A comparison of the effects of solution-based group learning and traditional teaching on the critical thinking of Teacher Training students

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Abstract— This study aims at a comparison of the effects of solution-based group learning and traditional teaching on the critical thinking of Teacher Training students. The research method was quasi-experimental using a two-group design and pre-tests and post-tests. Our sample consisted of 55 students having a Teacher Training associate degree (1385-1384) from Qom Azad University, from which 30 persons were selected as experimental group for solution-based group learning and 25 persons were selected as a control group for traditional education. Research is carried out using California Critical Thinking questionnaire and t-test was used to analyze the data. Results showed that the critical thinking disposition (the presence of systematic and ordered components in the research and maturity of judgment while considering all the aspects) in the group which were trained using group solution-based learning was higher than the control group who were trained by the traditional way but in other factors of Critical Thinking (Truth-seeking, curiosity, being analytical, self-confidence and open-mindedness) no difference was observed.

Index Terms— solution-based group learning, traditional teaching, critical thinking.

1 INTRODUCTION

Given the current situation of the world and the outstanding progress of various technologies, especially information and communication technology, it may be assumed that education and training should specifically focus on user training for the proper use of these technologies, but merely benefiting from this technology in the education and training world does not insure the success of today and future generations. In our current world, the main issue is the training of humans who can think well. Nowadays, learners should increasingly acquire thinking skills for a proper decision-taking and problem-solving in order to confront Impressive developments of 21th century. Many scholars such as Enis, Paul, and Lippmann (quoting from Shabani, 1382) believe that one of the main objectives of education and training is to train people to be thinkers. Paul (1992) believes that the training of people who are possessed of intellect and an exploring mind is the first aim and the final product of education and training. Myers (1374) believes that in an era in which textbooks quickly become absolute and innovation is constantly experienced, the final and main purpose of education and training should unavoidably change, in other words, the traditional teaching and learning methods i.e. the passive role of learners in a learning environment and focusing on filling the minds with information would not produce enough response to educational and other needs of the present and future generations. For an effective training of learners, they are required to think freely, creatively, critically, and scientifically and educational centers and school programs should transfer intellectual discipline to learners; they should be organized in such a way that instead of storing scientific facts, learners become involved in the problem. From Gouch's perspective (quoted from Islami, 1382) compliance with a world that is constantly changing would not be possible with the mere access to information and communications. One of the most important needs of this age of communication is thinking skills. Dam and Voloman (2004) believe that citizenship in modern world calls for competencies other than previous and traditional skill. Todays, people are not expected to know their place of living, but they are expected to define and specify their position in the society. Thomas Toch (quoting from Fathi Azar, 1382) believes that for learners, developing the ability to think and solve problems is more important than the technical and vocational training. In a society where its education and training system accepts matters without discussion and criticism and reflects them without thinking, the risk of emergence of incompetent, Inconsiderate, and mindless people is so high. Hallpern (1998) believes that the purpose of education and training for a democratic citizenship is critical thinking fostering. According to Paul's Viewpoint (1992) critical thinking is not one of the objectives of education and training but it is its main objective. Dewey defines critical thinking as a withholding judgment or safe pessimism (constructive criticism) and avoidance of the rush in judgment. In other words, he considers critical thinking as active, stable, and accurate Investigation of any belief or knowledge (Shabani, 1382). Myers (1374) considers it as the identification of false arguments, avoidance of contradictions and declared and undeclared assumptions in the arguments of others, lack of emotional excitement while facing with the problem, he also believes that the main factor in the critical thinking is the planning of questions relevant to the problem

