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Investigating Critical Thinking in Prospective Teachers: Metacognitive Skills, Problem Solving Skills and Academic Self-Efficacy

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Abstract

The aim of this study is to determine the extent to which prospective teachers' metacognitive skills, problem solving skills and academic self-efficacy explain their critical thinking tendencies. This study, designed as correlational survey method, was conducted with 229 prospective teachers studying at Van Yüzüncü Yıl University, Faculty of Education. "Critical Thinking Disposition Scale", "Metacognitive Skills Scale", "Problem Solving Inventory" and "Academic Self-efficacy Scale" were used for data collection. Data were analyzed using descriptive statistics, Pearson Product-Moment Correlation Coefficient and stepwise regression analysis. As a result of the study, a positive, moderate level and significant relationship was found between prospective teachers' critical thinking tendencies and metacognitive skills, problem solving skills, academic self-efficacy perceptions. This study concluded that prospective teachers' metacognitive skills, problem solving skills and academic self-efficacy perceptions together can explain about half of the variance (39.5%) in their critical thinking tendencies. However, this study revealed that problem solving skills doesn't make a meaningful contribution to the total variance and cannot explain prospective teachers' critical thinking tendencies to a significant extent.

Key words: *Teacher critical thinking tendencies, teacher metacognitive skills, teacher problem solving skills, teacher academic self-efficacy*

Introduction

Individual differences in today's learning environments are quite distinctive and affect students' learning to a great extent. Individual differences have shown that the skills needed to be an effective learner, and thinker, are in fact self-regulatory, specifically cognitive regulatory. In this respect, the students should control and manage his/her own learning processes and strategies (Modrek, Kuhn, Conway & Arvidsson, 2018). In the age of information and technology, the speed and amount of information is changing day by day and the current information become insufficient to keep up with the age. Therefore, in today's education systems, it is aimed to educate individuals who can construct knowledge by passing through their own cognitive filters rather than just

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memorizing existing knowledge. In this case, individuals are expected to have higher order thinking skills such as self-regulation strategies, critical thinking, problem solving and metacognitive thinking, etc. Among these skills, critical thinking is a key skill in terms of being used in most of thinking processes.

In the process of learning, self-regulation does not comprise all contributing factors pointing to its effectiveness. Still, the effects of self-regulation extend more largely, particularly to the critical skills of learning, at least in children and adolescents (Modrek & Kuhn, 2017). When understanding learning in teachers, then, it is noteworthy to understand what individual differences in teachers may explain their own learning processes.

The need for critical thinking skills for prospective teachers arises day by day because professional and life challenges increase by the developments in information and technology. The initial teacher education should equip the prospective teachers not only with critical literacy but also develop their critical thinking skills (Varga, 2011). As prospective teachers are expected to have critical thinking skills, it is important to determine their critical thinking tendencies and the factors related to their critical thinking tendencies.

Concerning educational life, critical thinking enhances meaningful learning (Uzuntiryaki-Kondakçı & Çapa-Aydın, 2013) and it is viewed as student's using existing knowledge to solve a problem and make judgments (Linn, 2000). In other words, critical thinking is a process in which the student uses his/her prior knowledge to understand the problem in a clear way and make decisions about the problem accordingly (Akın et al, 2015). So, it can be concluded that an individual uses critical thinking during problem solving process and problem solving activities increase the use of critical thinking. As a matter of fact, there are some studies in the literature (Friede et al, 2008; Kim & Choi, 2014; Memduhoğlu & Keleş, 2016; Tümkaya, Aybek & Aldağ, 2009) concluding that problem solving skills are related to critical thinking.

