, that is transmitted to them by the authorities. However, with increase in the grade level, students' thinking evolved that knowledge is tentative and it is developed by their active meaning formation. Inspired by Perry's work, King and Kitchener (1994) conducted interviews with high school students for 15 years in order to assess their beliefs about knowledge. They proposed a seven-stage developmental model of epistemological beliefs after analysis of interviews. Similar to Perry's classification, King and Kitchener (1994) asserted that knowledge is perceived as simple, certain and given by authorities without any justification of it by people at the earlier stages of their development. However, as they grow older, the meaning they attach to the knowledge also changes. They think that they take active role in knowledge construction, it can change, and it can be re-evaluated. Both Perry (1968) and King and Kitchener (1994) argued that people have uni-dimensional belief system, that is a person has only one belief structure at the particular time and it shows developmental patterns with respect to time.

Differently from the above researchers, who believe developmental and uni-dimensional nature of knowledge, Schommer (1990) proposed a new assertion about the nature of epistemological belief. She claimed that epistemological beliefs can be considered as a system of more or less independent beliefs. The below statement of Schommer (1994) reflects her ideas about characteristics of epistemological beliefs that a person holds:

> I proposed that epistemological beliefs be reconceived as a system of more or less independent beliefs. By system, I mean that there is more than one belief to consider. And by more or less independent, I mean that individuals may be sophisticated in some beliefs, but not necessarily sophisticated in other beliefs (Schommer, 1994, p. 300).

As understood from her claim, a person holds more than one belief. These beliefs were described as a) stability of knowledge related with the tentativeness of knowledge, b) structure of knowledge describing the knowledge from isolated pieces to highly interrelated concepts c) source of knowledge, (whether knowledge is derived from authority or personal reasoning) d) speed of learning, (whether learning is quick or gradual) e) ability to learn (whether it is fixed or can be improved by experience and time). Moreover, these beliefs can be inconsistent with each other. To exemplify, a person may have sophisticated beliefs in terms of source of knowledge, at the same time, he may have naïve beliefs about the structure of knowledge (Schommer, 1990).

In addition, an epistemological beliefs questionnaire was developed by Schommer (1990). Despite the five constructs hypothesized by Schommer (1990), four factor structure of epistemological beliefs, which were *structure of knowledge*, *stability of knowledge*, *speed of learning* and *ability to*

learn, was validated in college and high school students by Schommer (1990; 1993) respectively. On the other hand, some researchers using the same questionnaire obtained three factor structure (Qian & Alvermann, 1995); and two factor structure (Clareabout & Elen, 2001) or five factor structure (Dunkle, Schraw, & Bendixen, 1993). Moreover, Hofer and Pintrich (1997) criticised her classification of dimensions of epistemological beliefs in that quick learning and innate ability dimensions of Schommer (1990) do not belong to dimensions of epistemological beliefs, rather they are related with nature of learning. After the analysis of different theories and models of epistemological beliefs, Hofer and Pintrich (1997) concluded two broad clusters; the **nature of knowledge** and the **nature or process of knowing**. *Certainty of knowledge,* which refers to the views that change from the certainty of knowledge to the tentativeness of it and *simplicity of knowledge* referring to the views describing knowledge as isolated pieces of information to the aggregation of highly interrelated concepts were included under the **nature of knowledge** set. **Nature of knowing** set involved *source of knowledge*, indicating the ideas whether knowledge is transmitted from the external authority to oneself or knowledge is constructed by the learner by means of interaction with environment as well as *justification for knowing*, which is about whether learner accepts the knowledge as it is given by others or they evaluate the knowledge critically in the light of evidence or others' opinions.

Various studies have been conducted about the effect of students' characteristics (e.g, age, gender, education level, subject domain) (Oğuz, 2008; Schomer, 1990; Deryakulu & Buyukozturk, 2005; Chai et al, 2006; Stathopoulou & Vosniadou, 2007; Bath & Smith, 2009; Güven, 2009; Topcu & Yilmaz-Tuzun, 2009; Gurol, Altunbas, & Karaaslan, 2010).