and investigating the solutions without declaring the alternatives. From a philosophical perspective, critical thinking is mainly seen as a good criterion and norm of thinking and they focus on the sensible and logical aspect of human thinking and its enlightening and impartial features. Some of the psychologists refer to Bloom classification in order to define the critical thinking and they include it in Bloom thinking skills. They also believe that contrary to low level skills which are related to knowledge, comprehension, and application, critical thinking often is connected with high level skills i.e. analysis, composition and evaluation (Halpern, 1998) . In 1990, Facion carried out an interdisciplinary study based on the Delphi technique to achieve a shared conceptualization of critical thinking in which 46 critical thinking experts were attended. In this study, a conceptual census about critical thinking was obtained that included two aspects: emotional trend and cognitive skills. In this study, following factors are included as emotional aspects of critical thinking: Truth-seeking, open-mindedness, being analytical, being systematic, curiosity, self-confidence, etc. and cognitive processes of critical thinking include: evidence observation, relevant data selection, distinguishing between relevant and irrelevant facts, analysis and investigation of the validity of references (Dam and Voloman, 2004). Some psychologists have distinguished among critical thinking, creative thinking, and problem solving. Creative thinking results in various solutions while creative thinking is used to choose one single solution, in other words, critical thinking is the ability to judge in the real and complex situations, according to the evidence (Curtis, 1988). Hartman and Sternberg (1993) believe that critical thinking is a kind of cognitive system and individuals use it to choose among available situations, whereas creative thinking is used to form the environment or situation in which problem- solving I more explicit and there is a determined purpose i.e. It is mostly based on the reality and its objective is explicit and external. In other words, in problem-solving the individual encounters a problem that needs to find its solution but critical thinking is an ongoing effort to examine any idea or hypothetical knowledge based on the evidence (Curtis and Stevensenson, 1998). Research conducted around the world and in our country indicates that learners are faced with problems and drawbacks skills in schools and universities in acquiring the critical thinking skill. For example by examining the results of National Assessment of Educational Progress tests, Silver clearly revealed that the learners carry out their assignments automatically and without thinking. (Marzano et al, 1380). From Norris viewpoint (1983) the ability of critical thinking is not expanded among learners and they do not get satisfactory grades in tests which evaluate their ability of presupposition recognition, discussion rating, Arguments, and presumptions.

Anderson and Smith have revealed that elementary students can get a passing score in photosynthesis tests but they do not know that plants supply their own food (quated from Marzano et al, 1380). Myers (1986) believes that nowadays, the development of mental skills has undergone a critical state, since the output and the information of the society has gone further than the people's ability to think critically about this information so that in recent years, Education and training experts have increasingly expressed their concern about the inability of students in critical thinking. Researches carried out in Iran also shows that the ability of students in higher levels of learning is much lower than other countries' students, especially in performance and processing skills (Ahmadi, 1380).When Students of the Department of Basic Sciences in Isfahan Medical University were exposed to wrong questions and wrong texts they did not used critical thinking skills at all .Also when they were exposed to wrong booklets, only 8/6% of them have mentioned a few mistakes (Bahmani et al, 1384).The critical thinking skill of Semnan Nursing students in different levels was in the range of 11-12 which is approximately one-third of the California Critical Thinking Test. American and Korean students achieved higher scores than the test average and it seems that the Obtained scores of Iranian nursing students is lower than other countries' students (Baba Mohammadi and Khalili, 1383) . Many experts have advocated the educability of thinking. From Ristow's Perspective (1988) Critical thinking can be enhanced through practice and instruction. Walsh and Paul (1988) suggest that critical thinking is a skill which can be improved or increase in every and each person, however critical thinking cannot increase necessarily with individuals' development, instead it should be taught. For advocates of educability of critical thinking, the most basic presupposition is that learners can think better if they are taught by Learning Centers. There are two main view about the training of thinking skills: 1. direct method or the skill approach 2. The indirect method. In the first approach, it is supposed that the Teaching of thinking skills by means of various topics is not effective, as a result a course named "thinking" should be included in the curriculum. Doubono (quoted from Fathi Azar, 1382) has suggested various methods like Intrusive Method, Rational Teaching, Principles of Logics, Discussion method, Simulation Method, and Thinking Tool Method. Halpern (1998) believes that critical thinking can be taught as a curriculum course, so he considers a course named "Logics" an important tool for the teaching of critical thinking. Halpern (1998) believes that critical thinking can be taught as a special course named "logics" which in his view is an important tool for the teaching of critical thinking. The criticism of this method is that it is difficult to transfer "learning" from one situation to another. Therefore critical thinking skill cannot be learned as a separate subject from a single discipline instead it should be learned through practice in all the courses (Mc Pack, quoted from Shabani, 1382). In the second approach, thinking skills must be taught in all the subjects and various disciplines. If subjects are learned meaningfully, they will serve the mind as thinking tools. On this basis, the development of logical thinking, critical thinking, and problem-solving were the central core of theorists of learning and teaching programs (Fathiazar, 1382). Social Constructivistic Approach interprets learning an increasing ability to participate in discussions and group activities and considers it as a situational, cultural, and social process, also it uses the metaphor "participation" to specify the

