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Examination of Critical Thinking Standards and Academic Self-Efficacy of Teacher Candidates as a Predictor of Metacognitive Thinking Skills through Structural Equation Modelling

Üstbilişsel Düşünme Becerilerinin Eleştirel Düşünme Becerileri ve Akademik Öz-Yeterlik ile İlişkisinin Yapısal Eşitlik Modellemesi ile İncelenmesi

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ABSTRACT: The aim of this research is to examine the structural relationships between metacognitive thinking skills, critical thinking standards and academic self-efficacy of teacher candidates. The research was carried out according to the relational survey method and structural equation modelling was done in the analysis of the data. The data of the study were obtained from 244 teacher candidates. Personal information form, Critical Thinking Standards Scale, Metacognitive Thinking Scale and Academic Self-Efficacy Scale were used as data collection tools in the study. The findings of the research show that the teacher candidates have a positive moderate relationship between critical thinking standards and metacognitive thinking skills. There appears to be a positive low level of relationship between critical thinking standards and academic self-efficacy. There appears to be a positive moderate relationship between metacognitive thinking skills and academic self-efficacy. Various suggestions have been made to investigators and researchers in the findings obtained from the research.

Keywords: teacher candidates, critical thinking, metacognitive thinking, academic self-efficacy.

ÖZ: Bu araştırmanın amacı; öğretmen adaylarının üstbilişsel düşünme becerileri ile eleştirel düşünme becerileri ve akademik öz-yeterlikleri arasındaki yapısal ilişkileri incelemektir. Araştırma ilişkisel tarama yöntemine göre yürütülmüş olup, verilerin analizinde yapısal eşitlik modellemesi yapılmıştır. Araştırmanın verileri 244 öğretmen adayından elde edilmiştir. Araştırmada veri toplama aracı olarak; kişisel bilgi formu, Eleştirel Düşünme Standartları Ölçeği, Üstbilişsel Düşünme Ölçeği ve Akademik Öz-Yeterlik Ölçeği kullanılmıştır. Araştırma bulguları, öğretmen adaylarının eleştirel düşünme becerileri ile üstbilişsel düşünme becerileri arasında pozitif yönlü orta düzeyde, eleştirel düşünme becerileri ile akademik öz-yeterlikleri arasında pozitif yönlü düşük düzeyde, üstbilişsel düşünme becerileri ile akademik öz-yeterlikleri arasında pozitif yönlü orta düzeyde bir ilişkinin olduğunu göstermektedir. Araştırmadan elde edilen bulgular ışığında uygulayıcılara ve araştırmacılara yönelik çeşitli önerilerde bulunulmuştur.

Anahtar kelimeler: öğretmen adayları, eleştirel düşünme, üstbilişsel düşünme, akademik öz-yeterlik.

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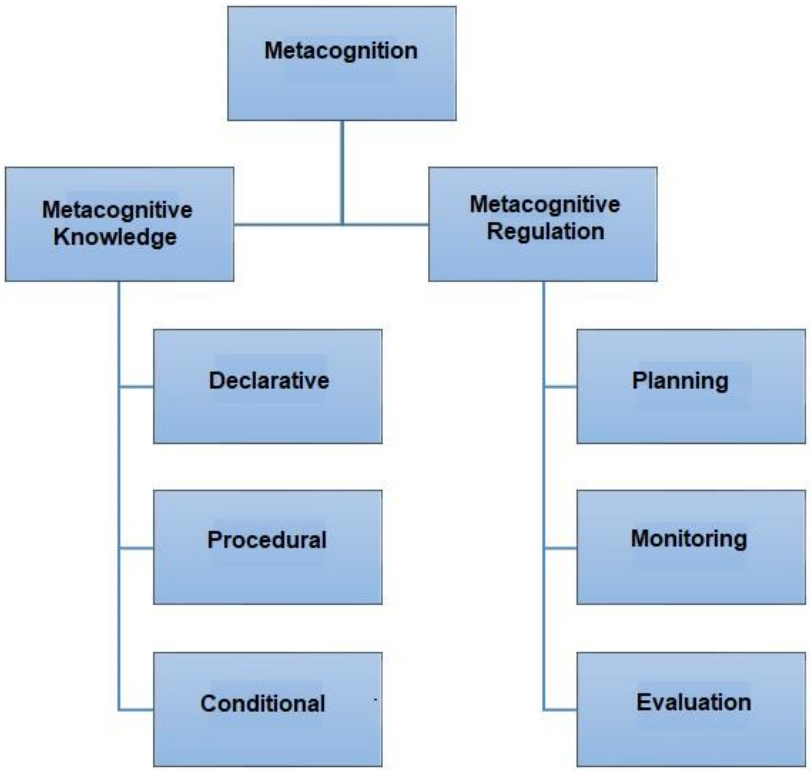
Introduction