In terms of the effect of gender on epistemological beliefs, inconsistent results have been obtained in the literature. For example, studies of Schommer (1993), Paulsen, and Wells (1998) and Topcu and Yilmaz-Tuzun (2009) showed that females were found to have more sophisticated knowledge about fixed ability and quick learning. Similarly, Deryakulu and Buyukozturk (2005) indicated that females had more sophisticated epistemological belief systems compared to the males. Likewise, studies of Guven (2009) and Oguz (2008) revealed the complexity of female students' epistemological beliefs related to the factors, learning depends on effort and ability. On the contrary, research of Paulsen and Wells (1998) revealed that men have more sophisticated beliefs in simple knowledge, they believe that knowledge is the accumulation of highly interrelated concepts more than the females. Moreover, females were found to have less sophisticated beliefs in terms of the knowledge transmitted by authorities (Belenky, Clinchy, Goldberger & Tarule, 1986; Chai et al, 2006; Topcu & Yilmaz-Tuzun, 2009). On the other hand, studies of Buehl, Alexander, and Murphy (2002), Chan and Elliott (2002), and Phan (2008) concluded no significant mean differences among undergraduate male and female students in terms of epistemological beliefs.

Considering the influence of grade level on epistemological beliefs, most research studies indicated the complexity of students' beliefs about knowledge and knowing as they move through schooling period. For example, study of Schommer-Aikins, Calvert, Gariglietti, and Bajaj (1997) showed that students develop more sophisticated beliefs as they progress through their high school education period. Compared to the first year students, senior students were found to believe more in the tentativeness, complexity of knowledge as well as innate ability to learn and quick learning less. This is also supported by research studies (Paulsen, & Wells 1998; Schommer, 1998; Brownlee, Purdie, & Boulton-Lewis, 2001; Kurt, 2009). On the other hand, study of Oguz (2008) showed that there were not any significant mean differences of trainee teachers' epistemological beliefs with respect to the grade level. Considering the link between students' epistemological beliefs with their learning and achievement, it is vital to assess their epistemological thinking. Though there were various studies carried out in order to detect students' epistemological beliefs in Turkey, few of them were conducted with the students at the elementary school level (Topcu & Yilmaz-Tuzun, 2009; Ozkan, 2008). This makes the need for research studies with the younger students. The present study would make a significant contribution to the related literature since it will provide some information about elementary school students' epistemological beliefs. In the present study, we will understand 4th

to 8th grade elementary students' epistemological beliefs. Research question in the present study is as follows:

What is the effect of elementary students' grade level and gender on their epistemological beliefs?

METHODOLOGY

Sample

Four hundred twenty seven elementary students from three different elementary schools participated in the current study. Gender distribution was nearly the same in the sample; there were 201 male and 212 female students whereas 14 students did not mention their gender and these were coded as missing data. Moreover, among the participants, 147 of them were the 4th grade students while there were 160 6th grade and 120 8th grade students. The schools took place in Çankaya district of Ankara. They were chosen conveniently and the schools had similar socioeconomic status. Data were collected at the spring semester of the 2010 academic year.

Instrument

As the instrument of the study, epistemological belief questionnaire was used. Epistemological belief questionnaire (EBQ) was originally developed by Conley et al (2004). For the present study, Turkish version of the questionnaire adapted by Ozkan (2008) was used. The questionnaire consists of 24 items in a five-point Likert scale (5= strongly agree, 1=strongly disagree) and measured three subscales of the epistemological beliefs; *justification, development, source/certainty*. Justification subscale measures students' beliefs whether students accept the knowledge as it is or whether students judge the knowledge critically by means of evidence and the experts' opinions. Higher scores on this subscale indicate that students believe that critical examination of evidence leads to construction of knowledge. Development subscale measures students' beliefs about the nature of knowledge, whether it is fixed or it can change. Higher scores indicate that students believe that knowledge changes. Source/Certainty refers to the views indicating the source of knowledge as external authority or the learners themselves. In addition, ideas judging whether there is one or more than one correct knowledge were included in the Source/Certainty dimension. Items in the source/certainty scale were reversed so that higher scores show that students believe that the knowledge is constructed by the learner and there may be more than a single correct knowledge. Table 1 below shows the dimensions of the epistemological beliefs questionnaire, number of items and sample item for each dimension as well as Cronbach alpha values for each dimension. Cronbach alpha values indicated the high reliability of the questionnaire.