learning formation (Dam and Voloman, 2004).Participation metaphor acknowledges the fact that learning is related to identity formation and active participation in a group is not only acquisition of skill and knowledge but also it includes membership in a group or society which requires that individuals recognize themselves as members of a team and have responsibility for their actions. Therefore learning process involves a change in personal identity, in other words that person shows himself to others or himself. In this approach, critical thinking is created by meaningful social activities and it is never learned by special programs in which relevant skills are taught. From Social Constructivistic Approach point of view, critical thinking learning is an inherently social process. Partcipatoanry methods are considered as valuable methods and group teaching techniques are often used e.g. discussions, students' working groups, role-playing (the same). Most of the researches in the field of critical thinking skills have used indirect method. Denik vaksly (1998) suggests four teaching techniques that cause an increase in critical thinking including: 1. Small groups teaching 2. Students' seminars 3. Problem-solving learning 4. Role Playing.

Due to the importance of critical thinking in the Current changing world (Hallpern, 1988; Dam and Voloman, 2004; Paul, 1992) and the low level of critical thinking among students(Bahmani et al,1384;Ahmadi,1382 ; Baba mohammadi and Khalili) the question of the present study is as follows:

Is it possible to influence on critical thinking disposition and readiness of the students by group problem-solving teaching method?

2 Literature review

Magnusson et al (2000) have investigated the effect of research-based teaching method on the critical thinking ability and showed that the learners who had obtained low scores on the Form A of Glaser Critical Thinking Test, got higher scores after a period of learning. In their experimental study on nursing student, Youngblood and Beitz (2001) showed that using active methods of teaching causes a development on the critical thinking ability of these students. In a study on students, Karabenick and Collins (1996) concluded that group participation teaching method results in an increase in the critical thinking ability of the students. Group problem-solving method has a positive effect on the development of critical thinking skills of 4th grade students (Shabani, 1378).Garside (1996) carried out an experimental study on the university students with a pretest and posttest, intended to answer the following question:does group discussion increase critical thinking skills more than traditional teaching methods like lecture? Results showed that there is no significant increase between these two teaching method. The results of Baumberger (2005) shows that participatory learning techniques and case study were effective for problem-solving and decision taking skills of university students. Critical thinking skills of university students was increased by using Constructivistic teaching method for eleven weeks in Educational Psychology lesson(Tynjala,1998). This study aims at determining the effect of group problem-solving teaching method on critical thinking disposition of university students(truth seeking, open-mindedness, ….)

3 Research hypothesis

Group problem-solving teaching is effective for critical thinking disposition of university students.

4 Methodology

Subjects:

Subjects consisted of 55 associate degree students of Teacher Training (15 males and 40 females) who studied at Sarab Azad University at 1384-1385. Their fields of study was religion, Arabic, mathematics, elementary, and English teaching. These students had chosen educational psychology as their educational course. They were in the second semester of a two-year associate degree. Their mean age was (20) and their standard deviation was (S=3/27).

Instrument:

In this study, in order to measure critical thinking, Critical Thinking Disposition Inventory (CTDI) questionnaire was used. This questionnaire consists of 75 questions in which these seven components are measured: truth seeking, open-mindedness, Analyticity, Systemacity, Inquisitiveness, Self-Confidence, and Maturity. The aforementioned questionnaire was created in California University and it consists of a six-point Likert scales ranging from completely agree to strongly disagree. The researcher translated the questionnaire, then the translated text was given to two professors who had graduated from universities in English-speaking countries so that they translate it to English again and the source text, and target text validity was proved. In addition, the Educational Sciences' professors of Tabriz University also approved its formal validity. In Falcon study (1992) on 164 students, instrument reliability for the total instrument was (0/90) and for the seven parameters was ($\alpha = 0/71 - 0/8$) using Cronbach alpha method. The calculated reliability for the translated instrument on 50 Tabriz University students of educational sciences was ($\alpha = 0/7$)for the whole test and ($\alpha = 0/71 - 0/8$) for the seven indicators. Only the reliability coefficient obtained for self-confidence component was (0/56) and the rest of the coefficients were higher than (0/6).

The research design

In this study, quasi-experimental design with pre-tests and post-tests and unequal groups is used. First, among various university classes that their students had chosen Educational Psychology as their course , two classes (25 and 30 students) were selected and in order to be sure about the equality of the groups, the mean score of the first semester of the two groups were compared in which the mean scores were not significantly different. In addition, pre-test scores of critical thinking disposition were compared and analyzed using t- test. Results showed that there was no significant relationship between experimental and control group. So, in the control group one of the PhD students of educational psychology taught the group using lecture method and in the experimental group , one the researchers taught the group using the group problem-solving teaching. Both teachers had the same academic

degree and record and in the previous evaluations conducted by the University Evaluation Center acquired equal scores.

