Evaluation of Critical Thinking Tendencies of Prospective Primary School and Primary Science Teachers

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Abstract: This research, aims to assess the critical thinking abilities of prospective primary school and primary science teachers, was obtained by using California Critical Thinking Tendency Scale The inventory was applied to 560 randomly selected prospective teachers (ranged from 1st, 2nd, 3rd and 4th year) in Faculty of Education at Çanakkale Onsekiz Mart University in Turkey in 2006 and analysed using SPSS program. The students who answered entry incorrectly excluded from the study. Finally, the answers of 480 teacher candidates were taken into consideration. In the analysis of data t, variance and Tukey's statistic tests were used.

It was found out that the point of views of teacher candidates from both departments about the whole inventory were between 31 and 39 (they're not sure about critical thinking disposition). On the other hand, a significant difference was not found between the gender, learning methods and critical thinking dispositions of teacher candidates. It was also found out that there is a significant difference between teacher candidates grade levels, their self confidence and their ways of searching for truth.

Today's teacher candidates who will become teachers of tomorrows are expected to improve 'critical thinking skills' through education process. Therefore, the teacher candidates should have critical thinking skills in order to contribute the development of their countries.

Keywords: Critical Thinking Disposition, Teacher Candidate, Primary School Teacher, Science Teacher

Introduction

Critical thinking concept has become popular in the recent years in education. Reasoning and problem solving are the two common critical thinking skills which are supported by the educationalists in schooling process. Today, there are master and doctorate programmes on teaching critical thinking skills at many universities. Therefore, critical thinking is the core concept in education.

Critical thinking has a number of definitions made by many researchers. Beyer (1983) defines critical thinking as the evaluation of the authenticity, accuracy and worth of knowledge, thoughts, beliefs or discussions. In addition, Norris (1985, p: 40-45) states that it supports teacher candidates to "apply everything they already know and feel, to evaluate their own thoughts and especially to change their behaviours…" Relatively, critical thinking disposition-as a part of our personality- is regarded as an approach to problem-framing problem solving through reasoning. Braman (1999) states that critical thinking is effective not only in academic studies or environments but also in solving every kind of problem. For this reason, teacher candidates are expected to teach the necessary information, skills and behaviours to their students for their future lives.

According to Scriven & Paul (1996), critical thinking is the intellectually disciplined process of actively and skilfully conceptualizing, applying, analysing, synthesizing, and/or evaluating information gathered from, or generated by, observation, experience, reflection, reasoning, or communication, as a guide to belief and action. In its exemplary form, it is based on universal intellectual values that transcend subject matter divisions: clarity, accuracy, precision, consistency, relevance, sound evidence, good reasons, depth, breadth, and fairness.

The experts in teacher education claim that lifelong learning and professionalism should be the basic qualities of teacher education programmes. Therefore, teacher candidates should develop traits of intellectuality about teaching in order to become teachers who are good researchers. According to Bruner, Piaget and Vygotsky experience encourages the development of cognitive processes (Rodriguez and Sjostrom, 1998).

Although contemporary education curriculum is criticised, the educationalists agree on that a new curriculum should be developed which enables the students to think well and to think for themselves (Pithers, 2000).

According to Ikuenobe (2001) critical thinking skills should be taught to students due to following reasons: (1) instructors motivate questioning by explaining to students its logic, functions and basis as an epistemic process- this may help to vitiate the negative attitudes and implications; (2) students have to see the

connections among questioning, critical thinking, inquiry and learning, and fallibilism; (3) instructors have to develop a constructive and non-threatening way to ask questions and teach students a process of asking questions so that one does not alienate and intimidate; and (4) the instructor must create, in general, a classroom environment that will allow students to express themselves, and they must be given the opportunity to actively participate in their own learning process, which involves acquiring the skills of questioning for the purpose of bringing about understanding, growth and progress in knowledge (Ikuenobe, 2001).

