Journal of Academic and Applied Studies
(Special Issue on Applied Linguistics)
Vol. 3(7) July 2013, pp. 1-14
Available online @ www.academians.org

ISSN1925-931X

The Effect of Problem-based Learning on Critical Thinking Ability of Iranian EFL Students

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ABSTRACT

In order to make a change in the way students are prepared to meet the demands of the new century, new teaching methods are under investigation. Problem-based learning is one such method believed to encourage the skills students need to succeed. It was hypothesized that problem-based learning can have impact on critical thinking ability of Iranian EFL students. The data was collected from Iranian students at Dorsa language institute located in Hashtgerd, Alborz province. To homogenize the participants, the researcher had a language proficiency test (PET) as pre-test to 71 EFL learners. Out of 71 students, 40 students were selected. They were divided into one experimental and one control group based on their scores. The researcher used independent sample T–Test to measure the statistical differences between the two groups. Before receiving instruction the students completed a critical thinking questionnaire. After sixteen sessions of problem-based instruction, the researcher administrated the post-tests to both experimental and control groups. Finally, the results of the analysis of the data revealed that doing problem-based activities enhanced critical thinking ability of the subjects. The findings of this study confirmed that participation in problem-based learning class had a significant effect on EFL learners' critical thinking ability.

Key words: Problem-based learning, Critical thinking ability, PET

1. Introduction

Thinking is a necessary part of our social and intellectual lives. Fisher (2001) argues that the quality of our lives and learning depends on the quality of our thinking. Thinking is part and parcel of being intrinsic to human development and that we gain pleasure from being exposed to intellectual stimulus and challenge.

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Acquiring thinking skills has been increasingly emphasized in education, especially with forces in globalization demanding its workers to be adaptable over and above being productive. Studies have recommended that students can no longer be "passive recipients of given information" and called for changes in pedagogical and learning environments that are geared towards "developing thinking skills and harnessing creativity" (Yip, 1997, 391).Moreover, the changes in society also imply that the static acquisition of facts cannot adequately prepare students for the world beyond the school environment. Instead, schools should prepare students to be able to learn and think for themselves. And to do this, they need to be able to think "critically and creatively at the highest possible level" (Fisher, 2001, 8). It is a skill that would make for our students being innovative and effective in the modern workplace. But a simplistic way of looking at how one thinks critically, we do not employ just one specific thinking skill when we view our understanding of new information or of the world around us. Often we employ a broad array of these skills to interact meaningfully with knowledge. Fisher (2001, 21) proposes that critical thinking can be better defined as "skilled and active interpretation and evaluation of observations and communications, information and argumentation is sometimes synonymous with higher order thinking skills. It implies that the individual is inferring or concluding something based on some specific criteria."

Brookfield (1987, p.13) also argues that being a critical thinker "involves more than cognitive activities such as logical reasoning or scrutinizing arguments for assertions unsupported by empirical evidence." It also involves being able to recognize "The assumptions underlying our beliefs and behaviors give justifications for our ideas and actions and judge the rationality of these justifications." We are then in a better position to "test the accuracy and rationality of these justifications against some kind of objective analysis of the 'real' world as we understand it." In other words, critical thinking requires a systematic monitoring of thought. It is thinking that is assessed for its clarity, accuracy, relevance, depth, breadth, and logicalness.

Critical thinking is often manifested in settings and domains that is divorced from the school or college classrooms. Hence it is not surprising that some researchers have shown that when a separate program is used as the 'sole vehicle' for instruction in thinking, the effectiveness of the transfer of such skills into other academic work and into everyday thinking is less automatic than what we would like it to be (Swartz, 1991, 177). Hence, if the ability to engage in content in order to derive meaningful and logical conclusions is our objective, we need to re-examine how we approach the teaching and application of thinking skills in our school programs such that our students are able to decide what thinking skills are appropriate and how they should be demonstrated for deep learning to effectively take place.