Problem solving is a process including lots of mental operations used for moving from existing situations to the target goal (Mayer, 1983). In addition, Krulik and Rudnick (1987) defined problem solving as the process in which the individual uses his/her background knowledge, skills and abilities to solve an unfamiliar problem. Each individual should have problem solving skills in order to achieve his/her objectives in life (Chaudhry & Rasool, 2012). Problem solving is a basic skill required for today's learners. Due to changing professional standards, new demands and changes in learning theories and education, educators revise educational curricula by including

learning environments that provide learners to use higher order thinking skills, especially problem solving skills (Foshay & Kirkley, 2003). Problem solving is critical for a student's success in the educational life and the community (Agran, Blanchard, Wehmeyer, & Hughes, 2002). Therefore, prospective teachers should have problem solving skills so that they can lead their students in teaching-learning process and develop their problem solving skills. For example, in the study conducted by Sandoval, Kwako, Modrek & Kawasaki (2018), a teacher development effort was made to change teacher thinking and learning, and observe student outcomes as a consequence. This study suggested that teacher thinking and learning has great importance in stimulating students' thinking processes, respectively.

Critical thinking possesses similar characteristics with problem solving skills. Similar to problem solving, critical thinking is a thinking process that includes cognitive processes such as reasoning, analyzing, evaluating, etc. Critical thinking is an intellectual skill that plays a pivotal role in both individual's educational and social life (Akın, Hamedoğlu, Arslan, Akın, Çelik, Kaya, & Arslan, 2015). Critical thinking process can be considered as a method of problem analysis (McPeck, 1983). Although there are various definitions of critical thinking, most of the definitions include common elements such as making decisions and problem solving (Halpern, 1998). Problem solving has the potential to develop one's critical thinking skills (Buku, Corebima, & Rohman, 2016). Therefore, it is hypothesized in this study that critical thinking and problem solving skills are related concepts and prospective teachers' problem solving skills influence their critical thinking tendencies.

Critical thinking also relates to metacognition (Kuhn, 1999; Lai, 2011). The metacognition is defined by scientists in different ways. Flavell (1979) defines metacognition as "the knowledge and cognition about cognitive phenomena and monitoring the individual's own cognitive processes", Anderson et al (2001) define as "the knowledge about cognition and one's awareness of his/her own cognition", Senemoğlu (2013) defines as "the individual's knowledge of his or her cognition system, in other words, the individual's being aware of his/her cognitive structure and learning characteristics, and being able to monitor and organize his/her cognitive processes". In this case, metacognition can be defined as the individuals' being aware of, monitoring and organizing their own cognition and cognitive processes.

In order to ensure the learning to be achieved at the desired level, it is important to develop metacognitive skills that enable the individual to control his/her own learning processes. An

individual with advanced metacognitive skills draws attention to the learning unit, distinguishes between important and unimportant information, knows which strategies should be used for keeping information in short-term memory, storing it in long-term memory and retrieving it when it is needed and evaluates whether he/she has learned or not (Altındağ, 2008). As metacognition is used to monitor and organize cognitive processes such as understanding, reasoning, problem solving and analyzing, it is thought that metacognition plays an important role in these processes. So, metacognition and higher order thinking skills such as problem solving and critical thinking are considered as closely related concepts in theory (Karakelle, 2012).

As critical thinking requires "awareness of the individual's own thinking and reflection on the thinking of himself/herself and others" (Kuhn & Dean, 2004), metacognition that is necessary to use higher order thinking skills is related to the development of critical thinking (Lockwood, 2003). In critical thinking process, the individual need to utilize certain metacognitive skills and metacognition facilitates the development of critical thinking skills. This implies that critical thinking is somewhat a product of metacognitive processes (Magno, 2010). Furthermore, there are some studies in the literature (Buku, Corebima, & Rohman, 2016; Magno, 2010; Sadeghi, Hassani, & Rahmatkhah, 2014; Semerci & Elaldı, 2014; Tabrizi & Erfani, 2014) concluding that metacognitive skills are related to critical thinking. Therefore, it is hypothesized in this study that critical thinking and metacognition are related concepts and prospective teachers' metacognitive skills influence their critical thinking tendencies.

