

The Relationship Between Teacher Candidates' Critical Thinking Standards and Reflective Thinking Skills

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Abstract

The aim of this study is to investigate the relationship between teacher candidates' critical thinking standards and reflective thinking skills. The study investigates the level of critical thinking standard and reflective thinking skills of teacher candidates as well. Also, another sub-problem of the study is whether reflective thinking skills significantly differentiate according to critical thinking standards divided into three sub-levels. When the findings are examined, it can be stated that students have a high level of critical thinking standards, "depth, width, and competence", "precision and accuracy", and "importance, relevance, and clarity" sub-dimensions, and reflective thinking skills. Also, there is a significant and positive correlation between teacher candidates' reflective thinking skills with critical thinking standards, "depth, width, and competence", "precision and accuracy", and "importance, relevance, and clarity" sub-dimensions. When the data are examined, it can be said that teacher candidates' reflective thinking skills differ significantly according to critical thinking standard level. Besides, it can be stated that the mean ranks determined in all scale are high in favor of teacher candidates with high critical thinking standard level. Compound effect of the level of critical thinking standards with gender and grade is not significant on reflective thinking skills but compound effect of critical thinking standards with department on reflective thinking skills is significant.

Keywords: Critical Thinking Standards, Reflective Thinking, Teacher Candidates.

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INTRODUCTION

The ability to think is a distinctive feature that distinguishes human beings from all other living things. Through the action of thinking, human beings have the opportunity to influence and change the environment and conditions in which they live. Thinking can be defined as an active, goal-oriented, and organized cognitive process in order to make sense of the conditions (Kurnaz, 2013). Considering that life is a problem solving process, mankind can face new situations and problems at any time. Nowadays, the progression in technology and the great accumulation of daily updated information make these problems more complicated. Therefore, today, effective thinking has become a bigger need.

Every person thinks, but if they do not acquire effective thinking skills, they usually have prejudiced, incomplete, and inaccurate thoughts basing on non-objective knowledge (Dogonay & Unal, 2006). According to Lipman (1988), the thinking skills can be grouped as follows: information processing, critical thinking and reasoning, creative thinking, problem solving, and meta-cognition (cited in Fisher, 1999). Moreover, there are some researchers classifying thinking skills according to the purpose and form of use and stated that thinking takes place at different levels. For example, Levis and Smith (1993) divided thinking skills into two main steps: lower-order thinking and higher-order thinking. Lower-order thinking is the application of a learned behavior to a problem encountered. However, in higher-order thinking, there is an original direction. The individual associates the elements that he/she has never previously brought together, analyses, makes predictions, or manipulates thoughts.

An important component of the higher-order thinking skills is critical thinking. Critical thinking is to assess the logical level, validity or accuracy of expressions, or the extent to which a result has been substantiated or justified (Paul, 1990; cited in Beyer, 1995). Scriven and Paul (2004, p. 74) defined critical thinking as a skill that develops thinking by recognizing the inherent structures in thinking and taking responsibility for coping with them by applying certain standards. This process is not solely about the acquisition of information. In this process, the individual actively learns, solves the problem, analyses the information units, and uses this information to establish logic (Kim, 2009). That is, critical thinking focuses on both a process and a product (Garrison, Anderson & Archer, 2001).

There are two basic elements of critical thinking. The first one is reflective thinking. Reflective thinking involves conducting a thinking process on one's own thinking, especially about the components of it. Second, critical thinking is called thoughtful thinking, and critical thinking should meet the high standards of thinking. To be able to connect with critical thinking, one must be aware of these standards and strive to achieve them (Bailin, Case, Coombs & Daniels, 1999; Nosich, 2009).

Furthermore, another higher-order thinking skill is reflective thinking. This skill can be defined as a close examination of a process after an accomplished task or while doing a task. It helps students to analyze their learning processes, and students can determine their learning standards by evaluating all learning experiences in this way (Eryaman, 2007; Moon, 2008). Weast (1996) listed the sub-skills of reflective thinking as below:

- examining the conclusion,
- examining the reasons and the evidence,
- examining ambiguous language,
- examining descriptive assumptions and value assumptions,
- evaluating statistical and logical reasoning,
- examining foreclosed information,
- articulating one's own values in a thoughtful and fair-minded way.

