



*Full Length Research Paper*

# **An investigation of critical thinking dispositions of mathematics teacher candidates**

**Abdullah C. Biber, Abdulkadir Tuna and Lutfi Incikabi\***

Assist. Prof. Dr. Kastamonu University, Department of Mathematics Education, Kastamonu, Turkey.

Abstract

**Critical thinking is a skill that is needed for success in every period of life. Teacher candidates, as being students currently, needs to their improve critical thinking skills and, as being teachers in future, are required to know the ways of improving their clients' skill of critical thinking. The aim of this study was to determine the mathematics teacher candidates' critical thinking dispositions based on the variables of grade level in college, high school type, gender, and reading practice. The study, being a case study, included a total of 99 mathematics teacher candidates as the sampling. Among the results of the study were that mathematics teacher candidates generally possessed low level of critical thinking dispositions (CTD) that high school was the only variable that significantly affecting teacher candidates' CTD, and that reading practices weakly correlated with CTD.**

**Keywords:** Critical thinking dispositions, mathematics teacher candidates, teacher education.

## **INTRODUCTION**

In today's information era, thinking skills attracts main interests of educated persons to cope with a rapidly changing world. Most researchers in the field of education carry the belief that specific knowledge, in future, will not be as important to workers and citizens as the ability to learn and make sense of new information. Critical thinking is not a luxury but a requirement that should not be neglected. Efficiency in teaching at different education levels is mainly supported by the students who can use thinking processes effectively (Paul and Elder, 2001). Students need to be able to analyze knowledge, in other words they should know how to use their knowledge (Brad, 1994). Within this regard, carrying expectation of academic achievement from the students who go through educational processes focusing on critical thinking would not be a mistake (Elias and Kress, 1994).

Norris (1985) defines critical thinking as change in the students' behaviors based on their evaluation of own thinking abilities after applying their whole knowledge on

a topic. According to Norris (1985), critical thinking "requires individuals to assess their own and others' views, to seek alternatives, make inferences, and to have the disposition to think critically" (pp. 44). According to Ennis (2002), students need to gain or improve the skill of thinking from a wide perspective and the skill of transferring their knowledge from other areas while solving problems in an area. Johnson (2000) defines critical thinking as processing information through organizing, analyzing and evaluating. Moreover, critical thinking is to investigate the information for its trueness and conciseness, and it values beliefs, arguments and hypothesis (Beyer, 1987). In 1990, with the leadership of American Psychology Association (ASA), 46 theoreticians from the USA and Canada convened in order to provide a common and interdisciplinary definition of critical thinking. The agreement produced a definition of critical thinking as evaluative and conscious judgment for deciding what to do and what to believe (Evancho, 2000). According to the definition, an individual with the ability of critical thinking decides by providing and stating conscious judgments about the evaluations on the subject. Branch (2000) states the characteristics of the individuals, who possess the critical thinking, as inquisitiveness, open mindedness, systematicity,

---

\*Corresponding Author E-mail: [lutfiincikabi@yahoo.com](mailto:lutfiincikabi@yahoo.com)

intellectual maturity, self-confidence and truth-seeking. Similarly, McGrath (2003) defines behaviors regarding critical thinking as analyticity, open mindedness, looking for the needed, systematicity, self-confidence, maturity and inquisitiveness.

Truth-seeking is the tendency for evaluating alternatives or different ideas. Open-mindedness means to be respectful for different approaches and to be able to tolerate one's own mistake. The main principal of open-mindedness is to take into account other thoughts during decision process. Analyticity includes paying attention to potential obstacles, reasoning even for the most difficult problems, and tending to use objective evidence. Systematicity is the tendency for researching systematic, planned and attentive. Systematicity is a decision-making strategy based on information and procedures. Self-confidence reflects one's confidence in his/her reasoning procedures. Inquisitiveness means the tendency for looking for information and learning new things without expecting any profit. Maturity is defined as mental and cognitive development (Facione and Facione, 1992; Facione et al., 1995; Kokdemir, 2003).

Critical thinking is a skill that is needed for success in every period of life. According to Gibson, thinking is as natural as breathing except that good thinking does not occur by itself; it urges education. Many educational researches highlights the value of critical thinking and the skills needed for critical thinking. According to Weiss (1993), the aim of education at all levels is to improve students' higher and complex thinking processes that will be contribute on their academic success in classrooms as well as on their future careers.

