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EXAMINATION OF PRE-SERVICE TEACHERS' METACOGNITION ACCORDING TO THEIR EPISTEMOLOGICAL BELIEF LEVELS

Research article

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Abstract

With the constructivist approach, learners are expected to construct and internalize knowledge and transfer it to their daily lives. One of the most important factors in the process of constructing knowledge is metacognition and the other is epistemological belief. The aim of this study is to examine pre-service teachers' metacognition according to their epistemological belief levels. The research has been a causal-comparative research, which is one of the quantitative research types. The study group consists of 312 pre-service teachers who participated voluntarily and were determined by simple random sampling technique. Data has been collected using the metacognition and epistemological belief scale. Mean, correlation, one-way analysis of variance and post hoc analyses have been used in this study. According to the results of the research, the relationship between pre-service teachers' meta-cognition and epistemological belief levels is moderately positive. There is a significant difference between pre-service teachers' epistemological belief levels and metacognition. Participants with high epistemological beliefs have higher metacognition than participants with both moderate and low epistemological beliefs. Likewise, pre-service teachers with moderate epistemological beliefs have higher metacognition than pre-service teachers with low epistemological beliefs.

Keywords: Pre-service teachers, Metacognition, Epistemological belief

1. Introduction

With the replacement of traditional education with contemporary education, the behaviorist approach has been shifted to the constructivist approach. This transition has brought subjective knowledge to the forefront rather than objective knowledge. Epistemology, which expresses the beliefs of individuals in knowledge, and metacognition, which expresses how to plan, implement and evaluate the process of acquiring knowledge, play an important role in the formation of subjective knowledge. The concept of metacognition was first put forward by Flavell in 1971. However, it dates back to the 17th century statement of Spinoza, "If a person knows something, he also knows that he knows it" (Karakelle and Saraç, 2010). Normally, our process of acquiring knowledge is expressed as cognition, while metacognition is our awareness of how we acquire knowledge, how we apply it, and how we evaluate it.

Metacognition is the ability of learners to be aware of their own thinking processes and to direct this process so that they can think independently (Welton & Mallan, 1999). Metacognition is the affective readiness and motivation of individuals about what they know and how they apply this knowledge by regulating their own thinking (Deniz, 2017). In another definition, metacognition is defined as knowing about one's own cognitive system, questioning

the thinking system, and being aware of and controlling mental processes during perception, processing and remembering (Huitt, 1997). Today, with the development of information technologies, it has become easier for students to access information. For this reason, rather than reaching and memorizing information, it is expected to reach the information sought in accordance with its purpose in the abundance of information, to use it and to make sense of it. This depends on the learners' metacognitive controls.

If the student is able to ask and answer the following questions about a topic they are dealing with:

- What do I know about the subject?
- How much time do I need to learn?
- How should I plan and follow the path to learn the subject in the most effective way?
- How should I review and correct the plan's failings?
- How do I find it if I make a mistake in the learning process?
- Does the resulting product from the process meet my expectations?
- If not, how should I change my schedule?

It is an indicator of the student's own meta-cognitive control knowledge (Senemoğlu, 2003).

In order to better understand metacognition, it is necessary to distinguish between cognition and metacognition. Flavell (1993) distinguishes between cognition and metacognition. He explains that metacognition is the knowledge that organizes any element of the cognitive process we carry out. According to Yurdakul and Demirel (2011), "cognitive strategies are activities that help individuals achieve their learning goals, and metacognitive strategies are activities that help determine and control whether the goal is achieved." Metacognition generally refers to the individual's capacity to control and reflect other cognitive processes (McWilliams et al., 2023). In other words, they stated that metacognitive strategies activate other cognitive strategies in order to achieve goals in learning and thinking.

Learners with metacognitive skills are expected to have some different skills. These are as follows

- Being aware of himself and his ways of learning,
- Acting consciously,
- Ability to control himself,
- Ability to plan their learning,
- Monitoring how you learn,
- Self-regulation,
- Self-evaluation (Doğanay, 1997).

In order for individuals to be aware of their own cognitive processes, to be able to question and evaluate their cognitive processes, their beliefs and attitudes towards knowledge, that is, their epistemological beliefs, are extremely important. Students with advanced epistemological beliefs use more information processing strategies in the learning process, show higher academic success in controlling their learning more frequently and accurately, develop positive attitudes towards school, and develop different ideas with deep and versatile perspectives (Deryakulu & Büyüköztürk , 2005). Cognitive strategies, changes and awareness that will be formed in pre-service teachers through epistemological beliefs will affect their learning skills and their teaching behaviors and teaching performances in their professional life (Cheng, Chan, Tang, & Cheng, 2009). Hofer and Pintrich (1997) define epistemological belief as individuals' beliefs about the nature of knowledge and how knowing occurs. Epistemological belief is

individuals' beliefs about what knowledge is and how they learn this knowledge (Deryakulu, 2004). When we look at the definitions made about epistemological beliefs in the literature, we see that the concept is defined as subjective beliefs, intuitions, perspective and attitude towards knowledge, opinions and thoughts about the nature of learning (Kaplan, 2006).