Reflection is a concept built on the basis of reflective thinking. Reflection is the cognitive inquiry process that contains analyzing the existing knowledge and finding ways which will lead to production of new knowledge and development of alternative ways. Dewey defined the reflective thinking as “active, persistent and careful consideration of knowledge structure supporting any belief or knowledge and results that it aims to reach”. Dewey focused on the importance of action and describes a reflective practitioner as an individual questioning his/her assumptions and practices as well as being active and determined (cited in Ross, 1989).

According to Schön (1987), reflective thinking has different varieties depending on when it takes place. The most complicated kind of reflective thinking is critical reflection (Black & Plowright, 2010; Rogers, 2001). Critical reflection is an act of deeper examination of the experiences acquired by the individual taking into account the social, political, and cultural context. Thus, the individual acquires an awareness of his/her assumptions and philosophy of life. In this way, the individual analyses the main points related to the phenomena he/she is interested in (Brookfield 1995; Hatton & Smith, 1995; Mezirow 1990, Rodgers, 2002). Educators say this is an important ability for students to develop greater depth of understanding and learning (Boud, Cohen & Walker, 1993; Hatton & Smith, 1994; Junsay, 2016; Moon, 2006).

There are some commonalities between reflective inquiry and critical thinking. First of all, both of these two thinking skills both share a focus on thinking. Additionally, two thinking skills emphasize the principles of logic and application of these principles (Glaser, 1941, p. 19). According to Paul and Elder (2013), a basic prerequisite of critical thinking is to be aware of own thinking process and responsible to develop reasonable criteria for evaluating it. From this point of view, critical thinking and reflective thinking are interdependent thinking skills, and one must think critically to be able to think reflectively (Elaldi, 2013; Riedler & Eryaman, 2016; Tican, 2013).

In the same manner, according to Facione and Facione (1996), self-monitoring is an important sub-skill of critical thinking. Also, Ivie (2001, p. 10) defined critical thinking skill in terms of reflective judgment and established a relationship between these two thinking skills. Moon (2008) stated that teachers’ use of open-ended questions involving students in team works and making use of different forms of reflection conducted in the context of the course subject could motivate students to think critically. Halpern (2007) used the term “metacognitive reflection” for implementing reflectivity in education, and this skill helps educators to develop awareness not only of their own thought processes but also those of their students. In the light of all this information, it is seen that critical thinking and reflective thinking skills are related to each other. Therefore, efforts to bring these two skills together in educational processes are considered important.

Problem Statement

The higher-order thinking skills have an important place in the theoretical and practical processes of university education because they support skills such as questioning all kinds of information units, analyzing complex issues, and revealing the premises behind the expressions (Choy & Cheah 2009). Nowadays, especially critical thought is a standard of participation in academic, individual, and social life (Scriven & Paul 2004). Therefore, one of the skills that form the basis of higher education curriculum should be higher-order thinking, and higher education should accept these skills as one of its main tasks.

Critical and reflective thinking skills increase the professional capacity of a teacher in performing the teaching profession. Reflection allows the teacher to question the experiences of the teacher in the teaching-learning process and to realize the effects of the structure of the organization in which he/she is a member (Posteguillo & Palmer, 2000). In teaching profession which is carried out in many different levels, situations, and different organizational structures, teachers should be able to adapt their skills according to the conditions (Tilley, Marsh, Middlemiss & Parrish, 2010). To be effective teachers, novice teachers should make sense the purpose behind their preferences about

instruction. They must understand the connections between different sub-parts of the course subject that they can understand how individual lessons fit in the greater curriculum picture (Danielson, 2002).

Also, many students cannot be critical thinkers because their teachers do not sufficiently set up the connection between subjects and activities with critical thinking skills which also include a certain amount of reflection (Choy & Oo, 2012). Therefore, only teachers who have acquired these skills can make effective arrangements for the use of these skills in the classroom. Also, teachers who have reflective thinking skills can self-assess their teaching-learning activities and help their students become critical thinkers (Shermis, 1999).