Methods:

At the first session of the semester, critical thinking questionnaire was completed by students in both the experimental and control groups and the rate of critical thinking disposition was recorded. In the control group, traditional teaching method continued until the end of the semester but in the experimental group, from the very first session students were divided into 6 groups each having 5 members and these groups were asked to choose a name for their group. By so doing, groups were given a distinct identity. The researcher expressed issues that could involve students with course subjects; then, students discussed with each other and presented their written answers. Various examples of issues that are relevant to the content of educational psychology course are as **follows:**

First session (educational psychology and its purpose)

1. Enlist what teachers try to teach students?
2. Among enlisted subjects, which one is more important? (Teaching which one comprises teaching all others?) Why?
3. If you teach a subject that is more important in your mind, what are its positive effects on class, school and society in your opinion?

Third session: (learning and theories)

1. Zainab is a housewife, whenever the phone rings, she goes pale and her His heartbeat becomes fast, why she suffers from such a status?
2. Ali uses a vulgar language at the dinner table and her father gets angry, Ali repeats it tomorrow again, in your opinion, how Ali has learned it?

Fourth session (learning theories)

1. Fatimah insists on watching kids' show first and then doing her homework, but her mother says that she should first do her homework then she may watch TV, in your opinion which one is right, why?
2. Zahra believes that if she wears brown dress, sport shows and black scarf, she will get better scores in her exams; investigate that how such an idea is created in her mind?

During 14 sessions, several examples of the above problems were put into group discussions, and then answers were continued generally with the discussion of group members on the whiteboard and each of groups presented their proofs against the counters or in agreement with other answers. At the end of fourteenth session, California critical thinking disposition questionnaire was administered to both groups.

5 RESULTS

1. Descriptive findings:

1.1. The mean and standard deviation of critical thinking disposition scores of experimental and control group in pre-test.

As it can be seen in table 1, the highest mean of critical thinking disposition is obtained in self-confidence component ($\bar{X} = 49/32$) and the lowest mean is obtained in open-mindedness ($\bar{X} = 39/68$) in the traditional teaching group.

Table 1: Descriptive indicators of critical thinking components in the pre-test

Components	Groups	Mean	Standard deviation
Truth seeking	Group problem-solving	44/36	5/29
	Lecture	41/36	4/68
Open mind-edness	Group problem-solving	41/78	5/89
	Lecture	39/68	5/12
Analyticity	Group problem-solving	42/86	3/81
	Lecture	41/88	5/93
Systemacity	Group problem-solving	43/63	5/45
	Lecture	42/96	4/14
Inquisitiveness	Group problem-solving	44/1	4/38
	Lecture	44/44	3/48
Self-Confidence	Group problem-solving	48/56	5/72
	Lecture	49/32	6/62
Maturity	Group problem-solving	40/6	4/45
	Lecture	42/88	5/51

1.2. The mean and standard deviation of critical thinking disposition and preparedness scores post-test.

As it can be seen in table 2, the highest mean of critical thinking disposition is obtained in self-confidence component ($\bar{X} = 48/72$) in the problem-solving based learning group and the lowest mean is obtained in open-mindedness ($\bar{X} = 41/04$) in the lecture teaching method group.

Table 2: Descriptive indicators of critical thinking disposition components in the post-test

Components	Groups	M	std
Truth seeking	Group problem-solving	44/36	5/29
	Lecture	41/36	4/68
Open mind-edness	Group problem-solving	41/78	5/89
	Lecture	39/68	5/12
Analyticity	Group problem-solving	42/86	3/81
	Lecture	41/88	5/93
Systemacity	Group problem-solving	43/63	5/45
	Lecture	42/96	4/14
Inquisitiveness	Group problem-solving	44/1	4/38
	Lecture	44/44	3/48
Self-Confidence	Group problem-solving	48/56	5/72
	Lecture	49/32	6/62
Maturity	Group problem-solving	40/6	4/45
	Lecture	42/88	5/51

1.3. Pretest-posttest difference in the different components of critical thinking disposition.

As it can be seen in table 3, the highest difference was in Systemacity component $(\bar{X} = 3/761)$ in the problem-solving based learning group and the lowest difference was maturity $(\bar{X} = -0/88)$ in the traditional teaching method.