A number of studies were carried out regarding the assessment of critical thinking disposition in the recent years (Brookfield, 1987; Costa and Lowery, 1989; Wade and Tavris, 1993; Facione, Facione and Giancarlo, 2000; Giancarla and Facione, 2001; Phillips, Chesnut and Rospond, 2004).

As a result of the developments in the field of education in the world, the educational reform process has started in Turkey not only in the primary and secondary education but also in teacher training. No matter what the individual differences which exist in the vision of elementary education in Turkey might be, there are views such as inquiry-questioning, critical thinking, problem solving, and decision making skills. For this reason, changes have been made to the curricula of primary school education and science education programs and training primary school and science teachers who can guide students to gain the values mentioned above has become important. Therefore, evaluating critical thinking tendencies of primary school and science teacher candidates constitute the problem of the research.

Purpose of the Research

The primary purpose of the research is to evaluate the critical thinking tendencies of primary school and science teacher candidates. In this respect, answers to the following questions are of vital importance.

1. What is the distribution regarding the general status of critical thinking tendencies of primary school and science teacher candidates?
2. Is there a significant difference between the genders and critical thinking tendencies of primary school and science teacher candidates?
3. Is there a significant difference between the type of schooling and critical thinking tendencies of primary school and science teacher candidates?
4. Is there a significant difference between the critical thinking tendencies of primary school and science teacher candidates?
5. Is there a significant difference between the class level they have received schooling and critical thinking tendencies of primary school and science teacher candidates?

Method

This study was conducted with 480 teacher candidates studying at Çanakkale Onsekiz Mart University, Faculty of Education, Primary School Teacher Training and Primary Science Teacher Training in 2009-2010 academic years. This study was limited to 51 articles used in California Critical Thinking Tendency Scale (CCTTS).

Sampling

560 teacher candidates from 1st, 2nd, 3rd, and 4th years studying at Çanakkale Onsekiz Mart University, Faculty of Education, Primary School Education and Science Education Program (day and evening groups) were selected randomly and scales were applied. 480 teacher candidates were included in the sampling process after excluding the candidates who provided incomplete and wrong answers (see Table I).

Student Teachers' Common Characteristics		f	%
Gender	Male	198	41.3
	Female	282	58.7
	Total	480	100.0
Type of Instruction	Day Group	240	50.0
	Evening Group	240	50.0
	Total	480	100.0
Department	Primary School Education	240	50.0
	Science Education	240	50.0
	Total	480	100.0
Class	First Year	120	25.0
	Second Year	120	25.0
	Third Year	120	25.0
	Fourth Year	120	25.0
	Total	480	100.0

Table 1. Distribution of the Student Teachers in Relation to Gender, Type of Instruction, Department and Classes.

Data Collection and Analysis

Data were collected by using the California Critical Thinking Tendency Scale. California Critical Thinking Tendency Scale was developed by Facione and Facione (1992) by considering the criteria mentioned in definition of critical thinking which was put forward by Delphi Project. Scale is composed of 6-options, 75 Likert type items and 7 sub-scales (Facione, Giacarlo, Facione & Gianen, 1995). The scale, which was originally written in English was adapted by Kokdemir (2003) into Turkish and factor analysis, validity and reliability studies were carried out. The new scale which was formed after these analyses were rearranged in the form of 51 items associated with 6 load factors and at the end of the application, reliability coefficient (Cronbach Alpha) of the whole scale was found as 0.88 6 sub-dimensions that take place in the Turkish form of California Critical Thinking Tendency Scale have been formed namely, Analytical Approach, Curiosity, Open-mindedness, Personal Confidence, Look for the Truth, Systematic Approach. Certain items which were listed in Cognitive Maturity sub dimension in the original scale, have been eliminated and some of them have been listed under the open-mindedness sub dimension (Hamurcu et al., 2005).