Table I: Dimensions of the epistemological beliefs questionnaire

Dimensions	Sample item	Cronbach alpha	n
Justification	Good answers are based on evidence from many different experiments	0.78	9
Development	Scientific ideas sometimes change.	0.69	6
Source/certainty	Whatever the teacher says in science class is true./Scientific knowledge is always true	0.85	9

RESULTS

Descriptive statistics was conducted in order to reveal the item mean scores of each dimension of epistemological belief for each year group and gender. As seen from Table II, as year groups increase, mean scores of students' epistemological beliefs with respect to justification and development of knowledge dimensions decrease. On the other hand, students' beliefs about

source/certainty of knowledge increase with the increase of year groups. To clarify, 8th grade students do not believe the tentativeness of knowledge compared to the 6th and 4th grade students. Similarly, 8th grade students' beliefs reflect that they accept the knowledge as it is given by authorities without judging it critically, whereas 4th grade students does not accept the knowledge as it is, rather they judge it more than 6th and 8th grade students. On the other hand, 8th grade students believes more than 6th and 4th grade students in that there may be more than one single correct answer and knowledge is constructed by self.

Table II: Descriptive statistics of epistemological beliefs dimensions for each year group

Year Groups	Justification	Development	Source/Certainty
4	4.57	4.23	2.27
6	4.25	3.89	2.99
8	3.97	3.76	3.18

* Maximum score for each dimension is 5.

As seen from Table III showing the item mean score values of each epistemological beliefs dimension for both male and female students, female students have more sophisticated beliefs about nature of knowledge and knowing. To clarify, they believe more in the justification of knowledge critically, changing nature of knowledge and construction of knowledge by self.

Table III: Descriptive statistics of epistemological beliefs dimensions for female and male students

Gender	Justification	Development	Source/Certainty
Female	4.37	4.02	2.94
Male	4.16	3.90	2.69

* Maximum score for each concern factor is 5.

In order to evaluate the effect of both year and gender on students' epistemological beliefs, two-way MANOVA was conducted. Firstly, assumptions of MANOVA, which were *normality*, the *homogeneity of variance-covariance matrices, and the independence of observations,* were tested. Skewness and kurtosis values ranged between +2 and -2 for dimensions of epistemological beliefs for each year group and gender, indicating the normality assumption was met. However, *homogeneity of variance-covariance matrices* was violated due to the significance of Box's M test. For this reason, Pillai's trace was examined for the interpretation of MANOVA. MANOVA analysis showed the significant effect of students' year on their epistemological beliefs (Pillai's trace = 0.280, F (6,812) = 22, p= 0.000, η^2= 0.14), and the significant effect of gender on students' epistemological beliefs (Pillai's trace = 0.067, F (3,405) = 9.65, p= 0.000, η^2= 0.067) while there was not a significant effect of interaction of gender and year group on students' epistemological beliefs (Pillai's trace = 0.024, F (6,812) = 1.64, p>0.05,). The partial eta squared values of 0.14 indicates the large effect of year groups on students' epistemological beliefs whereas the partial eta squared value of 0.067 is an indication of the medium effect of gender on epistemological beliefs.

As a follow-up to MANOVA, univariate ANOVA analysis revealed a statistically significant effect of year on students' justification (F (2,407) =40.97, p<0.05, η^2= 0.168), development (F (2,407)= 18.28, p<0.05, η^2= 0.087) and source/certainty (F(2,407)= 44.64, p<0.05, η^2= 0.180). The above eta-squared values show the large effect of year groups on students' beliefs about justification and source/certainty of knowledge and medium effect on development.

