International Journal of Progressive Education, Volume 18 Number 1, 2022

The Relationship Between Preservice Teachers' Critical Thinking and Epistemological Beliefs

Cafer Çarkıt [i]
Gaziantep University

Hasan Kurnaz [ii]
Gaziantep University

Abstract

In this study, the relationship between pre-service teachers' critical thinking dispositions and their epistemological belief perceptions was examined. The relational screening model was used in the study designed in quantitative research approach. The study group of the research is 234 teacher candidates who study at Education Faculties of Gaziantep University and are determined by simple random sampling method. In the study, data were collected with scales developed for two different variables as epistemological belief and critical thinking disposition. SPSS 22.0 packaged software has been used in the process of data analysis. During the research process, the data were evaluated using the arithmetic mean, Pearson Product Moments Correlation Coefficient and multiple regression analysis. In the study, it was determined that the epistemological belief perceptions of teacher candidates differ according to dimensions and their critical thinking dispositions were at a high level. However, positive relationships were determined between sub-dimensions of pre-service teachers' epistemological belief perceptions and sub-dimensions of critical thinking dispositions. Accordingly, a positive and a low level relationship between "access and acquisition of knowledge " and "reasoning" dimensions with "simple knowledge" and "reaching judgment" dimensions; a positive and moderate relationship between 'simple knowledge' and 'reasoning' dimensions were found. In addition, it was determined that 'reasoning', 'open-mindedness' and 'reaching judgment', which are sub-dimensions of the pre-service teachers' critical thinking dispositions; significantly predicted their perception of the epistemological beliefs regarding 'access to knowledge' and 'simple knowledge'.

Keywords: Epistemological Belief, Critical Thinking, Teacher Candidate, Correlation, Relationship Level

DOI: 10.29329/ijpe.2022.426.7

---

[i] **Cafer Çarkıt,** Assist. Prof. Dr., Nizip Faculty of Education, Gaziantep University, ORCID: 0000-0003-4126-2165

Correspondence: cafer_carkit_87@hotmail.com

[ii] **Hasan Kurnaz**, Assist. Prof. Dr., Nizip Faculty of Education, Gaziantep University, ORCID: 0000-0002-5804-946X

INTRODUCTION

Thinking is seen as an ability that is unique to humans and as old as human history. Thinking is the cornerstone of today's civilization. Thinking is at the center of the common heritage that humanity has carried to the present. Critical thinking is a way of thinking that is seen as the most advanced thinking level among the types of thinking. Thinking gains a critical dimension to the extent of the attention shown to the causes of phenomena or situations emphasized (Bailin & Siegel, 2003). In this framework, when the definitions of critical thinking in the literature are examined, it is seen that critical thinking is characterized by taking a high-level thinking skill that is considered one of the educational roots of the basic reality. As a matter of fact, Paul and Elder (2013) explain critical thinking as a way of thinking that allows access to new knowledge by questioning and evaluating the obtained information and that opens the doors to being autonomous. Tempelaar (2006) defines critical thinking as a metacognition. Similarly, Paul (1993) sees critical thinking as thinking on the act of thinking in order to improve one's own thinking process. Chaffe'e (1991) expresses critical thinking as a collective approach to understanding and solving how the world is given a meaning, rather than just a way of thinking. Yildirim (1997) defines critical thinking as the ability to examine a situation, opinion, explanation, behaviour or value judgment with an objective and rational approach in terms of accuracy and validity, in a measured scepticism. All these knowledge and definitions show that critical thinking is a cause-effect-oriented, multi-dimensional and disciplined way of thinking just like rational thinking.

Critical thinking; seen as a multidisciplinary thinking process that requires both cognitive and affective characteristics in itself and cannot be limited to a specific discipline. As a matter of fact, critical thinking includes affective features such as doubting, searching for evidence, being open-minded, and showing patience in addition to cognitive processes such as sorting, classification, analysis, evaluation, decision making, and problem solving (Alkin-Sahin et al., 2014). In the process of critical thinking, the critical thinker uses certain assessment standards to determine the virtue or value of knowledge, facts, situations or problems (Paul & Elder, 2013). With critical thinking, the individual has the opportunity to make definitive and final judgments about the correctness or falsehood of suggestions and solutions, and the validity or deficiency of ideas (Moore, 2004). In this sense, critical thinking has a structure that meets the logic criteria. Nosich (2015) explains the critical thinking process with the stages of asking questions, grasping the logic of these questions, trying to solve the problems, and believing the results of logic. In this respect, a good critical thinker is expected to have the basic features required by critical thinking.

In addition to the cognitive and affective features of critical thinking, critical thinking disposition emerges as one of the basic features of critical thinking. Disposition is an important factor in the effective execution of a job or skill. In this sense, disposition is expressed as a state of being prone to something (Ennis, 1996). Critical thinking disposition, on the other hand, is defined as the willingness and predisposition of individuals to use a critical view in the framework of certain criteria in the face of events, phenomena, situations or problems they encounter (Zhank, 2003; Gurkaynak et al., 2008). In other words, the way to be a good critical thinker is to have a high-level critical thinking disposition (Facione, 2004). A high-level critical thinking disposition depends on doubting different opinions and beliefs, revealing the reasons for the hypotheses clearly, offering alternative suggestions, having a coherent thinking style, and being brave and determined in seeking the truth (Beyer, 1988). Individuals with high critical thinking disposition can use their critical thinking skills effectively, thus critical thinking training for these individuals progresses systematically.