Another related concept with critical thinking, metacogniton and problem solving is academic self-efficacy. The concept of self-efficacy is based on Social Cognitive Theory developed by Bandura (Pajares & Schunck, 2002) and it is one's beliefs about his/her organizing and managing capacity of the activities that are necessary to deal with possible problems (Bandura, 1997). Teachers' academic self-efficacy perceptions, implying beliefs about their professional competences as teachers, can be defined as their perceptions in the ability to gain the target products (Tschannen-Moran & Woolfolk-Hoy, 1998).

Self-efficacy plays a crucial role in problem solving (Aurah, Cassady, & McConnell, 2014). It is stated that students with high self-efficacy use problem solving strategies more efficiently and put more effort to solve a problem (Pajares, 2005), are more likely to use critical thinking to handle a problem (Phan, 2009) and are more likely to use metacognitive strategies to get better solutions

(Kitsantas, 2000). Therefore, it can be concluded that academic self-efficacy is associated with critical thinking, metacognition and problem solving.

Self-efficacy as a motivational incentive has a critical role in the development of critical thinking skills (Dehghani, Jafari-Sani, Pakmehr, & Malekzadeh, 2011). It is emphasized that the individual's self-efficacy beliefs can influence and predict critical thinking skills (Sang, Valcke, Van Braak, & Tondeur, 2010; Wang & Wu, 2008). Therefore, it is hypothesized in this study that critical thinking skills and academic self-efficacy are related concepts and prospective teachers' academic self-efficacy perceptions influence their critical thinking tendencies.

Based on literature, it seems possible to state that critical thinking, metacognition, problem solving and self-efficacy are theoretically interrelated concepts. There are empirical studies in the literature revealing the relationships between these concepts. Many researchers have found a positive relationship between critical thinking and cognitive/metacognitive processes such as metacognition (Buku, Corebima, & Rohman, 2016; Magno, 2010; Sadeghi, Hassani, & Rahmatkhah, 2014; Semerci & Elaldı, 2014; Tabrizi & Erfani, 2014), self-efficacy (Basereh & Pishkar, 2016; Dehghani et al, 2011; Orujlu & Hemmati-Maslakpak, 2017; Phan, 2009), and problem solving (Friede, Irani, Rhoades, Fuhrman, & Gallo, 2008; Kim & Choi, 2014; Tümkaya, Aybek, & Aldağ, 2009). In addition to these studies, Aurah, Cassady, & McConnell (2014) investigated the predictive power of self-efficacy and metacognition on problem solving ability among high school students in Kenya and concluded that metacognition and self-efficacy significantly predicted problem-solving ability. Similarly, Sümen & Çalışıcı (2016) analyzed the effects of prospective teachers' metacognitive awareness, mathematical literacy and self-efficacy beliefs on problem solving skills and determined that metacognitive skills have positive effects on prospective teachers' problem solving processes. On the other hand, Uzuntiryaki-Kondakçı & Çapa-Aydın (2013) investigated the predictive power of university students' metacognitive self-regulation and chemistry self-efficacy on critical thinking and found that metacognitive self-regulation and chemistry self-efficacy explained 68.5% of the variance in critical thinking.

When the studies in the literature are examined, it is seen that most of the studies examined the relationship between the two concepts discussed in this study and concluded that these concepts are related with each other. While two studies (Aurah, Cassady, & McConnell, 2014; Sümen & Çalışıcı, 2016) investigated the predictive power of these concepts on problem-solving, a study (Uzuntiryaki-Kondakçı & Çapa-Aydın, 2013) investigated the predictive power of metacognitive

self-regulation and chemistry self-efficacy on critical thinking. In this case, it is seen that there is a need for describing a theoretical framework that bridge critical thinking and metacognitive skills, problem solving skills, academic self-efficacy perceptions and determining the extent to which these concepts facilitate to attain critical thinking.