Nowadays, schools are responsible for improving the skill of critical thinking (Kokdemir, 2003). Thus, it is aimed and expected results from the education to produce individuals with high critical skills (Branch, 2000; Halpern, 1993). Teacher candidates, as being students currently, needs to their improve critical thinking skills and, as being teachers in future, are required to know the ways of improving their clients' skill of critical thinking. In order to clearly, completely, correctly, meaningfully learn the new information by employing the prior knowledge and to transfer their knowledge to their life, individuals have to achieve critical thinking skills during their years in school (Caliskan, 2009).

### Mathematics education and critical thinking

Baykul (2003) stresses that mathematics courses should aim to improve such skills as reasoning, critical thinking and problem solving in order to prepare students for life and further education. However, mathematics is generally regarded as a science that does not allow for critical thinking (Kokdemir, 2003). The mathematical rules are known as firm and fixed. The system of critical thinking

does not abuse the rules in mathematics or does not deny the mathematical facts without evidence. However, this approach is aware that  $3 \times 3 = 9$  is not an undeniable rule as long as it was not defined in the base 10 or more (Kokdemir, 2003).

Under the light of the above explanations, the effect of college education on the critical thinking skill of mathematics teacher candidates is a matter of curiosity, since their field of education is regarded as closed for critical thinking. The current study, for this reason, aimed to determine the mathematics teacher candidates' critical thinking dispositions based on the variables of grade level in college, high school type that they were graduated, gender and practices of reading book and newspaper. Toward this aim, the main research problem was "how are the critical thinking dispositions of mathematics teacher candidates?" and included the sub-problems as follow;

1. Is there any difference in mathematics teacher candidates' critical thinking dispositions in terms of their year (grade) in college?
2. Is there any difference in mathematics teacher candidates' critical thinking dispositions in terms of high school type?
3. Is there any difference in mathematics teacher candidates' critical thinking dispositions in terms of their gender?
4. Is there any relation between mathematics teacher candidates' critical thinking dispositions and their practices of reading book and newspaper?

### METHODOLOGY

The methodology adopted in the current study was a case study, in which a researcher can examine one setting, or a single subject, a single depository of documents, or one specific event (Meriam, 1988; Stake, 1994). The case being examined within the scope of this study involves determination of some variables affecting critical thinking skills of mathematics teacher candidates.

### Sampling procedures

A total of 99 mathematics teacher candidates consisted of the sampling of the study. Participants were students in the department of elementary mathematics education at a university in Turkey. The demographics of the teacher candidates were provided in Table 1. The percentage of the female participants was more than double of the one of the males (70 percent versus 29 percent, respectively). Fifty one percent of the participants were graduated from Anatolian high schools where as 27 percent of them was graduated from regular high schools, and 21 percent from Anatolian Teacher

**Table 1.** Demographic information regarding mathematics teacher candidates participated to the study

Demographic Categories		F	%
<b>Gender</b>	Female	70	70,7
	Male	29	29,3
<b>Graduated high school type</b>	Anatolian high school	51	51,5
	Anatolian teacher high school	21	21,2
	Regular high school	27	27,3
<b>Grade in College</b>	Second grade	65	65,7
	Third grade	22	22,2
	Fourth grade	12	12,1
<b>Total</b>		99	100

high schools. The number of the teacher candidates who were their in second year in college ( $n=65$ ) was more than the total number candidates who were in their third and fourth year in college.

### Data collection tool

The data were collected through Turkish version of the California critical thinking disposition inventory (CCTDI-R). The instrument was developed by Facione et al. (1999) and was translated into Turkish by Kokdemir (2003). The translated version of CCTDI included 6 dimensions and 51 items. The dimensions and related reliability coefficient (Cronbach's alpha) of CCTDI are analyticity (0.75), open-mindedness (0.75), inquisitiveness (0.78), self-confidence (0.77), truth-seeking (0.61), and systematicity (0.63).

