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The Effect of Problem-Based Learning on Iranian EFL Learners' Vocabulary Learning

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Introduction

Cognitive engagement with content and learning strategies is in no certain terms a sine qua non in language learning (Ansarian, Adlipour, Saber, & Shafei, 2016; Kumaravadivelu, 2006; Laufer & Hulstjin, 2001). Research in the fields of education and applied linguistics has shown that cognitive skills used by learners, i.e., researching, reasoning, decoding, defining, and analyzing, to name a few, increase chances of retention of information and help students avoid superficial learning (Savery, 2006). In addition, cognitive teaching approaches are learner-centered, collaborative, and promote self-directed learning (SDL) (Ellis, 2007). In the context of Iran, however, a lack of cognition in learning has affected language education. Koosha and Yakhabi (2013) noted that content is usually decoded by the teachers and presented to the language learners. Low cognitive engagement can also affect learning vocabulary. Laufer and Hulstjin (2001), who proposed the involvement-load hypothesis, pointed out that cognitive engagement with new vocabulary can result in effective learning. Therefore, this study aimed at finding out whether increasing cognitive engagement with content could foster learning vocabulary among Iranian EFL learners. To this end, problem-based learning (PBL) as a highly cognitive approach was selected, and its effect on learning vocabulary was gauged. Moreover, in order to have a more vivid picture of the merits and demerits of the new approach, the participants were interviewed afterwards. The findings of this study can be significant from various perspectives and can contribute to the field of applied linguistics. Although research on the effects of PBL and learning some language skills has been documented (e.g., Aliyue, 2017; Ansarian et al. 2016; Azman & Shin, 2012), empirical evidence dealing with such an effect on vocabulary learning are very rare. Therefore, this study can provide the readership with empirical evidence in this regard.

Problem-based Learning (PBL)

PBL is not a new approach to education. The inception of PBL in medical education dates back to the 1970s (Hmelo-Silver, 2004). Theoretically, the underlying assumptions of PBL matches the characteristics of ideal language learning. One of the core components of PBL, for example, is collaborative learning (Savery, 2006). Collaboration is heavily based on Vygotsky's (1978) Zone of

proximal development (ZDP) (Afzali, Shabani, Basir, & Ramazani, 2017). Afzali, et al. (2017) conducted a comprehensive meta-analysis of vocabulary learning through cell phones and agreed that ZDP aids the process of vocabulary learning. Therefore, one of the main theoretical frameworks of this study is ZDP.

Another component of PBL is cognitive engagement. Cognitive engagement in PBL is usually achieved through implementing Bloom's higher order thinking skills (Bloom (1956), as cited in Hmelo-Silver, 2004). Bloom's higher order thinking skill is comprised of 6 steps, i.e., evaluation, synthesis, analysis, application, comprehension, and knowledge (Ansarian et al., 2016).

One of the PBL models with a step-by-step procedure for implementing Bloom's higher order thinking skill in practicum was suggested by Hmelo-Silver (2004). The PBL tutorship, based on the model, begins by representing an ill-structured problem scenario to the learners. Learners generate hypotheses and attempt to suggest possible solutions to the problem by utilizing their cognitive thinking skills and by searching for solutions. The hypothesis will be tested practically after creating a plan to implement the solution. The solutions will be rechecked and amended until the desired solution is gained. Unlike other well-known models such as 3C3R model, as suggested by Hung (2006), which mostly discussed problem creation and its main characteristics, various required stages are discussed by Hmelo-Silver (2004) in full detail. In addition, the model is not very general, such as the one proposed by Savery and Duffy (1995).

Research Questions

Q1: What is the effect of Problem-based Learning on the vocabulary learning of Iranian EFL learners?
Q2: What is the perception of Iranian EFL learners towards learning vocabulary through the problem-based learning approach?

Method

Conceptual Framework

The researchers in this study were interested in fostering vocabulary learning among Iranian EFL learners. To this end, problem-based learning was selected due to its established effect on learning communicative skills (Abdullah, 1998) and its possible effect on language learning (Larsson, 2001). To operationalize this approach, the researchers selected the model proposed by Hmelo-Silver (2004). However, the researchers attempted to highlight the role of culture and the diminished role of the first language in creating the problems for the study.

