

Full Length Research Paper

The effect of pedagogical training on prospective teachers' critical thinking skillsⁱ

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In a learning process, where an individual is in the centre, has access to information and makes research by himself/herself, the success rate is higher. Individuals' activities such as searching for knowledge, making research and using information in new applications are included in "Critical Thinking". In this context, this study aims to determine the effect of pedagogical training on the critical thinking skills of prospective teachers. With this aim, before and after the Pedagogical Formation Course including pedagogical formation lessons, "Critical Thinking Scale" that contains 55 items was applied to 75 prospective teachers in Science field and participating in the course at Firat University/Turkey. Pre-test and post-test single group experimental design was used as a research model. It is concluded from the research results that critical thinking skills of prospective teachers can be developed through pedagogical training. As a result it can be suggested that pedagogical training is to be allowed in searching, reconstructive and tolerant classroom environment.

Key words: Pedagogical training, critical thinking, prospective teachers, formation lessons.

INTRODUCTION

Thinking ability is to perceive complexity as a whole in the world (Morin, 2003). Critical thinking, regarded as a dimension of thinking, is a reflective thinking which enables someone to believe or decide what to do (Ennis, 1986). Critical thinking as an advanced thinking skill is quite important for a number of respects today. Though it does not have a complete and precise definition, researchers have basically taken into account two people's explanation as a reference on this issue recently. One of them is John Dewey who is a pioneer on the notion of thinking. He paid attention to this issue as a kind of thinking including a variety of meaning attributions in mind and showing attention towards them carefully.

Another important resource regarded as guidance on this issue is based on Bloom's cognitive taxonomy (Idol and Jones, 1991). Analysis, synthesis and evaluation in the higher order of Bloom's taxonomy are regarded to be equal with critical thinking.

Variety definitions of critical thinking have been made by a number of researchers. Paul and Elder (2007) have defined critical thinking as a process to develop thinking system by examining and evaluating the system; Halpern (1996) defines critical thinking as the usage of cognitive skills and strategies to increase the possibility of the expected result (cited in Rudd et al., 2000); Norris and Ennis have simply identified it as a reasonable and

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reflective way of thinking based on what to believe or what to decide to do (cited in Myers and Dyer, 2006). Critical thinking includes some traits such as the ability to make distinction between realities and thoughts, researching before accepting or refusing an idea, posing yourself and others questions to reveal the fact and self regulation to be sure not to make any mistake (Wood, 2002). Critical thinking contains observations, communications and evaluation and interpreting other information sources. Besides, it requires thinking, asking questions at the right time and making an inference concerning assumptions (Fisher, 2001). When we think critically, we use our intelligence and knowledge in an effective way to reach the most reasonable and truest decision as possible. When we do not think critically, our decisions turn out to be implausible and we do not act appropriately; however we are intelligent and knowledgeable. The purpose of critical thinking is obvious: testing one's behaviors and thoughts to be sure whether they are true and proving them to be sound based on the perspective of reason (Caroll, 2004).

A critical thinker who does not take for granted whatever happens in his/her environment and reshapes them after examination and evaluation (Paul, 1990) is neither dogmatic nor naive. The most obvious traits of a critical thinker's behaviors are broadmindedness and skepticism. These traits seem to be contradictory rather than complementary. However, a critical thinker would like to look at events from his/her point of views from different angles. On the other hand, he/she would like to learn which thoughts deserve to be searched. Besides, a thing which sometimes seems to be broadmindedness is just to be naivety and a thing which seems to be skepticism is just to be closed to ideas (Caroll, 2004). That is, critical thinking plays a role in having a qualified life style by providing new alternatives, gaining broadminded and different points of views and the most important of all these components is to enable someone to think over thinking. To develop the intellectual traits such as autonomy, empathy and logical confidence in those critical thinkers, cognitive standards such as knowledge and assumptions are required to be applied to logical components. In addition, researchers state that a critical thinker creates important questions and problems, expresses them in a clear and straight way, collects the necessary data and evaluates it, uses abstract ideas to interpret it, reaches logical outcomes and solutions by testing through the related measure and standards, finding solutions for complicated problems interacting with others (Paul and Elder, 2007).