The scale was applied to the sampling group in November 2006 by the researcher and the data were analysed by the SPSS program. In the analysis of the data obtained, distribution of the general status of critical thinking tendencies of teacher candidates was evaluated by calculating their arithmetic averages. t-test, which was used to measure the differences between the averages was applied to examine whether there is a significant difference between their genders, type of schooling, departments, and their critical thinking tendencies. One way analysis of variance (ANOVA) was used to determine whether there is a difference between class levels they received schooling and critical thinking tendencies; and Tukey test was used to identify the classes those differences exist.

Findings and Discussions

Findings obtained in the research have been listed under five categories.

Sub dimensions	Primary School Teacher			Science Teacher		
	n	$\overline{X}$	Std. Deviation	n	$\overline{X}$	Std. Deviation
Analytical Approach	240	41.36	5.70	240	41.32	6.11
Open-mindedness	240	43.92	6.68	240	43.84	7.08
Curiosity	240	35.69	5.43	240	35.12	5.10
Personal Confidence	240	28.92	4.32	240	28.75	4.85
Search for Truth	240	25.12	3.91	240	24.99	3.64
Systematic Approach	240	20.26	5.20	240	20.17	3.57
Total	240	32.54	3.10	240	32.36	2.71

Table 2. General Status of Critical Thinking Tendencies of Primary School and Science Teacher Candidates

Table 2 provides the distribution regarding the general status of critical thinking tendencies of primary school and science teacher candidates. Prior to the preparation of the tables, standard points for every sub-scale, and total point calculations were carried out separately. According to Kokdemir (2003), the maximum score that can be obtained from the scales is 60 and the minimum score is 6.

Giancarlo and Facione (2001) also state that while making calculations for every sub-dimension of the scale, people who receive a total of 30 points or less than 30 points for that particular subscale are considered as weak or in negative direction in terms of their tendency for critical thinking, people who receive a total of 40 points or higher than 40 points are considered as strong or in positive direction and people who receive a total score between 31 points and 39 points are considered as undecided. On the other hand, when the whole scale is examined, people who receive a total score of 180 points or less should be considered as having a weak or negative general critical thinking tendency and people receive 240 points or more are considered as having a strong or positive general critical thinking tendency.

According to results shown on the table 2, it can be concluded that the averages of the opinions of the teacher candidates for the whole scale are range between of 31-39. Therefore, it can be put forward that teacher candidates in primary school education and science education departments are "undecided" in the critical thinking tendencies. In addition to this, it can also be stated that in dimensions of analytic approach and open-mindedness, teacher candidates have a high and positive critical thinking tendencies as they have obtained points greater than 40. On the other hand, it is also remarkable that teacher candidates of both primary school education and science education departments have provided extremely similar opinions in all sub-dimensions.

Low points obtained in search for truth dimension of teacher candidates participated in the study overlap with the findings of various studies carried out in the same field (Giancarlo and Facione, 2001; Facione et al, 1995; Hamurcu et al, 2005). Facione et al (1985) have stated that it is worth examining these low points in "search for truth" dimension in terms of the quality of the university education and its possible effects on future generations.

Sub dimensions	**Gender**	**n**	$\overline{X}$	**Std. Deviation**	**Df**	**t**	**p**
Analytical Approach	Male	198	41.50	5.99	478	0.494	.621*
	Female	282	41.23	5.85			
Open-mindedness	Male	198	43.17	5.71	478	1.908	.057*
	Female	282	44.38	7.56			
Curiosity	Male	198	35.10	5.19	478	1.063	.288*
	Female	282	35.62	5.32			
Personal Confidence	Male	198	29.08	4.83	478	0.956	.340*
	Female	282	28.67	4.41			
Search for Truth	Male	198	25.06	3.97	478	0.011	.991*
	Female	282	25.05	3.64			
Systematic Approach	Male	198	20.40	4.25	478	0.792	.429*
	Female	282	20.08	4.60			

* The main difference is significant at the .05 level.