However, although both are high-level thinking skills, the nature of the relationship between critical thinking skills and reflective thinking skills is not clearly defined in the literature. Many researchers working on thinking expressed the relationship between critical thinking and reflective thinking skills, but they could not clarify the point of explaining the issue clearly such as which skill encompasses the other, to what extent they relate to each other, and where they intersect. So, in this study, whether there was a significant correlation between these two skills is investigated. Also, critical thinking standard and reflective thinking skill levels of the teacher candidates are determined. Furthermore, the compound effect of gender, grade level, and department with critical thinking standards on reflective thinking skills is also examined.

METHODOLOGY

Research Design

The research was conducted using the correlational survey model. The correlational survey model is important to reveal relationships between variables, determine the levels of these relationships, carry out higher level research on these relationships (Karasar, 2016, p. 114). Moreover, the correlational survey provides the necessary clues for conducting higher-level research on a relationship (Büyükoztürk, 2016, p. 185).

Population and Sample

The population of the study consisted of students in the Faculty of Education at a state university. The sample of the study consisted of 402 teacher candidates who were identified through convenience sampling in the first and fourth grades of teacher candidates studying at a state university. The distribution of the determined sample according to some variables is presented in Table 1.

Table 1. Distribution of the Sample

Variable	Value	f	%
Gender	Female	326	81,1
	Male	76	18,9
Grade level	1st Grade	229	57,0
	4th Grade	173	43,0
Department	Pre-School Education	153	38,1
	Primary School Education	70	17,4
	Science Education	93	23,1
	Mathematics Education	86	21,4
	TOTAL	402	100

Data Collection Tool

In the data collection process, “Critical Thinking Standards Scale for Teacher Candidates” developed by Aybek, Aslan, Dincer, and Coşkun Arısoy (2015) was used. The scale is a five-point Likert-type scale which shows a three-factor structure with a total of 42 items. The scale consists of three sub-factors: “Depth, Width, and Competence”, “Precision and Accuracy”, and “Importance,

Relevance, and Clarity”. In the present study, the Cronbach Alpha coefficient for the whole scale was calculated as .89 and of the sub-dimensions were calculated as .94, .89, and .82, respectively. Besides, “Reflective Thinking Scale for Teacher Candidates” developed by Güney (2008) was used to obtain the reflective thinking skill level of teacher candidates. The scale is a five-point Likert-type scale which has a single factor with a total of 42 items. In the present study, the Cronbach alpha coefficient for the whole scale was calculated as .92. These values are considered to be highly reliable for the scale to be used in the present research (Tavsancıl, 2006, p. 29).

Data Analysis

The data obtained from the evaluated scales were analyzed using a statistical program. In order to determine the level of teacher candidates' critical thinking standards and sub-dimensions and reflective thinking skills, the mean of their answers was taken. Then it was determined that the data that related to critical thinking standard and reflective thinking skill did not show a normal distribution according to results of normality test. So, a group of statistical analyses were conducted as follows:

- First, Spearman rank correlation test was conducted to determine whether there was a significant correlation between teacher candidates' critical thinking standards and sub-dimensions with reflective thinking skills;

- Critical thinking standards of teacher candidates were divided into three levels as low, positive, and high, and Mann Whitney-U test was applied to determine whether the reflective thinking skills differed significantly according to these three levels;

- Compound effect analyses were conducted to determine whether the reflective thinking skills of the teacher candidates differed significantly according to the standard level of critical thinking standards and the variables determined.

FINDINGS

In the first problem of the study, the level of teacher candidates’ critical thinking standards and reflective thinking skills was examined. The results are shown in Table 2.

Table 2. Descriptive Statistics on Critical Thinking Standards and Sub-Dimensions

Dimension	f	Minimum	Maximum	\bar{x}	S.D.
CT Standards	402	107,00	202,00	159,47	18,40
Depth, Width, and Competence	402	34,00	90,00	75,66	10,79
Precision and Accuracy	402	16,00	56,00	38,98	9,42
Importance, Relevance, and Clarity	402	16,00	59,00	44,82	7,68
Reflective Thinking	402	51,00	135,00	115,47	18,35

When the findings in Table 2 are examined, it can be stated that students have a high level of critical thinking standards, sub-dimensions, and reflective thinking skills.