In this study, it is aimed to determine the extent to which prospective teachers' metacognitive skills, problem solving skills, and academic self-efficacy explain their critical thinking tendencies by testing the following model:

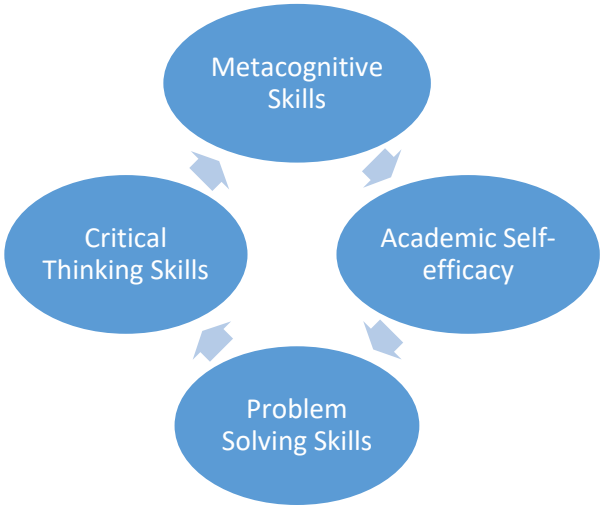

Figure 1: Model Used To Explain Critical Thinking Tendencies via Metacognitive Skills, Problem Solving Skills and Academic Self-Efficacy

Critical thinking is one of the main aims of the education. Then, it is important to determine cognitive factors that facilitate critical thinking of the students (Magno, 2010). Furthermore, it has some basic characteristics such as being related to metacognitive skills as well as cognitive ones (Uzuntiryaki-Kondakçı & Çapa-Aydın, 2013). Firsly, students control their own thinking, evaluate their efforts, conclusions and decisions in critical thinking process which are indicators of metacognition (Halpern, 1998). Secondly, it is emphasized that problem solving processes facilitate the development one's critical thinking skills (Buku, Corebima, & Rohman, 2016). Thirdly, self-efficacy has importance in critical thinking processes in terms of being a motivational incentive (Dehghani, Jafari-Sani, Pakmehr, & Malekzadeh, 2011). Accordingly, this study considers metacognitive skills, problem solving skills and academic self-efficacy as variables playing role in critical thinking skills. This study is important in terms of determining the variables that affect prospective teachers' critical thinking tendencies and the predictive power of these variables on their critical thinking tendencies. In this study, dependent variable was determined as

critical thinking tendencies of prospective teachers because of the fact that predictive variables, that are prospective teachers' metacognitive skills, problem solving skills and academic self-efficacy, are considered to facilitate critical thinking process as stated in the literature. In this respect, it is thought that this research will contribute to the related literature.

The present study highlights certain theoretical and practical implications. First of all, one of the expected theoretical contribution of the study is describing a theoretical framework that bridge critical thinking and metacognitive skills, problem solving skills, academic self-efficacy perceptions. Secondly, another expected theoretical contribution of the study is describing the relationship of metacognition with higher order thinking skills such as critical thinking. This study will contribute to the body of knowledge in the field of education in terms of revealing the relationships between the concepts of metacognitive skills, problem solving skills, academic self-efficacy and critical thinking tendencies based on the data obtained from prospective teachers. This study differs from the similar studies in this field in terms of investigating critical thinking tendencies of prospective teachers with metacognitive skills, problem solving skills and self-efficacy perceptions altogether. In addition, it is thought that the data obtained from this research will shed light on the preparation of initial teacher education curricula and academic studies in this field.

Method

Research Design

This study was designed as correlational survey model. Correlational studies do not establish cause and effect, but aim to determine the existence and degree of relationship between two or more variables (Karasar, 2013, p.81). As this study aims to determine the relationship among critical thinking tendencies, metacognitive skills, problem solving skills and academic self-efficacy, correlational design is considered to be appropriate for the aim of this study.