An important concept related to individuals' critical thinking dispositions and reflecting their beliefs about knowledge and learning is the concept of epistemological belief. Although epistemological beliefs are defined as beliefs of individuals about both knowledge and the nature of acquiring knowledge, they meet the thoughts and beliefs about what knowledge is, how it is acquired, its certainty and limit (Schommer, 1990; Hofer, 2001; Brownlee et al., 2001; Deryakulu, 2014). Epistemological beliefs of individuals have a significant effect on both their cognitive and metacognitive processes (Schommer, 1994). In this context, experienced and critical students believe

that a complete and finalized knowledge cannot exist, but that some of the information will continue to develop, while less experienced students believe that a very small part of the knowledge has changed and developed, and that a large part of the knowledge is completed and takes its final form. Schommer, 1990). In this respect, the level of analysing information with a critical point of view lies in the background of the meaning's individuals attribute to knowledge and the nature of knowledge. In other words, critical thinking levels are effective in shaping the epistemological beliefs developed by individuals regarding knowledge and the nature of knowledge.

When the literature is examined, it is seen that many studies have been conducted on the epistemological beliefs of teacher candidates (Sinatra & Kardash, 2004; Eryaman, 2007; Yadav & Koehler, 2007; Meral & Colak, 2009; Aypay, 2011; Taskin, 2012; Demir, 2012; Bakir & Adak, 2014; Dunekacke, et al., 2016; Turkan, et al., 2016; Bikmaz, 2017, Koc & Memduhoglu, 2017, Arslan & Aybek, 2018). However, the critical thinking perceptions of teacher candidates have been the subject of many studies (Guven & Kurum, 2008; Sen, 2009; Alper, 2010; Quin, et al., 2010; Kuvac & Koc, 2014; Can & Kaymakci, 2015; Kusaeri, 2019; Saputro, et al., 2020). On the other hand, there is no study in the literature to determine the effect of pre-service teachers' critical thinking dispositions on their epistemological beliefs and to determine whether these dispositions predict their epistemological beliefs. In this sense, two relevant variables were taken as the subject of this study and the relationship between pre-service teachers' critical thinking dispositions and their epistemological belief perceptions was examined. In this framework, the problems of the research were formed as follows:

1. What are the pre-service teachers' epistemological belief perceptions and critical thinking dispositions?

2. Is there a significant relationship between the sub-dimensions of pre-service teachers' epistemological belief perceptions and the sub-dimensions of their critical thinking dispositions?

3. Are sub-dimensions of pre-service teachers' critical thinking dispositions a significant predictor of their epistemological beliefs?

METHOD

Research Model

In this study, which was conducted to examine the relationship between pre-service teachers' critical thinking dispositions and their epistemological belief perceptions, relational scanning model, one of the quantitative research models, was used. Relational scanning is a research model conducted to describe the relationship between two or more variables (Frankel & Wallen, 2009). In studies conducted in the relational screening model, it is possible to examine the relationship between two or more variables without interfering with these variables in any way (Buyukozturk et al, 2014). In this study, it was aimed to determine the relationship between pre-service teachers' critical thinking dispositions and their epistemological belief perceptions. In this direction, scales for determining both variables were applied and the relationship status of these variables was determined by performing the necessary statistical operations.

Study Group

This research, was carried out with teacher candidates who continue their studies and voluntarily participate in the research at the Faculties of Education associated with Gaziantep University, located in the South-eastern Anatolia region of Turkey. In quantitative research, a working group suitable for the spirit of the universe is formed (Cohen, Manion & Marrison, 2007; Fraenkel & Wallen, 2009). The study group of the research is 234 teacher candidates selected by simple random sampling among the pre-service teachers who continue their education in Education Faculties of Gaziantep University. The demographic information of the sample is given below.

Table 1. Demographic information of the students who constitute the sample

Demographic Features		Frequency (f)	Percentage (%)
Gender	Female	185	79.1
	Male	49	20.9
Age	17-18	19	8.1
	19-20	94	40.2
	21-22	76	32.5
	23-24	14	6
	25-26	5	2.1
	27 or above	26	11.1
Department	Turkish Language Teaching	116	49.6
	Elementary School Teaching	41	17.5
	Social Studies Teaching	38	16.2
	Mathematics Teaching	36	15.4
	Other	3	1.3
Grade	1st Year	86	36.8
	2nd Year	42	17.9
	3rd Year	62	26.5
	4th Year	44	18.8

Data Collection Tools

Data on two different variables as critical thinking disposition and epistemological belief were collected in the study. "Marmara Critical Thinking Disposition Scale" developed by Ozgenel and Cetin (2018) to determine pre-service teachers' critical thinking dispositions, and the "Epistemic Belief Scale" developed by Schraw, Bendixen, and Dunkle (2002) and adapted to Turkish by Dinc, Inel and Uztemur (2016), to determine their epistemological belief perceptions were used. Necessary permissions were obtained to use the relevant scales during the research process. Information on the scales is presented below.