In recent years, it has been seen that concepts such as learning to learn, effective learning, collaboration, and self-learning with technology come to the fore in the educational literature. In this sense, the concept of metacognition is an element that supports a student in gaining the student's self-learning ability (Akpunar, 2011). The main reason why the concept of metacognition comes to the forefront in the learning-teaching process is the assumption that metacognition promotes learner autonomy (Yılmaz, 2014).

In the literature, the concept of metacognition initially introduced by Flavell (1979) who defines metacognition as an individual's awareness of his/her own learning process. According to the definition, it is a result of metacognitive awareness that the individual is able to know best how to learn, develop and use effective strategies for learning, make self-evaluation about what and how much s/he learns as a result of the learning process. Brown (1987) discusses metacognition under the two dimensions as "Knowledge of Cognition" and "Regulation of Cognition" (see Figure 1). Cognitive knowledge can be classified into three central components which are declarative knowledge, procedural knowledge and conditional knowledge. This knowledge aids students to organize learning resources and to effectively utilize learning strategies.

Figure 1. Brown's (1987) Model of Metacognition



Declarative Knowledge: The student knows how to learn about his/her own learning. For instance, it is declarative knowledge that a student knows that s/he can't learn in the best way just by listening to the teacher. Successful students have a high

level of declarative knowledge and use this knowledge to a great degree in their learning processes.

Procedural Knowledge: The student knows what strategies should be employed in order to make a job or task in the best way. An example of procedure knowledge is that a student who knows that s/he can't learn in the best way just by listening to the teacher employs a variety of strategies such as taking notes while listening to the teacher, repeating things s/he was taught, taking advantage of additional resources in order to be able to make an effective learning. These strategies that students can benefit from in the learning process will help students to carry out meaningful learning.

Conditional Knowledge: Students know why and when to use learning strategies. If the student is not aware that a strategy s/he is applying is not useful in the learning process, s/he will continue to use it. For instance, it is a conditional knowledge that a student knows that s/he needs to highlight significant points to be able to learn effectively. This student sees her/his classmate who utilizes the summarizing strategy to comprehend a topic and uses this strategy. S/he realizes that this strategy is more effective than the strategy s/he previously used. This awareness that the student has developed demonstrates that the student has her/his advanced conditional knowledge.

Regulation of cognition is in the second category of the metacognitive model proposed by Brown (1987). It includes activities associated with the regulation of cognition, control and management of learning. These activities are planning, monitoring and evaluation.

Planning: It is the process of choosing appropriate strategies and preparing cognitive resources before learning. For instance, the student plans to read an article. Spending enough time to read and checking prior knowledge by looking at the important points in the article are given as examples of the process of planning for the student.

Monitoring: In a sense, monitoring enables the student to develop awareness associated with his/her performance in the learning process. An example of monitoring performance in the learning process can be given that a group of students read an article and ask questions each other such as "what is the main topic of the article?" in relation to measuring what they understand. The student performs the control and management of the learning process through monitoring.

Evaluation: It is the process of determining the effectiveness of the strategy used by the student to achieve the goal. An example of the evaluation process can be given that the student utilizing the summarizing strategy realizes that this strategy is not very effective and then decides to apply a new strategy. When the student encounters a problem situation, s/he can make assessments about the solution process of the problem by using above-stated metacognitive strategies.

According to Brown (1987), the significant point in the metacognitive process is the regulation of cognition. A set of strategies and techniques are employed in the regulation of cognition. One of them is to get the student to ask himself/herself questions about his/her own learning processes. According to Blakey and Spence (1990), it is required that the student asks himself/herself questions directed towards planning the learning process at the beginning of the learning process, monitoring the learning process while continuing the learning process, and evaluating the learning

process at the end of the learning process and answers these questions in order to regulate his/her own cognition in this strategy.