Being Likert-type six, CCTDI had the standard scores of 6 (minimum) or 60 (maximum) that were calculated though dividing the raw scores for each dimension by the number of the items and then multiplying it by ten. For CCTDI dimensions, Facione et al. (1998) accepted the scores below of 40 as low level of critical thinking disposition, the ones between 40 and 50 as medium level of critical thinking, and the ones over 50 as high. Therefore, for the whole CCTDI, the individuals who score less than 240 ( $40 \times 6$ ) can be regarded low in critical thinking dispositions and the ones who score more than 300 ( $50 \times 6$ ) can be regarded high in critical thinking dispositions (Kokdemir, 2003).

### Data analysis

Data collected through the CCTDI instrument was analyzed by using SPSS 15.0. General characteristics of the research sample was determined by means of descriptive statistics and analyzed in order to answer the

related research question. In order to test the meaningfulness of the score differences between independent samples, the researchers utilized a one-way analysis of variance (ANOVA) and independent-samples t-test. The effect size for each analysis was also reported. During all computations, p value was taken as 0,05. The relationship between reading practice and critical thinking dispositions was analyzed by using Pearson correlation test.

### FINDINGS

The results relating mathematics teacher candidates' critical thinking dispositions were provided according to the research questions. Figure 1 shows the descriptive statistics related to critical thinking scores of the mathematics teacher candidates.

In general, mathematics teacher candidates' critical thinking dispositions ( $X = 31.06$ ) were lag behind the medium level based on the evaluation scale of Facione et al. (1998). Similar tendency were evident in the all dimensions of CCTDI but the dimension open-mindedness for which teacher candidates score was at the medium level ( $X = 43.75$ ).

### Grade and critical thinking dispositions

Table 2 shows the mean scores for the mathematics teacher candidates' logical thinking ability based on their grade level. Mathematics teacher candidates' total scores on CCTDI did not differ too much while teacher candidates who were in their second year in college received the highest mean score ( $X=187.05$ ,  $sd=23.60$ ). At all grade levels, teacher candidates' highest mean score occurred for the open-mindedness dimension while

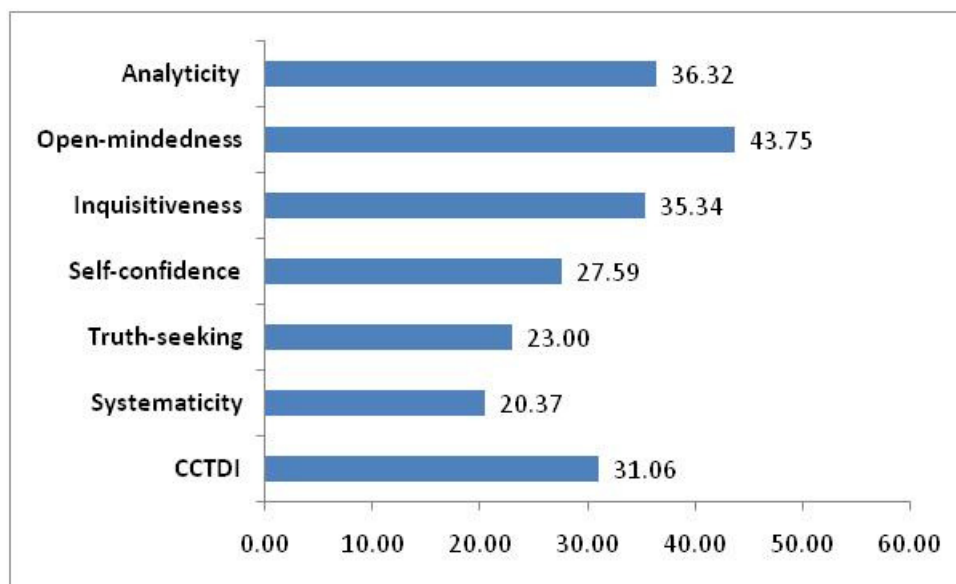


Figure 1. Mathematics teacher candidates' critical thinking scores on CCTDI dimensions

Table 2. Descriptive statistics regarding critical thinking dispositions of mathematics teacher candidates in terms of their grade level in college

Dimensions	Second Year (n=65)		Third Year (n=22)		Fourth Year (n=22)	
	Mean.	SD	Mean.	SD	Mean	SD
Analyticity	36,51	6,37	36,55	4,02	34,92	5,14
Open-mindedness	43,82	6,88	42,59	5,29	45,50	5,42
Inquisitiveness	35,31	6,69	35,05	4,60	36,08	4,72
Self-confidence	27,65	5,22	27,50	4,84	27,42	4,40
Truth-seeking	23,03	4,88	24,09	5,01	20,83	5,57
Systematicity	20,74	4,03	19,68	3,01	19,67	4,08
CCTDI	187,05	23,60	185,45	14,26	184,42	18,02

they had the lowest score for the dimension of truth-seeking.

