A Study of Problem-Based Pedagogy for Fostering English Grammar Acquisition in a Web-Based Context: A Pilot Study

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Abstract: The purpose of the pilot study is to initially explore the impact of the problem-based approach (PBL), a learner centered approach, on English learners' acquisition of English grammar. The target grammar feature is adjective comparison. There were two groups: the experimental group (23 participants) receiving the PBL training, while the control group (24 participants) received teacher interpretation of instructional treatment. After the treatment, the two groups of participants completed the follow-up test. An analysis of covariance (ANCOVA) was conducted to detect if a significant difference existed between the PBL and non-PBL treatments. The ANCOVA results revealed a significant difference between the PBL and non-PBL groups on the first section of the follow-up test score. Implications and future research are also presented.

Keywords: Grammar teaching, English as a foreign language, English comparison sentence, learner-centered approach, problem-based learning, the Internet

1. Introduction

Grammar is an absolutely necessary component of language. Numerous second language acquisition studies and several meta-analyses (Ellis, 2006; Hulstijn & de Graff, 1994; Norris & Ortega, 2006) have suggested that second language (L2) learners should be taught grammar. Constructive learning theory maintains that "knowledge is not received from outside, but that [the learner] constructs knowledge in [his/her] mind" (Alessi & Trollip, 2001, p. 31). Drawing on the constructivists' perspectives, the present study assumed that when L2 learners are asked to participate in a problem-based learning (PBL) activity or to complete a problem-solving task, they may have opportunities to construct their L2 grammar knowledge by themselves, make connections between their prior knowledge with the target linguistic forms, and to further facilitate their understanding of the target linguistic forms. In this way, they also likely undergo the negotiation of the meanings of the specific linguistic forms, and gradually increase control over the use of those forms.

Most junior high school and senior high school students in Taiwan need to take an entrance examination to enter the next educational settings. English is one of the core subjects to determine the totaled score a student could achieve. Therefore, most English instructors are focused on teaching grammatical rules to help the students achieve high scores in the examination. Among a variety of teaching methods, mechanical drills of doing grammar exercises and explicit interpretation of grammatical rules were the major teaching activities in class. "Such conventional curricula lack[ed] multiple dimensions of literacy and also fail[ed] to offer communicative practice" (Lin, 2017a, p. 18). To fill the gap of grammar instruction in the EFL Taiwanese context, Lin (2017a) advocated that PBL can be integrated into English grammar instruction to lead the students to use grammatical rules in a meaningful and communicative context.

At present, the researcher use online teaching materials and utilize a problem-based learning approach in an English course to foster university students' memorization and utilization of English linguistic forms. The results of this study contribute directly to promoting English learning knowledge and skills via the problem-centered learning approach when employing computers in education.

2. Literature Review

2.1 L2 Grammar Teaching Methods

Several scholars of grammar teaching have been examining grammar teaching methods to promote mastery of a second/foreign language (see reviews in Norris & Ortega, 2006). Nassai and Fotos (2004) stated three essential conditions for acquisition of grammatical forms: "(1) learner noticing and continued awareness of target forms, (2) repeated meaning-focused exposure to input containing them, and (3) opportunities for output and practice" (p. 137). Accordingly, grammar can be taught explicitly and implicitly. In this study, most university students had learned English grammatical rules in their previous elementary and secondary educational settings. It seems that teaching the grammatical rules explicitly is redundant. However, most English learners probably forget what they have learned by not keeping in continuous touch with grammar features. Rather than explicit explanation of grammatical rules, the instructor may engage learners in sufficient exposure to English environments and design meaning-focused communication activities. The purpose of the present study was to establish an English learning environment in which the learners may incidentally acquire grammatical rules.

2.2 Problem-Based Learning in a WebQuest-Based Classroom

Problem-based learning (PBL) can be regarded as a problem-posing pedagogic approach. In the context of L2 learning, problems provide resources, guidance, and opportunities for students to learn their linguistic knowledge. By integrating the web-based resources, Lin applied PBL to teaching English in Taiwan and conducted empirical studies (Lin, 2015, 2017b, 2018, 2019). As indicated in Lin's earlier studies, proposed problems are like an axle linking the content of the teaching materials. In a PBL English learning program, the teacher designs a problem based on the teaching materials, and on the other hand, the students are requested to search for information on the Internet to work out the solutions to the problems. Overall, the teacher acts as a facilitator to inspire students to learn English, whereas the students take on an active learning role in reading, listening, speaking and writing English in a comprehensive way.

