

World Conference on Educational Sciences 2009

The observation of the teacher candidates' epistemological beliefs according to some variables

Bilge Can^a, Sertaç Arabacıoğlu^{b*}

^a Pamukkale University,, Faculty of Education Department of Science Education, 20020-Denizli/TURKEY

^b Dokuz Eylul University Faculty of Education Department of Science Education, 35150-İzmir/TURKEY

Received October 25, 2008; revised December 15, 2008; accepted January 4, 2009

Abstract

The purpose of this study was to determine the epistemological beliefs according to some variables of science and mathematics teacher candidates having Science Laboratory Practises Lesson in learning programme of Science-Mathematic Teacher Education of Elementary Education Department. The research covered survey model. The participants of this study were formed of 73 preservice teachers in elementary mathematics (n=35) and science (n=38) department. Epistemological Belief Scale (EBS) developed by Schommer(1990) and Personal Data Form was used in order to obtain data. This research data was analyzed by SPSS 10.0 statistical program. Epistemological beliefs of the university students in this study have been proved to show variables according to same differences.

© 2009 Elsevier Ltd. Open access under [CC BY-NC-ND license](https://creativecommons.org/licenses/by-nc-nd/4.0/).

Keywords: Epistemology, beliefs, epistemological beliefs, science education, mathematic education

1. Introduction

Science education aims to grow persons who have the ability of thinking scientific and rationalist, who do not memorize knowledge but can reach knowledge, use and share this knowledge, and also persons who have the abilities of communication, are creative, finder, and prolific, and who are flexible for team work (Can, 2007). In order to improve in the direction of these properties, the belief system formed by the variables that effect the created education system has an important place.

All different beliefs the people have forms the belief system. The beliefs that form the belief system are related to each other. In other words, the belief system has an internal intensity. It is possible to see the effects of the belief system on the decisions of a person (Munby, 1986). Lasley claimed that the beliefs of a person improve since that person come under the opinions and the traditions of his or her family, partner, teacher, neighbor and different people next to him. Moreover, researches expresses that the belief system is attained by popular culture, school, and observations and furthermore the belief system is gained by these tools (Baydar, 2000).

As a result of the changes in education philosophy, it is seen that the interest to student opinions about the epistemological beliefs or the nature of knowledge and learning increases day by day lately. For this reason, the explorers direct their studies to reveal which variables affect epistemological beliefs (Schommer & Walker, 1997).

* Corresponding author. Tel.: +9-0536-311-2412.

E-mail address: sertacarabacioglu@hotmail.com

During last thirty years, as the education philosophy has changed from behaviorism to constructivism, it is seen that educators have given importance to researches about beliefs of teachers and teacher candidates (Tsai, 2002). The constructivists can claim that the future behaviours and thoughts of people depend on their past oriented experiences and thoughts. As a result, many of the researchers accept that the teachers' belief affect their teaching abilities in several aspects (Tsai, 2002). Moreover, Schommer (1990) defines the epistemological beliefs as beliefs of a person related to that person's knowledge and learning (Deryakulu & Büyükoztürk, 2005).

If we concentrate on the fundamentals of the epistemology concept, it is seen that the epistemology draw quite attention by the scientists like John Dewey, William James, and Charles S. Pierce. Most of the writings about epistemology are the studies based on observation more than experiments. Some scientists who forbear from behaviorism start to empirical studies just as they step into cognitive approach. These empirical studies start with Perry (1970) at first, and then Belenky *et al.* (1986) and Baxter Magolda (1992) explore the relation of epistemological development with gender. Moreover, the structure of epistemological beliefs is studied by Schommer (1990), Duell & Schommer-Aikins (2001) and finally Hofer and Pintrich (1997) explored the relations between learning and motivation (Schraw, 2001).

It is seen that most of the studies about epistemological beliefs in literature are interested in students' learning (belief-knowledge, belief-attitude, belief-behaviour) and teacher's teaching philosophy. Studying epistemological beliefs is a new subject in our country. Moreover, as compared with the studies done abroad, the number of studies about epistemological beliefs is very small. There are many factors affecting the epistemological beliefs. We can classify these factors as environmental factors, education level, and the family environment.

1.1. *Problem Situation:*

Do the epistemological beliefs of university students differ according to their sexuality and their departments (Science - Mathematic teacher candidates)?