Critical thinking does not convey critical traits because we just want to criticize. For critical thinking to be critical, it requires some standards such as clarity, plausibility, relevance and critical thinker has to have the skills to meet those standards (Fisher, 2001). Güven and Kürüm (2008) have put forward that complicated and abstract critical thinking are expressed by the means of some

skills. Glaser (1941) has enumerated those skills as a) being able to recognize the problem b) finding the right means to solve problems c) collecting the necessary data and enumerating them d) using language in a right, clear and straight way and comprehending e) interpreting data, recognizing logical relations among hypothesizes f) reaching valid conclusions and generalizations g) enumerating the conclusions and generalizations h) recreating the current belief system based on wider experience (cited in Fisher, 2001).

Critical thinking is a noticeable matter in education system as students who have not acquired these skills cannot think effectively; therefore, they can fail in the questions and actions requiring such skills as interpreting, analyzing, resolving and setting strategy which are in the highest level of Bloom's Taxonomy. The taxonomy of Bloom herein offered a way to classify instructional activities from easy to difficult ones. While the lower levels of activities require less thinking, higher levels require more. In fact the theory of critical thinking started with Bloom's cognitive domain in which he identified six levels of cognition (Knowledge, Comprehension, Application, Analysis, Synthesis, Evaluation) and each of these levels is related to different abilities. For instance in analysis, synthesis and evaluation levels critical thinking is included (Krathwohl, 2002).

Critical thinking is a process which increases the quality of thinking method providing intellectual standards (Paul and Elder, 2007). That is why, the fact that critical thinking is gained by students is desired (Hudgins and Edelman, 1988; Halpern, 1993). People can be taught critical thinking regardless of their age (Demirel, 1999). On the other hand, critical thinking is to learn knowledge better, adapt it to new situations and develop evaluation skill (Semerci, 2003). In this regard, it is a skill to persuade students to learn. Critical thinking is an acquired behavior afterwards and can be learned and taught. Duron et al. (2006) stated that teachers should give thoughtful consideration to current instructional methods to encourage critical thinking. As a result it can be inferred that the encouragement of critical thinking may succeed in any content area by incorporation of active, student-centered learning techniques. Moreover, it is a desired behavior for prospective teachers to think critically. As effective teachers who have critical thinking skills direct their students to seek for options and to defend their judgments (Patrick, 1986; Bowman, 1987), it should be among the goals of modern education programs to make students acquire critical thinking skills. However as Huitt (1998) mentioned, when critical thinking skills are not used they may be lost. Thus education programs at all stages should be prepared in such a way that will lead to use of critical thinking skills. For that reason determining the effect of pedagogical training practices at universities on critical thinking skills of prospective teachers constitutes the aim of this research.

Today, individuals being open-minded, capable of

scientific and critical thinking are of great importance for finding solutions to problems and taking healthy decisions. Critical thinking is a power that supports the production process of information. However, it is understood that the education programs do not have the necessary infrastructure in this regard. Even though the positive effects of critical thinking upon the academic achievement have been supported with a number of researches (Willingham, 2007; McKnight, 2000; Tmkaya, 2011; Gk and Erdođan, 2011; Demirhan et al., 2011), the situation in terms of both teachers and programs in Turkey hardly seems to be satisfactory. In this context, the programs should be prepared to provide the necessary support. Therefore, it has been decided to make the examination of the current status of critical thinking and pedagogical training in Turkey to reveal the positive and negative aspects of them. In addition, this study, regarding the effect of pedagogical training on critical thinking, is expected to contribute to the related literature, researches in the future, researchers and preparation of new programs at this point.

The aim of the research

The basic aim of this research is to determine the effect of pedagogical training on the critical thinking skills of prospective teachers. Based on this aim, the following questions were answered.

Regarding the effect of pedagogical training on the prospective teachers in terms of pre-test and post-test critical thinking;

1. Are there any significant differences in results?
2. Are there any significant differences in results regarding gender variation?
3. Are there any significant differences in results regarding branch variation?

METHOD

Pre-test and post-test single group experimental design was used as a research model. Critical thinking scale was applied and compared before the pedagogical lessons and at the end of the lessons. The data in the research were collected by the means of "Critical Thinking Scale". The scale consists of 55 items. Its KMO (Kaiser-Meyer-Olkin) value is 0.75 and its Cronbach Alpha reliability coefficient is 0.90. It is a six scaled item following (1) I do not agree, (2) I do not agree and cannot be persuaded, (3) I do not agree but I have a tendency to agree and can be persuaded to agree, (4) I agree partially, (5) I agree mostly and (6) I agree completely (Semerci, 2000).

