

Constructivism-Based Mobile Application for EFL Vocabulary Learning

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Abstract—In line with the mobile technology development, many researchers conducted mobile assisted language learning (MALL) research on vocabulary learning and gained positive outcomes in developing learners' vocabulary knowledge hoping that vocabulary learning based on the theory of constructivism can effectively improve learners' language proficiency. However, few research studies have been conducted on MALL in the context of Thailand and, to our best knowledge, no research has been done on teaching vocabulary based on constructivism via mobile application. Hence, the present study aims at investigating the implementation of a constructivism-based vocabulary learning application and its effects on EFL students' vocabulary learning achievement. The study was conducted on 90 second-year students in academic year 2015 at Suranaree University of Technology, Thailand. The vocabulary pretests, post-tests, student questionnaires and interviews were employed to collect data. To analyze the data, the descriptive analysis and t-test techniques were utilized. Results reveal that the vocabulary learning mobile application has positive effects on improving students' vocabulary in terms of receptive and productive knowledge, and students express positive opinions towards the implementation of the mobile application. The findings are directly beneficial to other researchers aiming at improving learners' vocabulary learning through integrating MALL with constructivism.

Index Terms—constructivism, Mobile Assisted Language Learning (MALL), mobile application, EFL vocabulary learning

I. INTRODUCTION

It is widely acknowledged that vocabulary is an indispensable part in learning a language. Rubin and Thompson [1] state that "one cannot speak, understand, read or write a foreign language without knowing a lot of words". Mastery of vocabulary is very important for L2 learners as vocabulary can support them when they communicate with others in the target language. However, acquiring a large number of vocabulary items may be one of the most difficult aspects of learning a foreign language for most learners. Inadequate vocabulary knowledge is reported by many Thai researchers as a

major problem among Thai learners, which causes them difficulties in reading, listening, speaking, and writing [2]-[4]. In Thailand, most teachers use repetitive drills to teach large amounts of vocabulary and push students to rote memorize new vocabulary. However, this behaviorism-based method is not motivating and has limited advocates for vocabulary learning. As for behaviorism, Beatty [5] pointed out that learning activities are sequenced from simple to complex with frequent reviews and tests of key points. Students soon forget the words they have learned and fail to store new words in long term memory [6]. They seldom links word meaning with its usage in contexts and this results in students' limited active vocabulary, which hinders them from speaking fluently and writing appropriately [7]. Moreover, the EFL class size is usually large in most Thai universities and the amount of the class time is limited. Therefore, finding new methods to help students to learn vocabulary outside of class is considerably significant.

Constructivism as a new trend in language learning has received advocates from many scholars. Constructivism is a psychological theory of knowledge and learning acquisition that people actively interpret and construct their own understanding and knowledge by interacting with their prior knowledge and new information [8]. Vocabulary learning based on constructivism theory can effectively improve learners' vocabulary learning achievements [7], [9], [10]. Compared with behaviorism, constructivism acknowledges that learners actively construct their own understanding of word knowledge through interacting with their prior knowledge and new information; therefore, students are more likely to remember the vocabulary and understand the word usage better. The learner plays the central role in the learning process as an active meaning-maker and interpreter. Liu [11] argues that vocabulary instruction is viewed to be more effective when learners are involved in the construction of the meaning through interactive processes. Therefore, scholars believe that the efficiency of vocabulary learning is higher when learners learn the new words through the constructive approach [9].

Constructivists have found that computer technologies are helpful for realizing constructive learning [12].

