The Impact of Inquiry-based Learning Approach on Critical Thinking Skill of EFL Students

Farid Ghaemi
Assistant Professor in TESL/TEFL, Islamic Azad University-Karaj branch-Iran
e-mail: farid.ghaemi@gmail.com

Seyed Javad Ghazi Mirsaeed (Corresponding Author)
Ph.D. Candidate in TESL/TEFL, Islamic Azad University-Karaj branch, Iran
e-mail: Javad_Ghazi@yahoo.com

Abstract
To modify the way how the students are getting ready to encounter the needs of the new era, some other different teaching approaches are under research. Inquiry-based learning is such a method supposed to empower the skills students need to master. The hypothesis was that inquiry-based learning can have impact on critical thinking ability of students. The data was from language learners at Guyesh language institute placed in Alborz(Iran). To homogenize the participants, they had a language proficiency test (PET) as pre-test. Out of 62 students, 38 students were selected. The learners were put into one experimental and one control group based on their exam results. The researchers 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 sessions of inquiry-based instruction, the researchers gave the post-tests to both experimental and control groups. Finally, the results of the analysis of the data ensured that doing inquiry-based activities increased critical thinking ability of the subjects. The outcome of this study confirmed that participation in inquiry-based learning class had a significant impact on learners’ critical thinking skill.

Keywords: inquiry-based learning approach, critical thinking skill
1. INTRODUCTION

Thinking is something completely necessary in our social and intellectual living. Fisher (2001) believes that the quality of our life and learning relies on the quality of our thinking. In fact human development has a close relationship with the quality of his thinking ability and that we enjoy being exposed to mental activities and education. Mastering thinking skills has been increasingly credited in education. Studies have proposed that students should no longer be passive receivers of provided information and asked for modifications in pedagogical and academic environments that are involved in improving thinking skills and limiting creativity (Yip, 1997).

In addition, the changes in society also show that the static learning of facts cannot appropriately prepare students for the life beyond the learning environment. Instead, schools should prepare students to be able to learn and think for themselves. And in order to do that, they need to be able to think creatively at the most favorable level (Fisher, 2001). But it is 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 scope of these skills to interact meaningfully with knowledge.

According to Fisher (2001) 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) believes that being a critical thinker includes more than cognitive activities like logical questioning or examining arguments for ideas not backed by empirical information. It also should recognize the assumptions behind our thinking and behaviors give acceptable reason for our ideas and actions and judge the appropriateness of these justifications. After that we are in a better position to evaluate the accuracy of the justifications against some kind of objective analysis of the real world as we perceive it. In other words, critical thinking needs a systematic control of thought. It is the way of thinking that is assessed for its clearness, sensibility and overall quality.

Critical thinking is often showed in fields that is aside from the school or college classes.so it is not surprising that some researches have shown that when a separate program is used as the only drive for instruction in thinking, the impact of the transfer of these skills into students thinking is less automatic than what we would expect (Swartz, 1991). Hence, if the ability to be involved in content to derive meaningful conclusions is our purpose, we have to examine how we adopt the teaching and use of thinking skills in our school programs in a way that our students be able to decide what thinking skills are suitable and how they should be presented for deep learning to effectively happen.

On the other hand Inquiry-based learning is a type of pedagogy that problems drive the thinking and learning process instead of teaching thinking skills from the beginning. It
has the background in constructivist learning. It is an approach that challenges students to encounter problems from real life contexts that are ambiguous and ill-structured. It is an enjoyable, motivating and challenging learning approach (Norman and Schmidt, 2000) that come from the process of working towards understanding or solving a problem. Inquiry-based learning was introduced several years ago. Since then, Inquiry-based learning has been supported and used in many higher educational institutions all over the world. Some authors mention that teaching critical thinking is about teaching students to appropriately use concepts and procedures to produce good results and critical judgments. Additionally, critical thinking has an important use for transfer of knowledge and application of problem solving skills to new situations (Garcia and Pintrich, 1992).