With the detection of this situation, the answers are also searched for the questions given below:

1. What is the level of epistemological beliefs of teacher candidates generally?
2. Do the epistemological beliefs of candidate teachers differ according to their sexuality?
3. Do the epistemological beliefs of candidate teachers differ according to their departments?

2. **Methodology**

In this section, we focus on the methodology used for collecting the research data, and also how they obtained data is analysed.

2.1. *Research Model*

This research was implemented by survey model.

2.2. *Data Collecting Tools*

In this research, to collect the necessary data, a form called as Personal Information Form and an Epistemological Belief Scale (EBS) were used. The chosen EBS was verified by Schommer (1990) to measure the epistemological beliefs of teacher candidates, and then Deryakulu & Büyükoztürk (2002) tested its validity and reliability. The original scale has four factors as "Fixed ability", "Learning is done at once", "Knowledge is simple" and "Knowledge is certain". When the scale is adapted into Turkish, since there are cultural differences, it come out with three factors such as "The belief of learning depends on effort (BLDE)", "The belief of learning depends on ability (BLDA)", and "The belief of there is only one true truth (BOTT)". The scale is the linker type. The points obtained from the scale are evaluated in factor base, the points belong to whole scale are not used. There are a total of 18 items including 17 negative items and 1 positive item, in the "The belief of learning depends on effort" factor of the scale. An example item of this factor is given as: "If one can understand one thing in a short time, he or she should continue to make efforts to understand." There are 9 items all of which are positive in "The belief of learning depends on ability" factor of the scale. An example item that takes place in this factor is given as: "The students who are really intelligent have no need to study for being successful at school". Finally, there are 8 items all positive in the third factor of the scale, which is called as "The belief of there is only one truth". An example of this factor says: "The best side of science lessons is that most of the problems have only one true answer". The high points get from each factor of the scale indicate that the person has matured and sophisticated beliefs related to that factor. The repetition reliability of the original scale is .74, while the reliability coefficients of the factors change between .63 and .85 (Schommer, 1993). The Cronbach Alpha inner consistencies of coefficients of the adapted version of the 35-items scale are .83 for the first factor, .62 for the second factor, .59 for the third factor and .71 for the whole scale (Deryakulu & Büyükoztürk, 2002).

2.3. *Sampling*

73 (n=35 (Science Teacher Candidates), n=38 (Mathematic Teacher Candidates) teacher candidates studying at an education department in Aegean Region form the sampling of this research. The data is collected at the end of the Science Laboratory Practice II lesson of teacher candidates. This lesson aims to make teacher candidates implement project studies with elementary education classes of 6, 7 and 8, and give candidate teachers the detailed knowledge and ability they need when they use empirical method. At the education faculty where the data is collected, the needed theoretical information is shared with the teacher candidates in the first part of the lesson, and then the empirical studies, which start from close-ended and go to open-ended are done with teacher candidates in the application part of the lesson. The basic aim for students is to reach scientific knowledge themselves. Finally, in the second part of the lesson, the experiments, which are planned by students, are discussed in class environment at the establishment where the data is gathered.

2.4. Findings:

The findings obtained at the end of the analyses are taken into consideration and interpreted one by one under the titles that are consistent to questions answered during the research. The arithmetic mean and standard deviation values for the first sub problem are given in the below.

Table1. The Arithmetic Means and Standard Deviations of Epistemological Beliefs' Dimensions

Dimintions	N	X	Standard deviation
The belief of learning depends on effort (BLDE)	73	62.5	23.5
The belief of learning depends on ability(BLDA)	73	28.6	8.5
The belief of there is only one true truth(BOTT)	73	23.7	6.4

When the results that show the general situation of the epistemological belief levels of teacher candidates according to dimensions are looked over, it is seen that the mean value is 62.5 at BLDE dimension. In this dimension of the scale, there are a total of 18 items including 17 negative items and 1 positive item. The highest point that can be got from this dimension is 90 where the lowest is 18. If it is considered that the highest point is 90 and the mean value is 62.5 for BLDE dimension, it can be said that “learning depends on effort” belief of students is at the average level. On the other hand, the mean is 28.6 for BLDA dimension. There are 9 items all of which are positive in this dimension of the scale. The highest point that can be got from this dimension is 45 where the lowest is 9. Under the considerations of the highest point and the mean value are 45 and 28.6 respectively for BLDA dimension, it can be reported that “learning depends on ability” belief of students is at the average level again. Finally, the mean value is 23.72 at BOTT dimension. There are 8 items all of which are positive in this dimension of the scale. The highest point that can be got from this dimension is 40 where the lowest is 8. The “learning depends on ability” belief of students is again at the average level, as it is in the other beliefs. The question of whether there is a difference between in epistemological belief levels of teacher candidates according to their sexuality or not is analysed with independent t test, and the results are given in the below.