In order to determine whether these slight differences in the mean scores were statistically meaningful, a one-way analysis of variance (ANOVA) test was utilized. Table 3 shows that, the grade variable was not a statistically significant factor [ $F(2;96)=0.104$ ;  $p > 0.05$ ] affecting critical thinking dispositions of mathematics teacher candidates for both CCTDI and its dimensions.

### High school type and critical thinking dispositions

Table 4 provides the descriptive statistics regarding the critical thinking dispositions of mathematics teacher candidates based on the high school type that they were graduated. The mathematics teacher candidates who

came through Anatolian high school possessed the highest mean score ( $X=190.67$ ) for CCTDI and were followed by the teacher candidates graduated from regular high school ( $X=183.96$ ). Anatolian teacher high school graduates held the least mean score on CCTDI ( $M=179.05$ ).

In order to determine whether these differences in the mean scores were statistically significant, a one-way analysis of variance (ANOVA) test was applied. As seen from Table 5, based on their high school type, mathematics teacher candidates' critical thinking skills differed significantly in the dimensions of analyticity [ $F_{(2;96)}=3,922$ ;  $p<0,05$ ] and truth-seeking [ $F_{(2;96)}=3,261$ ;  $p<0,05$ ]. In addition, the mean differences in the other dimensions and in the whole CCTDI could be statistically disregarded.

Scheffe analysis of Post Hoc tests showed that the

**Table 3.** ANOVA results of mathematics teacher candidates' scores on CCTDI

		Sum of Squares	df	Mean Square	F	Sig.
Analyticity	Between Groups	27,039	2	13,520	,402	,670
	Within Groups	3224,617	96	33,590		
	Total	3251,657	98			
Open-mindedness	Between Groups	66,584	2	33,292	,812	,447
	Within Groups	3938,103	96	41,022		
	Total	4004,687	98			
Inquisitiveness	Between Groups	8,606	2	4,303	,116	,890
	Within Groups	3553,717	96	37,018		
	Total	3562,323	98			
Self-confidence	Between Groups	,742	2	,371	,015	,986
	Within Groups	2451,278	96	25,534		
	Total	2452,020	98			
Truth-seeking	Between Groups	82,577	2	41,288	1,655	,197
	Within Groups	2395,423	96	24,952		
	Total	2478,000	98			
Systematicity	Between Groups	25,178	2	12,589	,855	,429
	Within Groups	1413,993	96	14,729		
	Total	1439,172	98			
CCTDI	Between Groups	93,939	2	46,969	,104	,902
	Within Groups	43473,233	96	452,846		
	Total	43567,172	98			

**Table 4.** Descriptive statistics regarding critical thinking dispositions of mathematics teacher candidates in terms of the variable of high school type

Dimensions	High school type	N	Mean	SD
Analyticity	Anatolian high school	51	37,71	5,00
	Anatolian teacher high school	21	33,76	4,21
	Regular high school	27	35,70	7,34
	Total	99	36,32	5,76
Open-mindedness	Anatolian high school	51	44,71	5,23
	Anatolian teacher high school	21	41,90	4,46
	Regular high school	27	43,37	9,03
	Total	99	43,75	6,39
Inquisitiveness	Anatolian high school	51	36,35	4,91
	Anatolian teacher high school	21	34,95	5,47
	Regular high school	27	33,74	7,92
	Total	99	35,34	6,03
Self-confidence	Anatolian high school	51	27,37	4,94
	Anatolian teacher high school	21	27,05	4,98
	Regular high school	27	28,41	5,23
	Total	99	27,59	5,00
Truth-seeking	Anatolian high school	51	24,04	3,96
	Anatolian teacher high school	21	20,81	4,87
	Regular high school	27	22,74	6,38
	Total	99	23,00	5,03
Systematicity	Anatolian high school	51	20,49	3,23
	Anatolian teacher high school	21	20,57	3,87
	Regular high school	27	20,00	4,86
	Total	99	20,37	3,83