Generally, an Inquiry-based learning lesson first starts with a session to introduce the problem, collaborative group work and a presentation of findings. In Inquiry-based learning approaches, students do not just learn by gathering knowledge, but through making an understanding of the concepts they face. Through a problem solving, the learner investigates ideas within a context, and considers the new concepts with his prior knowledge. Lipman (2003) argues that inquiry begins when there is a difference in what we encounter. This grabs our attention and demands our reaction and investigation. In presenting 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 makes cognitive dissonance that stimulates learning. In working with real world scenarios, students employ the components of critical thought and actions that are related depending on the audiences and contexts involved.

Previous studies have shown that students’ critical thinking abilities are significantly higher when the materials are taught through inquiry-based learning comparing with traditional teaching methods Wongkam et al (2014). In this study, the teacher assesses the student’s prior knowledge and engages the student’s interest in new concepts through short activities to help the student to use their prior knowledge in order to generate new ideas, explore questions and possibilities. Inquiry-based learning is a strategy in education that students pursue methods and practices like those of professional scientists to construct knowledge (Keselman, 2003). It can be explained as a process of finding new relations, with the students making hypotheses and testing them by doing experiments or having observations (Pedaste, Mäeots, Leijen, & Sarapuu, 2012). Often it is viewed as an approach to solving problems and involves the application of several problem solving skills (Pedaste & Sarapuu, 2006). Inquiry-based learning relies on active participation and learner's responsibility for discovering knowledge that is new to the learner (de Jong & van Joolingen, 1998). In this process, students often carry out a self-directed, partly inductive and partly deductive learning process by doing experiments to investigate the relations for at least one set of dependent and independent variables (Wilhelm & Beishuizen, 2003). It should be added that in the context of this study we are focusing on learners: what is new knowledge to them is not, in most cases, new knowledge to the world, even if the approach can be flexibly used by scientists in making their discoveries.
of new knowledge. In addition, it should be noted that an investigation does not always involve empirical testing.

1.1 Statement of the Problem
The purpose of this study is to investigate the effect of Inquiry-based learning on critical thinking skill of EFL students.

1.2 Research Question and Hypothesis

**RQ:** Does inquiry-based learning have any significant effect on EFL learners’ level of critical thinking skill?

In keeping with the above research question the following hypothesis is stated.

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

2. THEORETICAL BACKGROUND

2.1 The Concept of Critical Thinking

In last decades, critical thinking has been worked on in different educational settings. Many definitions of critical thinking have been suggested. In 1991, Pascarella and Terenzini stated that critical thinking usually is the person’s ability to distinguish main issues and assumptions in an argument, determine important relationships, make appropriate results from existing data, draw conclusions from information or data provided, see whether conclusions are on the basis of the data given, and check evidence.

Critical thinking is the formation of logical reasoning (Simon & Kaplan, 1989). Some scientists consider critical thinking to be higher order thinking or cognitive processing (Paul, 1994). According to Elder and Paul (1997), “Critical thinking is best perceived as the ability of thinkers to take the responsibility of their own thinking. This demands they develop logical criteria and standards for analyzing and evaluating their own thinking and make use of standards to increase its quality.”

Critical thinking can be put in a different category from problem solving (Hedges, 1991) in that it is a linear process. On the other hand, critical thinking is a comprehensive set of abilities permitting the researchers to facilitate each stage of the problem-solving process. According to Chafee (1988) critical thinking is our active, purposeful, and organized efforts to make sense of our world by carefully examining our thinking, and the thinking of others, in order to clarify and improve our understanding. According to Halpern (1989) critical thinking is thinking that is purposeful, reasoned and goal directed. It is the kind of thinking involved, in solving problems, formulating inferences, calculating likelihoods, and making decisions. To mention by using simple words, critical thinking is the logical and active thinking that concentrate on deciding what to believe or do. (Norris & Ennis, 1989).
2.2 Group Work and Critical Thinking

The concept of group work and pairing of learners for the purpose of getting an academic goal has been increasingly investigated and credited throughout the professional research. The word group work refers to a method in which students at different proficiency levels work together in small groups going toward a definite goal. The students are responsible for others and their own learning. So, the success of one student gives other students the kind of confidence to be successful. Supporters of group work believe that the exchange of questions and answers within students in small groups not only increases interest among the learners but also triggers critical thinking. According to Johnson and Johnson (1986), there is clear evidence that cooperative groups learn at higher levels of thought and remember information longer than those who work individually. When students are engaged in collaborative discussions their thinking skills will improve.