In the second problem of study, it was examined whether there was a significant correlation between critical thinking standards and sub-dimensions with reflective thinking skills. The results are shown in Table 3.

Table 3. Correlation between Reflective Thinking Skills with Critical Thinking Skills and Sub-Dimensions

		Critical Thinking Standards	Depth, Width, and Competence	Precision and Accuracy	Importance, Relevance, and Clarity
Reflective Thinking Skills	Correlation coefficient	,622**	,607**	,272**	,422**
	p	,00	,00	,00	,00

**Correlation is significant at the 0.01 level (2-tailed).

When the results in Table 3 are examined, it can be said that there is a significant and positive correlation between teacher candidates' reflective thinking skills with critical thinking standards, and sub-dimensions. All correlation coefficients are found to be significant. It can be seen that the relationship between reflective thinking skills and the "precision and accuracy" sub-dimension is found to be lowest.

In the third problem of the study, critical thinking standards of teacher candidates were divided into three levels as low, positive, and high, and independent Mann Whitney-U test was applied to determine whether the reflective thinking skills differed significantly according to these three levels. The study was carried out on two levels because there was no candidate with low critical thinking standard level, and so, the results are shown in Table 4.

Table 4. Differentiation of Reflective Thinking Skills according to Levels of Critical Thinking Standard

Group	N	Mean Rank	Sum of Ranks	U	p
Positive	149	128,82	19194,50	8019,50	.00*
High	253	244,30	61808,50		

*p<.05

When the data in Table 4 are examined, it can be said that teacher candidates' reflective thinking skills differ significantly according to critical thinking standard level. Besides, it can be stated that the mean ranks determined in all scale are high in favor of teacher candidates with a high critical thinking standard level. In other words, reflective thinking skill of teacher candidates with high critical thinking standards is found to be higher than the level of teacher candidates with positive critical thinking standard.

In the fourth problem of the study, compound effect analyses were conducted to determine whether the reflective thinking skills of the teacher candidates differed significantly according to the standard level of critical thinking and the variables determined. Firstly, compound effect of gender and critical thinking standard level was investigated, and results are shown in Table 5a and Table 5b.

Table 5a. Descriptive Statistics of Teacher Candidates' Reflective Thinking Skills according to Gender and Standard Levels of Critical Thinking

Gender	N	Positive			High			Total	
		\bar{x}	SD	N	\bar{x}	SD	N	\bar{x}	SD
Female	124	106,16	1,43	202	123,37	1,12	326	114,76	,91
Male	25	95,64	3,19	51	116,58	2,23	76	106,11	1,95

Table 5b. Differentiation of Teacher Candidates' Reflective Thinking Skills according to Gender and Standard Levels of Critical Thinking

Source	Sum of Squares	df	Mean Square	F	p
Gender	4123,22	1	4123,22	16,12	,00
CT Standard Level	20049,48	1	20049,48	78,39	,00
Gender*CTSL	192,42	1	192,42	,75	,38
Error	101794,04	398	255,76		
Total	5495746,00	402			

It was found that the compound effect of the level of critical thinking standards and gender was not significant on the reflective thinking skills of teacher candidates [$F(1,398) = ,75; p > .05$]. In other words, reflective thinking skills of female teacher candidates did not differ significantly from reflective thinking skills of male teacher candidates according to the level of critical thinking standards. However, the scores obtained showed a significant difference separately in terms of critical thinking standard level [$F(1,398) = 78,39; (p < .05)$] in favor of high level and gender [$F(1,398) = 16,12; (p < .05)$] and in favor of female teacher candidates.

In the fifth problem of the study, compound effect of class level and critical thinking standard level was investigated, and results are shown in Table 6a and Table 6b.