Moreover, univariate ANOVA results showed the significant effect of gender on students' beliefs about justification (F (1,407) = 15.47, p<0.05, η^2= 0.037), mean score values were 4.37 and 4.16 for female and male students respectively. Similarly, source/certainty of knowledge were significantly different for female and males (F (1,407) = 9.35, p<0.05, η^2= 0.022). Likewise, females had more sophisticated beliefs in terms of source/certainty of knowledge (M=2.94 for females,

M=2.69 for males). However, students' beliefs about development of knowledge did not change significantly in terms of their gender. Similarly, the interaction of year groups and gender was not significant on each dimension of students' epistemological beliefs.

For pair wise comparisons in order to determine means of which year group differ significantly from others for each dimension of epistemological beliefs, Post-Hoc analysis was run. 4^{th}, 6^{th}, and 8^{th} grade students' beliefs about justification of knowledge differed significantly from each other (M= 4.57, M=4.25 and M= 3.97 for 4^{th}, 6^{th} and 8^{th} grade students respectively). In terms of students' beliefs about development and source/certainty of knowledge, there were significant differences between 4^{th} and 6^{th} grade students as well as 4^{th} and 8^{th} grade students however, 6^{th} and 8^{th} grade students were not significantly different from each other. As seen from Table II, for students' beliefs about development, 4^{th} grade students had the most sophisticated beliefs than 6^{th} and 8^{th} graders (M= 4.23, M= 3.89, and M= 3.76 for 4^{th}, 6^{th} and 8^{th} grade students respectively). On the contrary, 4^{th} grade students had the most naïve beliefs about the source/certainty of knowledge compared to the other year groups (M= 2.27 for 4^{th} graders, whereas mean values are 2.99 and 3.18 for 6^{th} and 8^{th} grade students).

DISCUSSION

The present study investigated 4^{th}, 6^{th}, and 8^{th} grade elementary students' epistemological beliefs and how these beliefs change with grade level and gender. It was found that all year groups of students had naive beliefs with respect to source/certainty of knowledge compared to the other dimensions; which are development, and justification of knowledge (See Table II). In other words, elementary school students believe that knowledge takes place outside them, in the external authority, and knowledge is certain. Another important finding was that this study provided a piece of evidence to the independency of epistemological beliefs. For example, in the present study, elementary school students had naïve beliefs about source/certainty of knowledge; however, at the same time they had more sophisticated beliefs about development and justification of knowledge. This was one of the assertions put forward by Schommer (1990).

Compatible with research findings, younger students in the present study had naïve beliefs about the source/certainty knowledge, which is that they believed more in the source of the knowledge as the external authority such as teacher or textbook and there is only one correct answer for a question. This was what was expected and parallel to research findings indicating the complexity of students' epistemological beliefs as they get older (Schommer-Aikins et al, 1997; Schommer, 1998). However, different from the research findings about the effect of grade level on students' epistemological beliefs, this study concluded that students' beliefs became less sophisticated with respect to development and justification of knowledge as they progress through elementary education program. They tend to believe less in the role of evidence and experts' opinions in the justification of knowledge as well as the change in the scientific ideas as their year groups increase. These results are different from what was expected, since students' epistemological beliefs were expected to be more sophisticated with the increase in year groups. However, there may be several reasons for this.

Firstly, the way teachers teach may have affected the development of students' epistemological beliefs. Though the new science curriculum was based on the constructivist approach since 2004 (MEB, 2004; MEB, 2005), the new curriculum may not be implemented appropriately in classes, therefore, instead of constructivist teaching applications, the teachers may continue to teach traditionally. This assertion is also supported by some research studies (Guven, 2008; Aydin & Cakiroglu, 2010), indicating the problems of elementary science teachers in the implementation of activities in class due to time limitations and crowded classrooms.