The sample of the research constitutes prospective teachers at Physics, Mathematics and Biology departments of Firat University during 2013 and 2014 academic years, who were doing pedagogical education. There are 75 prospective teachers in science field taking pedagogical training. Of these prospective teachers, 24 students in Physics department, 22 students in Mathematics department and 15 students in Biology department and in total 61 students were selected randomly on a voluntary basis. "The Critical

Table 1. Pedagogical formation lessons.

The name of the lesson	
1	Introduction to Educational Sciences
2	Development Psychology
3	Learning and Teaching Theories and Applications
4	Program Development and Teaching
5	Measurement and Evaluation
6	Classroom Management
7	Teaching Technologies and Material Designing
8	Special Teaching Methods
9	Guidance
10	Teaching Experience

"Thinking Scale" was applied to these 61 prospective teachers at the beginning and end of the terms. The prospective teachers took 31 h lessons throughout the course (two terms) (Table1).

Process

Pedagogical training in Turkey refers to the education that prospective teachers must have in order to be a teacher. Following the education of subject field taken from any part of Science and Literature Faculties at universities, this training program is designed to give the graduated students the right to teach. Pedagogical training is given by the lecturers of Educational Sciences department in education faculties within a certain period of time. Higher education institution has changed this teacher training under the name of master's education and has given a new name as the pedagogical formation training since 2010 and 2011 academic year. Courses within the scope of the pedagogical training are indicated in Table 1.

Prior to the pedagogical training course, "The Critical Thinking Scale" was applied to the prospective teachers and the obtained data were transferred to computer. Then the courses in Table 1 were given to prospective teachers in a total of 31 h for 2 terms by the lecturers of education faculties in classrooms of the faculties at the university. At the end of the course, the same scale was applied to the prospective teachers again and statistical analyses were carried out with the data obtained. Then the relation between the data was compared and interpreted.

RESULTS

According to the findings, the average of critical thinking skills was 4.80 (SS:0.46) at the beginning of the course; that figure increased to 4.88 (SS: 0.40) at the end of the course and there was a considerable difference statistically ($t=-2.105$, $Sd=60$, $p=0.040$) (Table 2).

When pre-test and post-test critical thinking was examined in terms of gender variation, there was not a considerable difference statistically in pre-test ($t=0.063$, $p>0.05$) and in post-test ($t=1.638$, $p>0.05$) (Table 3).

According to Levene pre-test ($L=0.108$, $p=898$) and post-test ($L=0.877$, $p=0.422$) results for Table 4, the data were homogenous. When pre-test and post-test critical thinking was examined in terms of branch variation, there was a difference in favor of prospective teachers at

Table 2. T-test results of pre-test and post-test critical thinking.

	N	\bar{X}	SS	t	p
Pre-test	61	4.80	0.46	-2.105	0.040
Post-test	61	4.89	0.40		
P<0.05	Sd=60				

Table 3. T-test results of critical thinking in pre-test and post-test in terms of gender variation.

	N	\bar{X}	SS	t	p
Pre-test					
M	22	4.81	0.57	0.063	0.950
F	39	4.80	0.39		
Post-test					
M	22	4.99	0.48	1.638	0.107
F	39	4.83	0.33		
P>0.05	Sd=59				

Biology department among Biology and Physics and Biology and Mathematics departments in pre-testing ($F=5.359$, $p<0.05$) and there was not a considerable difference statistically in post-test ($F=2.727$, $p>0.05$). On the other hand, pedagogical training increased the critical thinking of Physics and Mathematics prospective teachers partially and there was a balance with Biology prospective teachers in post-test (Table 4).

Moreover analyses regarding the pre-test and post-test data in terms of branch following the pedagogical training course were made. In this regard, there was not a considerable difference statistically. At the end of the course, there was 0.08 increase for Physics prospective teachers (Pre-test $\bar{X}=4.74$, $SS=0.40$ and Post-test $\bar{X}=4.82$, $SS=0.34$). At the end of the course, there was 0.17 increase for Mathematics prospective teachers (Pre-test $\bar{X}=4.66$, $SS=0.43$ and Post-test $\bar{X}=4.83$, $SS=0.43$). At the end of the course, there was 0.02 decrease for Biology prospective teachers (Pre-test $\bar{X}=5.11$, $SS=0.47$ and Post-test $\bar{X}=5.09$, $SS=0.38$).