Marmara Critical Thinking Disposition Scale

The scale developed by Ozgenel and Cetin (2018) to determine the critical thinking dispositions of teachers consists of 28 items and 6 sub-dimensions, and is a likert-type scale of 5, rated as “never”, “rarely”, “occasionally”, “usually”, “always”. The structural validity of the scale was tested by explanatory factor analysis (EFA). In order to perform exploratory factor analysis, there must be a certain correlation / relationship between variables. In the calculation of this correlation, the Barlett sphericity test was performed and the Kaiser Meyer Olkin (KMO) value was calculated. As a result of statistical operations, the KMO value was calculated as 0.932, and the Bartlett test result was found= 6476.72 ($p<.001$) to be significant. As a result of the factor analysis performed within this framework, 28 items and 6 sub-factors were obtained. In this context, the first factor consisting of 6 items was named reasoning, the second factor consisting of 6 items, reaching a judgment, the third factor consisting of 4 items, searching for evidence, the fourth factor consisting of 4 items, searching for truth, the fifth factor consisting of 4 items, open-mindedness, and the sixth factor consisting of 4 items were named as systematicity. The scale consisting of 6 factors explained 56.35% of the total variance. It was determined that the correlation coefficients of the factors were significant. Cronbach's alpha coefficient was calculated for the internal consistency reliability of the scale, and this value for the overall scale was determined as .91. Item-total and item-remaining correlation coefficients were found to be significant, and it was determined that the items were distinctive as a result of the 27% sub-upper independent groups t-test. In the test-retest analysis, it was seen that the correlation coefficients for the sub-dimensions of the scale and the general were significant. As a result of all

these processes, it was concluded that the scale is a valid and reliable scale in determining critical thinking disposition.

Epistemic Belief Scale

The scale developed by Schraw, Bendixen, and Dunkle (2002) for determining epistemological belief perceptions was adapted into Turkish by Dinc, Inel, and Uztemur (2016). In order to determine the construct validity of the scale, first exploratory factor analysis and then confirmatory factor analysis were performed. The original of the scale consists of 28 items and 5 dimensions. As a result of the exploratory factor analysis conducted for adaptation to Turkish, it was determined that the scale consists of 4 dimensions and 15 items. In this context, the first factor consisting of 8 items was named the process of accessing and acquiring knowledge, the second factor consisting of 3 items was certain knowledge, the third factor consisting of 2 items was innate ability and the fourth factor consisting of 2 items was named simple knowledge. The scale consisting of 4 factors explained 52.22% of the total variance. Cronbach's alpha coefficient was calculated for the internal consistency reliability of the scale, and this value for the overall scale was calculated as .78. As a result of the confirmatory factor analysis performed to determine the cultural adaptation level of the Turkish version of the scale, it was found that the scale was compatible. Finally, it was concluded that the scale is a valid and reliable scale.

Data Analysis

In the analysis of the data obtained during the research process SPSS 22.0 package program was used. Arithmetic mean, standard deviation and standard error in determining the critical thinking levels and epistemological belief levels of the students participating in the study; Pearson Product Moments Correlation Coefficient in determining the relationship between sub-dimensions of epistemological belief scale and sub-dimensions of critical thinking disposition scale; multiple regression analysis calculations were used to determine the predictive power of sub-dimensions of critical thinking disposition on epistemological beliefs. Relevant assumptions for performing regression analysis; sample size, linearity, extreme values, normality, covariance and residual independence were examined. For the sample size, the formula N> 50 + 8m (Tabachnick & Fidell, 2013) was taken into consideration and it was decided that 234 people would be sufficient. In order to determine the extreme values, z scores and Boxplot graphs were examined, and no extreme values (all z scores between +3 and -3) were found in the data set. While examining the assumption of multiple common linearity; The criteria for the correlation between variables to be less than .70, the VIF values to be 10 and the condition index to be less than 30 (Durmus, Yurtkoru & Cinko, 2011) were taken into consideration. These criteria show that there is no multicollinearity problem in the data set. Kurtosis and skewness values and the Mahalanobis distance value were calculated for the single normality distribution. It was observed that the kurtosis and skewness coefficients of the variables ranged between +2 and -2 (George & Mallery, 2016), and the critical values of Mahalanobis distance calculated for 6 independent variables were less than 22.46 (Tabachnick & Fidell, 2013). According to the scatter plot drawn, it shows that the assumptions of no relationship between covariance and error terms were met.

FINDINGS

The main purpose of the study is to determine the relationship between pre-service teachers' epistemological belief perceptions and critical thinking dispositions. In this framework, the findings obtained from the analysis of the data collected within the scope of the research were presented in the context of the research questions and in tables. According to this, analysis and findings regarding the sub-problems "What is the level of pre-service teachers' epistemological beliefs and critical thinking perceptions?" and "Is there a significant relationship between the sub-dimensions of pre-service teachers' epistemological belief perceptions and the sub-dimensions of their critical thinking dispositions?" are shown in Table 2:

Table 2. The results of correlation analysis to determine the relationship between preservice teachers' epistemological perceptions of belief and critical thinking disposition levels, and these variables (N = 234)

Descriptive statistics and correlation coefficients (N = 234)

Variables	1	2	3	4	5	6	7	8	9	10
1. Access to knowledge	1									
2. Certain knowledge	.24**	1								
3. Simple knowledge	.21*	.21*	1							
4. Innate ability	.37**	.19*	.13*	1						
5. Reasoning	.19*	.06	.30**	.10	1					
6. Reaching a judgment	.02	.10	.22**	.05	.64**	1				
7. Searching for evidence	-.00	.01	.10	.00	.59**	.66**	1			
8. Searching for truth	.02	.01	.08	-.00	.59**	.66**	.70**	1		
9. Open-mindedness	.11	-.03	.07	-.02	.41**	.46**	0.44**	.50**	1	
10. Systematicity	-.02	-.02	.09	.07	.50**	.61**	.52**	.53**	.47**	1
Mean	4.51	4.00	3.32	3.73	4.17	4.12	4.19	4.11	4.18	4.20
Stand. Dev.	0.48	0.76	1.11	1.06	0.53	0.49	0.57	0.52	0.49	0.52
Skew.	-1.23	-.61	-.070	-.58	-.29	-.18	-.48	-.42	-.34	-.56
Kur.	1.23	.08	-1.02	-.43	-.15	-.10	.15	.37	.42	.26

*p < .05. **p < .01.