Table 3. Findings Regarding the Differences Between the Their Sexes and the Critical Thinking Tendencies of Primary School and Science Teacher Candidates

The gender variable is considered as one of the factors in the studies conducted to measure critical thinking tendencies (Facione et al, 1995; Giancarlo and Facione, 2001; Kokdemir, 2003; Hamurcu et al, 2005). In this study, Table 3 provides findings regarding the differences between the sexes and the critical thinking tendencies of primary school and science teacher candidates. The averages of the views of the male and female teacher candidates regarding their critical thinking tendencies show high similarities for all sub dimensions (Table 2). In this case, a meaningful difference at 0.05 significance level was not observed (at all sub dimensions) between the sexes and the critical thinking tendencies of primary school and science teacher candidates. Therefore, these two variables can be considered independent. In the study carried out by Hamurcu et al (2005), a significant difference was observed for analytic approach, open mindedness, personal confidence and search for truth sub dimensions of the sex variable; and no difference was observed for the curiosity and

systematic approach sub dimensions. Therefore, it can be concluded that none of the studies were able to observe any differences in curiosity and systematic approach sub dimensions.

Sub dimensions	Type of Instruction	n	$\overline{X}$	Std. Deviation	df	t	p
Analytical Approach	Day Group	240	41.74	6.45	478	1.485	.138*
	Evening Group	240	40.94	5.29			
Open-mindedness	Day Group	240	43.87	7.19	478	0.020	.984*
	Evening Group	240	43.89	6.57			
Curiosity	Day Group	240	36.10	5.50	478	2.941	.003*
	Evening Group	240	34.70	4.94			
Personal Confidence	Day Group	240	29.17	4.18	478	1.592	.112*
	Evening Group	240	28.50	4.95			
Search for Truth	Day Group	240	24.89	3.63	478	0.966	.334*
	Evening Group	240	24.52	3.91			
Systematic Approach	Day Group	240	20.14	4.85	478	0.368	.713*
	Evening Group	240	20.29	4.03			

* The mean difference is significant at the .05 level.

Table 4. Findings Regarding the Differences between the Type of Schooling and the Critical Thinking Tendencies of Primary School and Science Teacher Candidates

Table 4 provides findings regarding the differences between the type of schooling and the critical thinking tendencies of primary school and science teacher candidates. When the table is examined it is seen that averages of critical thinking tendencies of day and evening groups of primary school and science teacher candidates show similarities for all sub dimensions. In this case, a meaningful difference at 0.05 significance level was not observed (at all sub dimensions) between the type of schooling and the critical thinking tendencies of primary school and science teacher candidates. The critical thinking tendencies of both day and evening groups of teacher candidates are close to each other. This can be interpreted as that the type of schooling (day-evening group) is not an important factor in terms of their critical thinking tendencies.

Sub dimensions	Department	n	$\overline{X}$	Std. Deviation	df	t	p
Analytical Approach	Primary School Teacher	240	41.36	5.70	478	0.077	.939*
	Science Teacher	240	41.32	6.11			
Open-mindedness	Primary School Teacher	240	43.92	6.68	478	0.139	.889*
	Science Teacher	240	43.84	7.08			
Curiosity	Primary School Teacher	240	35.69	5.43	478	1.187	.236*
	Science Teacher	240	35.12	5.10			
Personal Confidence	Primary School Teacher	240	28.92	4.32	478	0.397	.692*
	Science Teacher	240	28.75	4.85			
Look for the Truth	Primary School Teacher	240	25.12	3.91	478	0.362	.717*
	Science Teacher	240	24.99	3.64			
Systematic Approach	Primary School Teacher	240	20.26	5.20	478	0.225	.822*
	Science Teacher	240	20.17	3.57			

The mean difference is significant at the .05 level.

Table 5. Findings Regarding the Differences between the Departments and the Critical Thinking Tendencies of Primary School and Science Teacher Candidates

Table 5 provides findings regarding the differences between the departments and the critical thinking tendencies of primary school and science teacher candidates. The findings indicate that averages of critical thinking tendencies of primary school and science teacher candidates show similarities for all sub dimensions. Therefore, a meaningful difference at 0.05 significance level was not observed (at all sub dimensions) between the departments and the critical thinking tendencies of primary school and science teacher candidates. The critical thinking tendencies of both primary school teacher candidates and science teacher candidates are close to each other. It overlaps with the results of the study conducted by Hamurcu et al. (2005) since these differences do not exist in open-mindedness, search for truth and systematic approach sub dimensions according to department.