DISCUSSION AND RECOMMENDATIONS

Critical thinking skills constituting an important part of contemporary education programs on learning thinking skills (Seferoğlu and Akbıyık, 2006) can be acquired through pedagogical training based on the results of the research. The results show that pedagogical training has increased the critical thinking skills of prospective teachers. However, the reliability of indirect scales within the scope of the research can be debated. The responses to "Critical Thinking Scale", which was applied to the prospective teachers in pre-testing at the beginning of

the course, could be given unconsciously. For instance, there was an average 0.02 decrease in the Biology prospective teachers at the end of the course compared with the beginning of the course in terms of critical thinking skills. The possibility to give high marks in pre-testing is high based on the assumption that pedagogical training does not decrease critical thinking. For that reason, these sorts of studies have to be carried out constantly and true answers have to be found through different methods by making triangulation. Critical thinking programs have to be incorporated into pedagogical training.

On the other hand, when the pre-test and post-test results for Physics and Mathematics prospective teachers were compared, an increase in the critical thinking skills in the post-test was observed. This shows that prospective teachers can generally acquire critical thinking skills through pedagogical training. In this regard, in the research carried out by Seferoğlu and Akbıyık (2006) some points are required to be given attention to gain critical thinking skills and trends. Some of them are to prepare learning environments where students feel confidence, track the thinking process of students, care questioning issues. Therefore, it is thought that more activities are to be given to prospective teachers to get critical thinking skills in education system (Güven and Kürüm, 2008). Consequently, it is understood that pedagogical training is to be given in searching, reconstructive and tolerant classroom environment. It is asserted that pedagogical training enabling prospective teachers to look at education contexts from broader perspective, interpret, express, question and examine, encourage the prospective teachers to think critically on this issue. From this point, Gündoğdu (2009) asserts that when practices concerning critical thinking are made, the education where critical thinking is applied will be more successful; it is quite natural that differences occur in critical thinking because of branch and classroom variations. In other words, it can be said that prospective teachers' branch variations do not have a major effect on critical thinking skills, but practices such as pedagogical training enable them to develop on this issue.

When the results of the research were examined it was concluded that following the pedagogical training male and female teachers' pre-test and post-test scores show no significant difference. In this case, it can be pointed out that the efficiency of pedagogical training on critical thinking skills of both male and female teachers is in the same direction. In literature review, many studies were seen which supported the result of the research as there is no significant difference between critical thinking and gender and also it was found that gender is not a determining factor on critical thinking (Demircioğlu and Kilmen, 2015; Özdemir, 2005; Kürüm, 2002; Ersan and Güney, 2012).

On the other hand, after the analysis of the pre-test scores between the groups in terms of gender, it was noticed that there is a significant difference between the

Table 4. ANOVA results of critical thinking in pre-test and post-test in terms of branch variation.

	Sum of squares	Sd	Average of squares	F	p	Differences
Pre-test						
Inter g.	1.965	2		5.359*	0.007	3 and 1
In group	10.636	48	0.983			
Total	12.601	60	0.183			3 and 2
Post-test						
Inter g.	0.808	2	0.404	2.727	0.074	
In group	8.589	58	0.148			
Total	9.396	60				

1: Prospective teachers at Physics department; 2: Prospective teachers at Mathematics department; 3: Prospective teachers at Biology department. *P<0.05.

pre-test scores of the participators in terms of branch variable in favour of prospective teachers of Biology. However the post-test scores of the teachers showed no significant difference between the groups in this regard. Thus it can be indicated that while pedagogical training has an underestimated positive effect on critical thinking skills of prospective teachers, teachers' views do not differs in terms of the branch variable. Similarly, in a study conducted by Alkan-Şahin and Gözütok (2013), teachers' supportive behaviors to critical thinking were examined and no difference was found among scores of the two of five dimensions in terms of branch. However, Emir (2012) found in his study that critical thinking skills of different branches show differences from each other. When the result of no significant difference of the present study is considered, the participatory teachers' branches were seen to be at the same faculty (Faculty of Science and Literature).

As a result it can be said that prospective teachers' gender and branch variations do not have a major effect on critical thinking skills, but it is quite clear that pedagogical training has a broad effect on developing critical thinking skills. Thus it can be suggested that the effect of pedagogical training on prospective teachers' critical thinking should be examined considering the variables such as socio-economic level, graduated university, parent's education level in addition to gender and branch variables. Besides, practices of pedagogical training in Turkey and in other countries can be compared and the extent these practices are effective on critical thinking can be determined.

Conflict of Interests

The author has not declared any conflict of interests.

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