Mobile Assisted Language Learning (MALL) is an emerging area of Computer-Assisted Language Learning (CALL) which has been suggested to be one plausible way to create a constructive learning environment. Generally, mobile learning refers to any form of learning mediated through a mobile device, which can take place anywhere, anytime and at the convenience of the learners [13]. MALL inherits many advantages such as multimedia environment, immediate feedback, individualized learning and portability that learners can study almost at anytime and anywhere [14]. Many research studies [15]-[17] have acknowledged that the use of mobile phones has positive effects on vocabulary learning. Vocabulary learning assisted by mobile devices in a constructivism approach focuses on learner-centered learning which will advocate learners' involvement in the process of constructing vocabulary knowledge. Learners control the vocabulary learning process and progress in their own pace based on their cognitive state. Moreover, learners can study and review the vocabulary knowledge as many times as they want. Presently, no published research study is conducted in the Thai context of combining MALL and constructivism to improve learners' vocabulary knowledge. To fill this gap, the present study attempts to examine the effect of implementing the constructivism-based vocabulary learning mobile application to enhance EFL students' English vocabulary learning and to explore the students' opinions towards using the mobile application to enhance EFL vocabulary learning.

II. RESEARCH METHODOLOGY

The current research is a quasi-experimental design study. The triangulation method is employed in the present study. During the research, both quantitative and qualitative data are collected to support the study.

A. Participants

90 second-year students participate in the study in second semester, academic year 2015 at Suranaree University of Technology, Thailand. Those participants attend an English for Academic Reading course for 3 hours a week for 12 weeks. The course focuses on improving students' reading comprehension skills and developing their vocabulary knowledge of the academic words [18]. The curriculum contains 12 units of the textbook and there are 12 target words in each unit. The participants in this study are chosen based on availability and convenience and they are in two intact classes. There are 45 students in each class. All of them take vocabulary pretests at the beginning of the semester and the average scores of vocabulary knowledge of the two classes from the pretest are 7.64 and 7.58 (from the total scores of 25) respectively. Their vocabulary proficiency level is statistically similar. Therefore, 45 students are put in the control group (non-mobile application group) and 45 students in the experimental group (mobile application group).

B. Instruments

The instruments for the quantitative study include two vocabulary tests and a questionnaire while the interview is a qualitative method for analyzing the data.

The subjects in this study are arranged to take two vocabulary tests: a pre-test and a post-test. The two vocabulary tests used in this study are designed according to [19] the distinction about English words and the multiple tests approach. Twenty-five words are selected randomly from all the core vocabulary in the textbook of the course for each test. These tests include three parts: matching the right definitions, filling in the gap with the given letters and multiple choices aiming at testing students' receptive and productive vocabulary knowledge. The purpose of this pre-test is to determine whether the subjects' vocabulary knowledge is at the same proficiency level. The post-test results aim to examine the effects of using the constructivism-based vocabulary learning mobile application to improve participants' vocabulary knowledge.

The questionnaire in this study is conducted after 12-week vocabulary learning via employing the mobile application. The purpose is to elicit students' opinions towards using the constructivism-based mobile application for vocabulary learning, to improve the vocabulary learning application and to help learners acquire vocabulary knowledge more effectively. The questionnaire is designed according to Du [7]. Some of the statements are presented in the Findings part. Alpha coefficient (α) is used to estimate the internal consistency of the questionnaire. The reliability is 0.721. A Likert's scale is used with five scales ranging from "strongly disagree" to "strongly agree" (1/2/3/4/5). In order to avoid misunderstanding and confusion, the questionnaires are written in both English and Thai.

A semi-structured interview is employed in the current study. The purpose of the interview is to find out the effectiveness of the application by questioning the participants about their opinions in depth on their vocabulary improvement after learning with the application. The interview consists of 8 items. A native Thai translator involves in the interview so that the interviewees can understand the questions better and the researchers also can get further information about their opinions.

C. The Development of the Application

The treatment in the present study is a constructivism-based mobile application which is designed by the researchers. The application is developed based on Cordova hybrid apps framework, which enables developers to create applications for Android and IOS devices using standard web technologies (HTML5, JavaScript and CSS). Through the application, students can interact with the vocabulary learning materials developed based on constructivism learning theory.