Source of Variance	Sum of Squares	df	Mean Square	F	p	Source of Variance
Personal Confidence	Between Groups	3	184.083	61.361	2.943	.033*
	Within Groups	476	9925.883	20.853		
	Total	479	10109.967			
Search for Truth	Between Groups	3	192.133	64.044	4.587	.004*
	Within Groups	476	6646.233	13.963		
	Total	479	6838.367			

The mean difference is significant at the .05 level.

Table 6. Findings regarding the differences between the grade levels with regard to type of schooling and the critical thinking tendencies of primary school and science teacher candidates

Table 6 provides findings regarding the differences between the class level with regard to type of schooling and the critical thinking tendencies of primary school and science teacher candidates. It has been limited to the personal confidence and search for truth sub dimensions. Because, it has been found that the critical thinking tendencies of teacher candidates have differentiated in these two sub dimensions. According to the results of the Tukey's test that was conducted in order to identify the differences between the teacher candidates, it was found out that according to personal confidence sub dimension, there were significant differences in favour of 3rd year teacher candidates between the 1st and 3rd year teacher candidates, and according to search for truth sub dimension, there were significant differences in favour of 3rd year teacher candidates between the 2nd and 3rd year teacher candidates. Therefore, it can be concluded that 3rd year teacher candidates have more positive critical tendencies compared to other teacher candidates particularly 1st and 2nd year teacher candidates. The findings of the study overlap with the findings of the study conducted by Hamurcu et al (2005) with regard to personal confidence sub dimension. On the other hand, Facione and et al. (1995) have found out that new students tend to obtain higher points for curiosity and open mindedness and lower points for systematic approaches sub dimensions.

Conclusion and Suggestions

This research had aimed at evaluating the critical thinking tendencies of primary school and science teacher candidates. As a result;

1. It has been found that opinions of teacher candidates in both departments regarding the whole scale are in the range of 31-39 points. Therefore it can be concluded that teacher candidates are undecided in their critical thinking tendencies.
2. There is no significant difference (including all sub dimensions) between the sexes of teacher candidates and their critical thinking tendencies. In this respect, it can be concluded that these two variables are independent of each other.
3. There is no significant difference (including all sub dimensions) between the types of schooling (day and evening group) of teacher candidates and their critical thinking tendencies. Thus, there is a similarity between the critical thinking tendencies of day and evening group teacher candidates.
4. There is no significant difference (including all sub dimensions) between the departments (primary school teacher and science teacher) of teacher candidates and their critical thinking tendencies (including all sub dimensions). Thus, it can conclude that there is a similarity between the critical thinking tendencies of teacher candidates in both departments.
5. Meaningful differences have been found in comparisons made according to class levels with regard to schooling type, particularly between the points obtained in Personal Confidence and Search for Truth sub scales and there are differences in higher class levels.
6. The low points for Search for Truth dimension obtained by the teacher candidates participated in the sampling also overlap with the various results obtained in similar areas (Giancarlo and Facione, 2001; Facione and et al, 1995; Hamurcu et al, 2005). Furthermore, Facione et al. (1995) have found out that new students tend to obtain higher points for curiosity and open mindedness and lower points for systematic approaches sub dimensions.

According to the above result the following suggestions could be made:

1. Creating an environment which will enable today's teacher candidates to gain "critical thinking" skills who will be training tomorrow's students is of vital importance. The teacher candidates who will

become intellectuals and managers are primarily responsible for constructing the future of their country. For this reason they should have the ability to think critically about events and facts. Therefore, it may be sensible to arrange subject areas where they will obtain and develop critical thinking skills.