Table (3): pre-test and post-test difference in the seven components and critical thinking

Critical thinking components	Groups	Mean	Standard deviation
Truth seeking	Group problem-solving	0/1	6/3
	Lecture	/56	3/5
Open mind-edness	Group problem-solving	1/07	4/26
	Lecture	1/36	6/6
Analyticity	Group problem-solving	/53	4/53
	Lecture	/8	5/81
Systemacity	Group problem-solving	3/76	4/27
	Lecture	-0/28	5/13
Inquisitiveness	Group problem-solving	1/53	4/77
	Lecture	1	5/45
Self-Confidence	Group problem-solving	0/03	7/28
	Lecture	-0/6	5/78
Maturity	Group problem-solving	2/73	4/68
	Lecture	-0/88	4/96

2. Findings of the hypotheses

As it can be seen in table 4 , the mean difference of pre-test and post-test scores in traditional teaching method group are compared using dependent t-test and the obtained t's and their significant level shows that traditional teaching method did not have significant effect on none of critical thinking components.

Table 4: the effect of traditional teaching method in various components of critical thinking disposition

Components	Pre test		Post test		The mean difference	t	d.f	sig
	M	std	M	std				
Truth seeking	41/36	4/68	41/92	4/81	/56	/781	24	/44
Open-mindedness	39/68	5/12	41/04	6/28	1/36	1/02	24	/31
Analyticity	41/88	5/93	42/68	6/89	/8	/8	24	/68
Systemacity	42/96	4/14	42/68	4/7	-/28	-/27	24	/78
Inquisitiveness	44/44	3/48	45/44	4/47	1	-/917	24	/36
Self-Confidence	49/32	6/62	48/72	6/29	-/6	-/518	24	/60
Maturity	42/88	5/51	42	4/81	-/88	-/88	24	/385

As it can be seen in table 5 , the mean difference of pre-test and post-test scores in the problem- solving group method are compared using dependent t-test and the calculated t's were significant for Systemacity (in thinking and research) and maturity (in judgments) at a $\alpha = 0/01$ level bot it did not have a significant effect on other components of critical thinking disposition(Truth seeking, Open mindedness, Analyticity , Inquisitiveness, Self-Confidence).

Table 5: the effect of problem- solving group method on the critical thinking disposition

Components	Pre test		Post test		The mean difference	t	d.f	sig
	M	std	M	std				
Truth seeking	44/36	5/29	44/46	4/41	0/1	0/08	29	0/93
Open mindedness	41/78	5/89	42/85	4/39	1/07	1/32	27	0/19
Analyticity	42/86	3/81	43/4	5/19	0/53	0/64	29	0/52
Systemacity	43/63	5/45	47/4	6/08	3/76	4/82	29	** /00010
Inquisitiveness	44/1	4/38	45/64	3/55	1/53	1/75	29	0/08
Self-Confidence	48/56	5/72	48/6	6/05	0/03	0/02	29	0/98
Maturity	40/6	4/45	43/33	4/51	2/73	3/19	29	0/003

As it can be seen in table 6 , the mean difference of pre-test and post-test in the experimental and control groups are compared using dependent t-test . the calculated t's for both experimental and control group shows that in the components of Systemacity in thinking and research ($t = 3/19$) and maturity in judgments ($t = 2/711$), there is a significant difference between the mean difference of pre-test and post-test scores. In other words, the effect of problem-solving method on the critical thinking is more than traditional teaching method.

Table 6: the comparison of the mean difference of pre-test and post-test in the seven components of critical thinking

Critical Thinking components	Mean		Standard deviation		d.f	t	p
	Experimental group	Control group	Experimental group	Control group			
Truth seeking	0/1	0/56	6/13	3/5	53	0/82	0/41
Open mindedness	1/07	1/36	4/26	6/6	53	-/19	0/85
Analyticity	0/53	0/8	4/53	5/81	53	-/19	0/84
Systemacity	3/76	-/28	4/27	5/13	53	**3/19	0/002
Inquisitiveness	1/53	1	4/77	5/45	53	0/38	0/7
Self-Confidence	0/03	-/6	7/28	5/78	53	0/35	0/72
Maturity	2/73	-/88	4/68	4/96	53	2/71	**0/008

6 Discussions

In this section, an attempt has been made to investigate and discuss about the results and explain research's findings.