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ISSN1925-931X

On the other hand PBL is a pedagogy where problems drive the thinking and learning process, rather than one where a specific thinking skill is 'taught' from the onset. It has its roots in constructivist learning theories. It is an approach that challenges students to confront problems from real world contexts that are vague and often ill-structured. It is a motivating, challenging, and enjoyable learning approach (Norman and Schmidt, 2000) that has resulted from the process of working towards understanding or resolving a problem. PBL was first introduced in the McMaster University in Canada in 1965. Soon after that, in 1974, the McMaster medical school PBL model was established. This model inspired other universities to implement a similar design into their curriculum. Since then, PBL has been popularized and used in several higher educational institutions across the world. Some features of this pedagogy are:

- Problem-based learning is student-centered. PBL makes a fundamental shift from a focus on teaching to a focus on learning. The process is aimed at using the power of authentic problem solving to engage students and enhance their learning and motivation. There are several unique aspects that define the PBL approach:

- Learning takes place within the contexts of authentic tasks, issues, and problems that are aligned with real-world concerns.

- In a PBL course, students and the instructor become co-learners, co-planners, co-producers, and co-evaluators as they design, implement, and continually refine their curricula.

- The PBL approach is grounded in solid academic research on learning and on the best practices that promote it. This approach stimulates students to take responsibility for their own learning.

- PBL is unique in that it fosters collaboration among students, stresses the development of problem solving skills within the context of professional practice, promotes effective reasoning and self-directed learning, and is aimed at increasing motivation for life-long learning.

Generally teaching critical thinking is the same important as for an individual is being educated (Norris, 1985). Some authors point that teaching critical thinking is about teaching students to appropriately use concepts, principles, and procedures, so that they are capable of

producing fruitful outcomes and critical judgments . Additionally, critical thinking has an important implication for transfer of knowledge and application of problem solving skills to novel situations (Garcia and Pintrich, 1992). In this capacity, several advantages for students learning are claimed for PBL to increase critical thinking ability.

Critical thinking involves the formation of logical inferences (Simon & Kaplan, 1989). Some scholars and educators erroneously assume critical thinking to be higher order thinking or cognitive processing (Paul, 1994). According to Elder and Paul (1997), "Critical thinking is best understood as the ability of thinkers to take charge of their own thinking. This requires that they develop sound criteria and standards for analyzing and assessing their own thinking and routinely use those criteria and standards to improve its quality."

Typically, a PBL lesson consists of a session to introduce the problem, collaborative group discussions and a presentation of findings. In PBL approaches, students do not merely learn through accumulating knowledge, but through constructing an understanding of the concepts they encounter. Through a problem trigger, the learner explores ideas within a context, and in doing so, integrates the new concepts with his prior knowledge; through reflection, he constructs a personal understanding of the knowledge. Lipman (2003, 21) argues that inquiry begins when there is a discrepancy in what we encounter. This captures our attention and demands our reflection and investigation. In using problems to drive the acquisition of cognitive skills, problems are designed to be similar to real world situations. The students engage with the problem and the problem inquiry process creates cognitive dissonance that stimulates learning. In working with real world scenarios, students get to apply the components of critical thought and actions that are interconnected depending on many audiences and contexts involved. Other than addressing the skills sets that are built into the problem scenarios, the beauty of working through Problems are that the collaborative process of social negotiation allows the student to evaluate the viability of his ideas.

The concept of collaborative learning, the grouping and pairing of students for the purpose of achieving an academic goal has been widely researched and advocated throughout the professional literature. The term "collaborative learning" refers to an instruction method in which students at various performance levels work together in small groups toward a common goal. The students are responsible for one another's learning as well as their own. Thus, the success of one student helps other students to be successful. Proponents of collaborative learning claim that the active exchange of ideas within small groups not only increases interest among the participants but also promotes critical thinking. According to Johnson and Johnson (1986), there

is persuasive evidence that cooperative teams achieve at higher levels of thought and retain information longer than students who work quietly as individuals. The shared learning gives students an opportunity to engage in discussion, take responsibility for their own learning, and thus become critical thinkers (Totten, Sills, Digby, & Russ, 1991).

