

THE EFFECTS OF ONLINE FLASHCARDS ON LANGUAGE LEARNERS' VOCABULARY SIZE

Tran Thi Thuy Linh

Department of Foreign Languages, Hanoi University of Natural Resources and Environment

Abstract. The purpose of this study is to investigate the effects of Quizlet online flashcards on language learners' vocabulary size. The participants were 76 English major students of three classes at pre-intermediate level using their flashcards for 11 weeks at Hanoi University of Natural Resources and Environment (HUNRE). An action research on vocabulary improvement of non-English major learners through using online flashcards at HUNRE was conducted to investigate learners' vocabulary acquisition in second language learning. The study indicated that online flashcards positively impact learners' vocabulary size; however, there was a small proportion of the participants did not gain benefits from using Quizlet online flashcards.

Keywords: online flashcards, vocabulary size, vocabulary learning software program.

1. Introduction

Through the researcher's observation, many English major learners at HUNRE had to encounter with vocabulary acquisition because of their short-term memory. Most of them have learned vocabulary with/ without vocabulary learning strategies.

Learning vocabulary is an ongoing process in which vocabulary learning strategies may support learners in better word retention. A variety of previous studies have demonstrated the positive outcome of vocabulary learning strategies on learners' language competence Ghazal, (2007) [1]. Cognitive strategies seem to be the most suitable for language learners to increase their vocabulary size among many vocabulary learning strategies. O'Malley et al. (1985, p. 561) note, "Training research on learning strategies with second languages has been limited almost exclusively to cognitive applications with vocabulary tasks"[2]. Nation (2001) also suggests that explicit vocabulary teaching should be a regular part of language classroom activities and that flashcards are practical tools of explicit vocabulary teaching where learners can memorize a more incredible amount of vocabulary in a short time [3].

In the era of technological innovation, vocabulary learning software programs have become increasingly widespread. Vocabulary learning via technology provides language learners with spaced repetition, which is considered more beneficial than massed repetition (Nation, 2001) [1]. Multimedia applied for learning vocabulary includes word annotations, online dictionaries, glossing, pre-packaged computer programs, or online flashcards (OFC). Recent evidence suggests that OFC programs can enhance learners' motivation by offering numerous multimedia possibilities (Hulstijn, 2001; Nakata, 2008) [4] [5]. Quizlet is one of the most popular sites for

Received October 28, 2021. Revised November 14, 2021. Accepted December 7, 2021.

Contact Tran Thi Thuy Linh, e-mail address: tranthithuylinh185@gmail.com

presenting, practicing, and testing vocabulary in a self-study mode, which has received researchers' ongoing attention.

That is why the researcher decided to apply an online flashcard strategy to help English major students improve their vocabulary size at HUNRE.

2. Content

2.1. Literature Review

2.1.1. Previous studies on using online flashcards to acquire vocabulary

An early example of research into online flashcards conducted by Nakata (2008) compared vocabulary learning with word lists, word cards, and personal computers to determine which material is most suitable for superior spaced learning [4]. 226 Japanese high school students were using three vocabulary learning tools to learn ten English words. The findings showed that one group using personal computers significantly outperformed the other group using word lists because it is burdensome to undertake expanded rehearsal or retrieval practice with lists. However, the card group's outcome was somewhat similar to two other groups partially due to differences in the learners' familiarity with learning materials. Finally, learners seemed to prefer using computers to lists or cards, which supports the importance of the computerized program to vocabulary acquisition.

In an investigation into the comparative usefulness of online and traditional vocabulary learning, Kilickaya and Krajka (2010) divided 38 non-English major participants at a private university in Ankara, Turkey, into two groups (the control group and the experimental group). During the five weeks, the control group of 20 participants practiced vocabulary items in ten reading passages through traditional instruction using vocabulary notebooks, cards, and paper dictionaries. The experimental group of 18 participants practiced the same vocabulary items in the passages through WordChamp (an online flashcards program). They used pre/post/delayed vocabulary tests as data collection instruments. The findings indicated that the experimental group using WordChamp while studying vocabulary items performed better than the participants in the control group who practiced traditional vocabulary learning activities. Consequently, the functions of WordChamp were highlighted: individualizing the language learning experience and raising the awareness of strategies that learners can use to learn on their own after leaving the language classroom [6].