2.3 What is Inquiry-Based Learning?

Inquiry-based learning is an approach that encourages students to learn through engagement in a real problem. It is in a way that simultaneously develops both problem solving methods and disciplinary knowledge skills because it places students in the active role of problem-solvers facing with an ill-structured condition that introduces the kind of issues they are likely to have as future agents in their workplace. Exline (2004).

Problem-based learning starts with the introduction of an ill-structured problem on which all learning is centered. The problem is one that students are likely to face as future professionals. Expertise is developed by engaging in progressive problem solving. Students individually and all together consider a big responsibility for their own learning and instruction. Most of the learning happens in small groups. The teacher role is more like that of a facilitator of student learning, being at different times as a resource, instead of being a distributor of information. Besides, the students are more involved as they are engaged as a problem-solver, decision-maker, rather than being just a passive thinker. Exline (2004).

2.4 Problems to inquiry-Based Learning

In order to do inquiry-Based Learning appropriately, teachers must have new roles that are completely very distinct from those of their past. In lecture-based classes, the teacher is the expert having the knowledge. In inquiry-Based Learning the teacher proposes the problem and then provides clues for student research and inquiry. The teacher works as a facilitator of the problem-solving process. A lot of teachers can't continue with this change in their role. These teachers don't know how to run the class without the control and power usual in traditional classes. Most of these programs still are based on rote learning and traditional lecture formats. It is not an easy job to force teachers to have learning policies that they have not had in their teacher education programs. Another barrier to inquiry-Based Learning is the shortage of ready materials for classroom. Few teaching materials are at access. Present materials don't include the variety of sample
problems or assessment criterion needed to advocate this teaching procedure on a wide scale. The philosophies behind that are well determined, but the ways to do it are not enough (Burruss, 1999; Gallagher et al., 1995).

3. RESEARCH METHODOLOGY

3.1 Research Design

A quasi-experimental research design with two groups was used in this study. In the present research, the pretest–posttest control group design was done to examine the impact of the independent variable on dependent variable (i.e. critical thinking skill of EFL learners). Since randomization was not feasible this design tested the effect of an intervention between two groups, the experimental and control groups. There were two groups of subjects: The experimental group who was in inquiry-based class, and the learners in control group who practiced the same activities with no inquiry-based homework. They were both first given pre-test and post-test at the end to see the possible effects of the treatment on EFL learners in experimental group. The control group did the same activities in classroom. During the experiment, the teacher monitored both groups in order to see their progress. In order to see the effect of experiment, independent sample t-test was used. English language proficiency of the participants was considered as the control variable as the participants were homogenized based on their language proficiency.

3.2 Sampling

The method of sampling in this research was non-random convenience sampling. Researchers used the subjects that were available to participate in this research study.

3.3 Participants

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 Guyesh language institute at Hashtgerd, Alborz province.