To effectively implement PBL, teachers must adopt new roles that are frequently very different from those of their past. In lecture-based instruction, the teacher is in control and is the "expert" dispensing knowledge. In PBL, the teacher selects the problem, presents it to the students, and then provides direction for student research and inquiry. The teacher functions as a facilitator, and the student controls the problem-solving process. For many teachers, such a change is untenable. One teacher assisting in research reported by Boud and Feletti (1991) wrote on the exit evaluation, "I can't handle this. I want to be in total control and PBL doesn't allow that" (p. 132). These teachers flounder without the control and "power" typical in lecture-based classes. Another factor inhibiting change was noted by Albion and Gibson (2000) and Novak (1990) in teacher education programs. Most of these programs still rely heavily on rote learning and traditional lecture formats. It is difficult to expect teachers to adopt learning methodologies that they have not experienced personally or through their teacher education programs. With many administrators, curriculum developers, and teachers lacking experience in interdisciplinary education, barriers to broad scale change can become insurmountable. Another barrier to PBL is the lack of prepared materials for classroom instruction. Few training materials are available. Present curriculum guides and textbooks do not contain the variety of sample problems or assessment tools needed to support this methodology on a broad scale. The philosophies supporting PBL are well established, but the "how toss" are in short supply (Burruss, 1999). Few teachers have the time or the motivation to prepare all new materials for classes. Not only are ill-structured problems unavailable for much of the public school curricula, but most accountability assessment that is presently in use is product driven and knowledge based. Teachers' and students' performances are examined in light of standardized testing that does not address critical thinking process skills. Meier et al. (1996) report that with many time constraints and administrative pressures to improve test scores, many teachers will not believe they can justify the time necessary for PBL.

Base on the above mentioned ideas, the purpose of this study is to investigate the effect of PBL on critical thinking ability of Iranian EFL students. So in line with the purpose of the study, the researcher is going to find answer to the following question, and In keeping with the research question, the following hypothesis is also stated.

RQ: Does problem-based learning have any significant effect on Iranian EFL learners' level of critical thinking ability?

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Journal of Academic and Applied Studies

ISSN1925-931X

Ho: Participation in problem-based learning classes has no effect on EFL learners' level of critical thinking skills.

2. Methodology

This study used a quasi-experimental research design with two groups. The participants were 40 male and female intermediate EFL learners from the same academic backgrounds, ranging in age from 15 to 23, learning English at Dorsa language institute at Hashtgerd, Alborz province. To ensure the homogeneity of the subjects in terms of their language proficiency several criteria were taken into consideration. The researcher chose students who were studying English at the same level. In fact these students had passed placement test of language school before entering intermediate level. Their scores in these exams had met language schools criteria. This showed that they were successful at passing the previous terms by obtaining acceptable scores. Moreover, to ensure the homogeneity of the participants apart from language school criterion, the researcher administered PET, a language proficiency test, to 71 EFL students as a pretest. Before the main administration, the PET was piloted in conditions similar to the main study to ensure its reliability for the target sample. The pilot group consisted of 30 participants of similar characteristics to the target group. Then, the final version of the piloted PET was administered to the target sample. From among the learners who took part in the testing session, learners whose scores were 0.8 standard deviation above and below the mean were selected as the subjects of the study. Out of 71 students, 40 students were selected. They were randomly divided into one experimental and one control group based on their scores (each group consisted of 20 students). Each group included both male and female students. Then the researcher used independent sample T–test to measure the statistical difference between two groups. This revealed that there is no significant difference between two groups.