The student might ask himself/herself the following questions related to the planning, monitoring and evaluating of his/her own learning process through this period (Karaoğlan Yılmaz, Olpak, & Yılmaz, 2018; Kujawa & Huske, 1995; Yılmaz, 2014; Yılmaz & Keser, 2017);

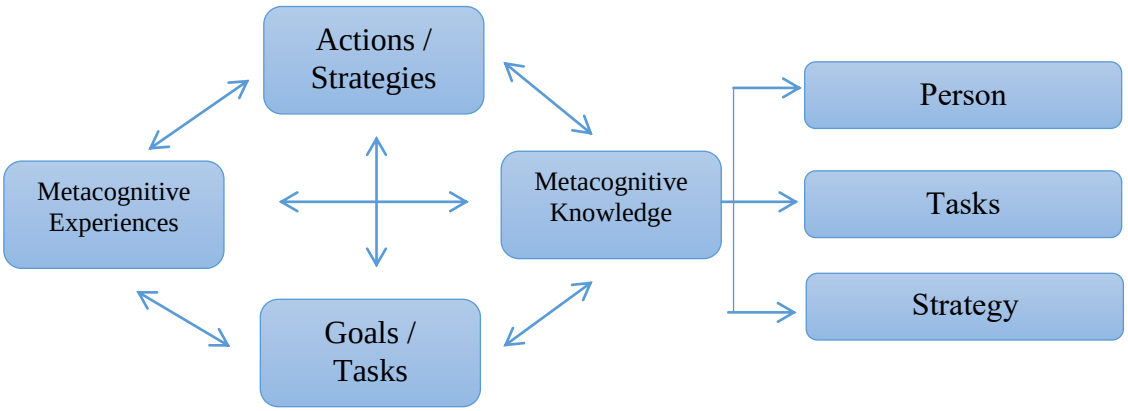
- In the planning process: "What information sources can help me in solving the present problem?", "What should I do first in the solution process?", "Where should I begin?", "Which strategy should I utilize?" etc.
- In the monitoring process: "Am I on the right track?", "Does the strategy I use work?", "What else can I do differently?" etc.
- In the evaluating process: "Did I do everything correctly?", "Is there anything I learn inadequately or wrongly?", "What did I learn from the task I did?" etc.

Researchers state that providing opportunities that enable the student to make planning, monitoring and evaluation practices that help him/her regulate his/her own cognitive processes will increase his/her metacognitive awareness and accordingly, metacognitive awareness will allow control and self-regulation on his/her thinking, learning processes and outcomes (Hartman, 1998; Karaoğlan Yılmaz, 2016; Yılmaz, 2014; Yurdakul, 2004).

According to Kuiper (2002), teaching the use of metacognitive strategies such as planning, monitoring and evaluation supports life-long reflective thinking, helps problem-solving, brings responsibility and develops self-confidence to make fast decisions. Metacognitive strategies for planning, monitoring and evaluation increase the level of the student's metacognitive awareness in respect to knowing cognitive resources and how to effectively and efficiently utilize all these resources in the best way. Successful learning can be achieved with the improvement of the level of metacognitive awareness (Livingston, 1997).

Flavell (1979) classifies metacognition into four components; metacognitive knowledge, metacognitive experiences, goals/tasks and actions/strategies. These four components are in constant interaction during the process of cognition control as seen in Figure 2.

Figure 2. Flavell's (1979) Model of Metacognition



Metacognitive knowledge, the first component in the metacognitive model of Flavell (1979), is related to the student's knowledge of his own cognitive processes. Flavell (1979) also categorizes metacognitive knowledge into three major variables including person, task, and strategy.

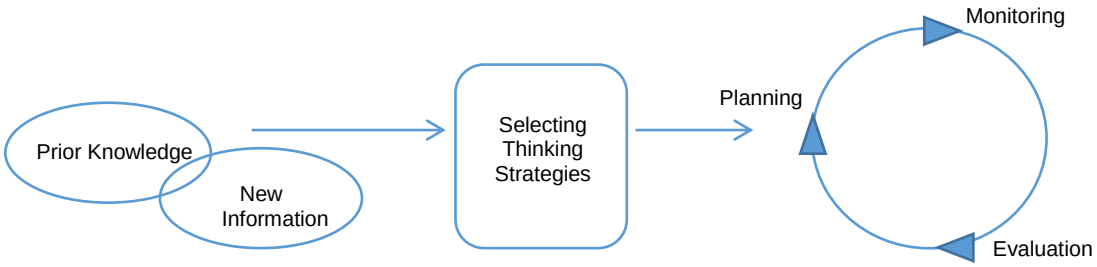
- *The person variables:* It is an individual's beliefs related to himself/herself and knowledge about himself/herself as a student. An example would be a student's self-belief that "I can use the word processor program well" (Yılmaz, 2014). The student thinks that these beliefs related to himself/herself will help him in the learning process. Flavell (1979) states that there are further three subcategories under this category: intraindividual, interindividual and cognitive generalizations.
    - *Intraindividual generalizations:* It is a person's beliefs towards himself/herself and knowledge about himself/herself.
    - *Interindividual generalizations:* It is a person's beliefs towards others and knowledge about others.
    - *Cognitive generalizations:* It is a person's generalizations that s/he determines towards all people, events and situations.
- *The task variables:* It is a knowledge that the individual has about the necessities of a task (job).
- *The strategy variables:* It is an individual's knowledge about strategies that s/he can apply when performing a task or solving a problem.