Population and Sample

The population of this study consists of 2.920 prospective teachers studying at Van Yüzüncü Yıl University, Faculty of Education in 2016-2017 academic year. The sample of this study consists of 229 prospective teachers determined by purposive sampling as one of the non-probability sampling approaches. In purposive sampling, the researcher selects the participants based on his/her own judgment taking aim of the study into consideration. One of the major limitations of the non-probability sampling is that the results of this study cannot be generalized to a larger

population on statistical grounds (Tongco, 2007). In this study, prospective teachers' grade level and branch (department) were taken into consideration and almost equal number of students was sampled from each grade level and department. Of these prospective teachers, 137 (59.8%) are female, 92 (40.2%) are male; 54 (23.6%) are first grade, 68 (29.7%) are second grade, 56 (24.5%) are third grade and 51 (22.2%) are fourth grade students from various departments such as basic education (42; 18.3%) , social sciences and Turkish language (44; 19.2%), foreign languages (36, 15.7%), computer and instructional technologies (24; 10.5%), mathematics and science education (36; 15.7%), fine arts (47; 20.6%) departments.

Data Collection Tools

For data collection, four scales were used in this study. The information about the scales is presented below:

Critical Thinking Disposition Scale: This five point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree) was developed by Sosu (2013) and adapted into Turkish by Akın et al. (2015). It consists of 11 items and two sub-dimensions that are "critical openness" and "reflective skepticism". Cronbach Alpha reliability coefficient of the total scale was calculated as 0.78; and in the sub-dimensions as 0.75. and 0.78., respectively. In this study, the scale's Cronbach Alpha reliability coefficient was found as 0.82. These values show that the scale is a valid and reliable measurement tool.

Metacognitive Skills Scale: This five point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree) was developed by Altındağ and Senemoğlu (2013). It is one-dimensional consisting of 30 items. Cronbach Alpha reliability coefficient of the scale was calculated as 0.94. In this study, the scale's Cronbach Alpha reliability coefficient was found as 0.95. These values show that the scale is a valid and reliable measurement tool.

Problem Solving Inventory: This six point Likert scale ranging from 1 (never) to 6 (always) was developed by Heppner & Peterson (1982) and adapted into Turkish by Şahin, Şahin and Heppner (1993). It consists of 35 items and six sub-dimensions that are "impulsive style", "reflective style", "problem-solving confidence", "avoidant style", "monitoring" and "planfulness". In scoring, three items are excluded, so the highest point obtained from the inventory is 192 and 32 to the lowest. Higher score is interpreted as the individual is insufficient in problem solving skills; lower score is interpreted as the individual is sufficient in problem solving skills. Cronbach Alpha reliability coefficient of the total scale was calculated as 0.88; and in the sub-dimensions as 0.78, 0.76, 0.64,

0.74, 0.69, and 0.59., respectively. In this study, the total scale's Cronbach Alpha reliability coefficient was found as 0.90. These values show that the inventory is a valid and reliable measurement tool.

Academic Self-efficacy Scale: This five point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree) was developed by Jerusalem & Schwarzer (1981) and adapted into Turkish by Yılmaz, Gürçay, & Ekici (2007). It is one-dimensional consisting of 7 items. Cronbach Alpha reliability coefficient of the scale was calculated as 0.79. In this study, the scale's Cronbach Alpha reliability coefficient was found as 0.85. These values show that the scale is a valid and reliable measurement tool.

Data Collection

Data were collected at Van Yüzüncü Yıl University, Faculty of Education in 2016-2017 academic year. Prior to the data collection, formal permission was taken from the Dean of Education Faculty. Participants were determined according to their departments and grade levels. General information and guidelines on scale application were explained by the researcher himself and all scales were administered to the students at the same time. Data collection process lasted approximately 4 weeks.