In the current research, the pretest–posttest control group design was implemented to investigate the effects of the independent variable on dependent variable (i.e. critical thinking skill of EFL learners).This design examined the effect of an intervention between two groups, the experimental and control groups, and was acceptable to evaluate the effect of a treatment since randomization is not feasible. There were two groups of participants: The experimental group who participated in problem-based class, and the learners in control group who practiced the same activities without problem-based assignments. Both groups were given pre-test at the beginning and post-test at the end in order to see the possible effects of the treatment on EFL learners in experimental group. The experiment took place in eight weeks. The control group did the same activities in classroom. During the experiment, the teacher monitored both groups in order to figure out and follow their progress. In order to find the influence of experiment, independent sample t-test was used. In this study gender was not considered as a moderator

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ISSN1925-931X

variable, so its potential effects on the results had not been separately taken into consideration. On the other hand, English language proficiency of the participants was considered as the control variable as the participants were homogenized based on their language proficiency.

In order to carry out this study, a sample of Preliminary English Test (PET) adopted from PET Practice Tests by Jenny Quintana (2003), Oxford University Press was used as a pretest to homogenize participants in terms of their general English language proficiency. Before administering the test, it was piloted with a group of 30 EFL learners who were at the same language proficiency level as the participants of the study. Item analysis and reliability estimates were carried out after the pilot administration. Analysis of the results included in tables 1, 2, 3 and 4 indicating that no items were required to be discarded.

Table.1. Descriptive Statistics of the PET pilot study

	N	Minimum	Maximum	Mean		Std. Deviation
	Statistic	Statistic	Statistic	Statistic	Std. Error	Statistic
Total score	30	16	62	37.84	2.75	15.09
Valid N	30					

Table.2. Reliability Estimate of the PET Pilot Study

	Number of participants	Number of items	Cronbach's Alpha
Total PET (Reading, Listening, Writing)	30	65	.946

Table .3. Descriptive Statistics of the PET Main Administration

	N	Minimum	Maximum	Mean		Std. Deviation
	Statistic	Statistic	Statistic	Statistic	Std. Error	Statistic
Total score	71	18	62	40.24	1.87	11.45
Valid N	71					

Table .4. Reliability Estimate of the PET Main Administration

Number of participants	Number of items	Cronbach's Alpha
71	65	**0.923**

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Peter Honey's critical thinking questionnaire was used in this study to measure the participants' critical thinking skills and was administered as both pretest and posttest with the aim of identifying any possible impact of the treatment on the development of the critical thinking skill of the participants. This questionnaire is constructed by Honey (2005) with the purpose of evaluating the skills of analysis, inference, evaluation, and reasoning. The questionnaire included 30 Likert type questions each followed by five alternatives including Never(1), Rarely(2), Sometimes(3), Often(4), and Always(5). Each participant's score could range from 30 to 150.

The method of sampling in this research was nonrandom convenience sampling. Researchers used the subjects that were available to participate in this research study. The participants were 40 male and female intermediate EFL learners from the same academic backgrounds, ranging in age from 15 to 23, learning English at Dorsa language institute at Hashtgerd, Alborz province. To ensure the homogeneity of the subjects in terms of their language proficiency several criteria were taken into consideration. The researcher chose students who were studying English at the same level. In fact these students had passed placement test of language school before entering intermediate level. Their scores in these exams had met language schools criteria. This showed that they were successful at passing the previous terms by obtaining acceptable scores. Moreover, to ensure the homogeneity of the participants apart from language school criterion, the researcher administered PET, a language proficiency test, to 71 EFL students as a pretest. Before the main administration, the PET was piloted in conditions similar to the main study to ensure its reliability for the target sample. The pilot group consisted of 30 participants of similar characteristics to the target group. Then, the final version of the piloted PET was administered to the target sample. From among the learners who took part in the testing session, learners whose scores were 0.8 standard deviation above and below the mean were selected as the subjects of the study. Out of 71 students, 40 students were selected. They were randomly divided into one experimental and one control group based on their scores (each group consisted of 20 students). Each group included both male and female students. Then the researcher used independent sample T–test to measure the statistical difference between two groups. This revealed that there is no significant difference between two groups table 5.