As Tsai (1999) and Brownlee et al (2001) stated, instruction has an influence on development of students' epistemological beliefs. It is also mentioned in the literature that application of instructional strategies as inquiry or hands-on teaching were found to have a positive effect on students' epistemological beliefs in a shorter time (Qian, & Alvermann, 2000; Conley et al, 2004;

Kaynar, Tekkaya, & Cakiroglu, 2009; Kizilgunes, Tekkaya, & Sungur,2009) On the other hand, traditional instruction would cause no effect or decrease in the complexity of epistemological beliefs. Since 8th grade students were exposed to more traditional instruction, this may have caused the decrease in the sophistication of elementary students' epistemological beliefs with the grade level.

Secondly, even if the science teachers applied teaching strategies parallel to constructivism, the 4th grade teacher had a 6-year experience in this new curriculum On the other hand, science and technology teachers, which give education 6th to 8th grades, only had 3 years experience in constructivist based curriculum. Teachers' experience in new curriculum could make difference on teachers' constructivist applications in classrooms.

Thirdly, 6, 7, and 8th grade students take a national examination test (Seviye Belirleme Sınavı-SBS), which is a kind of multiple choice test (Ayvaci & Er Nas, 2009). SBS test evaluates students' knowledge on their grade level. This test orients students to memorize their books, even examples, questions, and activities. This test could also help to decrease or make no difference on students' epistemological beliefs while grades increase. To get achievement in SBS, most of the students take private education (dershane) in weekend, and even after the school (Ayvaci & Er Nas, 2009; Sert, 2008). The dershane education is based heavily on memorization facts and techniques on solving multiple-choice questions in a faster way (Ayvaci & Er Nas, 2009). This type of education may have cultivated the decrease in epistemological beliefs of students and this decrease may increase with time due to this kind of education. This could be one of the explanations for decrease in epistemological beliefs of students with the increase in year. Because 6th grade students is the first year for this exam, 8th grade students was getting prepared for 3rd time for this exam, 4th grade students have not taken this exam yet.

Another finding of the present study was about the effect of students' gender on their epistemological beliefs. Female students were found to have sophisticated beliefs about justification, and source/certainty of knowledge. That is, females in the present study do not accept the knowledge as it is, they think that the knowledge needs to be justified in light of experiments, evidence etc. Moreover, they believe that there may be more than one correct answer and the source of knowledge is not the external authority as teacher or textbook, instead the learner constructs the knowledge. This finding contradicts with the studies of Belenky et al, 1986, Chai et al, 2006, and Topcu & Yilmaz-Tuzun, 2009, indicating that females view source of knowledge as external authority. In the literature, research studies about epistemological beliefs showed that there were different results on gender issue. Some of the studies concluded that there was not any significant mean differences between male and female students in terms of their epistemological beliefs (Buehl et al, 2002; Chan & Elliott, 2002; Chan, 2003; Terzi, 2005). On the other hand, some of the studies revealed the complexity of male students' epistemological beliefs in terms of the knowledge transmitted by authorities (Belenky, Clinchy, Goldberger & Tarule, 1986; Chai et al, 2006) whereas some studies showed that females had more sophisticated epistemological beliefs with respect to fixed ability (Schommer, 1993; Deryakulu & Buyukozturk, 2005; Guven, 2009; Oguz, 2008; Topcu & Yilmaz-Tuzun, 2009).However, research results with respect to the effect of gender on epistemological beliefs should be interpreted cautiously since different variables such as educational level, learning abilities, home-family variables etc may contribute to the differences on male and female students' epistemological beliefs (Buehl, 2003; King, Kitchener & Wood, 1994). As Sarier (2010) stated, in Turkey, female students were more successful than males in science, scores of females were higher in science test in the nation-wide exams such as SBS as well as international exams such as PISA. Similarly, as Serin (2010) mentioned, female students were more interested in learning science compared to the male students. These indicate the differences in male and female students with respect to achievement and interest level. The female advantage result of this study may be due to these variables and/or other variables.