The metacognitive experience is another component in the metacognitive model. Metacognitive experiences are experiences that accompany a cognitive experience and are the feelings belonging to that experience. For example, it is a metacognitive experience that a student feels confused after encountering a new mathematical formula. Metacognitive experiences can take place frequently under similar circumstances. These experiences will also influence the interest of students and their similar learning in the future. Besides, another component is the goals or tasks in the metacognitive model. This component requires defining the goals or outcomes of a cognitive action in the model. An example would be that understanding of the workings of the internet is determined as the goal. The student's metacognitive knowledge and previous metacognitive experiences will be influential in completing the task successfully. The last component is the actions or strategies in the metacognitive model. Strategies are tactics and methods used to achieve the goal. Strategies require the planning, monitoring and regulation of cognition. For instance, a strategy can help the student understand how a mathematical formula works and how it should be used.

Blakey and Spence (1990) state that metacognition is a three-phase process. The phases of this process include;

a) Connecting new information to prior knowledge.
b) Selecting thinking strategies and
c) Carrying out the planning, monitoring, and evaluation during the thinking process

Figure 3. Metacognitive Processes (Blakey and Spence, 1990)



The student asks various questions about the planning, monitoring and evaluating phases and strives to manage his/her own cognition and learning process according to the answers given to these questions through the metacognitive process in Figure 3.

It can be pointed out that metacognition necessitates action to improve the situation by unveiling the current situation of the individual when looking into the structures described above about the concept of metacognition. In this sense, it can be stated that metacognitive thinking is based on a critical approach to the processes of the planning, monitoring and evaluation of the current situation of the individual and it is important for the individuals to have a developed academic self-efficacy in structuring these processes appropriately. However, when the literature was reviewed, any study investigating the structural relations between metacognitive thinking, critical thinking and academic self-efficacy was not found. Therefore, the aim of this study is to examine the structural relationships between metacognitive thinking skills and critical thinking standards and academic self-efficacy of teacher candidates. In the context of teacher candidates, this research that studies structural relationships between metacognitive thinking skills, critical thinking skills, and academic self-efficacy by handling them has a unique value. It is thought that the results of the study will contribute to the theoretical discussions associated with what can be done to improve the metacognitive thinking skills of teacher candidates.

Theoretical Framework and Hypotheses

The relationship between critical thinking skills and metacognitive thinking skills. Dewey defines critical thinking as supporting an idea and knowledge by considering an active, persistent and careful manner in the light of theoretical foundations and then making inferences (Dewey, 1909; as cited in Fisher, 2001). It is seen that Dewey defines critical thinking as an active process. Since, in the process of critical thinking, the individual is expected to have processes such as producing ideas on his/her own, asking himself/herself questions, and finding the relevant information on his/her own, as opposed to getting information or ideas from other people in a passive manner. Chance (1986) defines critical thinking as “the ability to analyze facts, generate and organize ideas, defend opinions, to make comparisons, draw conclusions, evaluate arguments and solve problems” (as cited in Huitt, 1998). It is seen that these skills indicated in the definition are related to the planning, monitoring and evaluation phases of the process of metacognitive thinking. Since, an individual is expected to reveal

his/her strengths and weaknesses by critically approaching his/her current situation, to plan towards overcoming deficiencies in his/her weaknesses by taking advantage of his/her strengths and to develop strategies for this in the planning phase of metacognitive thinking. However, the individual who cannot critically handle the planning phase of metacognitive thinking is not able to develop an effective strategy due to not being confidently aware of his/her strengths and weaknesses. In the monitoring and evaluation phases of the process of metacognitive thinking, the individual needs to critically approach the process in order to determine whether the strategies s/he developed work or not in the process and develop new strategies in place of the strategies that s/he can't take advantage. In this sense, it can be stated that critical thinking plays an important role in all phases of the process of metacognitive thinking. Therefore, it can be asserted that the development of individuals' critical thinking skills contributes to the development of their metacognitive thinking skills. However, it is seen that there is a need for research results that investigate the relationship between these two structures in terms of teacher candidates when the literature is examined. Thus, the first hypothesis of the study is as follows:

H1: *Critical thinking skills of teacher candidates are a significant predictor of metacognitive thinking skills.*

The relationship between academic self-efficacy and metacognitive thinking skills. Individuals' beliefs whether or not they can successfully achieve an academic task or educational and instructional goals at school can be referred to as academic self-efficacy (Bandura, 1997; Pajares, 2008). In other words, academic self-efficacy is addressed as the concept of self-efficacy in the context of school and academic tasks. The academic tasks that the student is expected to achieve throughout the education period, the perception of whether or not s/he can successfully perform are elucidated by the concept of academic self-efficacy (Bong & Skaalvik, 2003; Zimmerman, 2000). Students who have the perception of high academic self-efficacy aim to be successful, have positive expectations for achievement, enjoy taking risks, have the commitment to achieve academic tasks, don't give up when encountering difficulties, have no difficulties for self-control, have high confidence and are aware of their potential (Anderson, 2004). The perception of high academic self-efficacy that students have has various benefits. One of them is thought to be related to the contribution to the development of students' metacognitive thinking skills. For instance, a systematic review study conducted by Honicke and Broadbent (2016) revealed a moderate positive relationship between academic self-efficacy and academic performance. The student who has high academic self-efficacy will be able to more effectively organize the planning, monitoring and evaluation processes of metacognitive thinking. In these processes, the student is able to set attainable goals by being aware of his/her potential and will be able to evaluate whether or not s/he achieves these goals. If s/he has not achieved his/her goals, s/he will inquire about the reasons for this failure and generate new strategies to attain these goals. Therefore, the state of having advanced academic self-efficacy contributes to the development of students' metacognitive thinking skills. However, a student whose academic self-efficacy is not developed is not expected to demonstrate these behaviors. In this sense, it can be stated that academic self-efficacy plays an important role in the process of metacognitive thinking. Therefore, it can be asserted that the development of individuals' academic self-efficacy contributes to the

development of their metacognitive thinking skills. However, it is seen that there is a need for research results that investigate the relationship between these two structures in terms of teacher candidates when the literature is examined. Thus, the second hypothesis of the study is as follows:

H2: *The academic self-efficacy of teacher candidates is a significant predictor of metacognitive thinking skills.*

Method

Research Design

This study is designed as a correlational study to determine teacher candidates' metacognitive thinking skills, critical thinking skills and the level of academic self-efficacy and to investigate the structural relationships among them. As is known, survey models are models that aim to describe an event or situation as it exists. The event or situation is described in its own circumstances and as is (Creswell, 2012).

Study Group

The participants of this study consisted of 244 pre-service teachers who study in various departments of the faculty of education at a public university and voluntarily participate in the study. They were 116 (47.54%) first-year undergraduate students, 128 (52.46%) fourth-year undergraduate students. The participants of the undergraduate students were enrolled in the five departments including the Elementary Education (*f*=44, 18%), Social Science Teaching (*f*=52, 21.3%), the Turkish Language Teaching (*f*=43, 17.6%), Science Teaching (*f*=48, 19.6%), Elementary Mathematics Teaching (*f*=57, 23.5%). When the gender distribution of the undergraduate students was analyzed, it is seen that 60.7% (*f*=148) of them are female and 39.3% (*f*=96) of them are male. Their ages ranged from 18 to 25 years and the average was 19.82.

Data Collection Tools

The data were collected in the study by using the personal information form, the Metacognitive Thinking Scale, the Critical Thinking Standards Scale and Academic Self-Efficacy Scale.

Metacognitive Thinking Scale. The Motivated Strategies for Learning Questionnaire (MSLQ) was developed by Pintrich, Smith, Garcia and McKeachie (1991) and adapted into Turkish by Büyüköztürk, Akgün, Özkahveci and Demirel (2004). The aim of the scale is to determine the students' motivational orientations and their use of learning strategies in general. This scale consists of two essential sub-sections which are the motivation section that has 6 factors and the learning strategies section that has 9 factors and each section can be independently scored in a modular manner (Pintrich, Smith, Garcia, & McKeachie, 1993). Therefore, a metacognitive thinking subscale consisting of 12 items was used in this study. The scale has a seven-point Likert-type rating. The reliability (Cronbach alpha) value of the scale for the participants of this study is .81.