3.4 Data Collection

Before the experiment, the researchers had Peter Honey's critical thinking questionnaire to measure the participants’ critical thinking skills. Since the participants in both groups were good at English, the English versions of the two questionnaires were used in this study. 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 start, the teacher familiarized the learners in treatment group with the course and what it's going to happen in the class. He made sure students know the benefits of an Inquiry-based approach for language learning. The teacher told about the importance of using English in problem-solving activities. The following sessions the researchers introduced problems to the students. The teacher provided them with needed vocabularies and asks students about their personal experiences with the problem. The group proposed possible solutions
based on the knowledge and information on access. The students discussed the problem in small groups. Then the group went to see what kind of information is needed to solve the problem, confirm or disconfirm hypotheses. They knew that there is no single answer or solution. The teacher checked students and provided help as needed, but didn’t try to control their thinking in solving the problem. They went through what they have learned from working on the problem. The teacher gave some other activities based on his observations. He assessed students’ participation and success in the activity. For both experimental and control groups, there was no necessity to have a conclusion at the end. However, some discussions resulted in findings and the participants could go 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. The estimation was that each student in the experimental group would work on problems himself before coming to the class. All the activities in both groups were considered as their assignments.

4. ANALYSIS OF DATA

4.1 PET Pilot Study

First it was needed to pilot the Preliminary English Test (PET). After the piloting the test, the mean and standard deviation were calculated. The mean and the standard deviation of this administration were found to be 37.84 and 15.09, respectively.

Table 1: Descriptive Statistics of the PET pilot study

<table>
<thead>
<tr>
<th>N Statistic</th>
<th>Minimum Statistic</th>
<th>Maximum Statistic</th>
<th>Mean Statistic</th>
<th>Std. Error Statistic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total score Valid N</td>
<td>30</td>
<td>16</td>
<td>62</td>
<td>37.84</td>
</tr>
</tbody>
</table>

The reliability of the test was calculated by Cronbach Alpha.

Table 2: Reliability Estimate of the PET Pilot Study

<table>
<thead>
<tr>
<th>Number of participants</th>
<th>Number of questions</th>
<th>Cronbach’s Alpha</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total PET</td>
<td>30</td>
<td>65</td>
</tr>
</tbody>
</table>
4.2 Results of the PET main exam for homogenizing the participants

The researchers used the piloted PET as an instrument for homogenizing the participants of the study at Guyesh language institute. The mean and the standard deviation of the participants on the PET main administration are demonstrated in the Table below. It shows that the mean of the scores for the 62 students was 40.24 and the standard deviation was 11.45. So those subjects whose scores are between .8 standard deviation above and below the mean were selected as the participants of this study. This resulted in the selection of 38 students and they were then randomly assigned into control and experimental groups.

Table 3: The mean and the standard deviation of the participants

<table>
<thead>
<tr>
<th>Total score Statistic</th>
<th>N</th>
<th>Minimum Statistic</th>
<th>Maximum Statistic</th>
<th>Mean Statistic</th>
<th>Std. Error</th>
<th>Std. Deviation Statistic</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>62</td>
<td>18</td>
<td>62</td>
<td>40.24</td>
<td>1.87</td>
<td>11.45</td>
</tr>
</tbody>
</table>

Descriptive Statistics of the PET Main Administration

The reliability estimated for this test was calculated through Cronbach Alpha, which came out to be .92 as shown in Table.

Table 4: Reliability Estimate of the PET Main Administration

<table>
<thead>
<tr>
<th>Number of participants</th>
<th>Number of items</th>
<th>Cronbach’s Alpha</th>
</tr>
</thead>
<tbody>
<tr>
<td>62</td>
<td>65</td>
<td>.923</td>
</tr>
</tbody>
</table>

An index of .92 reassured the researchers of the reliability of the scores in the main administration of this test.

4.3 Critical Thinking Evaluation

Results of the administration of the Critical Thinking Questionnaire

The researchers administered the Peter Honey’s Critical Thinking questionnaire among the two control and experimental groups once prior to the treatment process and once after the treatment process was completed.

Descriptive Statistics of the Critical Thinking (CT) Questionnaire

The reliability of Critical Thinking pretest and posttest was computed using Cronbach’s Alpha. The Cronbach’s Alpha for both pretest and posttest were very high and came out to be .903 and .962 respectively.
Table 5: Reliability Statistics of CT Questionnaire Pretest and Posttest

<table>
<thead>
<tr>
<th></th>
<th>Reliability Statistics</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Number of Participants</td>
</tr>
<tr>
<td>Pretest</td>
<td>38</td>
</tr>
<tr>
<td>Posttest</td>
<td>38</td>
</tr>
</tbody>
</table>

The descriptive statistics for the CT pretest and posttest were computed and are presented in Table.