The learning materials are divided into 6 units. In each unit, it includes two parts: Preview and Review. As for the preview part, the participants need to construct the target word meanings based on the visual and contextual

clues. That is, the new words are shown in sample sentences with related pictures and sounds. If the participants construct the correct English definitions of the target words, they proceed to another task in which they choose the Thai meaning of the target word from four choices. If participants choose the incorrect English definitions of the target words, they need to guess the Thai meaning of the target words in a new context. The immediate feedbacks of the target word knowledge construction tasks help scaffold students' word meaning construction. The feedback of each word includes four features which are spelling, pronunciation, meaning in Thai language, and English definition. After finishing a group of the target words, they continue with the matching exercises and multiple choices so that they can understand and remember the words better. The details for the procedure of the preview part on target vocabulary learning are shown in Fig. 1.

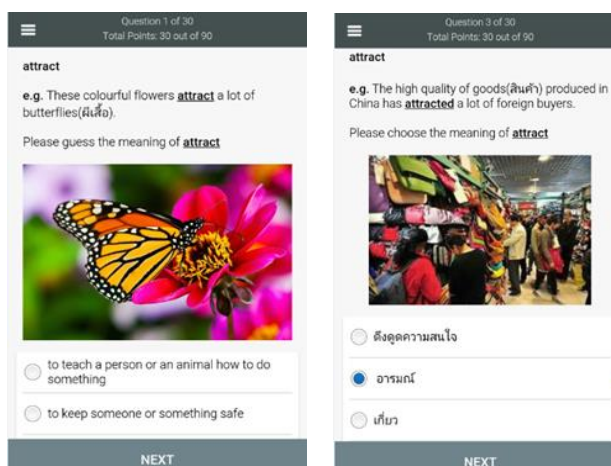


Figure 1. The procedure of the preview part via the mobile application

Furthermore, as for the review part, words are reinforced for learners' receptive and productive use with 3 exercises including matching the words with English definitions or Thai meanings, gap filling with the given letters of words and choosing the correct word from four choices. The immediate feedbacks of each exercise help the learners reflect and enhance their vocabulary knowledge. The details of the procedures of the review parts are shown in Fig. 2.

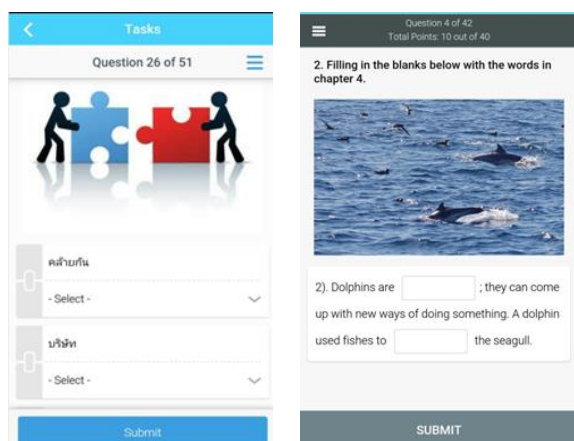


Figure 2. The exercises of the review part via the mobile application

To monitor students' performance and the total time spent on the vocabulary learning, the system recorded the scores obtained from the preview part and review part in each unit and these data serve in evaluating the effectiveness of the mobile application, and send the scores to the researchers' e-mails. The researchers could obtain the information of the participants' achievement in the vocabulary learning. Moreover, according to the recorded data by the system, the researchers could identify the words the students commonly make mistakes and, then, design related exercises in the review part for the next unit.

D. Data Collection and Analysis

The experiment extends from November of 2015 to February of 2016. The experiment group and the control group take a vocabulary pretest at the beginning of the semester. During the 12-week study, the experimental group uses the vocabulary learning mobile application to preview and review the target words of every chapter out of the classroom. Meanwhile, the control group adopts the traditional vocabulary learning approach. As for vocabulary preview, the participants need to find the target words' meanings and definitions by looking them up in their dictionaries. During the class, the students receive the same treatment with the experimental students that they learn the target words under the teacher's instruction. As for the review part, the control group students are required to review and memorize the target words through finishing the exercises in the textbook and the word list provided by the researchers. At the end of the treatment both groups are post-tested on their vocabulary achievement. Also, data from the questionnaires done with the experimental group and the semi-structured interviews are collected.

III. FINDINGS AND DISCUSSION

After the 12-week study on implementing the constructivism-based vocabulary learning application, from the data analysis, the results of the study can be summarized in terms of: 1) students' vocabulary knowledge; and 2) students' opinions towards the implementation of constructivism-based vocabulary learning application.