Individuals with and without improved epistemological belief levels have very different perspectives on knowledge and learning. According to Schommer (1990), epistemological beliefs of individuals are divided into two as improved epistemological belief and unimproved epistemological belief. Individuals with unimproved epistemological beliefs see information as simple and precise. They also argue that learning occurs instantly and learning ability is determined at birth and cannot be improved later. According to Cheng et al., (2009), individuals with improved epistemological beliefs tend to question the source of knowledge, believing that learning effort is more important than innate learning ability, that knowledge can change. In addition, pre-service teachers with improved epistemological beliefs are more open to knowledge construction and persuasive teaching (Sinatra & Kardash, 2004) and are more successful in web-based learning, which is the learning style of our age (Tsai, Tsai, & Hwang, 2011).

It is assumed that examining pre-service teachers' metacognition, which will play an important role in the education system, according to their epistemological belief levels, which means their belief in knowledge, will contribute to the literature. In this context, the study has been carried out within the framework of one general research question and four sub-questions.

1.2. Main research question:

What is the meta-cognition of pre-service teachers according to their epistemological belief levels?

1.2.1 Sub-research questions:

1. What are the metacognition levels of pre-service teachers?
2. What are the epistemological belief levels of pre-service teachers?
3. Is there a significant relationship between pre-service teachers' metacognition and their epistemological beliefs?
4. Is there a significant difference between the epistemological belief levels and metacognition of pre-service teachers?

2. Method

2.1. Aim of The Research

In the study, it is aimed to examine the metacognition of pre-service teachers according to their epistemological belief levels.

2.2. Research Method

Causal-comparative research, which is one of the quantitative research types, has been used in this study. The scores of the pre-service teachers from the epistemological belief scale have been divided into three levels as high, moderate and low according to the mean and standard deviations (X±1SD). These levels have been accepted as the independent variable, and their metacognition has been accepted as the dependent variable. The difference between causal-comparative research and experimental research is that the variable in causal-comparative research is an unmanipulated one (Fraenkel, Wallen, & Hyun, 2011).

2.3. Study Group

The study group consists of 312 pre-service teachers who filled out the scales completely, volunteered to participate in the research, and were chosen by simple random sampling technique. 185 of the participants were female (59.30%) and 127 were male (40.70%). Of the pre-service teachers, 102 (32.69%) are studying in classroom teaching, 90 (28.84%) in science teaching, 72 (23.07%) in Turkish teaching and 48 (15.38%) in special education teaching departments.

2.4. Data Collection

In the study, meta-cognition and epistemological belief scales have been applied to the participants as a data collection tool.

Metacognition Scale: Developed by Turan (2009) in his doctoral study, the scale has 28 items, a five-point Likert structure, and is one-dimensional. The scores that can be obtained from the scale range from 28 to 140. There is no reverse scored item in the scale. The Cronbach Alpha value of the scale is 0.91. The reliability coefficient for the sample in this study is 0.875.

Epistemological Belief Scale: Epistemological Belief Scale, originally developed by Schommer (1993), translated into Turkish by Deryakulu and Büyüköztürk (2002), and updated by Aydın, Selçuk, Çakmak, and İlğan (2017) and applied to 1242 pre-service teachers for validity and reliability has been used in this study. The scale has 23 items, three sub-dimensions and a five-point Likert structure. The reliability coefficients for the sub-dimensions of the scale have been calculated as 0.88 for the effort dimension, 0.88 for the ability dimension, and 0.85 for the single correct dimension, and it is 0.889 for the sample in this study.

2.5. Data Analysis

In order to determine the epistemological belief and metacognition levels of the participants with the 1st and 2nd sub-questions of the research, the mean of the scores of the participants from the scales has been examined. Pearson correlation analysis has been used to determine the relationship between epistemological belief and metacognition, which is the third sub-question, and one-way analysis of variance to determine whether there is a significant difference in metacognition according to the fourth sub-question epistemological belief levels. Post hoc analyses have been performed to determine which groups the difference favored.

3. Findings

In order to determine the metacognition levels of the pre-service teachers, which is the first sub-question of the research, the average scores of the participants from the metacognition scale have been examined and the results are given in Table 1.

Table 1. *Descriptive statistics of the metacognition scale*

N	Minimum	Maximum	Mean	Standard Deviation
312	37	132	95.60	15.61

According to Table 1, the values of pre-service teachers' scores from the metacognition scale are 37 minimum, 132 maximum. Their mean is 95.60, and their standard deviation is 15.61. Since the scores that can be taken from the scale are between 28 and 140, the level of metacognition between 28 and 65 points is low, between 66 and 102 points is moderate and

between 103 and 140 points is high. According to this average, pre-service teachers' metacognition levels are moderate. In order to determine the epistemological belief levels of the participants with the second sub-question of the study, the average scores of the participants from the scale have been examined and the results are given in Table 2.

