

# Effect of Critical Thinking Education on Problem Solving Skills and Self-Esteem in Iranian Female Students

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## ABSTRACT

**Introduction:** Critical thinking is a process of analysing, synthesising and evaluating the information in order to achieve an answer or conclusion.

**Aim:** To evaluate the effect of critical thinking education on problem solving skills and self-esteem.

**Materials and Methods:** A quasi-experimental study was carried out among Iranian female high school students, from November 2016 to December 2016. Cassidy and Long's Problem Solving Questionnaire and Rosenberg Self-esteem Scale were used for data collection. A multistage random sampling was used. First, two high schools of girls were randomly selected and all study participants were asked to complete the problem solving questionnaire. Then, 60 students who had lower scores in problem solving skills (10-14) were identified and

randomly assigned to the experimental and control group. The experimental group received eight 60 minutes sessions of critical thinking education. Before and after the intervention, students completed Problem Solving questionnaires and Rosenberg self-esteem scale. Data analysis was performed by the Multivariate Analysis Of Variance (MANOVA).

**Results:** There was a significant correlation between problem solving skills and self-esteem ( $r=0.389$ ,  $p=0.002$ ). There was a significant difference between groups in problem solving skills ( $p=0.0001$ ) and self-esteem ( $p=0.0001$ ).

**Conclusion:** Educating about critical thinking to the students had a positive effect on problem solving skills and self-esteem. Therefore, it can be said that critical thinking education is one of the important tools to create, cultivate and increase problem solving skills and self-esteem.

**Keywords:** Cognitive, Reasoning ability, Training

## INTRODUCTION

Critical thinking has roots in philosophy, psychology and education [1]. It is one of the most important concepts involved in education [2], so that one of the main goals of modern education is to cultivate individuals to know what they learn and why they learn [3]. This approach of learning was supported by cognitive, metacognitive and constructivism theories. From the cognitive perspective, learners are active processors of information on their learning process and they search information for solving their problems. Metacognitive approaches also support cultivating and strengthening critical thinking in education process. According to this approach, learners should have an active monitoring of their mental processes and set and repair their mental activities. From the constructivism perspective, learning is a perceptual process from experience. Constructivists believe that curriculum planners should provide a situation in which learners, via reasoning debates which accelerate and facilitate interaction and analysis in the classroom, think critically [4].

In addition, emphasis on the development of reasoning ability and demand for inclusion of reasoning education in curriculum, as a fourth element of basic education after reading, writing and counting, are indicatives of unprecedented attention to critical thinking [5]. Therefore, learning critical skills is essential for all people [6]. So that, they can strengthen their thinking power and establish effective communication with others [7]. Some experts believe that the problem solving is a sub-category of critical thinking, while, others argue that these two concepts have overlapped [8]. In fact, problem solving is a behavioural-cognitive and innovative process that provides effective strategies for routine problems. In addition,

problem solving is an important coping strategy that increases the personal capability and decrease stress. Therefore, critical thinking and problem solving are important skills that should be considered in any educational system [9].

Furthermore, it seems that critical thinking affect insight and judgment of individuals about themselves and critical thinkers have higher self-esteem [10]. Self-esteem is most commonly defined as an evaluation of one's own self-worth [11]. Therefore, it can be said that individuals who positively evaluate their performance, enjoy high self-esteem and vice-versa [12]. Despite considerable theoretical basis and emphasis of different learning approaches on discussion, problem solving and critical thinking, little argumentation and reasoning took place in classrooms and many teachers spend most of their class time on talking and asking questions that is nothing more than simple remembering of facts. A previous study showed that female adolescents have lower self-esteem and experience more stress in decision-making than male adolescents [13]. Given that the creating and cultivating critical thinking skills in female students is one of the most important educational needs, therefore, the present research was conducted to study the effect of critical thinking education on problem solving skills and self-esteem of female high school students.

## MATERIALS AND METHODS

In a quasi-experimental study, the effect of critical thinking education on problem solving skills and self-esteem were evaluated among Iranian female high school students of Ilam west of Iran, from November 2016 to December 2016. The study was approved by the Ethical Committee of Ilam University of Medical Sciences, Iran (EC. 947017/143).