In the interpretation of the arithmetic mean scores in Table 2, it was taken into account that the scales are in the 5-point Likert type. Accordingly, the epistemological beliefs of the teacher candidates participating in the study about access to knowledge are very high (= 4.51); Beliefs towards certain knowledge (= 4.00) and innate ability (= 3.73) were found to be high and their beliefs towards simple knowledge were found to be moderate (= 3.32). These findings show that teacher candidates' beliefs about access to knowledge are very sophisticated / developed; that beliefs about certain knowledge and innate ability are sophisticated / developed; that their beliefs about simple knowledge are moderately sophisticated / developed.

The scores the teacher candidates obtained from the critical thinking scale; in the dimensions of reasoning (= 4.17), reaching a judgment (= 4.12), searching for evidence (= 4.19), searching for truth (= 4.11), and open-mindedness (= 4.18) at a high level; in the systematicity dimension, on the other hand, (= 4.20) was found to be at a very high level. These findings show that pre-service teachers' critical thinking perceptions are at a high level.

Table 2 shows that there are some significant relationships between the epistemological beliefs and critical thinking perceptions of the teacher candidates participating in the study. Accordingly, there is a significant, positive and low level (r =.19, p<.001); relationship between access to knowledge and reasoning; significant, positive and low level (r = .22, p <.001) relationship between simple knowledge and reaching a judgment; a significant, positive, and moderate (r = .30, p <.001) relationship between simple knowledge and reasoning was found. This finding obtained can be interpreted as; as the pre-service teachers' reasoning and judgment reaching levels increased, their beliefs about access to knowledge and simple knowledge beliefs also increased; as their level of reasoning and reaching judgment decreased, beliefs of access to knowledge and beliefs of simple knowledge also decreased. On the other hand, it was observed that the other relationships between the sub-dimensions of the epistemological belief scale and the sub-dimensions of critical thinking skill were insignificant.

Multiple regression analysis was conducted to increase the strength of the findings obtained as a result of the correlation analysis during the research process and to determine whether the sub-dimensions of the pre-service teachers' critical thinking dispositions significantly predicted their epistemological beliefs towards access to knowledge and simple knowledge, and if they did, their predictive power. In this sense, analysis and findings regarding the sub-problem "Are sub-dimensions of teacher candidates' critical thinking skills a meaningful predictor of their epistemological beliefs?", which is the third questioned in the study, are shown in Table 3 and Table 4.

Table 3. multiple regression analysis results regarding the prediction of sub-dimensions of critical thinking epistemological beliefs towards access to knowledge (N = 234)

Variable	B	Std. Error	β	t	p	Tolerance	VIF
Fixed	31.94	2.54		12.53	0.00		
Reasoning	0.43	0.10	0.35	4.04	0.00	0.50	1.96
Reaching a judgment	-0.74	0.13	-0.05	-0.55	0.57	0.38	2.58
Searching for evidence	-0.22	0.16	-0.13	-1.39	0.16	0.41	2.40
Searching for truth	-0.10	0.18	-0.05	-0.57	0.56	0.40	2.48
Open-mindedness	0.30	0.15	0.15	1.98	0.04	0.67	1.47
Systematicity	-0.25	0.15	-0.14	-1.64	0.10	0.55	1.81

Predicted variable: Access to knowledge

R=.30, R^2 =.09, adjusted R^2= .06, F (6,227) = 3.729, p<.001

When Table 3 is examined, according to the results of the multiple regression analysis, it is seen that the epistemological beliefs of pre-service teachers about access to knowledge; is significantly predicted by reasoning (β=.35, t = 4.04, p <.001) and open-mindedness (β =.15, t = 1.98, p <.05) which are sub-dimensions of the critical thinking skill. It is observed that sub-dimensions of critical thinking, namely, reaching a judgement (β= -.05, t = -.55, p>05), searching for evidence (β= -.22, t= -1.39, p>05), searching for truth (β= -.10, t = -.57, p>05) and systematicity (β= -.25, t = -1.64, p> 05) did not significantly predict epistemological beliefs towards access to knowledge. According to the findings, a 1-unit increase in the reasoning sub-dimension of critical thinking, will create a .35-unit increase in pre-service teachers 'epistemological beliefs about access to knowledge; and a 1-unit increase in open-mindedness sub-dimension, will create a .15-unit increase in pre-service teachers' epistemological beliefs about access to knowledge. According to the analysis results, 6% of the pre-service teachers' epistemological beliefs about access to knowledge are explained by reasoning and open-mindedness, which are sub-dimensions of critical thinking ($_{adjusted}R^2$=.06; p<.001). According to these findings, it can be said that reasoning and open-mindedness, which are sub-dimensions of critical thinking, contribute to the development of pre-service teachers' epistemological beliefs about access to knowledge.