Research Design

This study uses a mixed-methods design. The quantitative portion of the study used a between-subjects design in which the experimental group (PBL) was compared to the comparison group (conventional approach). The qualitative section of the study was conducted through interviews and analyzed using grounded theory, as suggested by Strauss and Corbin (1997).

Participants and settings

Power analysis was conducted to find the number of participants required for the quantitative portion of the study. Considering a moderate to strong effect size, it was found that 23 participants were required for each of the two groups in this study. Volunteers at intermediate and advanced levels in Tehran University's language institute were selected for this study. The participants were both male (23%) and female (77%). All participants were adult EFL learners who were already studying in an intermediate and pre-advanced course in the institute. Table 1 shows demographic data for the participants.

Table 1
Participants' Demographics

Group	N	Age	Gender	Ethnicity	Language Learning Experience
Experimental	26	17-21	Mixed	Iranian	2 to 3 years
Control	26	18-21	Mixed	Iranian	18 months to 28 months

Procedure

This study lasted for 22 sessions over the period of one academic semester. Every session was 60 minutes and about eight vocabulary items were practiced in each session, although only 112 words were targeted in this study.

In the first phase of the study, consent forms were given to the participants to comply with the rules of ethical research. Next, the Nelson Language Proficiency Test (Flower & Coe, 1976) was administered to 89 language learners who volunteered for the study. Based on the results and by considering one standard deviation above and below the mean score 52 participants were selected. The Nelson vocabulary test was administered to these participants as a pretest. Using the scores of the pretest, the participants were distributed into an experimental group (n=26) and a control group (n=26). Vocabulary from the book *504 Absolutely Essential Words* (Bromberg, 1988) were used to design a Likert scale Vocabulary Knowledge scale based on Wesche and Paribakht (1996). The researchers identified 112 words which were unknown to the participants in both meaning and usage. These vocabulary items were taught to the participants in both the experimental and control groups. The researcher adopted an input-based instructional method to teach vocabulary to the participants in the control group, which is the conventional approach used at the language center at Tehran University. In this method, vocabulary items were presented to the participants in written form. Initially, the teacher attempted to elicit the meaning from the participants. Other forms of meaning clarification including searching dictionaries, examples, demonstrations, and synonym versus antonyms were used in the class. Having clarified the meaning, the participants were asked to give both oral and written examples with the words.

In the experimental group, the participants were presented with an ill-structured problem scenario. The problems were decoded by the participants. Based on the analysis the learners could inquire which words were intended and required to solve the problem. They began an online search for the vocabulary through their smartphones. They could also elicit information from group members. Next, they analyzed the accumulated information through discussion and selected the most appropriate words, and based on this they designed a conversation. The conversation was presented to the class and they received feedback on the accuracy of their vocabulary usage. One of the difficulties in this stage of the study was selecting vocabulary items which were not targeted in the research; therefore, the course tutor (the researcher) attempted to guide the search to the target vocabulary. As all conversations were followed by a class discussion, the course tutor had another chance to direct the participants' attention to the targeted vocabulary by asking them for alternative vocabulary which could be used.

Following the study, all participants were given a researcher-made vocabulary test which was designed based on the target vocabulary words. The test included 25 multiple choice items.

Data Analysis

In the first step of the data analysis, distribution of the scores was checked for all tests.

Table 1
Distribution of Scores

	N	Std. Deviation	Skewness		Kurtosis	
	Statistic	Statistic	Statistic	Std. Error	Statistic	Std. Error
Nelson	89	4.5609	.242	.255	.615	.506
Posttest (Experimental)	26	2.1155	-.523	.456	.170	.887
Posttest (Control)	26	3.0432	.789	.456	.331	.887

As can be seen in Table 1, ratios of skewness and kurtosis were within the range of +/_1.96; therefore, normal distribution of scores was assumed (Strevens, 2009).

In the next step the reliability of all three tests was checked via Cronbach's Alpha formula. The α index range between 7.94 and 8.21; therefore, the reliability of the scores was assumed. In addition, as the number of participants who took the researcher-designed posttest was low, a panel of two experts was asked to analyze the test for construct validity instead of running a factor analysis.