Table 2. *Descriptive statistics of the epistemological belief scale*

N	Minimum	Maximum	Mean	Standard Deviation
312	63	110	83.12	Ara.43

According to Table 2, the scores of the pre-service teachers from the epistemological belief scale are 63 minimum, 110 maximum. Their mean is 83.12 and their standard deviation is 12.43. Since the scores that can be taken from the scale are between 23 and 115, the epistemological belief level between 23 and 54 points is low, between 55 and 85 points is moderate and between 86 and 115 points is high. According to this average, the epistemological belief levels of the participants are moderate.

Pearson correlation analysis has been performed to determine the relationship between pre-service teachers' metacognition and epistemological beliefs, and the results are given in Table 3.

Table 3. *Results of correlation analysis between metacognition and epistemological belief*

	Independent Variable Epistemological Belief		
Dependent Variable	N	r	p
Metacognition	312	.379	.00**

Note **p ≤ .01.

According to the results of the Pearson correlation analysis in Table 3, it shows that there is a statistically significant relationship between the scores of the pre-service teachers from the metacognition scale and the scores they got from the epistemological belief scale (r = .379 ; **P < .01). An r value of .379 indicates that this relationship is moderate and positive.

The epistemological beliefs of the pre-service teachers participating in the study were divided into three levels: high, moderate and low. Descriptive statistics for these three levels are given in Table 4.

Table 4. *Descriptive Statistics of the Scores of the Participants from the According to the Levels of Epistemological Belief Scale*

Epistemological Belief Levels	N	Mean	Standart Deviation
High	110	102.10	15.59
Moderate	89	97.17	14.72
Low	113	88.04	Ara.99
Total	312	95.60	15.61

According to Table 4, participants with high epistemological beliefs have higher mean scores than those with moderate and low epistemological beliefs. Those with moderate epistemological beliefs have a higher mean than those with low epistemological beliefs.

Another question to be answered in the study is one-way analysis of variance (ANOVA) to determine whether there is a significant difference between the participants' metacognition and epistemological belief levels, and the results are given in Table 5.

Table 5. *One-Way Analysis of Variance (ANOVA) Results between Metacognition Scale and Epistemological Belief Scale Levels*

Dependent Variable	df	Square of Means	F	p
Between Groups	2	5.666.851	27.482	.00**
In Groups	309	208.682		
Total	311			

Note **p ≤ .01.

As seen in Table 5, according to the results of the one-way analysis of variance, a significant difference has been found between pre-service teachers' metacognition and epistemological belief levels F(2, 309)= 27.482, p<.001). In order to determine which groups this difference is in favor of, post hoc analysis has been performed and the results are given in Table 6.

Table 6. *Results of Post hoc Analysis Between Metacognition Scale and Epistemological Belief Scale Levels*

(I)	(J)	Difference of Means (I-J)	Standart Error	p
HLBE	MLBE	4,92	2,05	.017*
	LLEB	14,06	1,93	.00**
MLBE	LLEB	9,13	2,04	.00**

Note. *M* = *p ≤ .05. **p ≤ .01. HLEB: High Level of Epistemological Belief, MLEB: Moderate Level of Epistemological Belief, LLEB: Low level of Epistemological Belief

As seen in Table 6, the mean scores of pre-service teachers with high epistemological beliefs in the metacognition scale differ statistically significantly from those with both moderate and low epistemological beliefs. This difference is significant at the moderate level (p<.05) and at the low level group (p<.01). In addition, the scores obtained from the metacognition scale of the participants with moderate epistemological beliefs differ statistically significantly compared to the participants with low epistemological beliefs. The difference between the moderate and low level groups is also significant at the (p<.01) level.

4. Discussion and Conclusion

In this study, the causal-comparative research, which is one of the quantitative research types, has been used. It has been aimed to examine the metacognition of pre-service teachers according to their high, moderate and low epistemological belief levels. Data collected from 312 pre-service teachers with metacognition scale and epistemological beliefs scale have been analyzed with mean, pearson correlation, one-way analysis of variance and post hoc analyses.