Table 4. Multiple regression analysis results related to the sub-dimensions of critical thinking predicting epistemological beliefs towards the simple knowledge (N = 234)

Variable	B	Std. Error	β	t	p	Tolerance	VIF
Fixed	2.30	1.44		1.60	0.11		
Reasoning	0.26	0.06	0.37	4.32	0.00	0.50	1.96
Reaching a judgment	0.15	0.07	0.20	2.06	0.04	0.38	2.58
Searching for evidence	-0.10	0.09	-0.11	-1.14	0.25	0.41	2.40
Searching for truth	-0.15	0.10	-0.14	-1.47	0.14	0.40	2.48
Open-mindedness	-0.00	0.08	-0.00	-0.10	0.91	0.67	1.47
Systematicity	-0.09	0.08	-0.08	-1.06	0.28	0.55	1.81

Predicted variable: Simple knowledge

R=.35, R^2 =.12, adjusted R^2= .10, F (6, 227) = 5.585, p<.001

When Table 4 is examined, according to the results of the multiple regression analysis, it is seen that the pre-service teachers' epistemological beliefs about the simplicity of knowledge; is significantly predicted by reasoning (β=.26, t= 4.32, p<.001) and reaching judgment (β =.15, t= 2.06, p<.05) which are sub-dimensions of the critical thinking skill. It is observed that sub-dimensions of critical thinking, namely, searching for evidence (β= -.10, t= -1.14, p>05), searching for truth (β= -.15, t= -1.47, p>05), open-mindedness (β= -.00, t = -.10, p>05) and systematicity (β= -.25, t = -1.64, p> 05) did not significantly predict epistemological beliefs towards access to knowledge. According to the findings, a 1-unit increase in the reasoning sub-dimension of critical thinking, will create a .37 unit increase in pre-service teachers' epistemological belief about the simplicity of knowledge; and a 1-unit increase in the sub-dimension of reaching a judgement will create a .20-unit increase in pre-service

teachers' epistemological beliefs about simplicity of knowledge. According to the results of the analysis, 10% of the pre-service teachers' epistemological beliefs about the simplicity of knowledge are explained by reasoning and reaching judgment, which are sub-dimensions of critical thinking ($_{adjusted}R^2$=.10; p<.001). According to these findings, it can be said that reasoning and reaching judgment, sub-dimensions of critical thinking, contributed to the development of pre-service teachers' epistemological beliefs towards the simplicity of knowledge.

CONCLUSION AND DISCUSSION

In this study, the relationship between pre-service teachers' critical thinking dispositions and their epistemological belief perceptions was examined. In this framework, first of all, the arithmetic mean of the epistemological belief levels of teacher candidates were evaluated according to their sub-dimensions. Accordingly, it is determined that the epistemological belief levels of teacher candidates participating in the study; very sophisticated in dimensions of access and acquisition of knowledge; sophisticated in the dimensions of innate ability and certain knowledge; moderately sophisticated in the dimension of simple knowledge. These results show that pre-service teachers' epistemological belief perceptions differ according to dimensions. In this sense, the results obtained are in line with the findings of the study conducted by Uztemur and Dinc (2018) on pre-service history and social studies teachers. In the related study, researchers concluded that pre-service teachers' epistemological belief perceptions differ according to dimensions. Similarly, in many studies in the literature, it is stated that epistemological beliefs have a multi-dimensional structure (Schommer, 1990; Hofer, 2000; Conley et al., 2004; Mason et al., 2011; Koseman & Sahin, 2014). In this respect, the research supports the findings of the relevant studies conducted in the literature. According to these results, it is thought that variables such as sociocultural level, family structure, school culture, and reading level are effective on the differentiation of pre-service teachers' epistemological belief levels according to dimensions.

Secondly, in the research process, the arithmetic mean of the critical thinking levels of the teacher candidates were examined according to the sub-dimensions. Accordingly, the critical thinking levels of the teacher candidates participating in the study were high in the dimensions of reasoning, reaching a judgment, searching for evidence, searching the truth and open-mindedness; in terms of systematicity, it has been determined as a very high level. Although these results are in parallel with the results of the studies in which the critical thinking levels of the teacher candidates were determined and the critical thinking levels of the teacher candidates were found to be high (Deringol, 2017; Egmir & Ocak, 2020; Terzi et al., 2020); it differs from the results of the studies in which the critical thinking levels of pre-service teachers were found to be low (Incikabi, et al., 2013; Baran & Balci, 2017; Sarıtas & Yildirim, 2020). It is observed that variables such as reading levels, socio-cultural levels, philosophical beliefs about education, metacognitive reading awareness, learning styles are effective on the critical thinking dispositions of pre-service teachers (Cansoy et al., 2018). Depending on these variables, it is thought that different results have been reached in the studies presented in the literature.

Thirdly, the relationship between variables was examined in the study. Accordingly, it was determined that there are low and medium level significant relationships between the access to knowledge and simple knowledge dimensions of the epistemological belief scale and the reasoning and reaching a judgment dimensions of critical thinking. Similar to the findings of this study, significant relationships between epistemological beliefs and some dimensions of critical thinking are found in the research results in the literature (Basbay, 2013; Chan et al. 2011; Hofer, 2004; Kandemir and Egmir, 2020; Koyunlu Unlu and Dokme, 2017; Sivgin, 2019). Chan et al. (2011) determined that there is an important link between naive epistemological beliefs and weak critical thinking disposition. In their study, Koyunlu Unlu and Dokme (2017) determined that there are low-level relationships between critical thinking and epistemological beliefs that learning depends on effort and ability. In their study with secondary school students, Kandemir and Egmir (2020) concluded that there are moderately significant relationships between some sub-dimensions of the epistemological belief scale and critical thinking disposition. These findings show that dispositions towards critical thinking are closely related to some dimensions of epistemological beliefs. However, when the studies mentioned are compared, it can be said that the dimensions of epistemological beliefs related to critical thinking

and their level of relationship may differ. These differences seen between studies can be explained by the complex structure of epistemological beliefs. Individuals may develop different beliefs about the source, precision and structure of knowledge, depending on the culture and environment they are in.