The present study investigated elementary students' epistemological beliefs and how these beliefs showed differences with year groups. It was disappointing for us to find that older students (8th graders) had the most naïve beliefs in terms of justification and development of knowledge. We think one of the reasons may be due to the instruction of the teacher. Since different variables such as

conceptual change, knowledge construction, interpreting information etc are related with these beliefs, instruction that promotes students' epistemological beliefs would be beneficial. For example, as mentioned in the literature, inquiry-based activities or hand-on activities would enhance students' epistemological beliefs. For a future study, the evaluation of the effect of different teaching methods on students' epistemological beliefs could be conducted.

REFERENCES

Aydin, S. & Cakiroglu, J. (2010). İlköğretim fen ve teknoloji dersi öğretim programına ilişkin öğretmen görüşleri: Ankara örneği. *İlköğretim Online, 9*(1), 301-315.

Ayvaci, H. S. & Er Nas, S. (2009).Fen ve Teknoloji Dersi Konularının Okulda ve Dershanede İşlenişiyle İlgili Durumların Belirlenmesi. *Dicle Üniversitesi Ziya Gökalp Eğitim Fakültesi Dergisi, 13,* 113-124.

Bath, D. M., & Smith, C. D. (2009). The relationship between epistemological beliefs and the propensity for lifelong learning. *Studies in Continuing Education, 31(*2), 173-189.

Belenky, M. F., Clinchy, B. M., Goldberger, N .R., and Tarule, J. M. (1986). Women's Ways of Knowing: The Development of Self, Voice, and Mind. New York: Basic Books.

Brownlee, J., Purdie, N., & Boulton-Lewis, G. (2001). Changing Epistemological Beliefs in Pre-service Teacher Education Students. *Teaching in Higher Education, 6(*2), 247-268.

Buehl, M. (2003). At the Crossroads of Epistemology and Motivation: Modeling the Relations between Students' Domain-Specific Epistemological Beliefs, Achievement Motivation, and Task Performance. Unpublished doctoral dissertation. Maryland University, America.

Buehl, M. M., & Alexander, P.A. (2001). Beliefs about academic knowledge. *Educational Psychology Review, 13(*4), 385 - 418.

Buehl, M. M., Alexander, P. A., & Murphy, P. K. (2002). Beliefs about schooled knowledge: Domain specific or domain general? *Contemporary Educational Psychology, 27*, 415-449.

Cano, F. (2005). Epistemological beliefs and approaches to learning: Their change through secondary school and their influence on academic performance. *British Journal of Educational Psychology, 75*, 203–221

Chai, C. S., Khine, M. S., & Teo, T. (2006). Epistemological beliefs on teaching and learning: a survey among pre-service teachers in Singapore. *Educational Media International, 43(*4), *285–298*

Chan, K. (2003). Hong Kong teacher education students' epistemological beliefs and approaches to learning. *Research in Education, 69,* 36-50.

Chan, K., & Elliott, R. G. (2002). Exploratory study of Hong Kong teacher education students' epistemological beliefs: Cultural perspectives and implications on beliefs research. *Contemporary Educational Psychology, 27,* 392-414.

Clareabout, G., & Elen, J. (2001). The ParlEuNet-project: Problems with the validation of socio-constructivist design principles in ecological settings. *Computers in Human Behavior, 17*, 453-464.

Conley, A.M., Pintrich, P.R., Vekiri, I., & Harrison, D. (2004). Changes in epistemological beliefs in elementary science students. *Contemporary Educational Psychology, 29,* 186-204.

Deryakulu, D. & Buyukozturk, S. (2005). The re-examination of the epistemological beliefs questionnaire's factor structure: comparing epistemological beliefs in terms of gender and program type. Eurasian Journal of Educational Research, 18, 236-252.

Dunkle, M. F., Schraw, G, J., & Bendixen, L. (1993, April). The relationship between epistemological beliefs, causal attributions, and reflective judgment. Paper presented at the annual meeting of the American Educational Research Association, Atlanta.