A multistage random sampling was used. First, two high schools of girls were selected randomly and all study participants were asked to complete the problem solving questionnaire. In order to select the sample, all 10<sup>th</sup> grade students of two high schools were asked to complete the Cassidy and Long's Problem Solving Questionnaire [14]. The sample size was computed using  $\alpha=5\%$  and power by 80% and 54 eligible students were estimated as the study sample size. We consider the possibility of sample loss, therefore, finally, 60 students who had earned the lowest score (10-14) from this questionnaire were identified (30 students per school). Half of students were randomly assigned to the experimental group and the other half were assigned to the control group. Randomisation was determined on a 1:1 basis using random number tables. The experimental group received eight 60 minutes sessions of critical thinking education two times a week for four weeks. Instructional materials were taken from the book "critical thinking skills success: in 20 minutes a day" [15]. Before and after the intervention, students in both groups completed both the questionnaires.

### Research Tools

**Cassidy and Long's Problem Solving Questionnaire:** This questionnaire that was developed by Cassidy and Long's (1996), has 24 items and measures six factors (helplessness, control of problem solving, creative problem solving styles, confidence in the solution of the problem, avoidance style, and approach style). Each factor has four items. The score range of the scale was 0 to 24 [14]. Reliability of the Persian version of Cassidy and Long's Problem Solving Questionnaire has been approved previously [16,17]. In this research, the reliability coefficient of the questionnaire using Cronbach's alpha was 0.75.

### Rosenberg Self-Esteem Scale

This scale that was developed by Rosenberg which contains 10 items and assesses positive and negative self-esteem [18]. Reliability of the Persian version of Rosenberg self-esteem scale has been approved previously [19]. In another research, the Cronbach's alpha coefficient was 0.84 [20]. In the present research, the reliability coefficient of the scale using Cronbach's alpha was 0.77.

## STATISTICAL ANALYSIS

Data analysis was performed by SPSS version 20.0. Using descriptive statistics and the MANOVA. Before conducting the MANOVA, normality, multicollinearity and homogeneity or equality of covariance matrices was examined. The values for kurtosis and skewness between -2 and +2 are considered acceptable in order to prove normal distribution. A significance level of  $\alpha=0.05$  was considered for hypothesis.

## RESULTS

A total 60 high school female students were studied. Both experimental and control groups were homogeneous in variables including; age, father and mother education and father and mother's occupation ( $p>0.05$ ) [Table/Fig-1].

The mean of problem solving and self-esteem scores has been increased after training in the experimental group. Differences between pre-test and post-test problem solving and self-esteem scores among the study participants are presented in [Table/Fig-2].

The MANOVA was used to test the significance of the difference. Before conducting it, the normality, multicollinearity and homogeneity or equality of covariance matrices were examined.

As shown in [Table/Fig-3], the values for Kurtosis and Skewness are between -2 and +2. Therefore, distribution of dependent variables (problem solving skills and self-esteem) was normal. Pearson correlation coefficient between problem solving skills and self-esteem ( $r=0.389$ ,  $p=0.002$ ), indicate that the avoidance

Characteristics	Group**		p-value
	Experimental (n=30)	Control (n=30)	
Age* (years)	15.1±0.2	15.3±0.1	0.531
<b>Fathers education level</b>			
Elementary	3 (10)	2 (6.6)	0.345
High School	4 (13.33)	5 (16.66)	
Diploma	12 (40)	12 (40)	
Academic	11 (36.67)	11 (36.67)	
<b>Mother's education level</b>			
Elementary	9 (30)	10 (33.33)	0.267
High School	10 (33.33)	9 (30)	
Diploma	11 (36.67)	10 (33.33)	
Academic	0 (0)	1 (3.33)	
<b>Fathers occupation</b>			
Governmental	18 (60)	17 (56.66)	0.114
Non-governmental	12 (40)	13 (43.34)	
<b>Mothers occupation</b>			
Governmental	14 (46.66)	15 (50)	0.205
Non-governmental	16 (53.34)	15 (50)	

[Table/Fig-1]: The parents characteristics in study participants.

\*Values are given as mean±SD, \*\*N (%)

Variable	Group	Pretest	Post-test
		mean±SD	mean±SD
Problem solving	Experimental	12.56±0.98	15.96±1.68
	Control	12.83±0.67	13.31±1.71
Self-esteem	Experimental	3.73±4.77	6.26±3.27
	Control	4.26±4.29	3.66±3.19

[Table/Fig-2]: The mean and standard deviation of problem solving and self-esteem scores of the groups at both pretest and post-test.

Variable	Group	Pre and post-test difference scores		
		mean±SD	Kurtosis	Skewness
Problem solving	Experimental	3.40±1.78	-0.74	0.38
	Control	0.48±1.68	1.17	-0.27
Self-esteem	Experimental	2.53±2.23	0.53	0.07
	Control	-0.60±2.04	0.50	0.24

[Table/Fig-3]: Differences between pretest and post-test problem solving and self-esteem scores among the study participants.