Data Analysis

In this study, the relationships between prospective teachers' critical thinking tendencies, metacognitive skills, problem solving skills and academic self-efficacy were analyzed with Pearson Product Moments Correlation Coefficient (r). Furthermore, stepwise regression analysis was used to determine whether prospective teachers' metacognitive skills, problem solving skills and academic self-efficacy significantly explained their critical thinking tendencies significantly. In stepwise regression analysis, independent variables that make a significant contribution to the dependent variable are included in the analysis and independent variables that do not make a significant contribution to the dependent variable are excluded from the regression model (Büyüköztürk, 2012; Cohen, Cohen, West & Aiken, 2003). Prior to the analysis, the assumptions of stepwise regression analysis such as multivariate normality and linearity, multicollinearity were examined. It was concluded that research data show multivariate normality and linearity. Concerning multicollinearity, in order to detect the presence of one or more strong bivariate correlations, the commonly used cutoffs are 0.70 and above (Yoo et al, 2014). In this study, intercorrelations among the predictor variables vary from 0.345 to 0.617. Based on correlations

among variables and the variance inflation factor (VIF), it can be concluded that there is not multicollinearity problem.

Findings

The Pearson Product Moments Correlation Coefficients calculated for analyzing the relationships between the variables included in this study are presented in Table 1.

Table 1

Pearson Product Moments Correlation Coefficients Concerning All Variables Included in This Study

Variables	***(1)***	***(2)***	***(3)***	***(4)***
1. Metacognitive skills	1.00			
2. Problem solving skills	.468**	1.00		
3. Academic self-efficacy	.529**	.399**	.1.00	
4. Critical thinking tendencies	.617**	.345**	.428**	.1.00

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

According to the data in Table 1; a positive, moderate level and significant relationship was found between prospective teachers' critical thinking tendencies and metacognitive skills (r=.617; p<.01), problem solving skills (r=.345; p<.01), academic self-efficacy perceptions (r=.428; p<.01). Stepwise regression analysis results concerning the prediction of prospective teachers' critical thinking tendencies with metacognitive skills, problem solving skills and academic self-efficacy perceptions are presented in Table 2.

Table 2

Stepwise Regression Analysis Concerning the Prediction of Prospective Teachers' Critical Thinking Tendencies

Steps	***Predictive Variables***	***β***	***Predictive power (R)***	***Variance explained (R^2)***
1	Metacognitive skills	.617	.617	.380
2	Academic self-efficacy	.142	.628	.395

According to the data in Table 2, it was found that the variables of metacognitive skills and academic self-efficacy perceptions can explain %39.5 of the variance in prospective teachers' critical thinking tendencies. The results of variance analysis concerning stepwise regression analysis in Table 2 are presented in Table 3.

Table 3

The Results of Variance Analysis Concerning the Prediction of Prospective Teachers' Critical Thinking Tendencies

Model	***Sum of squares***	***sd***	***Mean square***	***F***	***p***
Regression	28.818	2	14.409	73.649	.000
Residual	44.216	226	0.196		

According to data in Table 3, it is seen that the predictive power obtained in the stepwise regression analysis given in Table 2 is significant ($F_{(2, 226)} = 73.649$, $p < .001$). The stepwise regression analysis took place in two steps. Accordingly, it is seen that two variables (metacognitive skills, academic self-efficacy perceptions) are important predictors in terms of their contribution to the variance in prospective teachers' critical thinking tendencies. However, it is seen that the variables included in the analysis differ in their contribution to the variance explained in prospective teachers' critical thinking tendencies. In the first step of the analysis, the variable *"metacognitive skills"* explaining 38% of the variance was included. In the second step, the variable *"academic self-efficacy"* explaining 1.5% of the variance was included in the analysis. In terms of their contribution to the variance, two important predictors of prospective teachers' critical thinking tendencies are ordered as metacognitive skills and academic self-efficacy perceptions, respectively. These analysis results show that these two variables together can explain about half (39.5%) of the variance in prospective teachers' critical thinking tendencies. However, it was found that problem solving skills don't make a meaningful contribution to the total variance and cannot explain prospective teachers' critical thinking tendencies significantly.