Critical Thinking Standards Scale. In order to measure students' critical thinking skills, critical thinking standards scale developed by Aybek, Aslan, Dinçer and

Arısoy (2015) consists of 42 items and three sub-dimensions (1- Depth, width and competence, 2- Precision and accuracy, 3- Importance, relevance and clarity). The scale has a five-point rating scale. The reliability value (Cronbach alpha) of the scale is .71 for the participants of this study.

Academic Self-Efficacy Scale. The scale developed by Owen and Froman (1988) to determine students' academic self-efficacy was adapted to Turkish by Ekici (2012). It consists of three sub-dimensions (1- Social status dimension, 2- Cognitive applications dimension and 3- Technical skills dimension) and 33 items. It has a five-point Likert-type rating. The reliability value (Cronbach alpha) of the scale is .93 for the participants of this study.

Data Analysis

In order to determine whether the data meet the requirements of structural equation modeling in the study, the data were analyzed in terms of sample size, linearity, normality and multiple linearity. Therefore, it was ascertained that the data were appropriate for structural equation modeling. Skewness-kurtosis (between -1 and +1) and Kolmogorov-Smirnov test (p>.05) were used to determine whether or not the distribution was normal, and normal distribution was found (Hair, Black, Babin, Anderson, & Tatham, 2013). The suitability of the data was analyzed for factor analysis via Kaiser-Meyer-Olkin (KMO) and Bartlett Sphericity. The test results showed that KMO values were .95 for the critical thinking standards scale, .88 for metacognitive thinking scale and .89 for the academic self-efficacy scale. It was found that KMO values were greater than .60 and the results of Bartlett Sphericity were significant (p<.05) so the data were suitable for factor analysis. Initially, the results of multiple correlation analysis were evaluated in order to determine the relations among the structures in the hypotheses. Then, a principal component analysis was used to explore the structural relationships between the scales. In the evaluation of the suitability of structural modeling; NFI, NNFI, X^2/df, RMSEA, GFI, AGFI and CFI fit indices were examined.

Findings

Findings Related to Scores Obtained from Scales

The results of the descriptive statistics related to students' responses to the scales are exhibited in Table 1.

Table 1

Descriptive Statistics

Scales	Number of items	Lowest score	Highest score	$\bar{X}$	*sd*	$\bar{X}/k$
Critical Thinking Standards Scale	42	97.00	173.00	140.89	13.78	3.35
Metacognitive Thinking Scale	12	24.00	84.00	55.67	12.04	4.64
Academic Self-Efficacy Scale	33	47.00	165.00	112.04	22.38	3.40

According to Table 1, it is seen that the participants' average score obtained from critical thinking standards scale was 140.89 (3.35 out of 5), their average score obtained from the metacognitive thinking scale was 55.67 (4.64 out of 7) and their average score obtained from academic self-efficacy scale was 112.03 (3.40 out of 5).

Based on (5-1)/3 evaluation interval, when the arithmetic average is between "1.00 – 2.33", "2.34 – 3.67" and "3.68 – 5.00" score range, the evaluation criterion is determined to respectively indicate low, moderate and high level for critical thinking standards scale and academic self-efficacy scale in the interpretation of the findings after data analysis (Kabakçı Yurdakul, 2011). Similarly, based on (7-1)/3 evaluation interval, when the arithmetic average is between "1.00 – 3.00", "3.01 – 5.00" and "5.01 – 7.00" score range, the evaluation criterion is determined to respectively indicate low, moderate and high level for metacognitive thinking scale. In this sense, it can be stated that students' critical thinking standards, metacognitive thinking skills and academic self-efficacy are moderate level.

Findings Related to Relationships between Variables

The Pearson correlation values showing the relationships between the scores of critical thinking standards, metacognitive thinking and academic self-efficacy are exhibited in Table 2.