Finally, in the study, based on the significant correlations seen between variables, it was examined whether pre-service teachers' critical thinking dispositions significantly predicted epistemological beliefs towards access to knowledge and simple knowledge. Analyzes show that a significant part of the pre-service teachers' epistemological belief variance towards access to knowledge is explained by reasoning and open-mindedness, which are sub-dimensions of critical thinking. In this scale, as the dimension named as access to knowledge contains items from expert authority and rapid learning dimensions from the scale developed by Schraw et al. (2002), it can be said that critical thinking is also related to expert authority and rapid learning. Individuals with sophisticated epistemological beliefs about the source of knowledge believe that the source of knowledge is observation and judgment rather than experts. Similarly, people who have sophisticated beliefs about the pace of learning accept that learning is a gradual process (Schommer-Aikins, 2004; Riedler et al., 2016). In this context, it can be said that individuals whose reasoning and open-mindedness skills are developed, their sophisticated beliefs about the source of knowledge and the speed of learning will also develop. In the studies in the literature, it is seen that there is a two-way relationship between critical thinking disposition and epistemological beliefs. While Basbay (2013) found that critical thinking disposition explains the epistemological belief variance, Akbay, Akbay, and Gulsoy (2018) found that epistemological beliefs significantly explain the variance of critical thinking. As a result, it can be said that the development seen in one of the variables of critical thinking and epistemological belief will reflect positively on the other.

It has been observed that the pre-service teachers' epistemological belief variance towards the simplicity of knowledge, is significantly explained by reasoning and reaching a judgment, which are sub-dimensions of critical thinking. Naive beliefs that knowledge is simple, predispose one to a fixed, one-perspective approach to problems. Sophisticated beliefs that knowledge is complex lead one to think flexible and versatile (Schommer, 1998). Considering that pre-service teachers have a high level of critical thinking disposition in this study, it can be said that pre-service teachers' flexible thinking dispositions are effective on their sophisticated beliefs about the simplicity of knowledge. In this sense, it is thought that pre-service teachers' acumen, reasoning and reaching a judgment skill are effective in increasing the beliefs about the structure of knowledge to the sophisticated level.

As a result, it can be stated that there is an important relationship between having high-level critical thinking skills and having developed epistemological beliefs. However, people with high critical thinking skills may not always have sophisticated beliefs about the nature, structure and source of knowledge. As a matter of fact, in many studies, there is usually a low level of correlation between epistemological beliefs and the sub-dimensions of critical thinking disposition (For example, Koyunlu Unlu & Dokme, 2017). In addition, it is observed that people's high critical thinking dispositions and sophisticated beliefs are not reflected in an equivalent way to their performance (Hyytinen et al. 2014). There are a few limitations that can negatively affect the generalizability of the results obtained in this study. The first of these is that the measurement tools used are in the style of self-report. Another limitation is that the sample used consists of students from similar cultures. In this context, in future studies, different data collection tools can be used to collect data other than self-report style measurement tools. The study can be repeated on samples chosen from different cultures.

REFERENCE

Akbay, T., Akbay, L., & Gulsoy, V. G. B. (2017). Causal effect of two predominant factors on critical thinking disposition. *Mehmet Akif Ersoy University Journal of Education Faculty*, *45*(1), 88-104.

Alkın-Sahin, S., Tunca, N., & Ulubey, Ö. (2014). The relationship between pre-service teachers' educational beliefs and their critical thinking tendencies. *Elementary Education Online, 13*(4). 1473-1492. https://doi.org/10.17051/io.2014.56482

Alper, A. (2010). Critical thinking disposition of pre-service teachers. *Education and Science 35*(158), 14-27.

Aslan, S., & Aybek, B. (2018). An ınvestigation of the epistemological beliefs of prospective teachers in terms of certain variable. *Inonu University Journal of the Faculty of Education, 19*(2), 328-340. https://doi.org/10.17679/inuefd.350368

Aypay, A. (2011). Adaptation of epistemological beliefs questionnaıre in Turkish and investigation of pre-service teachers' beliefs. *Eskisehir Osmangazi University Journal of Social Sciences, 12*(1), 1-15.

Bailin, S. & Siegel, H. (2003). Critical thinking. In Nigel Blake, Paul Smeyers, Richard Smith, and Paul Standish (Eds), *The blackwell quide to the philosophy of education (pp. 181-193).* Blackwell Publishing. https://doi.org/10.1002/9780470996294.ch11

Bakir, S. & Adak, F. (2014). Epistemological beliefs of pre-service science teachers. *Cumhuriyet International Journal of Education, 3*(4), 24-36. https://doi.org/10.30703/cije.321355

Baran, M., & Balcı, F. (2017). A research on the critical thinking tendency of nurse managers. *Journal of Health and Nursing Management*, *4*(2), 63-71.

Basbay, M. (2013). Analysing the relationship of critical thinking and metacognition with epistemological beliefs through structural equation modelling. *Education and Science, 38*(169). 249-262.

Beyer, B. K., (1988). Developing a scopeand sequence for thinking skills instruction. *Educational Leadership, XLV*(7), 26-30.

Bikmaz, F. (2017). Investigating the teaching and learning conceptions and scientific epistemological beliefs of pre-service teachers': A longitudinal study. *Education and Science, 42*(189). http://dx.doi.org/10.15390/EB.2017.4601

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.

Buyukozturk, S., Kilic-Cakmak, E., Akgun, Ö. E., Karadeniz, S. & Demirel, F. (2014). *Scientific research methods.* Pegem Publication.