TABLE I. A COMPARISON THE TWO TESTS SCORES BETWEEN THE EXPERIMENTAL GROUP AND THE CONTROL GROUP

Group	Test	Mean	S. D.	N	t	Sig.
*EG	Pretest	7.58	2.515	45	-37.991	.000
	Post-test	19.07	3.732	45		
*CG	Pretest	7.64	2.633	45	-8.786	.000
	Post-test	11.60	5.061	48		

Note. *EG: Experimental Group; CG: Control Group.

A. Receptive and Productive Vocabulary Knowledge

The results from the statistics of the control group and experimental group in the pretest and post-test are presented in the following table. As shown in Table I, from the descriptive statistics and paired samples t-test

analysis, the mean scores of the post-test of the two groups (experimental/control) were 19.07 and 11.60 respectively.

As can be seen in Table I, in the control group, there was a statistically significant difference between the two tests, significant at $p=0.000$. Also, in the experimental group, there was a significant difference between the pretest and post-test scores because the p value was lower than 0.05 ($p = 0.000 < 0.05$) and the mean scores of the pretest and the post-test were obviously different (7.58/19.07). It signifies that students in the two groups noticeably improved on their vocabulary learning but the experimental group which employed the mobile application obviously improved much more than the control group.

Furthermore, from the independent samples t-test of the vocabulary post-test scores between the control group and the experimental group, as shown in Table II below, there was a statistically significant difference between the two scores because the p value was 0.005 which was lower than 0.05. It specifies that students in the experimental group using the mobile application significantly outperformed those in the control group in their EFL vocabulary learning.

TABLE II. A COMPARISON OF THE POST-TEST SCORES BETWEEN THE TWO GROUPS

Group	Scores	Mean	S.D.	N	t	Sig.
*EG	Post-test	19.07	3.732	45	-7.966	.005
*CG	Post-test	11.60	5.061	45		

Note. *EG: Experimental Group; CG: Control Group.

In addition, in terms of receptive and productive vocabulary knowledge, the post-test scores of the experimental group and the control group were analyzed by descriptive analysis and independent samples t-test, as presented in Table III below.

TABLE III. A COMPARISON OF THE 2-TYPE VOCABULARY KNOWLEDGE FROM THE POST-TEST SCORES BETWEEN THE TWO GROUPS

Vocabulary	Group	Mean	S. D.	N	t	Sig.
Receptive	*EG	11.02	2.379	45	-6.832	.047
	*CG	7.07	3.070	45		
Productive	*EG	8.05	1.870	45	-7.490	.006
	*CG	4.53	2.528	45		

Note. *EG: Experimental Group; *CG: Control Group.

This table shows that after the experiment, the average scores of students' receptive knowledge in the experimental group and the control group were 11.02 and 7.07, respectively. There was significantly different in terms of the receptive vocabulary knowledge between the two groups because the p value is 0.047.

In light of productive vocabulary knowledge, as presented in Table III, the mean in the experimental group (8.05) was higher than that of the control group (4.53). The significance was 0.006 ($p<0.05$), it is obvious that there was a significant difference in students' productive vocabulary knowledge between the two

groups. On the basis of the analyses of Table III, it can be inferred that the constructivism-based vocabulary learning application has a positive influence on improving students' receptive and productive vocabulary knowledge.

In brief, the quantitative data analysis indicates that effects after the implementation of constructivism-based vocabulary learning mobile application were as positive as expected, as evidenced by the fact that the scores in the vocabulary post-tests improved and there was a highly significant difference between the vocabulary pretest and vocabulary post-test.