Table 6: The Descriptive Statistics for the CT Pretest and Posttest

<table>
<thead>
<tr>
<th></th>
<th>Minimum</th>
<th>Maximum</th>
<th>Mean</th>
<th>Std. Deviation</th>
<th>Skewness</th>
<th>Skewness ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Statistic</td>
<td>Statistic</td>
<td>Statistic</td>
<td>Statistic</td>
<td>Statistic</td>
<td>Statistic</td>
</tr>
<tr>
<td>Total CT Pretest</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Experimental Group</td>
<td>20</td>
<td>75</td>
<td>93</td>
<td>83.94</td>
<td>.933</td>
<td>5.279</td>
</tr>
<tr>
<td>Control Group</td>
<td>20</td>
<td>68</td>
<td>117</td>
<td>87.69</td>
<td>2.489</td>
<td>14.08</td>
</tr>
<tr>
<td></td>
<td>.229</td>
<td>.414</td>
<td>.229</td>
<td></td>
<td>.414</td>
<td>1.647</td>
</tr>
<tr>
<td>Total CT Posttest</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Experimental Group</td>
<td>20</td>
<td>90</td>
<td>130</td>
<td>111.69</td>
<td>2.108</td>
<td>11.923</td>
</tr>
<tr>
<td>Control Group</td>
<td>20</td>
<td>72</td>
<td>113</td>
<td>88.38</td>
<td>2.058</td>
<td>11.639</td>
</tr>
<tr>
<td></td>
<td>-.848</td>
<td>.414</td>
<td>.414</td>
<td></td>
<td>.674</td>
<td>1.62</td>
</tr>
<tr>
<td>ValidN (listwise)</td>
<td>20</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

As it is demonstrated in the above table the mean scores of both control and experimental groups demonstrated increase from pretest to posttest (83.94 to 111.69 for the experimental group and 87.69 to 88.38 for the control group). However, the increase in the experimental group is much more than that of the control group.

Data analysis & Investigation of the Research Question

The research question asked, “Does inquiry-based learning any effect on critical thinking ability of EFL students? The null hypothesis H-(0) stated, ”The inquiry-based learning has no effect on critical thinking skill of EFL students."
Table 7: The Results of the Independent Sample T-test Between Control and Experimental group

<table>
<thead>
<tr>
<th>Levene’s Test for Equality of Variances</th>
<th>t-test for Equality of Means</th>
<th>95% Confidence Interval of the Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>F</td>
<td>sig.</td>
<td>T</td>
</tr>
<tr>
<td>Equal variances not assumed</td>
<td>-10.243</td>
<td>29.054</td>
</tr>
</tbody>
</table>

After being in classes working on inquiry-based activities, the level of students’ critical thinking skill was measured by the critical thinking questionnaire (independent sample t-test).

As shown in Table, the outcome of the independent sample t-test showed a statistically noticeable difference in learners’ critical thinking skill after inquiry-based instruction. The result was .00. The p-value along with the t-test is smaller than t-critical (< 0.05), so the null hypothesis was rejected.

Table 8 displays the descriptive statistics for the experimental and control groups on the critical thinking questionnaire. The mean scores for the experimental and control group were 31.4 and 6.75. When comparing posttest with pretest, it turned out that the use of the critical thinking increased That increase was statistically significant. The experimental students reported a greater increase in the critical thinking ability following inquiry-based instruction. This shows that inquiry-based instruction helps students improve the critical thinking skill of EFL students.