**Table 4.** Continue

CCTDI	Anatolian high school	51	190,67	16,99
	Anatolian teacher high school	21	179,05	15,41
	Regular high school	27	183,96	29,20
	Total	99	186,37	21,08

**Table 5.** ANOVA test results for CCTDI mean scores of mathematics teacher candidates based on the high school type variable

		Sum of Squares	df	Mean Square	F	Sig.
Analyticity	Between Groups	245,629	2	122,815	3,922	,023
	Within Groups	3006,027	96	31,313		
	Total	3251,657	98			
Open-mindedness	Between Groups	121,993	2	60,996	1,508	,227
	Within Groups	3882,694	96	40,445		
	Total	4004,687	98			
Inquisitiveness	Between Groups	124,539	2	62,269	1,739	,181
	Within Groups	3437,785	96	35,810		
	Total	3562,323	98			
Self-confidence	Between Groups	26,628	2	13,314	,527	,592
	Within Groups	2425,392	96	25,265		
	Total	2452,020	98			
Truth-seeking	Between Groups	157,655	2	78,828	3,261	,043
	Within Groups	2320,345	96	24,170		
	Total	2478,000	98			
Systematicity	Between Groups	5,284	2	2,642	,177	,838
	Within Groups	1433,888	96	14,936		
	Total	1439,172	98			
CCTDI	Between Groups	2223,923	2	1111,962	2,582	,081
	Within Groups	41343,249	96	430,659		
	Total	43567,172	98			

mathematics teacher candidates who were graduated from Anatolian high school had significantly higher level of analyticity than those graduated from Anatolian teacher high schools (Table 6). The score differences in analyticity between other schools did not produce a statistical importance. In addition, the meaningful differences in the truth-seeking were evident between the mathematics teacher candidates who were graduated from Anatolian high school and the teacher candidates from Anatolian teacher high schools, in favor of Anatolian high school graduates. Similarly, the truth-seeking scores of the mathematics teacher candidates who came through regular high schools were meaningfully higher than those of Anatolian teacher high school graduates. Although the scores of Anatolian high

school graduates were meaningfully higher than those of regular high school graduates, the difference was not statistically important.

#### Gender and critical thinking disposition

Table 7 shows the descriptive statistics and independent-samples t-test results regarding CCTDI mean scores of mathematics teacher candidates based on the gender variable. Although the CCTDI mean scores of female mathematics teacher candidates ( $X=187.91$ ) were higher than those of the male teacher candidates ( $X=182.66$ ), the difference was not statistically meaningful ( $F(97)=1.131$ ;  $P>0.05$ ). Among

**Table 6.** Post hoc results of CCTDI mean scores of mathematics teacher candidates based on the high school type variable

Dependent Variable	(I) High school type	(J) High school type	Mean Difference (I-J)	Std. Error	p
Truth-seeking	Anatolian teacher high school	Regular high school	2,00	1,33	,327
		Anatolian high school	-3,94	1,45	,028
		Regular high school	-1,94	1,63	,494
		Anatolian high school	-2,00	1,33	,327
		Anatolian teacher high school	1,94	1,63	,494
		Anatolian teacher high school	3,23*	1,27	0,04
	Regular high school	Regular high school	1,30	1,17	0,54
		Anatolian high school	-3,23*	1,27	0,04
		Regular high school	-1,93*	1,43	0,41
		Anatolian high school	-1,30	1,17	0,54
		Anatolian teacher high school	1,93*	1,43	0,41
		Regular high school	1,93*	1,43	0,41

\*The mean difference is significant at the 0.05 level.