B. Participants' Opinions

45 participants in the experimental group were required to answer the questionnaires after they finished their 12-week study. The results are presented in Table IV below:

TABLE IV. RESPONSES FROM STUDENT QUESTIONNAIRES ON THE LIKERT-SCALE (N=45)

Items	5 %	4 %	3 %	2 %	1 %
1.The vocabulary learning application helps me remember target words.	31.1	68.9	0	0	0
2.The vocabulary learning application is easy to use.	37.8	62.2	0	0	0
3.Learning vocabulary via the application is convenient since I can choose the place and time to learn new words.	35.6	53.3	11.1	0	0
5. I enjoyed using the application to learn vocabulary more than the method I used in the past.	22.2	68.9	8.9	0	0
6.The vocabulary learning application motivates me to learn new words.	15.6	80	4.4	0	0
13.Using the target words in new contexts increases my awareness of the word usage.	20.0	73.3	6.7	0	0
17.The Review 1 part enables me to revise the vocabulary knowledge.	26.7	64.4	8.9	0	0
18.The reviewing exercises help me apply what I've learned to	17.8	73.3	8.9	0	0
20.The application enables me to extend my vocabulary learning out of classroom.	24.4	73.3	2.3	0	0

Note. 5=Strongly Agree, 4=Agree, 3=Not sure, 2=Disagree, 1=Strongly Disagree

The participants delivered supportive opinions towards the implementation of the constructivism-based vocabulary learning application in EFL vocabulary learning. From item 1 and item 2, all of the participants agreed that the mobile application is helpful and easy to use for learning vocabulary. From item 3, 88.9% of them agreed that the mobile application is convenient since they can learn vocabulary anywhere and anytime. As shown in Table IV above, 95.6% of the students expressed that the vocabulary learning application motivates them to learn new words and 91.1% of them enjoyed using the application to learn vocabulary more than the approach they used in the past. Moreover, from item 13, 93.3% of them reported that using the target words in new contexts can raise their awareness of the word usage. Additionally, from item 17 and item 18,

91.1% of the students agreed that the mobile application helps them review the target words well and use it productively and 97.7% of them reported that the mobile application helps them learn the target words effectively beyond the classroom.

In addition, 19 of the students in the experimental group were randomly chosen to participate in the interviews in order that more informative data could be gathered. In general, the interviewees delivered positive opinions towards the implementation of the constructivism-based vocabulary learning application. All of them enjoyed learning vocabulary by the application because it is very convenient for them to learn new words anywhere and anytime, and it helps them understand and remember the word meaning easily, for example:

S1: *"I enjoy learning vocabulary by the application because it is easy to use and helps me understand and remember the word meaning easily. I can use it anywhere and anytime that I want."* (Translated)

S5: *"I like the application because it can improve my vocabulary knowledge. It helps me learn and remember the words."*

Secondly, all of the interviewees reported that the pictures, contexts and some unfamiliar words in Thai meaning are helpful for them to construct and understand the target words knowledge better, for example:

S8: *"I think it is good for me to learn the new words with the pictures and my own knowledge. It is better than learning only the words. It helps me remember the word easily."*

S12: *"If I guess and understand the new word by myself, it is not easy to forget."*

Furthermore, 79% of the students considered that the preview and review parts in the application are helpful for them in the process of vocabulary learning. The preview part makes them construct the word meaning by themselves with the help of scaffoldings and they can understand the course in the class better; and the review part can help them use their vocabulary knowledge that they learned in different contexts. However, four interviewees felt that the review part is helpful for them to use the words but it is a little difficult in terms of the gap-filling exercise because of the differences of their English proficiency levels.

In addition, all of them believed that constructing the vocabulary knowledge (word meaning and word usage) by themselves is helpful for understanding the word meaning better and remembering the words in longer time. The comments were as follows:

S15: *"I can remember the vocabulary meaning longer when I learn words by myself because I use my own knowledge to guess the word meaning."*

S17: *"It is good for me to learn and understand the new words with the pictures and my prior knowledge. It is better than learning only the words. It helps me remember the word easily."*

Moreover, they suggested adding more exercises in the review parts for them to use new words in different contexts. Meanwhile, they hoped that learners can use the mobile application to learn and review vocabulary

without connecting to the internet because sometimes the network is unstable and the speed is slow. They needed to enter the application again which wasted their time. Those problems may discourage students to learn and review the target words by the constructivism-based vocabulary learning mobile application.