Table2. T Tests Result According to Levels of the Students'Epistemological Beliefs and Their Sexuality

Dimensions	sexuality	N	X	SS	t	p
BLDA	female	46	65.9630	25.39001	0.948	.346
	male	27	60.5435	22.46549		
BLDA	female	46	28.5652	8.36036	0.155	.003
	male	27	28.8889	9.10339		
BOTT	female	46	23.5870	6.20958	0.339	.736
	male	27	24.1111	6.65255		

The mean value of the epistemological belief levels of teacher candidates at BLDE dimension is found as 65.96 for females, where it is found as 60.54 for males. The calculated t value between two groups is 0.346 (p>0.05). This result shows that there is no significant difference between two groups at 0.05 level. The mean value of the epistemological belief level at the BLDA dimension is calculated as 28.5 for females, where the mean is 28.8 for male teacher candidates. The t value which is estimated in order to state the difference between two groups is found as 0.003 (p<0.05). This time, the result shows that there is a significant difference between two groups at 0.05 level. Finally, the mean value of the epistemological belief level at the BOTT dimension is calculated as 23.58 for females, where it is 24.11 for male teacher candidates. The t value calculated between two groups is found as 0.736 (p>0.05). Like in the BLDE dimension, the result shows that there is no significant difference between two groups at 0.05 level at the BOTT dimension. According to the results above, it is found that there is no meaningful difference between groups according to sexuality at BLDE and BOTT dimensions, while there is a significant difference at the BLDA dimension. When the direction of the

difference is analysed, it is understood that the male students have this belief more than female students at BLDA dimension where the belief of “learning depends on ability” is measured. The question of whether there is a difference between in epistemological belief levels of teacher candidates according to their departments or not is analysed with independent t test, and the results obtained are given in the below

Table3. T Tests Result According to Department of The Conditate Teachers' Epistemological Beliefs

	Department	N	X	SS	t	p
BLDE	Mathematic	35	40.5429	10.24506	0.396	0.000
	Science	38	82.8158	10.19500		
BLDA	Mathematic	35	21.6000	5.06545	0.696	0.000
	Science	38	35.2105	5.33807		
BOTT	Mathematic	35	28.1143	3.93156	0.119	0.000
	Science	38	19.7895	5.45823		

When the epistemological belief levels of teacher candidates are investigated according to the departments they study in, the mean value of mathematics teacher candidates is found as 40.5 at BLDE dimension, where the mean value of science teacher candidates is found as 82.81. The t value which is estimated in order to state the difference between two groups is found as 0.396 ($p < 0.05$). This estimated value indicates that the difference between the mean values of mathematics teacher candidates and science teacher candidates is significant at 0.05 level at BLDE dimension. The mean value of the epistemological belief level at the BLDA dimension is calculated as 21.6 for mathematics teacher candidates, where it is 35.2 for science teacher candidates. The t value, which is calculated in order to state the difference between two groups is found as $t = 0.696$ ($p < 0.05$) for the dimension in which the belief of “learning depends on ability” is measured, expresses that there is a significant difference between two groups at 0.05 level statistically. That is, there is an important difference recorded between mathematics teacher candidates and science teacher candidates about the matter of learning depends on ability. When the mean values of the groups at this dimension are examined, it is seen in Table 3 that this difference is in favor of mathematics teacher candidates. In other words, the mathematics teacher candidates believe in learning depends on ability more than science teacher candidates. Finally, as a result of the t test which is used for revealing whether there is an important difference between mathematics teacher candidates and science teacher candidates about the subject that there is only one truth or not, the mean value of the mathematics teacher candidates is calculated as 28.11, where the mean value is 19.7 for science teacher candidates. The t value calculated between two groups is found as $t = 0.119$ ($p < 0.05$), which expresses that there is a significant difference between two groups at 0.05 level statistically. According to the results above, it is obvious that there are meaningful differences between groups according to BLDE, BLDA and BOTT dimensions. Moreover, it is seen in Table 3 that all three differences are in favor of science teacher candidates.