Can, S. & Kaymakci, G. (2015). Pre- service teachers' critical thinking tendencies. *Education Sciences, 10*(2), 66-83

Chaffe, J. (1991). *Thinking critically.* Haugton Mifflin Company.

Chan, N., Ho, I. T., & Ku, K. Y. (2011). Epistemic beliefs and critical thinking of Chinese students. *Learning and Individual Differences, 21*(1), 67–77. https://doi.org/10.1016/j.lindif.2010.11.001

Cohen, L., Manion, L. & Morrison, K. (2007). *Research methods in education*. Routledge Falmer.

Conley, A. M., Pintrich, P. R., Vekiri, I., & Harrison, D. (2004). Changes in epistemological beliefs in elementary science students. *Contemporary Educational Psychology, 29*(2), 186-204. https://doi.org/10.1016/j.cedpsych.2004.01.004.

Cansoy, R., Parlar, H. & Polatcan, M. (2018). Teacher candidates' critical thinking tendencies research in Turkey: A content analysis. *Universal Journal of Educational Research 6*(9), 1974-1980.

Demir, M. K. (2012). Investigation of the epistemological beliefs of primary school candidate teachers. *Journal of Uludag University Faculty of Education, 25*(2), 343-358.

Deringol, Y. (2017). Determining critical thinking standards of teacher candidates. *Igdır University Journal of Social Sciences,* 13, 44-65.

Deryakulu, D. (2014). Epistemological beliefs. In Kuzgun Y. & D. Deryakulu (Eds), *Individual differences in education* (pp. 261-289). Nobel Publication.

Dinc, E., Inel, Y. & Uztemur, S. (2016). Epistemic belief inventory: Its adaptation into Turkish and the testing of its validity and reliability. *Ahi Evran University Journal of Kırsehir Education Faculty*, *17*(3), 767-783.

Dunekacke, S., Jenßen, L., Eilerts, K. & Blömeke, S. (2016). Epistemological beliefs of prospective preschool teachers and their relation to knowledge, perception, and planning abilities in the field of mathematics: a process model. *ZDM, 48*(1-2), 125-137.

Durmus, B., Yurtkoru, E. S. & Cinko, M. (2011). *Data analysis with SPSS in social sciences*. Beta Publication.

Egmir, E. & Ocak, I. (2020). The relationship between teacher candidates' critical thinking standards and reflective thinking skills. 156-170. *International Journal of Progressive Education, 16*(3), 156-170. https://doi.org/10.29329/ijpe.2020.248.12

Ennis, R. (1996). Critical thinking dispositions: Their nature and assess ability. *Informal Logic, XVIII*(2), 165-182.

Eryaman, M. Y. (2007). From reflective practice to practical wisdom: Toward a post-foundational teacher education. *International Journal of Progressive Education*, *3*(1), 87-107.

Facione, P.A. (2004). *Critical thinking: What it is and why it counts*. Academic Press.

Frankel, J. R. & Wallen, N. E. (2009). *How to design and evaluate research in education* (7th Ed.). Mcgraw-Hill.

George, D., & Mallery, P. (2016). *IBM SPSS statistics 23 step by step: A simple guide and reference* (13. Ed). Routledge.

Gurkaynak, I., Ustel, F. & Gulgoz, S. (2008), *Critical thinking.* Education Reform Initiative.

Guven, M. & Kurum, D. (2008). The relationship between teacher candidates' learning styles and critical thinking dispositions. *Elementary Education Online, 7*(1). 53-70

Hofer, B. (2001). Personal epistemology research: Implications for teaching and learning. *Journal of Educational Psychology Review, 13*(4), 353–383.

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

Hofer, B. K. (2004). Epistemological understanding as a metacognitive process: Thinking aloud during online searching. *Educational Psychologist* 39, 43 - 55.

Hyytinen, H., Holma, K., Toom, A., Shavelson, R. J., & Lindblom-Ylanne, S. (2014). The complex relationship between students' critical thinking and epistemological beliefs in the context of problem solving. *Frontline Learning Research*, *2*(5), 1-25.

Incikabi, L., Tuna, A. & Biber, A. Ç. (2013). An analysis of mathematics teacher candidates' critical thinking dispositions and their logical thinking skills. *Journal of International Education Research, 9*(3), 257-266.

Kandemir, S. N., & Egmir, E. (2020). The effect of epistemological beliefs of secondary school students on critical thinking tendency and academic self-efficacy. *International Journal of Euroasian Researches, 8*(24), 178-208. https://doi.org/10.33692/avrasyad.831759

Koc, S. & Memduhoglu, H. (2017). Epistemological beliefs of preservice teachers: A mixed method study. *Electronic Journal of Social Sciences, 16*(60), 119-134. https://doi.org/10.17755/esosder.289655

Koyunlu Unlu, Z., & Dokme, I. (2017). Science teacher candidates' epistemological beliefs and critical thinking disposition. *Eurasian Journal of Educational Research,* 72, 203-220. https://doi.org/10.14689/ejer.2017.72.11

Kosemen, S. & Sahin, A. (2014). An evaluation of teachers' views towards social studies curriculum in connection with their epistemological beliefs. *Journal of Theory and Practice in Education, 10*(1), 279-296.

Kusaeri, K. (2019). Pedagogical beliefs about critical thinking among Indonesian mathematics pre-service teachers. *International Journal of Instruction, 12*(1), 573-590. https://doi.org/10.29333/iji.2019.12137a

Kuvac, M. & Koc, I. (2014). Preservice science teachers' critical thinking dispositions: Istanbul university sample. *Turkish Journal of Education, 3*(2), 46-59. https://doi.org/10.19128/turje.181081

Mason, L., Ariasi, N., & Boldrin, A. (2011). Epistemic beliefs in action: spontaneous reflections about knowledge and knowing during online information searching and their influence on learning. *Learning and Instruction, 21*(1), 137-151. https://doi.org/10.1016/j.learninstruc.2010.01.001.