Table 8: The Descriptive Statistics for the Experimental and Control Groups on the Critical Thinking Questionnaire

<table>
<thead>
<tr>
<th>Groups</th>
<th>N</th>
<th>Mean</th>
<th>Std. Deviation</th>
<th>Std. Error Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control</td>
<td>19</td>
<td>6.7500</td>
<td>5.07704</td>
<td>1.13526</td>
</tr>
<tr>
<td>Experimental</td>
<td>19</td>
<td>31.4000</td>
<td>9.48905</td>
<td>2.12182</td>
</tr>
</tbody>
</table>

5. DISCUSSION

Critical thinking skills are amongst the skills most in demand and most needing to be acquired and improved by learners (Omar & Safinas, 2016; Al Zahrani & Elyas, 2017). Many other studies advocate the effectiveness of inquiry-based learning as an
The Impact of Inquiry-based Learning Approach on Critical Thinking Skill

instructional approach. Alfieri, Brooks, Aldrich, and Tenenbaum (2011), for example, did a meta-analysis comparing inquiry to other forms of instruction, such as direct instruction or unassisted discovery, and they found that inquiry based teaching lead to better learning. A meta-analysis by Furtak, Seidel, Iverson, and Briggs (2012) considered studies using a wide range of terms to describe inquiry-based learning (e.g., mastery learning, constructivist teaching); they reported an overall mean effect size of 0.50 in favor of the inquiry approach over traditional instruction. A positive trend supporting inquiry-based science instruction over traditional teaching methods was found in a research synthesis by Minner, Levy, and Century (2010). Besides, it was shown that web-based guided inquiry-based learning can foster different inquiry skills, such as diagnosing problems, writing questions and hypotheses, doing experiments, collecting and analyzing data, presenting the results, and drawing conclusions (Mäeots, Pedaste, & Sarapuu, 2008). Recent technological advancements increase the success of applying inquiry-based learning even more (de Jong, Sotiriou, & Gillet, 2014). Educational policy figures around the world consider inquiry-based learning as an important element in building a scientifically knowledgeable community (European Commission, 2007; National Research Council, 2000). Therefore, it is worth examining inquiry-based learning further in more detail and identifying its core elements.

6. CONCLUSIONS

The result of this study confirmed that both groups post-tests on critical thinking were significantly different. The control group also had an improvement from the pretest to the posttest, but not to the extent of the experimental group. Most of the participants believed that their critical thinking abilities changed positively. So, a significant relationship was found between these two variables. The difference between the treatment and control group’s critical thinking skill shows that inquiry-based instruction helps students improve critical thinking abilities. According to this study the researchers understood that students in inquiry-based classes try to make their own meaning from the information they perceive. Students always try to change their mental figures according to new knowledge and experiences they receive. Moreover, the researchers reached this point that inquiry-based tasks make students keep students involved in the process of learning long enough to have helpful results. Solving problems helps students to feel fully present in English classes and being completely involved. They no longer sit passively in their places presented new data.so the kind of activities like these help students to have a creative thinking. The result showed that the students had a positive attitude toward enquiry based process. Doing inquiry based learning has some challenges like the ability of students to go in the process of self-study and learning to become independent learners and problem solvers.

Implications

This study probed the impact of inquiry-based learning on critical thinking skill of EFL students. This study shows support for the use of inquiry-based learning activities in the
class instead of the use of conventional methods. In addition the teachers should be familiar with the nature of PBL to keep the communicative atmosphere of the language classes. So, it is logical to give some time to the training of teachers in this field. The teachers need to spend time for designing materials for these classes to be used. This needs full readiness to make sure that the students are given relevant appropriate tasks. It can take students from simple tasks to more difficult ones in a good manner. So the teachers need to consider students prior knowledge. These tasks allow students to stimulate the kind of real world that they are probably being exposed outside the class. The findings of this research will be useful for both English learners and material developers. In addition, learners need multiple exposures to real life activities. This is certainly of greater importance for foreign language learners, who in general, have had much less exposure to the language. Therefore, it is worth mentioning that there should be opportunities for students to have enough exposure to English language in different materials and inquiry based activities are a big help.

References