Discussion, Conclusion and Implications

Individual differences in today's learning environments are quite distinctive and affect learning to a great extent, yet little is known about individual differences in teachers' learning skills. While vast literature on individual differences have shown that the skills needed to be an effective learner are, for example, in fact cognitive regulatory and not purely behavioral. (Modrek, Kuhn, Conway & Arvidsson, 2018; Modrek & Kuhn, 2017), it is worth understanding how this extends not only to adult populations such as teachers, but also other underlying cognitive mechanisms that may explain variation in teachers' thinking and learning. This study differs from the similar studies in this field in terms of investigating critical thinking tendencies in prospective teachers with metacognitive skills, problem solving skills and self-efficacy perceptions altogether. Therefore,

this study has importance in terms of determining predictive power of these variables on students' critical thinking tendencies. Furthermore, this study has importance in terms of describing a theoretical framework that bridge critical thinking and metacognitive skills, problem solving skills, academic self-efficacy perceptions; and describing the relationship of metacognition with higher order thinking skills such as critical thinking.

This study revealed a positive association between prospective teachers' critical thinking skills, metacognitive skills, problem solving skills, and perceptions of academic self-efficacy. This result supports the findings of similar studies in the literature. Many researchers have found a positive relationship between metacognition/metacognitive skills and cognitive processes such as problem solving (Anandaraj & Ramesh, 2014; Kapa, 2001; Karakelle, 2012; Özçakır-Sümen & Çalışıcı, 2016), self-efficacy (Tavakolizadeh, Tabari & Akbari, 2015; Uzuntiryaki-Kondakçı & Çapa-Aydın, 2013) and critical thinking (Buku, Corebima, & Rohman, 2016; Magno, 2010; Sadeghi, Hassani, & Rahmatkhah, 2014; Semerci & Elaldı, 2014; Tabrizi & Erfani, 2014). Similarly, many researchers have found a positive relationship between self-efficacy and cognitive processes such as problem solving (Behjoo, 2013; Erözkan, 2014; Özçakır-Sümen & Çalışıcı, 2016) and critical thinking (Basereh & Pishkar, 2016; Dehghani et al, 2011; Orujlu & Hemmati-Maslakpak, 2017; Phan, 2009). These results show consistency with the findings of similar studies (An & Cao, 2014; Özçakır-Sümen & Çalışıcı, 2016; Rozencwajg, 2003; Safari & Meskini, 2016; Zare & Mohammadi, 2011) which found that metacognitive skills have positive effects on students' problem solving processes. Furthermore, some studies (Friede et al, 2008; Kim & Choi, 2014; Memduhoğlu & Keleş, 2016; Tümkaya, Aybek & Aldağ, 2009) concluded that problem solving skills are related to critical thinking dispositions. On the other hand, Aurah, Cassady, & McConnell (2014) found that metacognition and self-efficacy significantly explained problem solving ability. In this respect, it can be concluded that critical thinking tendencies, metacognitive skills, problem solving skills and academic self-efficacy perceptions are interrelated concepts.

The results of this study determined that prospective teachers' metacognitive skills and academic self-efficacy perceptions together can explain about half (39.5%) of the variance in their critical thinking tendencies. Furthermore, in terms of their contribution to the variance, two important predictors of prospective teachers' critical thinking tendencies is ordered as metacognitive skills (38%) and academic self-efficacy perceptions (1.5%), respectively. This results show consistency

with the studies and views in the target literature. In defining the term of critical thinking, many researchers associated critical thinking with many twenty-first century skills such as metacognition, problem solving skills, creative thinking etc. (Lai, 2011). In education, various studies were conducted on metacognition as a crucial term and some of these studies analyzed the effect of metacognition on other skills (Safari & Meskini, 2016). Metacognition can be considered as a supportive element for critical thinking because monitoring one's own cognitive processes makes it more possible that one will use higher order thinking skills (Lai, 2011).