One of the results is that problem-solving group learning method causes an increase in critical thinking disposition and readiness in the maturity component of university students. In other words, university students who were taught using problem-solving group learning acquired more maturity in judgment and evaluation compared to student who were taught using traditional teaching method (lecture).

These findings are similar to Kondayk (1995), Karabenick and Collins (1996), Danick and Excel (1998), Magnussen et al (2000), Youngblood and Binns (2001), and Boam Berger (2005).

These findings can be explained based on the social constructivist perspective as follows:

Essentially critical thinking learning was created through the ability to participate in discussions and actions that are relevant to the group; therefore students who were taught using problem-solving group method acquired the necessary capability to evaluate and analyze the beliefs and ideas of themselves and others; in fact, using problem-solving group method caused them to develop a better understanding of critical skills including judgment about different ideas and they achieved a higher maturity. All of the above-mentioned capabilities were acquired since after expressing a particular issue, these students studied, investigated and expressed their opinions in small groups and they defended their ideas by mentioning their reasons based on scientific facts. On the other hand, the use of problem-solving groups provides more opportunities to exchange ideas, expression of ideas, and viewing the quality of the thinking performance of various students and the background for the development of critical thinking.

Since critical thinking is defined as a set of thinking activities which carry out the evaluation, analysis, and judgment about strategies and thinking productions (Marzano et al, quoted by Shaabani, 1382), also in the problem-solving process, there is 3 steps of presenting the question, knowledge transfer and evaluation of the results. For the very same reason it can be said that students who were taught using group problem-solving method developed their ability to control the operational behavior (metacognition), and achieved greater maturity in the judgment.According to Piaget's Cognitive Constructivism, it can be said that students' mental structures goes through a state of imbalance when they are exposed to a real problem, so they have been compelled to Intellectual efforts to seek and exchange information and to experience others' ideas through mutual interaction in small groups, and change their mental structures which was first formed in a self-centered judgment framework. The process of exchanging ideas that is called "social transfer" by Piaget has caused a development in their mental skills and critical thinking disposition and readiness. Another finding of the present study is the effect of group problem-solving learning method on the systemacity in

thinking and scholarship of the students.in other words, results showed that students who were taught using problem-solving learning possess a more organized and systematic thinking compared to those who were taught using traditional teaching method. These findings can be explained as follows: critical thinking and problem-solving are inherently the same and both of them are considered as thinking skills. According to Syfret, critical thinking deals with thinking process more and problem-solving deals with the product of the thinking and many psychologists have proposed the same teaching and learning steps for both of them (Seyf, 1382), therefore, given the features of Learner-centered problem-solving learning, activities in the small learning groups, the teacher's role as a Facilitator, confronting with real problems, problem as a data collection instrument and self- regulation in the process of learning, a particular dynamics is created in the class (Douki, 2003). Therefore, students who were taught using this method acquired a disposition and readiness that enables them to systematically investigate and study a problem from various views with their own view and show a better tendency to identify different solution and their systematic evaluation and totally acquire a particular emotional readiness toward complicated problems and issues. Another finding of the present study is that problem-solving method was not effective for other components of critical thinking i.e. open-mindedness, Truth seeking, analyticity, inquisitiveness, and self-confidence, and there was no significant difference in the aforementioned components between students of the groups. These findings show that critical thinking skill and disposition is a skill of higher-level thinking. In addition, critical thinking is not merely a skill, it is also a manner. Readiness for judgment and doubting results and information does not depend only to a particular knowledge or situation in which the individual practices thoughtfully but it also depends on a set of personality factors such as preservance, tolerance, ambiguity and certainty, readiness for pause and delay, rationality, freedom of discussion, and Perception of others (Smith quoted from Shabaani, 1382) and as for the complexity of critical thinking and the lack of census among the Education and Training experts about the definition of critical thinking concept, teaching methods and learning (Beyer, 1985) and the emphasis of some researchers (Yeh and Shen, 2004) about considering critical thinking as a long-term process and its beginning from schools and primary years, it can be said that 14 sessions of problem-solving group learning method was not enough for the development of critical thinking disposition in students and conducting continuous research in the field of the effects of educational methods in the future researches will pave the way for various aspects of critical thinking skills and the emphasis of researchers (Yeh and Shen, 2004) about considering critical thinking as a long-term process and its beginning from schools and primary years.

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