**Table 7.** An independent-samples t-test result for CCTDI mean scores of mathematics teacher candidates based on the gender variable

Dimensions	Gender	N	Mean	SD	t	df	p
Inquisitiveness	Female	70	35,47	6,35	,327	97	,745
	Male	29	35,03	5,27			
Analyticity	Female	70	37,21	5,94	2,452	97	,016
	Male	29	34,17	4,73			
Open-mindedness	Female	70	44,29	6,91	1,306	97	,195
	Male	29	42,45	4,77			
Self-confidence	Female	70	27,99	4,81	1,239	97	,218
	Male	29	26,62	5,40			
Truth-seeking	Female	70	22,80	4,99	-,613	97	,541
	Male	29	23,48	5,17			
Systematicity	Female	70	20,16	4,01	-,873	97	,385
	Male	29	20,90	3,36			
CCTDI	Female	70	187,91	22,52	1,131	97	,261
	Male	29	182,66	16,92			

**Table 8.** Pearson correlation test results for Mathematics teacher candidates teaching practices and their CCTDI scores

	RP	I	A	OM	SC	TS	S	CCTDI
Pearson Correlation	1	,160	,127	,156	,114	,108	,057	,191
RP Sig. (2-tailed)		,113	,210	,123	,263	,285	,578	,058
N	99	99	99	99	99	99	99	99

RP:Reading practices; I: Inquisitiveness; A: Analyticity; OM: Open-mindedness; SC:Self-confidence; TS: Truth-seeking; S:Systematicity.

the dimensions of CCTDI, analyticity has produced a significant change ( $F(97)=2.452$ ;  $P<0.05$ ] between female ( $X=37.21$ ) and males (34.17) by favoring females. Overall, it can be deduced that gender variable was not a affecting factor of the critical thinking dispositions.

### Reading practices and critical thinking disposition

Pearson correlation test was applied to Mathematics teacher candidates' CCTDI scores and their practices of reading book and newspaper (Table 8). The results produced a weak correlation between mathematics teacher candidates' reading practices and their CCTDI scores.

### CONCLUSIONS AND DISCUSSIONS

This study aimed to investigate whether the critical thinking dispositions of mathematics teacher candidates were being affected by the variables of grade level, graduated high school type, gender, and reading practices. The results obtained during this study were limited to the participants and the instrument that was utilized.

Among the results of the study was that mathematics teacher candidates, in general, possessed low level of critical thinking dispositions. Similar results were also evident in a study conducted by Guven and Kurum (2007) who sought for teaching styles of mathematics teacher candidates besides their critical thinking dispositions. Although some studies (Korkmaz and Yeşil, 2009; Özdemir, 2005a; Saçlı and Demirhan, 2008; Şen, 2009) have shown that undergraduate students had medium level of critical thinking skills, the number of studies (Bulut et al., 2009; Dutoğlu and Tuncel, 2008; Şenlik et al., 2011) that found college students' level of critical thinking as low can not be deemphasized.

Another conclusion was that mathematics teacher candidates' year in college was not significantly changed their critical thinking dispositions. A general synthesis of this result might be that mathematics teacher education programs do not contribute on the students' critical thinking dispositions. When considered the importance of the critical thinking ability in teaching of mathematics (Aslan, 2003; Erdoğan and Uşak, 2005; Yapıcı, 2007; Yetim and Göktaş, 2004), it is suggested that mathematics teacher education programs should include courses or activities towards improving critical thinking skills. Moreover, student-centered teaching approaches should replace traditional teaching in college mathematics courses.

A significant difference was evident between mathematics teacher candidates' critical thinking

dispositions and the high school type that they graduated, especially in favor of the Anatolian high school graduates. The study also indicated that analyticity disposition of the female teacher candidates meaningfully higher than those of the male teacher candidates whereas CCTDI of males and females, in general, did not differ significantly. This result shows that gender variable was not an affecting factor of the critical thinking dispositions. Similar results were also evident in some other studies (Aybey, 2006; Gelen, 2002; Kokdemir, 2003; Yaman and Yalcin, 2004; Yeh, 1997).

The study lastly indicated the weak correlation between critical thinking dispositions and reading practices of the mathematics teacher candidates. In the educational settings where critical thinking education is a part of continuing education, students did not only perform (academically) better but also they behave more responsible and helpful in their social life by leaving their addictions (Elias and Kress, 1994). Under consideration of these benefits of critical thinking education, in all education levels, courses and their ingredients should be adjusted and supported with the activities improving higher-order cognitive skills such as problem solving and critical thinking. Teacher education programs should also include critical thinking courses that would contribute to teacher candidates in three contexts: Conversation ability, perception of the cognitive procedure and intellectual development (Kurfiss,1988).