Table 6a. Descriptive Statistics of Teacher Candidates' Reflective Thinking Skills according to Grade and Standard Levels of Critical Thinking

Grade	N	Positive		High		Total			
		\bar{x}	SD	\bar{x}	SD	\bar{x}	SD		
1 st Class	79	106,70	1,82	150	121,65	1,32	229	114,18	1,12
4 th Class	70	101,78	1,94	103	122,51	1,60	173	112,15	1,25

Table 6b. Differentiation of Teacher Candidates' Reflective Thinking Skills according to Grade and Standard Levels of Critical Thinking

Source	Sum of Squares	df	Mean Square	F	P
Grade	380,87	1	380,87	1,44	,23
CT Standard Level	29376,84	1	29376,84	111,32	,00
Grade*CTSL	772,38	1	772,38	2,92	,08
Error	105025,79	398	255,76		
Total	5495746,00	402			

It was found that the compound effect of the level of critical thinking standards and grade was not significant on the reflective thinking skills of teacher candidates, [$F(1,398) = 2,92; p > .05$]. In other words, reflective thinking skills of the first class teacher candidates did not differ significantly from reflective thinking skills of the fourth class teacher candidates according to the level of critical thinking standards. However, as seen in Table 6b, the scores obtained show a significant difference in terms of critical thinking standard level [$F(1,398) = 111,32; (p < .05)$] in favor of high level but do not show a significant difference according to grade [$F(1,398) = 1,44; (p > .05)$].

In the sixth problem of the study, compound effect of department and critical thinking standard level was investigated, and results are shown in Table 7a and Table 7b.

Table 7a. Descriptive Statistics of Teacher Candidates' Reflective Thinking Skills according to Department and Standard Levels of Critical Thinking

Department	N	Positive		High		Total			
		\bar{x}	SD	N	\bar{x}	SD	N	\bar{x}	SD
Science	47	98,36	22,85	46	121,04	19,03	93	109,58	23,84
Mathematics	42	111,61	14,60	44	116,77	13,02	86	114,25	13,97
Pre-School	38	105,73	17,85	115	122,80	9,73	153	118,56	14,26
Primary School	22	101,18	23,33	48	125,79	14,41	70	118,05	20,82

Table 7b. Differentiation of Teacher Candidates' Reflective Thinking Skills according to Department and Standard Levels of Critical Thinking

Source	Sum of Squares	df	Mean Square	F	p
Department	1330,97	3	443,65	1,75	,15
CT Standard Level	25321,39	1	25321,39	100,00	,00
Grade*CTSL	4639,46	3	1546,48	6,10	,00
Error	99762,74	394	253,20		
Total	5495746,00	402			

It was found that the compound effect of the level of critical thinking standards and department was significant on the reflective thinking skills of teacher candidates [F (1,394) =6,10; p<.05)]. However, as seen in Table 7b, the scores obtained show a significant difference in terms of critical thinking standard level [F (1,394) = 100,00; (p<.05)] in favor of high level but do not show a significant difference according to department [F (1,394) = 1,75; (p>.05)].

As a result of the variance analysis made to analyze the common effect, there was a significant difference between the mathematics education students with primary school education and pre-school education students in favor of mathematics education students with the positive critical thinking standard level. Again, between pre-school education and science education students, there was a difference in favor of pre-school education students. There was a significant difference between mathematics education students with primary school education and pre-school education students with the high critical thinking skill standard level in favor of primary school education and pre-school education students. Moreover, the standard level of critical thinking constituted a significant difference on reflective thinking skills except mathematics education department in favor of the high critical thinking skill standard level.

DISCUSSION AND CONCLUSION

The aim of this study was to investigate the relationship between teacher candidates' reflective thinking skills and critical thinking standard levels. When the findings were examined, it could be stated that there was a significant and positive correlation between teacher candidates' reflective thinking skills with critical thinking standards and sub-dimensions. It could be seen that the relationship between reflective thinking skills and the "precision and accuracy" sub-dimension were found to be lowest. Also, the teacher candidates had a high level of reflective thinking skills, critical thinking standards and sub-dimensions.

Reflective thinking is a constructivist process in which an individual creates his/her own unique intellectual products. With reflective thinking, the individual comes to a conclusion by associating the ideas about an information unit or subject in a consecutive way (Gelter, 2003). During critical thinking which is a purposeful, logical, and goal-oriented way of thinking, the individual creates inferences, calculates the possibilities, and makes decisions in a certain context in the light of these. Reflective thinking is a critical view of what is happening in this process. In this way, the individual will have the opportunity to analyze and evaluate the process of self-learning from the level of mentally immature to the highest level of experience (Halpern, 1996; Moon, 2008).