Table 2

Correlation between Scales

		Critical thinking standards	Metacognitive Thinking	Academic self-efficacy
Critical thinking standards	*r*	1		
	p			
Metacognitive Thinking	*r*	.345**	1	
	p	.000		
Academic self-efficacy	*r*	.144*	.550**	1
	p	.024	.000	

*Correlation is significant at the .05 level

**Correlation is significant at the .01 level

When Table 2 is examined, the correlation values between the scores of critical thinking standards scale and metacognitive thinking scale are ($r = .345$, $p < .01$), the correlation values between the scores of critical thinking standards scale and academic self-efficacy scale are ($r = .144$, $p < .05$) and the correlation values between the scores of metacognitive thinking scale and academic self-efficacy scale are ($r = .550$, $p < .01$). According to Büyüköztürk (2017), correlation values between from $r = .00$ to .30 indicate a small relationship, between from $r = .31$ to .70 indicate a moderate relationship and between from $r = .71$ to 1 indicate a strong relationship. Based on the findings, it can be pointed out that there is a positive moderate correlation between critical thinking standards scale and metacognitive thinking scale, a positive low correlation between critical thinking standards scale and academic self-efficacy scale

and a positive moderate correlation between metacognitive thinking scale and academic self-efficacy scale.

Results of Path Analyses

The fit indices of the model based on the results of the analysis are demonstrated in Table 3.

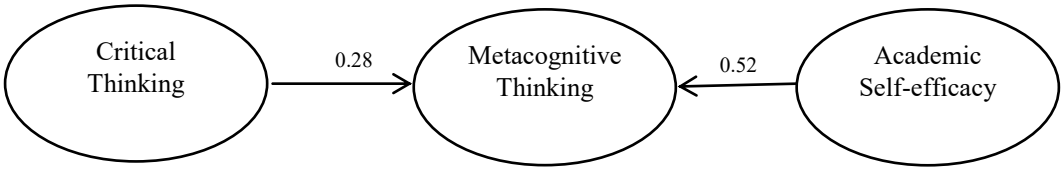
Table 3

Evaluation of Model Fit Indices

Fit indices	Criteria for acceptable fit	Model value (standard)	Resources
x^2 / df	$0 \leq x^2/df \leq 3$	2.75	Kline (2005), Sümer (2000)
RMSEA	$0 \leq RMSEA \leq .08$	.08	Hooper, Coughlan, and Mullen (2008)
NFI	$.90 \leq NFI \leq 1.00$	.97	Thompson (2004)
NNFI	$.90 \leq NNFI \leq 1.00$	.95	Tabachnick and Fidell (2007)
CFI	$.90 \leq CFI \leq 1.00$	.98	Tabachnick and Fidell (2007)
GFI	$.90 \leq GFI \leq 1.00$	.99	Tabachnick and Fidell (2007), Miles and Shevlin (2007)
AGFI	$.90 \leq AGFI \leq 1.00$	.96	Tabachnick and Fidell (2007)

When Table 3 is examined, it is ascertained that the fit indices are acceptable. The results from path analysis which was conducted to reveal the structural relationships between the scales are illustrated in Figure 4.

Figure 4. Hypothetical Model of Structural Relations between Scales



When the structural model in Figure 4 is examined, it is seen that the most significant variable on metacognitive thinking is academic self-efficacy and regression coefficient is β=.52. The regression coefficient of critical thinking on metacognitive thinking is β=0.28. The acceptance/rejection of hypotheses is given in Table 4.

Table 4

Acceptance / Rejection of Hypotheses for Proposed

Hypothesis	Structural Relationship	If Hypothesis Supported
H1	Critical thinking standards → Metacognitive thinking skills	Yes
H2	Academic self-efficacy → Metacognitive thinking skills	Yes

When Table 4 is examined, it is seen that all hypotheses are accepted. Therefore, teacher candidates' critical thinking skills are a significant predictor of their metacognitive thinking skills and similarly, their academic self-efficacy is a significant predictor of their metacognitive thinking skills.

Discussion and Conclusion

In this study, the role of critical thinking skills and academic self-efficacy as a predictor of metacognitive thinking skills of teacher candidates was investigated. In this sense, metacognitive thinking scale (Büyüköztürk et al., 2004), critical thinking standards scale (Aybek et al., 2015) and academic self-efficacy scale (Ekici, 2012) were used in the study and the relationships among the scales were scrutinized through structural equation modeling.

The findings demonstrated that there is a positive moderate correlation between metacognitive thinking and critical thinking standards scales in the study. Similarly, it was revealed that there is a positive moderate correlation between metacognitive thinking and academic self-efficacy scales. On the other hand, it is unveiled that there is a positive low correlation between the critical thinking standards and the academic self-efficacy scales. These findings indicated that the development of students' critical thinking skills and academic self-efficacy will contribute to the development of their metacognitive thinking skills. According to these results, it is possible to assert that critical self-efficacy standards and metacognitive thinking are statistically significant predictors of critical thinking standards.