### REFERENCES

- Aslan K (2003). Eğitim Fakültelerinin Yeniden Yapılandırılmalarına İlişkin Bir Değerlendirme. Balıkesir University Social Sciences Journal, 6(9): 23-37.
- Aybek B (2006). Konu ve Beceri Temelli Eleştirel Düşünme Öğretiminin Öğretmen Adaylarının Eleştirel Düşünme Eğilimi ve Düzeyine Etkisi. Unpublished doctoral dissertation. Adana: Çukurova University.
- Baykul Y (2003). İlköğretimde Matematik Öğretimi 1-5 Sınıflar için. Ankara: Pegem Yayıncılık.
- Beyer B (1987). Practical Strategies for the Teaching of Thinking. Boston: Allyn and Bacon, INC.
- Brad R (1994). Eleştirel Düşünme Becerilerini Öğretme. (Çev: Güzin Büyükkurt). Education and Science. 18(91): 45-49.
- Branch BJ (2000). The Relationship Among Critical Thinking, Clinical Decision Making, and Clinical Practica: A Comparative Study. Master's Thesis. University of Idaho.
- Bulut S, Ertem G, Sevil Ü (2009). Hemşirelik Öğrencilerinin Eleştirel Düşünme Düzeylerinin İncelenmesi. Dokuz Eylül Üniversitesi Hemşirelik Yüksekokulu Elektronik Dergisi, 2(2): 27-38.
- Çalışkan H (2009). Sosyal Bilgiler Öğretiminde Araştırmaya Dayalı Öğrenme Yaklaşımının Eleştirel Düşünme Becerisine Etkisi. Kastamonu Education Journal. 17: 57-70.
- Demirel Ö (2002). Planlamadan Değerlendirmeye Öğretmen Sanatı. Ankara: Pegem A Yayıncılık.
- Dutoğlu G, Tuncel M (2008). Aday Öğretmenlerin Eleştirel Düşünme Eğilimleri ile Duygusal Zeka Düzeyleri Arasındaki İlişki. Abant İzzet Baysal Üniversitesi Eğitim Fakültesi Dergisi, 8(1).
- Elias MJ, Kress JS (1994). Social decision-making and life skills development: a critical thinking approach to health promotion in the middle school. Journal of School Health. 64(2): 62-66.
- Ennis RH (2002). "A Super Streamlined Conception of Critical