According to Dewey (1933, 1938), reflective thinking and critical thinking expressions are sometimes used interchangeably (cited in King & Kitchener, 1994). Critical thinking is the activity of making an assessment based on criteria against all events, facts, or opinions that the individual faces. Reflective thinking is associated with critical thinking of the individual on his/her own experiences. The main focus of critical thinking is the logical evaluation of all information, ideas, observations, discussions, events, and communications. The process of the reflective thinking is basically that the individual thinks critically on own experiences, defines and solves the problems encountered, and reconstructs his/her ideas for the future.

In the light of this information, it can be said that the individual must have a critical thinking skill to think reflectively, and critical thinking skill has a critical function in terms of reflective thinking skill. To be considered reflective, critical thinking skills must be used first. Therefore, it is expected that educational processes aimed at developing critical thinking skills will also show a positive change in the reflective thinking ability of the individual. Weast's (1996) list of reflective thinking sub-skills coincides with the sub-skills of critical thinking. For example, identifying causes and evidences, evaluating logical justifications, evaluating implications, and ignoring information that is not mentioned are the skills that fall within the scope of both thinking skills. Reflective thinking is a part of the critical thinking that specifically expresses the processes of analyzing and making sense of experiences (Choy & Oo, 2012).

However, accuracy which is a standard of critical thinking skill is about defining things as realistic as they are by ideas and words. In the context of this standard, it is a requirement to judge accuracy and reality by establishing an effective logic using the most reliable sources. Thinking is precise when someone is sufficiently qualified and detailed to think rationally about a topic. The point to be considered here is that the exact thing is related to the purpose of thinking and the situation. So, precision and accuracy, both, are related to level of openness of expressions used by individuals while they are expressing themselves to other individuals. In contrast, reflective thinking is an intrinsic activity and related to self-experiences and knowledge. So, the nature of this sub-dimension and reflective thinking is not so much related, and the statistics support this situation.

Norton (1994) stated that teachers and students who are good at reflective thinking are individuals who constantly question their goals, follow the results of their applications, think short and long term, and take into consideration the opinions of others while making evaluations and show a critical thinker feature in this sense. In this context, the process of developing critical thinking skills in the research provides an improvement in students' reflective thinking skills and supports the expression of the close and mutual relationship between these two skills in the literature. Also, Griffin (2003) found in his study that a supervised field experience including skills based and coaching in which critical events are used improves teachers' critical and reflective thinking skills.

In Chi's (2010) research, at the end of a curriculum which included reflective thinking activities as a result of the development of teachers' reflection skills, it was determined that they were more competent in situations of uncertainty, instability and conflict of value in various contexts. Also, the process raised awareness on instructional efficiency and improved critical thinking skills of both teachers and learners. Saçlı (2013) found in his study that critical thinking in the reflective student diaries is a dominant component among the intellectual difficulties encountered in the lessons and the logical solutions produced at the beginning and end of the period. However, it has shown that critical thinking has been used as an intellectual resource from the beginning of the period to the end and critical thinking skill developed along this process. Aktaş (2016) carried out study on 400 undergraduate students and tried to determine whether there was a relationship between students' reflective thinking dispositions and their critical reading self-efficacy perceptions. According to the results of the research, there is a significant relationship between students' perception of critical reading self-efficacy and reflective thinking scores. These findings are in line with the results of the study.

In the study, critical thinking standards of teacher candidates were divided into three levels as low, positive, and high. When the data were examined, it could be said that teacher candidates' reflective thinking skills differed significantly according to critical thinking standard level. Besides, it can be stated that the mean ranks determined in all scale were high in favor of teacher candidates with high critical thinking standard level. This result supports the existence of the relationship between the two skills. Critical thinking, in particular, serves as an important provocative for reflective thinking and significantly affects the level and efficiency of reflective thinking in students.

Brabeck (1981) determined that critical thinking skill was in the context of reflective judgment and also limited its conduction. In other words, the inadequacy of critical thinking skills will lead to deficiencies in the application of reflective thinking skills. In the study, the reflective thinking skills of the students with high critical thinking skills were found to be significantly higher than those with low critical thinking skills. Also, the sub-skills of deduction, inference, recognition of assumptions, interpretation, and evaluation were found to be associated with a high level of reflective judgment in this study. So, findings of that study support the claim that critical thinking skill is an important predictor of reflective thinking skill.