From the reviewed literature on implementing the PBL approach in the field of education, PBL is effective for enhancing the ability of students to increase the transferability of skills and knowledge from the classroom to situations in the real world (Delialioğlu, 2012). From the reviewed literature, the PBL approach has been applied in various academic fields and documented fruitful outcomes (Boud & Feletti, 2001).

As Lin (2017a, 2019) reviewed, PBL has been used in the EFL context. In the past decades, PBL has been applied to foster English learners' reading and listening comprehension ability, vocabulary acquisition, and writing. More recently, learner affect and metacognition are considered as an essential factor influencing L2 learning outcomes. Another PBL research path pertains to examining whether it can effectively improve learners' willingness to communicate (Lin, 2017b). Moreover, Lin (2019) integrated metacognitive strategies into a PBL English course and found that the PBL participants used problem-solving strategies more than the non-PBL participant; the PBL participants exhibited stronger confidence and lower anxiety while listening to English than their counterparts. PBL research has demonstrated positive instructional outcomes. However, this approach has not been fully developed in English grammar instruction.

With the advancement of digital/information technology, radical changes in human beings' learning are increasing in the cotemporary world. Computers are a vital dimension in literacy which cannot be ignored in language education. In this way, computers have been widely used to enhance learning. Among a great amount of computing, WebQuest, hereafter WQ, is a popular teaching model by which the instructor corporates computer technological tools in the classroom (Dodge, 1998). Several benefits of a WQ learning environment are documented in earlier studies (Ebadi & Rahimi, 2018). Among these benefits, WQ provided an optimal learning environment to promote leaners' problem-solving abilities. When proposing a framework of PBL English pedagogy in this study, the researcher emphasized that computers played an essential role in developing a PBL grammar instructional curriculum. The Internet, one of the most frequently used technological tools, was adopted as a supportive teaching devise in this study.

The purpose of the pilot study is to examine the impact of PBL grammar instruction on EFL learners' learning of adjective comparison (AC) sentences. For the purpose of this study, the following question is addressed:

Is there any significant difference between the effects of intervention (PBL grammar instruction) and non-intervention (non-PBL grammar instruction) on the acquisition of the target grammatical rule, adjective comparison, by university students in Taiwan?

3. Methodology

3.1 Participants

The researcher conducted a project to examine whether PBL could significantly improve English learners' grammar learning. A pilot study was conducted prior to a formal study. The pilot study included 47 undergraduate university students recruited from two English elective courses. The two intact classes were randomly assigned as one experimental group (23 participants), receiving the PBL grammar instruction, and one control group (24 participants) receiving no PBL instruction. Each class met once a week for 100 minutes each week and was taught with the same material.

3.2 Instruments

3.2.1 English Proficiency Test
The researcher adopted the English proficiency (EP) test used in Lin's (2017b) study. The EP test consisted of reading and listening sections. The reading section involved answering 40 multiple-choice question items. The maximum score for this section was 40. The listening section also involves answering 45 multiple-choice question items. The maximum score for this section was 45. One correct response was awarded one point. The total score of the two sections was 85 points. The Cronbach's alpha reliability estimate was .86.

3.2.2 Adjective-comparison Follow-up Test

The present study only focused on three degrees of AC sentences, including positive adjectives (i.e., an adjective that makes no comparison), comparative adjectives (i.e., the comparative degree compares two people, things, activities or qualities), and superlative adjectives (i.e., the superlative degree compares a person, thing, activity or quality with a group)(Learn ESL, 2019).

The purpose of the follow-up test was to check for differences in knowledge of forming the positive, comparative and superlative degrees of adjective comparison between the two treatments. In total, there were three sections. The first section contained five items in which the participants followed the sample to compose the comparison sentence. The sample sentence goes like this:

> Their sport jacket is comfortable and attractive, but our sport jacket is more comfortable and more attractive than theirs.