To sum up, the students' responses in the questionnaires and the interview revealed amounts of insightful information about using the constructivism-based mobile application to improve EFL learners' vocabulary knowledge. Overall, most of them were satisfied with using the mobile application to learn and review vocabulary. Moreover, they perceived that the mobile application can improve both their receptive and productive vocabulary knowledge. Whereas the constructivism-based mobile application provided amounts of benefits to the students including: portability, convenience, flexibility, the multimedia environment and immediate feedback.

IV. CONCLUSION

In order to evaluate the effectiveness of the constructivism-based vocabulary learning mobile application, both qualitative and quantitative data collection techniques were employed. On the basis of the afore-mentioned results and discussions from the vocabulary pretest scores, post-test scores, student questionnaires, and student interviews, the research findings can be concluded that the constructivism-based vocabulary learning mobile application has positive effects on improving EFL students' receptive and productive vocabulary knowledge. Students can use the vocabulary knowledge in different contexts actively and correctly. For example, the students can actively construct the target word meanings through the pictures, meaningful contexts and their schemata. Also, they are able to recognize the words in different contexts or generate the target words productively based on the given letters of the target words and multiple contexts in the exercises of the review part. Furthermore, most of the students expressed positive opinions towards the implementation of the constructivism-based vocabulary learning mobile application to improve their vocabulary achievement. Scaffoldings such as textual and visual contextual clues, and some unfamiliar words offered in Thai meaning are necessary and helpful because they relate pictures and sample sentences to help the participants activate their schemata and understand the contexts better so that they can construct the word meaning and usage. The immediate feedback helps the learners reflect on their vocabulary construction. With the assistance of the mobile application, participants actively engage in the process of vocabulary construction and apply the vocabulary knowledge in new contexts. And the exercises in the review part prompt learners to use new words productively. The learners become the knowledge constructors, the active independent thinkers, and the interpreters in the process of their learning. They actively construct the vocabulary knowledge instead of passively accepting it. The teacher plays the role as a guide and

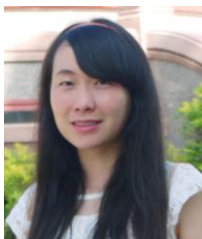
facilitator who provides visual contextual clue and comprehensible textual contextual clue for learners to construct the word knowledge with their prior knowledge. The constructive learning environment is helpful for learners to construct vocabulary knowledge. The finding elaborated previous research findings of Daloğlu *et al.* [9] and Du [10] that vocabulary learning based on constructivism can effectively improve the learners' outcome, especially in using the vocabulary knowledge productively.

MALL is a convenient, accessible and effective way that can be utilized to help EFL learners with their vocabulary learning [20]. Furthermore, the constructive MALL can motivate students to construct vocabulary knowledge in their preferred time and place and review the vocabulary knowledge as many times as they want without time limitation. Mobile applications offer a wide range of learning tools to learners that can be downloaded to their smartphones and used productively at available times [21]. So, from the results of the study, it can be concluded that the integration of MALL and constructivism is essential to the success of EFL vocabulary learning. It is necessary to employ a constructivism-based mobile application to learn vocabulary because students can construct the vocabulary knowledge through interacting with the new information and their prior knowledge independently beyond the class. The findings from this study are directly beneficial to not only other researchers in the field of vocabulary instruction, but also to those in other fields who are interested in integrating MALL with constructivism. The study enriches the understanding of applying MALL and constructivism in the Thai context for its theoretical and practical significance. The present study provides some insights and suggestions into how constructivism and MALL could be effectively used to assist learners in Thailand in learning vocabulary. Future research studies could be conducted to examine how constructivism and MALL can help students construct new knowledge in other language skills.

However, though comparatively satisfactory results are obtained from this study, the subjects in this study are the limited population of second-year undergraduate students. This may affect the generalization of the result. Therefore, the future studies about implementing the constructivism-based vocabulary learning mobile application to other Thai universities are called for and welcomed. Additionally, the researchers hope that learners can download all of the lessons at once and then learn the vocabulary without connecting to the internet in the future.

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