In the study conducted by Magno (2010), the influence of metacognition on critical thinking skills were analyzed and it was found that metacognition is a significant predictor of critical thinking. Similarly, in the study conducted by Uzuntiryaki-Kondakçı & Çapa-Aydın (2013), it was concluded that metacognitive self-regulation and chemistry self-efficacy explained 68.5% of the variance in critical thinking and metacognitive self-regulation plays a pivotal role in critical thinking skills. In the literature, many researchers have drawn the relationship between metacognition and critical thinking (Brown, 2004; Buku, Corebima, & Rohman, 2016; Halpern, 1998; Magno, 2010; Sadeghi, Hassani, & Rahmatkhah, 2014; Schoen, 1983; Semerci & Elaldı, 2014; Tabrizi & Erfani, 2014). It is believed that the individual begins to use multiple skills to reach an end when higher order thinking skills are targeted (Magno, 2010). In accordance with the results of this study and similar studies in the literature, it can be said that one of facilitating skill of critical thinking is metacognitive skills. It can be concluded that the individuals using more metacognitive skills use critical thinking more or more easily. As Willingham (2007) states, it can be inferred that metacognitive skills make critical thinking more possible. It can be thought that the individual's ability to monitor and organize his/her cognitive processes increases or makes it more possible his/her higher order thinking processes such as critical thinking, making judgments or reaching a decision.

According to the results of this study, another variable that has positive effect on critical thinking is prospective teachers' academic self-efficacy as it explains 1.5% of the variance in prospective teachers' critical thinking tendencies. This result shows consistency with the findings of similar studies (Basereh & Pishkar, 2016; Dehghani et al, 2011; Orujlu & Hemmati-Maslakpak, 2017; Phan, 2009) in which a positive and significant relationship was found between self-efficacy and critical thinking. Students with high self-efficacy perceptions are expected to be better in critical thinking (Bandura, 1997, Cited by Uzuntiryaki-Kondakçı & Çapa-Aydın, 2013). It can be

concluded that the students who believe in their academic knowledge and skills are higher in critical thinking tendencies. As critical thinking requires basic knowledge and skills to question and compare ideas, make judgments or make conclusions, it is an expected outcome. However, this study concluded that prospective teachers' problem solving skills don't make a meaningful contribution to the total variance and cannot explain prospective teachers' critical thinking tendencies significantly. Considering the positive relationship between prospective teachers' problem solving skills and critical thinking tendencies, this is an unexpected and remarkable result. In this respect, it can be said that prospective teachers' problem solving skill is not a significant variable in explaining their critical thinking tendencies.

The present study highlights certain theoretical and practical implications. First of all, one of the theoretical contribution of the study is that this study describes a theoretical framework that bridge critical thinking and metacognitive skills, problem solving skills, academic self-efficacy perceptions. This theoretical framework shows that certain higher order thing skills or processes such as metacognitive skills, problem solving skills, and academic self-efficacy facilitate to attain critical thinking. When the prospective teachers are able to control their cognitive processes, develop problem solving skills and have self-confidence in academic issues, the more likely they think critically to the issues presented to them. Secondly, another theoretical contribution of the study describes the relationship of metacognition with higher order thinking skills such as critical thinking. The results of the present study reveal that metacognition is beyond the knowledge and regulation of cognition. It rather functions as specific skills that are used in order to attain higher order thinking such as critical thinking.

Concerning practical implications, it is suggested to conduct experimental studies on several diverse samples across different age groups and compare to see their cognitive skills and determine cause-effect relationships. The utilization of a similar methodology is also possible with other data sources (observation, interview etc.) or a different population. Furthermore, longitudinal studies can be conducted in order to observe the influence of metacognitive skills, problem solving skills, academic self-efficacy perceptions on critical thinking.

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