As shown in the aforementioned sample, the participants needed to complete the underlined part. In this section, the response of one item was given a score of two points if the participants produced a completely correct AC sentence; a score of one point if there was one grammatical error in a sentence, and if there were at least two errors, the sentence was scored as 0.

The second section required the participants to fill in the blank with superlative adjective forms. The third section was a cloze test. A passage contained six blanks, in which the participants filled in the blanks with proper positive, comparative and superlative degrees of adjective forms. In the two sections, the response was scored with two points if the participants answered a complete correct response in the blank. The response was scored with one point if one error was detected. If the participant produced a completely wrong response, the response was scored as 0.

3.3 Data Analysis

An English proficiency test was administered before the treatment and an English adjective-comparison follow-up test after the treatment. The participants were recruited from two English elective courses. The two classes likely differed from each other in their English reading and listening proficiency. Both

English reading and listening proficiency test scores were used as covariates to control for any preexisting differences in the participants' English ability before the treatments. Owing to different numbers of question items in each section of the follow-up test, all testing scores were converted into percentages representing the participants' correct responses relative to the total number of question items on each test. The significant level of statistical results was set to $\alpha = .05$.

3.4 PBL and Non-PBL Treatments

The researcher followed the five-step teaching framework in Lin's studies (2017a) to design the instructional procedures of the two treatments. The PBL teaching scheme was completed in a cycle of five meetings: presenting the problem, examining the problem, re-examining the problem, reviewing the problem, and presenting the solutions (Lin, 2017a, pp. 23-24). The two treatment procedures are briefly presented in the following section.

3.4.1. Instructional Procedure in the PBL Group
During the 5 weeks of instruction, in the first week meeting, the PBL intervention comprised approximately 30 min. of explicit grammar instruction and 70 min. of problem-solving activities; in the last week meeting, each group presented the solutions via the computer. The explicit grammar instruction was to notify the participants of the syntactic patterns of target AC sentences. In this way, the problem-solving activities mostly focused on implicit grammar instruction; that is, the participants undertook incidental acquisition of the target grammar features during the process of working out the solutions to the problem. In order to lead the participants to practice AC sentences, the proposed problem and the website used in the pilot study are presented as follows:

Problem: Historians have reported that the ancient Olympic Games started in 776 BC. How have the Olympic Games changed over the years since 776 BC? What are the differences and similarities between ancient Olympic Games and modern Olympic Games?

Website: Scholastic Teacher's Activity Guide: Origin and History of the Olympic Games. http://teacher.scholastic.com/activities/athens_games/history.htm (retrieved Sep. 10, 2019)

During the treatment, the participants were divided into small groups and were encouraged to undertake small-group discussion. The Internet was used as a supportive learning tool in the present study. Each group of participants needed to have a survey on the Internet. In this way, Internet survey on the computer supported the PBL participants learned how to screen out potential information for the problem and as well practiced synthesizing the information from different Internet resources to work out solutions to the problem.

3.4.2 Instructional Procedure in the non-PBL Group
Participants in this group were provided with explicit interpretations of grammatical rules of AC sentences during the 5-week intervention. They also focused on practicing the grammar exercises. There were no group work and Internet survey activities during the intervention. The researcher displayed the articles on the Internet and the students followed the researcher's interpretations.

4. Results and Discussion

To answer the research questions, descriptive statistics (means and SDs) were calculated, and ANCOVA was used to compare the follow-up test scores of the participants in each group receiving a different type of instruction. The assumption of homogeneity in the regression of the covariates and the dependent variables was first examined. The results showed that the assumption of homogeneity of the regression slopes was not violated (Covariate 1: Reading proficiency: $F = .016$, $p > 0.05$; Covariate 2: Listening proficiency: $F = .252$, $p > 0.05$). Before the intervention, the two groups of participants were similar in their English reading and listening abilities.