Grouping the Participants

As it was important to ensure that the participants in both groups did not differ in language proficiency prior to the main study, their scores on the Nelson language proficiency test were compared with independent sample t-tests.

Table 2
Independent Samples t-test; Control vs. Experimental Language Proficiency

t-test for Equality of Means						
T	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval	
					Lower	Upper
.574	50	.569	.34615	.60320	-.86540	1.55771

As can be noted in Table 2, the results of an independent sample t-test (t(50)=.574, p= .569)[-.8654, 1.55771] indicate that the difference between groups (*MD*=.346) is negligible.

First Research Question

What is the effect of problem-based learning on the vocabulary learning of Iranian EFL learners?

In order to answer the first research question, an independent samples t-test was run between the posttest scores of the experimental group and the control group.

Table 4
Independent Samples T-test; Posttest of Vocabulary (Control vs. Experimental Group).

T	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval	
					Lower	Upper
2.484	50	.016	1.80769	.72769	.34609	3.26929

Second Research Question

What is the perception of Iranian EFL learners toward learning vocabulary through the problem-based learning approach?

The researchers used grounded theory based on Strauss and Corbin (1997) in order to seek the answer to the second research question. Although grounded theory is a very time consuming process and may require more participants than the participants in this study, the initial analysis of the interview revealed

that there are certain categories in the respondents' interview data which could be used to form a theory of Iranian EFL learners' perception towards PBL. This issue is significant, as there seems to be no prior theory dealing with language learners' perception towards PBL in the EFL context of Iran.

Sampling of the Respondents

We used two groups of participants for analysis through grounded theory. The initial group included 15 respondents from the experimental group. The results gained from these participants were later compared to the interview results from other participants in the experimental group (n=11) in order to ensure consistency in the results.

Coding

As the first stage in the analysis, the researchers began coding the data based on the main concerns with regard to PBL process. Chunks of data in the respondents' interview were categorized into different categories. New categories emerged as chunks of data did not fit into previous categories. The main categories that emerged in this stage were: a) hesitancy, b) lack of control, c) transition to new approach, d) frequent monitoring, e) motivation, f) group practices, g) meaningful context, h) argumentation, i) expectancy, and j) time allotment. There were some other themes which did not really relate to PBL; therefore, the researcher excluded those themes through coding.

Finally, the researcher selected the most relevant categories. Each category is interpreted in terms of core phenomenon, causal conditions, strategies, and outcome.

Table 4
Main Themes Extracted through Grounded Theory

Core Component	Causal Conditions	Strategies	Outcome
Hesitancy	Decoding should be done by the learners	Learners searched the Internet Made use of their reasoning skills Asked peers for help Generated and tested hypothesis Referred to the tutor	Solutions were found and tested.
Lack of confidence	Talkative group members, more skillful group members	Shared responsibilities Used silence as a strategy	Learners collaborated to find the answers
Transition to New Approach,	Change from lecture-based instruction to self-directed learning	Tutors justified the change, Learners attempted to tolerate ambiguity	Most learners became used to the new approach, some of them still favored lecturing by teachers
Frequent Monitoring of Tutors	Caused anxiety and stress	The tutor reduced the number of times for monitoring the participants toward the final sessions	More friendly learning atmosphere
Motivation	Learning by doing is fun.	Feeling responsible for own learning. Doing one's best without worrying about the results	Self-directed learning
Group Practices	Fostering learning by negotiation and discussion	Discussing search results. Justifying relevance of selected data	Data was narrowed down and solution plan was created
Time Allotment	Participants need to know how much time they have	Shared tasks with group members if there were time shortages	In most cases, group activities were finished on time.

Discussion

Before discussing the findings of the study, it seems timely to mention that PBL has not been studied in language classes as much as it has been studied in disciplines such as medicine, nursing, and engineering. Although some studies have accorded focus to the effects of PBL on language learning (e.g., Aliyue, 2017; Azman & Shin, 2012; Fonseca-Martínez, 2017; Hashim, Selamat, & Sulaiman, 2014; Mathews-Aydinli, 2007), qualitative studies dealing with language learners' perceptions of the implementation of PBL in language classes are extremely rare.