When the literature was reviewed, it was found out that there are various research results investigating the relationships between metacognitive thinking skills and critical thinking skills within different samples and contexts. Arslan (2018) who probed the relationships between critical thinking and metacognition on 390 undergraduate students who were enrolled in a variety of programs at Sakarya University, in Turkey found that there is a significant positive correlation between students' critical thinking skills and metacognitive thinking skills in his study. Sadeghi, Hassani and Rahmatkhah (2014) conducted a study on female and male students between the age ranges of (15-23) years, and their results revealed that there is a positive significant relationship between metacognitive thinking skills and critical thinking skills for both male and female students. A study was conducted by Samsudin and Hardini (2019) who investigated the influence of metacognitive thinking skills on critical thinking by collecting data from 55 students who enrolled in a Korean Education Study Program at a state university in Indonesia and revealed that metacognitive skills have a significant influence on their critical thinking. Mall-Amiri and Ahmadi (2014) examined the relationship between EFL students' critical thinking skills and

metacognitive thinking skills in their research. It was concluded that there is a significant positive relationship between the two components as a result of their research. A study was conducted by Karasakaloğlu, Karacaloğlu and Özelçi (2012) who aimed to identify Turkish language teacher candidates' metacognitive reading strategies, critical thinking attitudes, and motivational cognitive and metacognitive competencies. They uncovered that there is a significant positive correlation between critical thinking attitude and metacognitive skills scale. Another study conducted by Semerci and Elaldi (2014) revealed that there is a positive significant relationship between metacognitive beliefs and critical thinking skills, but the relationship can be considered as lower than moderate level. Lukitasari, Hasan and Murtafiah (2019) explored the relationship between metacognitive abilities and critical thinking skills by sampling 76 students who study in the Department of Biology Education, Indonesia and unearthed that there is a strong positive relationship between the two structures. Based on these results, it can be concluded that the development of students' critical thinking skills contributes to the development of their metacognitive thinking skills.

When the literature was surveyed, it was ascertained that there are various research results exploring the relationships between metacognitive thinking skills and self-efficacy within different samples and contexts. Chen, Björkman, Zou and Engström (2019) conducted a study aimed to scrutinize the relationships between the self-regulated learning ability, metacognitive ability and general self-efficacy of 216 nursing students at a university in China and found positive relationships between the three structures as a result. A study conducted by Tunca and Alkın-Şahin (2014) revealed that there is a positive significant positive relationship between teacher candidates' academic self-efficacy beliefs and their metacognitive learning strategies. Another study conducted by Koç and Arslan (2017) unveiled that there is a positive significant positive relationship between secondary school students' metacognitive awareness of reading strategies and their academic self-efficacy. Coutinho and Neuman (2008) examined the relationship between achievement goal orientation, learning style, self-efficacy and metacognition by collecting data from 629 undergraduate students. They found out that there is a significant positive relationship between students' self-efficacy and their metacognitive thinking skills. This aligns with Moradkhani, Raygan and Moein (2017) who indicated there is a strong correlation between 102 Iranian EFL teachers' self-efficacy and their metacognitive reflection according to the result of their study. Based on these results, it can be concluded that the development of students' critical thinking skills contributes to the development of their metacognitive thinking skills.

In light of the findings obtained from the research, it would be beneficial to develop their critical thinking skills and academic self-efficacy in order that their metacognitive skills can be utilized. When it is taken into account that the development of critical thinking skills and academic self-efficacy is a lengthy process, it will be appropriate to create instructional programs to help students acquire these skills at an early age. This study has some limitations. Although the research was conducted on the adequate sample size, it included only teacher candidates as a sample group, so it is possible to investigate the generalizability of the results by conducting similar studies in different samples such as primary, secondary, high school students and adults. Besides, instead of conducting research on teacher candidates, doing research on students studying in different fields such as medical education and engineering can be repeated

in the future in order to compare model results. Similarly, the model results can be compared in future studies by taking into consideration the variables such as gender, age, and departments where teacher candidates study. In order to develop metacognitive thinking in the design of learning environments, practices that enhance academic self-efficacy can be implemented. The change of metacognitive skills between the groups in which academic self-efficacy support is provided and the groups in which this support is not given can be investigated. Similarly, the results of the model can be examined whether the metacognitive thinking skills differ between the groups of students who have high critical thinking skills and the groups of students who have low critical thinking skills.

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