2. It is also important for academicians at the universities to have critical thinking skills who train teacher candidates. Moreover, they should be able to use these skills and serve as role models for those candidates. For this reason, practices aimed at developing critical thinking skills of students should be included in the programs to train academicians.
3. A similar study can be conducted which would cover different faculties and departments in different universities. In this study, teacher candidates from primary school and science education departments have been selected. Because, individuals first face primary school teachers and science teachers play a vital role to educate individuals to understand the society, and the world.
4. Another study can be conducted to measure the relationship between the critical thinking tendencies and academic achievement of teacher candidates or university students. A research covering secondary education students, current secondary and primary school teachers and family members may even be carried out.
5. In this study, complete California Critical Thinking Tendency Scale with its subscales analytical approach, curiosity, open-mindedness, personal confidence, search for the truth, systematic approach, and related questions were used and results were interpreted according to the sub dimensions. In another research, a more extensive analysis can be done by only including one or some other sub dimensions of the measurement tool.

References

Beyer, B. (1983) Common sense about teaching thinking skills. *Educational Leadership* Vol.41, EJ 289-719. pp. 44-49.

Braman, O. R. (1999) Teaching peace to adults: Using critical thinking to improve conflict resolution. *Adult Learning*, 102 (2), 30-32.

Brookfield, S. D. (1987) Developing Critical Thinkers: Challenging Adults to Explore Alternative Ways of Thinking and Acting. Josey-Bass Publishers. San-Francisco, CA.

Costa, A. L.; & Lowery I, Lawrence F. (1989) Techniques for Teaching Thinking. Critical Thinking Press and Software. Pacific Grove, CA.

Facione, P.A., Facione, N.C.& Giancarlo,C.A. (2000) The disposition toward critical thinking. It's character, measurement, and relationship to critical thinking skill. *Informal Logic, vol.*20, no. 1, pp. 61-84.

Facione, P.A., Giancarlo, C.A., Facione, N.C.& Gainen, J. (1995) The disposition toward critical thinking. *Journal of General Education, vol.* 44, no. 1, pp. 1-25.

Giancarlo, C.A. and Faacione, P.A. (2001) A look across four years at the disposition toward critical thinking among undergraduate students. *The Journal of General Education, vol.* 50, no. 1, pp. 29-55.

Hamurcu, H., Günay, Y., Akamca, G.Ö. (2005) Profiles of critical thinking dispositions of science and class students. *Eurasian Journal of Educational Research,* vol.20, pp. 147-157.

Ikuenobe, P. (2001) Questioning as an epistemic process of critical thinking. *Educational Philosophy and Theory, vol.33*, no. 3 & 4, pp. 325-341.

Kökdemir. D. (2003) *Belirsizlik Durumlarında Karar Verme ve Problem Çözme.* Ankara Üniversitesi Social Science Faculty, Phd Thesis, Ankara.

Norris, S.P. (1985) Synthesis of research on critical thinking. *Educational Leadership*, vol. 42, pp. 40-45. EJ 319-814.

Phillips, C. R., Chesnut, R. J., Rospond, R. M. (2004) The California critical thinking instruments for benchmarking, program assessment, and directing curricular change. American Journal of Pharmaceutical Education, vol. 68, no. 4.

Pithers, R.T., (2000) Critical Thinking in Education: A Review.Educational Research. vol. 42, no. 3, winter, pp. 237-249.

Rodriguez, Y.E.G., Sjostrom, B.R. (1998) Critical reflection for professional development: a comparative study of non-traditional adult and traditional student teachers. Journal of Teacher Education, vol. 49, no. 3.
Scriven, M. & Paul, R. (1996) "Defining critical thinking: A draft statement for the National Council for Excellence in Critical Thinking", Retrieved: March 12, 2007, from http://www.criticalthinking.org/University/univlibrary/library.nclk

Wade, C.& Tavris, C. (1993) Critical& Creative Thinking: The Case of Love and War. Harper Collins College Publisher, New York NY.