Prior to the experiment, the researcher used the Peter Honey's critical thinking questionnaire to measure the participants' critical thinking skills. It was used to evaluate the skills of analysis, inference, evaluation, and reasoning of students. Since the participants in both groups were at intermediate level of language proficiency, the English versions of the two questionnaires were used in this study. The textbook used in this study in both groups was

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interchange 3 (Jack C. Richards, 2005 third edition), depending on the exact level of the participants. During the experiment, the participants in both groups received the same amount of instruction and also the same method of teaching was used in both groups. In the beginning the teacher familiarized the learners in treatment group with the course and requirements. He made sure students understand the goals and benefits of a Problem-based approach for language learning and explained what they are going to do during the course. He emphasized the importance of using English in problem-solving activities.

Table.5.The Results of Independent Sample T-test Between Control and Experimental group

	Levene's Test for Equality of Variances		t-test for Equality of Means						
	F	sig.	**t**	**df**	sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
								Lower	Upper
Equal variances assumed	8.686	.005	-10.243	38	.000	-24.65000	2.40643	-29.52157	-19.77843
Equal variances not assumed			-10.243	29.054	.000	-24.65000	2.40643	-29.57131	-19.72869

In the following sessions the researcher introduced problems to the students by using examples; the teacher provided them with related vocabularies and asks students about previous personal experiences with the problem. He made sure that students understand the problem and the expectations. The group brainstormed possible solutions/hypotheses based on the available knowledge and information. The students discussed the problem in small groups (each group 5 students). Then the group decided what further information is needed to solve the problem, prove or disprove hypotheses. He emphasized that there is no single answer or solution, and that they need to choose what appears to be the most viable solution to them and be prepared to explain why they chose that solution. The teacher observed students and provided support as needed, but didn't attempt to direct their efforts or control their activity in solving the problem. He observed and provided feedback on student participation in the activity and on language used during the activity then provided students with opportunities to present and share the results of their work. They reviewed what they have learned from working on the problem. The teacher gave follow-up activities based on his observations; e.g., instructions on grammar, vocabulary and pronunciation. He assessed students' participation and success in the activity.

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Depending on the complexity of the problem, more research was needed as the group narrowed the possible solutions. For example one problem which was introduced in the class was a letter from someone who announces his/her arrival and students must prepare everything in order to receive the guest. The students will try to find how to entertain the guest, which tourist objectives will visit, which hotel is the best and which food will they prepare for the guest. For both experimental and control groups, it was not necessary to have a conclusion at the end of the process. However, some discussions resulted in conclusions and the participants could move to the next topic. In fact at the last 30 minutes of each session of classes the participants in the treatment group were asked to discuss the problems with their classmates in the class. It was estimated that each participant in the experimental group would work on problems at home before coming to the class. All the activities in both groups were considered as their assignments. Sixteen sessions were held twice a week for both groups.

The SPSS 15.0 package program was used for the analysis of data. "Independent sample t-test" was used in order to determine whether problem-based learning has any effect on critical thinking of Iranian intermediate EFL students. Before applying statistical methods, it was necessary to make sure that the assumption of the normality of the collected data was not violated. One common test for checking the normality is Shapiro-Wilk test. The null hypothesis of Shapiro-Wilk test is that the samples are taken from a normal distribution. So, because the p value of the data, in this study, on the Peter Honey's Critical Thinking Questionnaire was greater than .05, the researchers confirmed the null hypothesis, and understood that the samples are taken from a normal distribution. Thus, the researchers needed to use parametric tests. It is worth to mention that after eleven sessions of problem-based learning classes, and obtaining needed information regarding the acceptance or rejection of the null hypothesis, the gain scores from pretests to posttests were computed for each participant by subtracting each person's pretest scores from his or her posttest scores.