In his major study, Altiner (2011) studied 13 intermediate-level students who used a computer-based flashcard program (Anki) for their academic vocabulary improvement and perceptions about the program. The reading results indicated that participants' vocabulary knowledge with Anki's assistance increased exponentially after the three-week intervention process. Learners practiced about two hundred academic words in three weeks, and their scores increased dramatically. Learners' insight into the use of online the flashcard program for vocabulary learning was categorized under three subheadings: usefulness, usability, and enjoyment. The findings suggested that learners found learning academic vocabulary with Anki useful and that they were capable of using Anki. Specifically, Anki kept track of learners' performance and presented the words in an adaptive sequencing manner. Despite learners reporting that example sentences and definitions were generally usable, the interview showed learners' different points of view. Some complained that the definitions were long and unknown words interfered with their understanding. Regarding learners' perceptions of enjoyment, the integration of a computer-based flashcard program into vocabulary acquisition, a few learners had to wait for a long time to log in to Anki, which reduced their enjoyment [7].

Dodigovic (2013) examined the effects of vocabulary learning with electronic flashcards designed by teachers or students. The study had a large purposeful sample size of 102 university applicants with paper-based TOEFL scores ranging roughly from 350-450. The results indicated that students' learning outcomes were worse when using their cards than when using teacher-designed cards because student-designed electronic word cards seemed to include less useful information and appeared less coherent than teacher-designed cards [8]. This outcome can be regarded as unexpected because Schmitt (2010) pointed out the potential learning benefits of creating one's word cards. While designing one's cards may undoubtedly lead to deeper processing, the number of word retrievals leads to word retention. Upon investigation, student-designed cards were designed with less semi-contextualizing information than the teacher-designed cards, which means the semi-contextualizing features are complicated and more training is needed for students to master these techniques than prior anticipation [9].

Many researchers have advocated the use of online flashcards rather than traditional ones (paper flashcards) because the former offers a bulk of advantages that the latter do not have. First of all, computers can be easily programmed to keep track of users' learning outcomes and control the sequencing of items to make sure that unknown or difficult items are studied more frequently than known or easy items, which is very complicated to do manually (Nakata, 2008). Another benefit of using online flashcards includes enhanced presentation of materials due to its multimedia capabilities, introduction of various vocabulary exercises types and positive effects on learners' motivation (Allum, 2004). Additionally, vocabulary learning via technology enables learners to be exposed to spacing, which is believed to be more effective than massing (Kornell, 2009).

2.1.2 Gaps in the previous studies

Although online flashcards have been used to teach vocabulary at school for a long time, there was little empirical research concerning the effects of OFC application on learners' vocabulary size. Therefore, the nature of the relationship between the use of flashcard strategy and the degree of lexical attrition and retention that language learners get is still far from clear. For this reason, this paper tries to shed light on how online flashcards should be used to enhance learners' vocabulary size.

2.1.3 Theoretical background of applying online flashcards to acquire vocabulary

2.3.1.1. Definition of traditional and online flashcard

Online (computer-based/web-based/digitized/electronic) flashcards are rather similar to traditional flashcards regarding appearance and contents; however, they do not have physical existence. Unlike traditional cards, electronic word cards require learners to type in the word during retrieval, thus combining the advantage of writing like ready-made cards. They can also manage the learning process, utilizing what is known about the transition from short-term to long-term memory (Nakata, 2008) [5].

Browne and Culligan (2008) provided a definition of an online flashcard which has two sides: the front side displays the target word in L2 while the other lists definitions in English (including different 'senses' whenever a word has multiple meanings), definitions in the learner's first language, part of speech, sound files with native speaker pronunciations of the words, frequent collocations for each target word (based on corpus analysis), sample sentences [10].

Traditional vocabulary flashcard is defined by Komachali and Khodareza (2012, p. 137): "A flashcard is cardboard consisting of a word, a sentence, or a simple picture on it... On one side, the new word is written in L2 and perhaps with a picture beside it and on the other side is the translation... Flashcards are useful for drilling new letters, syllables, words, and other information. They are normally used in a classroom, but can also be used more informally. A flashcard or flashcard is a set of cards bearing information, as words or numbers, on either or

both sides, used in classroom drills or private study. Flashcards can bear vocabulary, historical dates, formulas, or any subject matter that can be learned via a question and answer format. Flashcards are widely used as a learning drill to aid memorization by way of spaced repetition” [11].