A number of studies have found PBL to be an effective approach to language learning. Ansarian et al. (2016) concluded that PBL, if implemented correctly, can increase Iranian EFL learners' speaking proficiency. Through a vigorous data analysis procedure, they concluded that PBL affects various aspects of speaking proficiency, i.e., coherence and cohesion, pronunciation, grammar, and vocabulary. The positive effect of PBL on vocabulary learning was also observed by Aliyue (2017) in the ESL context of Nigeria. Aliyue's focus was on writing, but he also took the use of proper words as a rubric in assessing the participants' writing. In line with these studies, it was observed that PBL can have positive effects on the vocabulary learning of language learners. Indeed, PBL increases language learners' cognitive engagement with content, which has been a long lasting desire in vocabulary learning (Laufer & Hulstjin, 2001).

Kumaravadivelu (2006) has argued that one of the shortcomings of some language teaching methods is lack of language learners' opportunities to produce the language, even calling this issue an impetus to move from teacher-centered approaches to language learning to learner-centered ones. PBL is a learner-centered approach to learning and can offer more contextualized and meaningful learning opportunities to learners (Hmelo-Silver, 2004; Savery, 2006). Therefore, learning language through PBL can be more rewarding for the language learners.

In terms of vocabulary learning and context, Sun and Dong (2004) argued that contextualized vocabulary learning can have more positive effects than the decontextualized learning of vocabulary. In the same vein, PBL gives the learners the opportunity to use the language in context so much that Hung (2006) pointed to context as one of the main components of learning in PBL. This aids learning processes in PBL and fosters learning.

Jin and Bridge (2016) argue that the robust answer to the question of whether PBL is a suitable approach to learning is obscure. They mentioned that contrary perceptions of educators and learners toward PBL makes it difficult to draw one general conclusion about the appropriateness of PBL. However, as they report in their comprehensive review of qualitative studies on PBL, in most occasions learners have had a positive perception towards PBL.

Another issue highlighted by the participants in this study was lack of confidence. Lack of confidence was the product of working with more skillful language learners in one group, which is difficult to control, as people have various levels of reasoning and researching abilities (Hung, 2006). In addition, Gentry (2000) perpetuated the role of briefing on a new approach before implementing it in practice.

It should also be noted that the shift from lecture-based instruction to self-directed learning is cumbersome. It can cause anxiety and nervousness. The participants in this study also highlighted this issue as one of the main challenges they perceived. Wee and Kek (2002) pointed out that PBL is different from many other approaches to learning, as in PBL learners can no longer hide themselves behind their books. However, the transition from teacher-centered learning to PBL should be smooth (Utecht, 2003). Students should be given time to find their place in the new approach and own the learning process. Although some participants in this study could not adjust themselves to PBL (about 20%), some of them stated that they could learn through PBL after becoming acquainted with the new approach over time.

In this study we also observed that the amount of time allotted to the learning tasks was found to be insufficient by some participants, as they could not finish the tasks on time. Ellis and Hafner (2008) also noted that PBL tasks require time. Therefore, educators should find a way to tackle this problem in PBL classes.

Conclusion

The main problem under investigation in this study was finding an approach to increase Iranian EFL learners' opportunities for learning vocabulary. Having selected PBL as a possible approach to vocabulary learning, it was implemented in the experimental group. As the students gained experience with PBL, the researcher also delved into their perceptions regarding PBL. It was revealed that PBL can have an effect on learning vocabulary among Iranian EFL learners. In addition, the learners used various strategies to tackle problems in the PBL process so much that they were content with the new approach and had positive perceptions regarding PBL.

This study can have pedagogical implications for language teachers. In general, in many language classes, language teachers are in charge of designing classroom tasks. For vocabulary learning, language teachers can design and implement problem-based vocabulary tasks to increase the opportunities for learning vocabulary for the language learners. It comes highly recommended by the authors that teachers consider their learners' level of reasoning and research skills and adjust the difficulty level of the tasks to the learners' cognitive skills in order to avoid creating overwhelming tasks.

It is also suggested that future researchers delve into the issue of vocabulary learning through problem-based tasks with regard to learners' personal differences (e.g., anxiety level, motivation, attitude), types of vocabulary, and both recall and retention of vocabulary through problem-based language learning.

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