Gurol, A., Altunbas, S., & Karaaslan, N. (2010). Öğretmen Adaylarının Öz Yeterlik İnançları ve Epistemolojik İnançları Üzerine Bir Çalışma. *e-Journal of New World Sciences Academy, Education Sciences, 5,(*3), 1395-1404.

Guven, S. (2008). Sınıf öğretmenlerinin yeni ilköğretim ders programlarının uygulanmasına ilişkin görüşleri. *Milli Eğitim, 177*, 224-236.

Hofer, B. K. (2000). Dimensionality and disciplinary differences in personal epistemology. *Contemporary Educational Psychology, 25(*4), 378-405

Hofer, B. K., & Pintrich, P. R. (1997). The development of epistemological theories: Beliefs about knowledge and knowing and their relation to learning. *Review of Educational Research, 67*, 88-140.

Kaynar, D., Tekkaya, C., & Cakiroglu, J. (2009). Effectiveness of 5E Learning Cycle Instruction on Students' Achievement in Cell Concept and Scientific Epistemological Beliefs. *Hacettepe University Journal of Education, 37*, 96-105.

Kienhues, D., Bromme, R., & Stahl, E. (2008). Changing Epistemological Beliefs: The Unexpected Impact of A Short-Term Intervention. *British Journal of Educational Psychology , 78,* 545–565.

King, P. M. & Kitchener, K. S. (1994). *The development of Reflective Judgment in adolescence and adulthood*. Jossey Bass: San Francisco.

King, P. M., Kitchener, K. S., & Wood, P. K. (1994), Research on the reflective judgment model. In K. S. Kitchener & P. M. King, *Developing reflective judgment: Understanding and promoting intellectual growth and critical thinking in adolescents and adults* (pp. 124-202). San Francisco: Jossey-Bass.

Kizilgunes, B., Tekkaya, C., & Sungur, S. (2009). Modeling the Relations Among Students' Epistemological Beliefs, Motivation, Learning Approach, and Achievement. *The Journal of Educational Research, 102*(4), 243-255

Kurt, F. (2009). Investigating Students' Epistemological Beliefs Through Gender, Grade Level, and Fields of the Study. Unpublished master's thesis, Middle East Technical University, Ankara, Turkey.

Lodewyk, K. R. (2007). Relations among Epistemological Beliefs, Academic Achievement, and Task Performance in Secondary School Students. *Educational Psychology. 27(*3), 307–327.

MEB (2004). Fen ve teknoloji dersi programı, İlköğretim 4–5. sınıf. Ankara.

MEB (2005). İlköğretim 1. 2. ve 3. Sınıflar Hayat Bilgisi Dersi Öğretim Programı ve Kılavuzu, Ankara: Devlet Kitapları Müdürlüğü Basımevi.

Oguz, A. (2008), Investigation of Turkish trainee teachers' epistemological beliefs, Social Behavior and Personality, 36(5), 709-720.

Ozkan, S. (2008). Modeling elementary students' science achievement: the Interrelationships among epistemological beliefs, Learning approaches, and Self-regulated learning strategies. Unpublished doctoral dissertation, Middle East Technical University, Ankara,Turkey.

Paulsen, M. B., & Wells, C. T. (1998). Domain differences in the epistemological beliefs of college students. *Research in Higher Education, 39*(4), 365-384.

Perry, W. G., Jr. (1968). Patterns of development in thought and values of students in a liberal arts college: A validation of a scheme (Contract No. SAE-8973). Cambridge, MA: Harvard University, Bureau of Study Counsel. (ERIC Document Reproduction Service No. ED 024 315)

Phan, H. P. (2008). Multiple regression analysis of epistemological beliefs, learning approaches and self-regulated learning, *Electronic Journal of Research in Educational Psychology, 6(*1), 157-184

Roth, W. M., & Roychoudhury, A. (1994). Physics students' epistemologies and views about knowing and learning. *Journal of Research in Science Teaching, 31*, 5-30.