Meral, M. & Colak, E. (2009). Investigating student teachers' scientific epistemological beliefs. *Ondokuz Mayis University Journal of Education Faculty,* 27, 129-146.

Moore, T. (2004) The critical thinking debate: How general are general thinking skills? *Higher Education Research & Development, 23*(1), 3-18, https://doi.org/10.1080/0729436032000168469

Nosich, G. M. (2015). *Learning to think things through a guide to critical thinking across the curriculum.* (B. Aybek, Trans.). Ani Publication. (Original work published 2001).

Ozgenel, M. & Cetin, M. (2018). Development of the marmara critical thinking dispositions scale: validity and reliability analysis. *International Journal of Eurasia Social Sciences, 9*(32), 991-1015.

Paul, R. & Elder, L. (2013). *Critical thinking* (A. E. Aslan & G. Sart, Trans. Eds.). Nobel Publication. (Original work published 2012).

Paul, R. W. (1993). *Critical thinking: How to prepare students for a rapidly changing world*. Foundation for Critical Thinking.

Qing, Z., Jing, G. & Yan, W. (2010). Promoting preservice teachers' critical thinking skills by inquiry-based chemical experiment. *Procedia-Social and Behavioral Sciences, 2*(2), 4597-4603. https://doi.org/10.1016/j.sbspro.2010.03.737

Riedler, M. & Eryaman, M.Y. (2016). Complexity, diversity and ambiguity in teaching and teacher education: practical wisdom, pedagogical fitness and tact of teaching. International Journal of Progressive Education, 12(3), 172-188.

Saputro, A. D., Atun, S., Wilujeng, I., Ariyanto, A., & Arifin, S. (2020). Enhancing pre-service elementary teachers' self-efficacy and critical thinking using problem-based learning. *European Journal of Educational Research, 9*(2), 765-773. https://doi.org/10.12973/eu-jer.9.2.765

Saritas S. & Yildirim M. (2020). Determination of critical thinking trends of operating room nurses. *Acibadem University Health Sciences Journal, 11*(2), 252-256. https://doi.org/10.31067/0.2019.123

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

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

Schommer, M. (1998). The role of adults' beliefs about knowledge in school, work, and everyday life. In M. C. Smith & T. Pourchot (Eds.), *Adult learning and development: Perspectives from educational psychology* (pp. 127-143). Lawrence Erlbaum Associates.

Schommer-Aikins, M. (2004). Explaining the epistemological belief system: Introducing the embedded systemic model and coordinated research approach. *Educational Psychologist, 39*(1), 19-29.

Schraw, G., Bendixen, L. D., & Dunkle, M. E. (2002). Development and validation of the epistemic belief inventory. In B. Hofer, & P. R. Pintrich (Eds.), *Personal epistemology: The psychology of beliefs about knowledge and knowing* (pp. 261- 277). Lawrence Erlbaum.

Sinatra, G. M., & Kardash, C. M. (2004). Teacher candidates' epistemological beliefs, dispositions, and views on teaching as persuasion. *Contemporary Educational Psychology, 29*(4), 483-498. https://doi.org/10.1016/j.cedpsych.2004.03.001

Sen, Ü. (2009). An evaluation about turkish teacher candidates' critical thinking attitudes in terms of difference variable. *Journal of World of Turks, 1*(2), 69-89.

Sivgin, C. (2019). *Examination of relationships between high school students' critical thinking skills, epistemological beliefs and science process skills* [Unpublished master's thesis]. Marmara University.

Tabachnick & Fidell (2013). *Using multivariate statistics* (6. ed.). Pearson.

Taskin, C. S. (2012). Epistemological beliefs: As predictors of preservice teachers' learning aprroaches. *Mustafa Kemal University Journal of Social Sciences Institute, 9*(19), 273-285.

Tempelaar, D. T. (2006). The role of metacognition in business education. *Industry and Higher Education, 20*(5), 291–297.

Terzi, A. R., Dulker, A. P., Derin, R. & Terzi, A. (2020). The relationship between pre-service teachers' attitudes towards philosophy course and their critical thinking dispositions. In V.

Krystev, M. S. Dinu, R. Efe & E. Atasoy (Edt.) *Advences in social science research* (pp. 10-29). St. Kliments Ohridski University Press.

Turkan, A., Aydin, H. & Üner, S. S. (2016). The relationship between teacher candidates' attitudes towards multicultural education and their epistemological beliefs. *Elemantary Education Online, 15*(1). 148-159. http://dx.doi.org/10.17051/io.2016.16818

Uztemur, S., & Dinç, E. (2018). Comparative analysis of epistemological beliefs of history and social studies student teachers. *Journal of Anatolian Cultural Research, 2*(2), 41-64.

Yadav, A., & Koehler, M. (2007). The role of epistemological beliefs in preservice teachers' interpretation of video cases of early-grade literacy instruction. *Journal of Technology and Teacher Education, 15*(3), 335-361.

Yildirim, C. (1997). *Bilimsel düşünme yöntemi* [Scientific thinking method]. Bilgi Publication.

Zhang, L. F. (2003). Contributions of thinking styles to critical thinking dispositions. *The Journal of Psychology, CXXXVII*(6), 517-544.