The level of significance was set at .05. Then the researchers referred to p-value which was computed by SPSS. The level of significance was set at .05 result was .00. The p-value associated with the t-test is smaller than t-critical (< .05), so there is evidence to reject the null hypothesis. In other words, there is evidence that the mean is significantly different at the significance level reported by the p-value. Since the p-value is lower than its t-critical value, it can be claimed that problem-based learning has a significant impact on the critical thinking of Iranian intermediate EFL students. Thus the null-hypothesis is rejected.

Results of reliability statistics of Critical Thinking Questionnaire of pre-test and post-test were .90 and .92 respectively (Table.6). Considering the data and in answer to research question,

a significantly positive effect was found between the problem-based learning and critical thinking. When comparing the gain scores between the control group and the experimental group, the researchers found a very significant difference between the treatment and control group's critical thinking. This shows that problem-based learning helps students improve critical thinking. Other tables of information are presented in the appendix.

Table.6. Reliability Statistics of CT Questionnaire Pretest and Posttest

	Number of Participants	Number of items	Cronbach alpha
Pretest	**40**	**30**	**.903**
Posttest	**40**	**30**	**.962**

3. Discussion

A hypothesis to be tested was as following: there is no significant difference in critical thinking ability between the control and experimental groups. Independent sample t-test was used for testing of mean difference of experimental group and control group. The result indicated that both groups post-test on critical thinking were significantly different .The control group did show improvement from the pretest to the posttest, but not as much as the experimental group**.** The critical thinking for PBL students increased as expected, due to the treatment duration. Most of the participants claimed that they felt their critical thinking abilities increased. So, a significantly positive effect was found between the problem-based learning and critical thinking ability. When comparing the pretests and posttests between the control group and the experimental group, the researcher found a very significant difference between the treatment and control group's critical thinking ability.

This shows that problem-based instruction helps students improve critical thinking abilities. The students who used problem-based activities more reported that they have high critical thinking ability.

4. Conclusions

Base on the findings of this study the researcher understood that students in problem-based classes try to make sense of all information that they perceive, and that each individual, therefore, "construct" their own meaning from that information. Learners constantly are trying to

derive their own personal mental model of the real world from their perceptions of that world. As they perceive each new experience, learners continually update their own mental models to reflect the new information, and, therefore, construct their own interpretation of reality. Furthermore, the researcher understood that the problem-based tasks help the students to increase their power of creative thinking, and keep students actively engaged in the learning process long enough to gain some tangible results.

Solving problems helps students to be intellectually present in the class and make students feel involved in classroom activities. They don't sit passively in their seats anymore being bombarded by new information and if the teacher includes these tasks in his syllabus during the term, it would contribute to every student's success in learning language. The emergent data revealed that the participants had a favorable attitude toward the process of learning using PBL. Specifically, the perceptions of PBL were dependent on the participants' learning experiences, group work and the availability of resources. The implementation of PBL is perceived to include challenges such as the ability of students to handle self-directed learning and the designing of problems. Students' perceptions revealed PBL students did learn to become independent learners and problem solvers.

This study investigated the effect of problem-based learning on critical thinking ability of Iranian EFL students. Therefore, this study indicates some support for the use of problem-based learning tasks in the class rather than the use of traditional methods. Moreover, teachers need to be familiarized with the techniques of PBL to keep the communicative nature of the language classes. So, it would be reasonable to allocate some time to the training of teachers in this regard. The teacher's role must include spending time developing or preparing the material for the students to use. This can require detailed preparation to ensure that the students are exposed to relevant authentic tasks. This may encompass preparing collaborative environments to expose students to multiple Micro worlds the learner progress from simpler to more complex skills and they, therefore, place great emphasis on the prior abilities of students.

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