Pre-service teachers' meta-cognitive skill levels have been found to be moderate. Karakuyu and Uyar (2020) emphasize the importance of metacognition so that teachers and students can make the necessary evaluations and corrections in the learning and teaching process. In addition, metacognition plays a leading role in strengthening the links between education and training (Tobias, 2013). Metacognition is one of the factors that enable pre-service teachers to identify effective teaching skills and reflect them on their practice skills (Wiens et al., 2021) and has an advanced effect on inductive learning (Lee & Ha, 2019). In this respect,

metacognition is an important concept for both teachers and pre-service teachers. In the literature, in which different studies have been conducted with both pre-service teachers in general and pre-service teachers on the basis of different branches, the level of metacognition has been found to be at moderate or high levels. Sapancı (2012) finds pre-service teachers' meta-cognition levels to be moderate in his study. Özsoy, Çakıroğlu, Kuruyer, and Özsoy (2010) reveal in their study with pre-service classroom teachers that they have a moderate level of metacognitive awareness. Özsoy and Günindi (2011) find that pre-service teachers have a moderate-high level of metacognitive awareness in their study with pre-service teachers. Baysal, Ayvaz, Çekirdekçi, and Malbeleği (2013) and Aykut, Karasu, and Kaplan (2016) find a high level of metacognition in their studies with special education pre-service teachers.

In the second sub-question of the study, the epistemological belief levels of the pre-service teachers have been found to be moderate. In other words, pre-service teachers' perspectives on the limits of knowledge, its source and perspectives on knowledge and learning are at a moderate level. According to Hashweh (1996), the high epistemological belief levels of pre-service teachers are important because these teachers will use more teaching strategies than other teachers. According to Erdem, Yılmaz, and Akkoyunlu (2008), epistemological beliefs are important as they will be effective in the learning of both teachers and students. Kosa (2018) in his master's study, and Güler (2015) in his doctoral study find the epistemological belief levels of pre-service teachers at a moderate level. Özdemir (2019), Yorulmaz, Can, and Çokçalışan (2017) find that the epistemological belief levels of prospective pre-school teachers have been moderate in their study with prospective pre-school teachers. Kaleci (2012), on the other hand, reaches the same results in his study with pre-service mathematics teachers.

Another question to be answered in the research is the relationship between the participants' metacognition and their epistemological beliefs. As a result of the pearson correlation analysis, a moderate and positive relationship has been found between the two variables. Metacognition, being aware of the process of acquiring knowledge and self-management of the process, are two closely related concepts in that epistemological belief is the individual's belief in knowledge. According to Schommer-Aikins (2004), epistemological beliefs emphasize how students learn, how teachers teach, and how teachers change these beliefs of students, that is, they affect their metacognitive skills. Kuhn (2001) emphasizes the relationship between the two concepts by expressing that in order to understand metacognition, which is about the processes of knowing and acquiring knowledge, and individuals' understanding of their own knowledge, their epistemological beliefs should be examined. In their study with pre-service teachers, Otting et al. (2010) determine a constructive relationship between students' epistemological beliefs and their understanding of teaching and learning, similar to the findings of this study. Savoji, Niusha, and Boreiri (2013) identify a relationship between high school students' epistemological beliefs, their self-regulated learning strategies, and their academic achievements, and point to metacognition. In the literature, it has been determined that there is a significant relationship between metacognition and epistemological beliefs or sub-dimensions of epistemological beliefs (Deryakulu, 2004; Güven & Belet, 2010; Özgelen, Yılmaz-Tüzün, & Hanuscin, 2010; Belet & Güven, 2011; Sapancı , 2012; Endeavor, 2018; Lonka, Ketonen and Vermunt, 2021).

In order to determine whether there is a significant difference between the high - moderate - low epistemological belief levels of the pre-service teachers and their metacognition, a statistically significant difference has been found as a result of the ANOVA analysis, and post hoc analyses have been carried out to determine which group this difference is in favor of. Participants with high epistemological beliefs have higher metacognition than those with both moderate and low beliefs, and those with moderate belief have higher metacognition than those with low belief. According to this finding, high epistemological belief levels of pre-service

teachers are important during the processes of acquiring knowledge, learning and teaching. Pre-service teachers with low epistemological beliefs believe that knowledge is certain and unchanging, and they will not make any effort to improve their metacognitive skills and strategies because they think that learning is an innate ability. In some studies (Çınar, 2007; Özkan, 2008; Demir, 2009; Liang & Tsai, 2010; Koç, 2015) it has been determined that epistemological beliefs have an important role in individuals' learning, understanding and interpreting what is happening around them.

In conclusion, the metacognition levels of the pre-service teachers, who will be a guide in the process of acquiring knowledge in their professional life, has been examined according to their epistemological belief levels, the metacognition levels, and epistemological beliefs of the pre-service teachers have been found at a moderate level, and a moderate positive relationship has been found between them. In addition, there is a significant difference between the metacognition levels of these pre-service teachers according to their epistemological belief levels. This difference is significant in favor of those with high epistemological belief levels compared to those with moderate and low belief levels, and in favor of those with moderate epistemological beliefs when compared with those with low belief levels. Therefore, the metacognition levels of pre-service teachers increase as their epistemological belief levels increase.

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