3. Conclusion

When the question of at what level the epistemological belief of science and mathematics teacher candidates generally is investigated under the findings obtained at the end of this research, it is seen that the belief of “there is only one truth” of teacher candidates has higher rates than the beliefs of “learning depend on effort” and “learning depends on ability”.

If the empirical evidences gathered at the end of this research are examined under the question of whether there is a difference between epistemological beliefs of teacher candidates according to their gender or not, it can be said that the female students have the belief of “learning depends on effort” more than the male students; while the male students have the belief of “learning depends on ability” more than the female students. To explain the reasons of this difference, the difference in growing styles can be mentioned. Schommer (1993) found that there is a significant effect of sexuality over these four epistemological factors. In other words, it is obtained that the female students think less simple than male students about the belief of “learning depends on ability”. This study shows that the female students do not believe in learning depends on ability but they believe in learning depends on effort. Furthermore, Eroğlu & Güven (2006) also showed that female students have the belief of “learning depends on effort” more than male students; and male students have the belief of “learning depends on ability” more when compared to female students.

When the empirical evidences of this research and evidences gathered from other researchers are compared and the question of whether the epistemological belief of teacher candidates differs according to their departments or not is asked, it is seen that science teacher candidates have epistemological belief more than the mathematics teacher candidates. That is, a significant difference between science teacher candidate and mathematics teacher candidate is found after science laboratory lesson. science and mathematics teacher candidates, who take science laboratory theoretic lesson in their university degree, find the chance of improving different education styles about having knowledge so that this difference can make sense.

That is, when the results obtained from two groups are compared, it is seen that the results change between two groups about the belief of “there is only one truth”. Furthermore, there is no difference recorded between two groups about the beliefs of learning depends on effort and learning depends on ability.

3.1 Suggestions

According to the results of this research,

- Science philosophy lesson, which aims to improve epistemological belief, can be added to the scheduled program of university education of teacher candidates studying in science and mathematics departments.
- The scientific knowledge and knowledge theory can be more emphasized in the laboratory lessons of teacher candidates.
- Emphasizing to improve the epistemological belief in programs can provide teacher candidates, who will be teachers of future, to understand the importance of knowledge theory and so that make them emphasize epistemology in their lessons.



References

- Baydar, S. C. (2000). ODTÜ ve Gazi Üniversitesi hizmet öncesi matematik öğretmenlerinin matematiğin doğası ve öğretimi ile ilgili inançları. *Middle East Technical University, (Unpublishing Master Dissertation)*, Ankara.
- Can, B. (2007). Yaratıcılık ve fen öğretimi. *İlk öğretmen Eğitim Dergisi*, 13 , 42-45.
- Deryakulu, D., & Büyüköztürk, Ş. (2002). Epistemolojik inanç ölçeğinin geçerlik ve güvenilirlik çalışması. *Eğitim Araştırmaları*, 2 , 111-125.
- Deryakulu, D., & Büyüköztürk, Ş. (2005). Epistemolojik inanç ölçeğinin faktör yapısının yeniden incelenmesi: cinsiyet ve öğrenim görülen program türüne göre epistemolojik inançların karşılaştırılması. *Eurasian Journal of Educational Research*, 18 , 57-70.
- Eroğlu, S. E., & Güven, K. (2006). Üniversite öğrencilerinin epistemolojik inançlarının bazı değişkenler açısından incelenmesi. *Selçuk Üniversitesi Sosyal Bilimler Enstitüsü Dergisi*, 16, 296-392.
- Jehng, J., Johnson, S. & Anderson, R. (1993). Schooling and students' epistemological beliefs about learning. *Contemporary Educational Psychology*, 18, 23-25.
- Munby, H. (1986). Metaphor in the thinking of teachers: an exploratory study. *Journal of Curriculum Studies*, 18 , 197-209.
- Schommer, M. (1993). Epistemological development and academic performance among secondary students. *Journal of Educational Psychology*, 85, 406-411.
- Schommer, M., & Walker, K. (1997). Epistemological beliefs and valuing school: considerations for college admissions and retention. *Research in Higher Education*, 38, 173-186.
- Schommer, M. (1990). Effects of beliefs about the nature of knowledge on comprehension. *Journal of Educational Psychology*, 82 , 493-504.
- Schraw, G. (2001). Current themes and future directions in epistemological research: a commentary. *Educational Psychology Review*, 13 , 451-464
- Tsai, C. (2002). Nested epistemologies: science teachers' beliefs of teaching, learning and science. *International Journal of Science Education*, 28 , 771-783