- Thinking". Retrieved August 3, 2007, from <http://www.criticalthinking.com/articles.html> 15.12.2008
- Erdoğan M, Uşak M (2005). Fen Bilgisi Öğretmen Adayları Memnuniyet Ölçeğinin Geliştirilmesi. *Journal of Gazi Educational Faculty*. 25(2): 35-54.
- Evancho RS (2000). Critical thinking skills and dispositions of the undergraduate baccalaureate nursing student. Unpublished doctoral dissertation. Connecticut: Southern Connecticut State University.
- Facione PA, Facione N. (1992). The California Critical Thinking Dispositions Inventory (CCTDI); and CCTDI Test Manual, Millbrae, CA: California Academic Press,
- Facione PA, Facione NC, Giancarlo CAF (1995). The Disposition Toward Critical Thinking. *Journal of General Education*. 44(1): 1-25.
- Facione PA, Facione NC, Giancarlo CAF (1999). Professional Judgment and the Disposition Toward Critical Thinking. California Academic Press.
- Gelen İ (2002). Sınıf Öğretmenlerinin Sosyal Bilgiler Dersinde Düşünme Becerilerini Kazandırma Yeterliklerinin Değerlendirilmesi. *Çukurova University Social Sciences Journal*. 10(10): 100-119.
- Güven M, Kürüm D (2007 ). Teacher Candidates' Learning Styles And Critical Thinking Dispositions. *Electronic Social Sciences Journal*. 6(21): 60-90.
- Halpern DF (1993). Assessing The Effectiveness of Critik-Thinking Instruction. *The Journal of General Education*. 42(4): 338-353.
- Johnson A (2000). Using Creative and Critical Thinking Skills to Enhance Learning. Boston: Allyn and Bacon.
- Karasar N (1999). Bilimsel Araştırma Yöntemi: Kavramlar, İlkeler, Teknikler, Ankara: Nobel Yayınevi.
- Korkmaz O, Yeşil R (2009). Öğretim Kademelerine Göre Öğrencilerin Eleştirel Düşünme Düzeyleri. *Ahi Evran University Kırşehir Education Faculty Journal*. 10(2): 19-29.
- Kökdemir D (2003). Belirsizlik Durumlarında Karar Verme ve Problem Çözme. Unpublished doctoral dissertation. Ankara: Ankara University.
- Kurfiss J (1988). Critical thinking: Theory, research, practice, and possibilities. ASHE-ERIC Higher Education Report No. 2. Washington, DC: Association for the Study of Higher Education.
- McGrath J (2003). The Relationship of Critical Thinking Skills and Critical Thinking Dispositions of Baccalaureate Nursing Student. *Journal of Advanced Nursing*. 43(6): 569-577.
- Meriam SB (1988). The case study research in education. San Francisco: Jossey-Bass.
- Norris SP (1985). Synthesis of research on critical thinking. *Educational Leadership*. 8: 40-45.
- Özdemir S (2005). Web Ortamında Bireysel ve İşbirlikli Problem Temelli Öğrenmenin Eleştirel Düşünme Becerisi, Akademik Başarı ve İnternet Kullanımına Yönelik Tutuma Etkileri. Unpublished doctoral dissertation. Ankara: Gazi University.
- Özden Y (2005). Öğrenme ve Öğretme. Ankara: PegemA Yayıncılık.
- Paul R, Elder L (2001). Critical Thinking: Tools for Taking Charge of Your Learning and Your Life . Upper Saddle River, Nj: Prentice Hall.
- Saçlı F, Demirhan G (2008). Beden Eğitimi ve Spor Öğretmenliği Programında Öğrenim Gören Öğrencilerin Eleştirel Düşünme Düzeylerinin Saptanması ve Karşılaştırılması. *Spor Bilimleri Dergisi*. 19 (2): 92-110.
- Seferoğlu S, Akbıyık C (2006). Eleştirel Düşünme ve Öğretimi. *Hacettepe University Education Faculty Journal*. 30: 193-200.
- Semerci N (2000). Kritik düşünme ölçeği. *Education and Science*. 25(116): 23-26.
- Stake RE (1994). Case studies. In YK Denzin and YS Lincoln (Eds), *Handbook of qualitative research*. Thousand Oaks, CA: Sage, pp.236-246.
- Şen Ü (2009). An Evaluation about Turkish Teacher Candidates' Critical Thinking Attitude's in Terms of Difference Variable. *Journal of World of Turks*. 1(2): 69-89.
- Şenlik NZ, Balkan Ö, Aycan Ş (2011). Öğretmen Adaylarının Eleştirel Düşünme Becerileri: Muğla Üniversitesi Örneği. *C.B.Ü. Fen Bil. Dergisi* 7(1), 67-76.
- Torres RM, Jamie C (1995). Learning Style: A Factor to Critical Thinking? *Journal of Agricultural Education*. 36(4): 55-62.
- Weiss, C. A. (1993). But how do we get them to think? In M.Svinicki (Ed), *Teaching excellence: Toward the best in the academy*. Ames, IA: PODNetwork.
- Yaman S, Yalçın N (2004). Fen Bilgisi Öğretiminde Probleme Dayalı Öğrenme Yaklaşımının Yaratıcı Düşünme Becerisine Etkisi. *İlköğretim-Online*. 4(1): 42-52.
- Yapıcı M (2007). Öğretmen tutumları ve yansımalar. *Science, Education and Thinking Journal*. 7(3).
- Yeh Y (1997). Teacher Training For Critical-Thinking Instruction Via a Computer Simulation. PhD Thesis. Univerty of Virginia.
- Yetim AA, Göktaş Z (2004). Öğretmenin Mesleki ve Kişisel Nitelikleri. *Kastamonu Education Journal*. 12(2). 551-560.