SD. Error of Kurtosis=0.83, SD. Error of Kurtosis=0.43

of multicollinearity was met. In addition, non-significant values of Box's test of equality of covariance matrices ( $p=0.615$ ) indicate that the homogeneity of variance-covariance matrices assumption was met. Therefore, the multivariate analysis of variance can be used to examine the effect of critical thinking education on self-esteem and problem solving skills in experimental and control groups. As shown in [Table/Fig-4], the result was significant. In other word, there is a significant difference between experimental and control groups atleast on one of the dependent variables. It means that critical thinking education had has influenced on self-esteem or problem solving skills.

Effect	Value	F	Hypothesis df	Error df	p-value	Partial Eta Squared
Pillai's Trace	0.563	36.655	2	57	0.0001	0.563
Wilks' Lambda	0.437	36.655	2	57	0.0001	0.563
Hotelling's Trace	1.286	36.655	2	57	0.0001	0.563
Roy's Largest Root	1.286	36.655	2	57	0.0001	0.563

[Table/Fig-4]: The effect of critical thinking education on self-esteem and problem solving skills using logistic regression analysis between the study participants.

Furthermore, results of the test of between subjects post-intervention [Table/Fig-5] indicate that there was a significant difference between groups in both problem solving skills ( $F=42.427$ ,  $p=0.0001$ , partial  $\eta^2=0.422$ ) and self-esteem ( $F=32.273$ ,  $p=0.0001$ , partial  $\eta^2=0.358$ ). Furthermore, 42.2% of the variance of problem solving skills and 35.8% of the variance of self-esteem can be explained by the independent variable (critical thinking education). In other words, critical thinking education had a positive effect on self-esteem and problem solving skills and improved them in participants.

Dependent Variable	Sum of Squares	df	Mean Square	F	p-value	Partial Eta Squared $\eta^2$
Problem solving	127.604	1	127.604	42.427	0.0001	0.422
Self-esteem	147.267	1	147.267	32.273	0.0001	0.358

[Table/Fig-5]: Tests of between-subjects effects.

## DISCUSSION

Our results showed that critical thinking education had a positive effect on problem solving skills and self-esteem of students; so that the estimated effect size was 42.2% of problem solving skills and 35.8% for self-esteem. These findings are consistent with the studies of Wangenstein S et al., and Paul RW and Elderl, [10,21]. In the former, critical thinking education, improved the problem solving skills and self-esteem of students and in the latter, self-esteem was affected by critical thinking education. Therefore, critical thinking education can be an important tool to improve and increase the self-esteem and problem solving skills.

In explaining the findings, it can be said that judgment, assessment and evaluation of oneself or self-esteem requires critical thinking skills. In other words, individuals who have critical thinking skills, enjoy high judgment, analysis and evaluation abilities in different affairs such as judgment about oneself. So, they have a higher self-esteem. Moreover, the results of studies indicated that there is a significant relationship between self-esteem and depression [22, 23]. According to a considerable effect of critical thinking education on self-esteem [24], not only we can increase the self-esteem, but also we can indirectly decrease the depression and help the student to have a happier life.

On the other hand, individuals, especially teenagers, face many problems and challenges in their life. Suitable and timely encountering with these problems and challenges and solving them require problem solving skills. Furthermore, in today's complicated world, many changes happen in individuals life. For e.g., in rapid development of technology, especially new technologies, virtual worlds and social networks, individuals assess a large amount of information in the shortest possible time. In such situation, the issues of optimum use of the information are posed which in turn requires critical thinking and problem solving skills. Therefore, creating, cultivating and improving of these skills is necessary and important.

Educational system plays an important role in creating and cultivating of these skills but our educational systems and schools rather than cultivating individuals who have ability to solve problems and think critically, focus mainly on transferring of information and facts. Thus, one of the main goals that our educational system should seek to achieve is to educate and cultivate critical thinking skills in students, because critical thinking education can affect and improve problem solving skills and self-esteem of students [2,25].

## LIMITATION

The present study was conducted at the Ilam, Iran as the capital province, among 10<sup>th</sup> grade of female students. However, there can be different results if another study designed in urban and rural areas, at different educational levels including both female and male.

## CONCLUSION

Based on the results of the present research, it is suggested that educational and curriculum planners pay attention to critical thinking in their educational and curriculum planning. Planning critical thinking courses or workshops can be useful. Moreover, it is suggested that the effect of critical thinking education on other variables or factors will be investigated in future studies.

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