Sarier, Y. (2010). Ortaöğretime giriş sınavları (OKS-SBS) ve PISA sonuçları ışığında eğitimde fırsat eşitliğinin değerlendirilmesi, *Ahi Evran Üniversitesi Eğitim Fakültesi Dergisi,11*(3), 107-129.

Schommer, M. (1990). Effects of beliefs about the nature of knowledge on comprehension. *Journal of Educational Psychology, 82*(3), 498-504.

Schommer, M. (1998). The influence of age and education on epistemological beliefs. *British Journal of Educational Psychology, 68,* 551-560.

Schommer-Aikins, M., Calvert, C., Gariglietti, G., & Bajaj, A. (1997). The development of epistemological beliefs among secondary students: A longitudinal study. *Journal of Educational Psychology, 89*(1), 37-40.

Schommer, M., Crouse, A., & Rhodes, N. (1992). Epistemological beliefs and mathematical text comprehension: Believing it is simple does not make it so. *Journal of Educational Psychology, 84*(4), 435-443.

Schommer, M. (1993). Epistemological development and academic performance among secondary students. *Journal of Educational Psychology, 85*(3), 406-411.

Schommer, M. (1994). Synthesizing epistemological belief research: Tentative understandings and provocative confusions. *Educational Psychology Review, 6*(4), 293-319.

Schommer, M., & Walker, K. (1997). Epistemological beliefs and valuing school: Considerations for college admissions and retention. *Research in Higher Education, 38*(2), 173-186.

Schraw, G., Horn, C., Thorndike-Christ, T., & Brunning, R. (1995). Academic goal orientations and student classroom achievement. *Contemporary Educational Psychology, 20*, 359-368.

Serin, G. (2010). İlköğretim 7. sınıf öğrencilerin fene karşı meraklarının incelenmesi, *Mustafa Kemal Üniversitesi Sosyal Bilimler Enstitüsü Dergisi, 7*(13), 237-252.

Sert, N. (2008). İlköğretim Programlarında Oluşturmacılık. *Eğitimde Kuram ve Uygulama, 4(*2), 291-316.

Stathopoulou, C. & Vosniadou, S. (2007). Exploring the relationship between physics-related epistemological beliefs and physics understanding. *Contemporary Educational Psychology, 32,*255–281.

Qian, G., & Alvermann, D. (1995). Role of epistemological beliefs and learned helplessness in secondary school students' learning science concepts from text. *Journal of Educational Psychology, 87*(2), 282-292.

Qian, G., & Alvermann, D. (2000). Relationship Between Epistemological Beliefs and Conceptual Change Learning. *Reading Writing Quarterly, 16*(1), 59-74.

Terzi,A. R.(2005) Üniversite Öğrencilerinin Bilimsel Epistemolojik İnançları Üzerine Bir Araştırma. *Afyon Kocatepe Üniversitesi Sosyal Bilimler Dergisi, 7(2),* 298-311.

Tsai, C. C. (1999). The progression toward constructivist epistemological views of science: A case study of the STS instruction of Taiwanese high school female students. *International Journal of Science Education, 21*(11), 1201-1222.

Tsai, C. C. (2000). The effects of STS-oriented instruction on female tenth graders' cognitive structure outcomes and the role of student scientific epistemological beliefs. *International Journal of Science Education, 22*(10), 1099-1115.

Topcu, M. S. & Yilmaz-Tuzun, O. (2009). Elementary Students' Metacognition and Epistemological Beliefs Considering Science Achievement, Gender and Socioeconomic Status. *Elementary Education Online, 8(*3), 676-693.

Yilmaz-Tuzun, O., & Topcu, M. S. (2008). Relationships among Preservice Science Teachers' Epistemological Beliefs, Epistemological World Views, and Self-efficacy Beliefs. *International Journal of Science Education, 30(*1), 65-85.

Yilmaz-Tuzun, O., & Topcu, M. S. (2010). Investigating the Relationships Among Elementary School Students' Epistemological Beliefs, Metacognition, and Constructivist Science Learning Environment. *Journal of Science Teacher Education, 21,* 255-273.