In their study Meral and Semerci (2009) found a significant relationship between critical and reflective thinking dispositions of teacher candidates and also according to them, there were significant relationships between the sub-skills of these two skills. Many researchers have found that activities related to one of these two skills have positive effects on the other skill (Bruster & Peterson, 2013; Forneris & Peden-McAlpine, 2007; Francis, 1997; Griffin, 2003; Griffith & Frieden, 2000; Sparks-Langer & Colton, 1991).

Also, Demir (2015) stated that critical and reflective thinking skills support and strengthen one another. For this reason, developing these two skills is highly important for gaining the ability to acquire scientific perspective. According to some researchers (Kennison, 2006; Naber & Wyatt 2014; Scheffer & Rubinfeld, 2000), using reflective discussions or reflective writing activities in teaching processes had a significant effect on development of critical thinking skill. Ghanidzeh (2017) also found that reflection and critical reflection predicted critical thinking positively and significantly. Also, self-monitoring which was an important skill for reflective thinking had a positive and significant impact on critical thinking. So, there is a clear correlation between critical thinking and reflective thinking. In her experimental study, Junsay (2016) divided teacher candidates into two groups as lecture/discussion and the reflective learning group. As a result, the reflective learning approach was found effective in developing the critical thinking skills of the teacher candidates, and this indicated a relationship between these two thinking skills.

In learning-teaching processes, reflective thinking and critical thinking skills are necessary for teachers whose roles have changed fundamentally since constructivist approach was used in educational settings. During the 1980s and 1990s, the goals of student teacher research moved toward reflection and critical thinking. Modern pre-service teacher education focuses on teacher candidates' reflect on their own practice. Rather than merely reflecting on what they teach, they must reflect on how they teach (Kember et al., 2000). Teachers can reach a level that can make specific decisions by changing the objectives, content, strategy and method, and evaluation dimensions by taking into account the reflections they make and the educational context they are in. They see themselves as decision-makers and critical/reflective thinkers who can make a difference in the lives of children. They are not passive recipients of the ideas and the knowledge of others. Pre-service teacher education programs must search ways to develop the reflective/critical thinking skills of teacher candidate if we are to have a role in reforming and restructuring schools (Raines, 2015).

In this study, also, compound effect analyses were conducted to determine whether the reflective thinking skills of the teacher candidates differed significantly according to the critical thinking standards level and the variables determined. It was found that the compound effect of the critical thinking standards level and gender and grade was not significant on the reflective thinking skills of the teacher candidates. However, it was found that the compound effect of the critical

thinking standards level and department was significant on the reflective thinking skills of teacher candidates.

Some reflective judgment studies (Brabeck, 1981; Brabeck, et al, 1981) indicated that reflective judgment scores increase with educational level. Therefore, the level of reflective thinking skills depends not only on other thinking skills such as critical thinking skills, but also on other variables. In this study, the department variable has emerged as a variable that constitutes this difference. As a result of the study conducted by Şahin (2011), it was determined that gender variable had no effect on reflective thinking disposition. So the finding of Şahin (2011) related to gender is in line with the findings of this study.

Also, it was found that the reflective thinking tendencies of the prospective teachers in the fourth grade were higher than those of the first grade. In spite of this, many researchers state that thinking skills do not develop automatically by maturation, but that these skills develop only when students gain experience through deliberate and planned educational activities (Beyer, 1991; Daniel & Auriac, 2011; Feuerstein, Hoffman, Rand, Jensen, Tzuriel, & Hoffmann, 1985; Sternberg, 1987). This view supports the finding that the class variable does not have a significant effect on reflective thinking.

According to the results of the study, the reflective thinking skills of the pre-service teachers of mathematics teaching department were found to be higher than the other departments. This situation can be explained by the instruction of mathematics discipline. The widespread support of different ways of thinking in mathematics teaching and the support of flexible thinking for solutions rather than transferring knowledge and the exact use of specific procedures may have had a positive impact on the thinking skills of students in this department.

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