In Table 1, the ANCOVA results revealed a significant difference between the PBL and non-PBL groups on the first section of the follow-up test score, $F_{(1, 45)} = 10.964$, $p < .05$. The result revealed that PBL group's adjusted mean score of the third section is significantly higher than the non-PBL group's. That is, the PBL group achieved a significantly higher mean score for the first section

($Mean$ = 77.927[a]) than the non-PBL group ($Mean$ = 52.403[a]) on the first section of the follow-up test (see adjusted mean scores of the follow-up test in Table 2).

The significant outcome of the first section of the follow-up test can be attributed to the participants' familiarization with the target grammatical rule in a comprehensive way. Among three sections of question items in the follow-up test, the task of writing AC sentences in the first section can be more complicated than those of writing AC forms in the second and third sections.

Regarding the AC forms, all the participants needed to do was to fill in the blanks with the addition of suffixes or the words "more" or "most" to convey comparison. In the situation of filling in a positive degree of an adjective, the participants did not need to alter the word form in any way. In contrast, when completing the sentence in the first section, the participants likely needed to consider English linguistic knowledge of AC in a comprehensive way rather than the forms of positive, comparative, and superlative adjectives. For example, when combining two simple sentences into one AC sentence, the participants usually needed to utilize English linguistic knowledge of identifying the subject and the object, and the word order of an English comparison sentence.

Table 1

Analysis of Covariance on the Follow-up Test of PBL and Non-PBL Groups

Dependent Variable	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Square
Section I	6409.680	1	6409.680	10.964	0.002*	.203
Section II	96.452	1	96.452	.307	.582	.007
Section III	167.399	1	167.399	.506	.481	.012
TOTAL	671.154	1	671.154	2.958	.093	.064

Note. 1. * $p < .05$ 2. PBL = problem-based learning

Table 2

Adjusted Mean Scores of the Follow-up Test

Dependent Variable	Group	Mean	SD	95% Confidence interval	
				Upper bound	Lower bound
Section I	PBL	77.927[a]	5.285	67.269	88.585
	Non-PBL	52.403[a]	5.164	41.989	62.818
Section II	PBL	77.750[a]	3.873	69.939	85.561
	Non-PBL	74.619[a]	3.784	66.987	82.251
Section III	PBL	64.341[a]	3.977	56.320	72.361
	Non-PBL	60.216[a]	3.886	52.379	68.052
TOTAL	PBL	74.291[a]	3.292	67.651	80.931
	Non-PBL	66.032[a]	3.217	59.544	72.520

5. Conclusion

Holding a belief that English is a lifestyle, the researcher hopes students can learn English and learn to use English in a meaningful and communicative context. Thus, the researcher has applied PBL to teaching English in Taiwan. The present study made a comparison of the effects of PBL and non-PBL on university English learners' acquisition of ACs. The results of the follow-up test showed that the PBL treatment was significantly more effective in terms of learning the grammar features of AC than the non-PBL treatment. In this study, when preparing to present solutions, the PBL participants might have repeatedly rehearsed what they would say or write in sentences. With these mental rehearsals, the students likely familiarized themselves with how to use the AC grammar features in a contextualized situation. The PBL pedagogy continuously engaged the participants in the production of solutions, which gradually evolved not only in meaning but in sentence structures. In this way, the participants likely developed procedure knowledge of ACs in a comprehensive way, and their procedural knowledge could be likely further automatized in a discourse context.

Due to the complexity of grammatical features, one cannot necessarily jump to the conclusion that the students who received the PBL training mastered AC grammatical knowledge and knew how to use it well in different situations. Armed with the results of the pilot study, the instructor may consider use problems as supportive instructional scaffolding, leading English learners to practice using the target grammatical rules. Regarding the measurement of AC grammar knowledge, the researcher would like to construct a writing task to further measure the participants' ability to utilize English linguistic knowledge of AC in the formal study. In addition, the researcher will construct a test to evaluate the learner's ability to judge the correct patterns of AC. The educational significance of PBL addresses goals for English learners that are much broader than the memorization of inert subject knowledge in the textbook (Lin, 2017b). Keeping such goals in mind, the researcher has conducted empirical studies to examine its instructional effectiveness. With the increasing popularity of computer education in all aspects, PBL can be regarded as an optimal teaching method to foster English learning.

Acknowledgements

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