2.3.1.2 The effects of flashcard strategy on vocabulary size

Many researchers have advocated using online flashcards rather than traditional ones (paper flashcards) because the former offers a bulk of advantages that the latter do not have. First of all, computers can be easily programmed to keep track of users' learning outcomes and control the sequencing of items to ensure that unknown or complicated items are studied more frequently than known or easy items, which is very complicated to do manually (Nakata, 2008) [5]. Another benefit of using online flashcards includes enhanced presentation of materials due to its multimedia capabilities, the introduction of various vocabulary exercises types and positive effects on learners' motivation (Allum, 2004) [12]. Additionally, vocabulary learning via technology enables learners to be exposed to spacing, which is more effective than massing (Kornell, 2009) [13].

With regard to the efficacy of the word card strategy, Kuo and Ho (2012) concluded that word card strategy helps learners retrieve the meaning and form of the word from memory, learn a large amount of receptive and productive vocabulary learning at an initial stage of word learning, avoid serial/list effect, use time efficiently, allow students to use first language (L1) translation, enhance the diversity of in-class activities, involve manual activities, build up the feeling of achievement, and easy to bring anywhere [14]. Similarly, Nation (2001) stated that using flashcards to learn vocabulary is a time-honored, effective, and efficient vocabulary learning strategy [15].

Another characteristic of online flashcards involves giving instant feedback to learners. According to Fryer and Bovee (2016), e-learning provides instant feedback to language learners, which improves their vocabulary acquisition. Such feedback allows learners to self-assess their performance [16]. Deutsch et al. (2012) highlighted the positive impacts of self-assessment on learners' motivation. The fact that Quizlet's seven activities provide instant feedback on learners' answers may help learners increase their motivation in learning vocabulary [17]. However, Winters et al. (2008) argue that learners' abilities to apply such meta-cognitive strategies should not be taken for granted [18] as not all students are "ready to learn from a technology-integrated" approach Tondeur et al.(2017) [19].

In addition, online learning tools such as Quizlet consist of distinctive characteristics of serious gaming. Online games can enhance the effectiveness of vocabulary acquisition. Derakhshan, A., & Khatir, E. D. (2015) conclude that online games are effective in vocabulary acquisition because they can create an interactive and motivating context where learners can share their information under the rules and obligations on players during playing. The players acquire vocabulary via the online games because they are willing to be the winner, and the competition and cooperation with each other is a challenging environment [20].

After reviewing the literature dealing with vocabulary acquisition and learners' perceptions in second language learning, the researcher decided to conduct this action research on the effects of using online flashcards on second language (L2) vocabulary improvement for non-English major learners at HUNRE. The purpose of this study is to help HUNRE students retain vocabulary effectively and change their perceptions towards learning foreign languages in general and learning vocabulary in particular. Furthermore, it is expected that the findings of this study can offer HUNRE teachers of foreign languages a deeper insight into their students' vocabulary learning process.

2.3. Methodology

2.2.1. Research question

(1) To what extent does the use of online flashcards increase English major learners' vocabulary size at HUNRE?

2.2.2. Research methodology and research participants

2.2.2.1. Research methodology

This study applied action research to convey the effects of using online flashcards on language learners' vocabulary size. There are four main stages in the action research, Mertler (2013) [21]:

Stage 1. Planning, including four steps: (1) Identifying and limiting the topic; (2) Gathering information; (3) Reviewing the related literature; (4) Developing a research plan.

Stage 2. Acting: including two steps: (5) Implementing the plan and collecting data; (6) Analyzing data.

Stage 3. Developing: (7) Developing an action plan

Stage 4. Reflecting: including two steps: (8) Sharing and communicating the results; (9) reflecting on the process.

According to Mertler & Charles (2011), action research is a cyclical process in nature. Therefore, these stages were implemented again in order to improve the educational setting sequentially [22].

2.2.2.2. The participants

The participants of this study were 76 freshmen aged 18 to 20 years old taking Reading - Writing 1 course for the academic year of 2021-2022 at the Hanoi University of Natural Resources and Environment.

2.2.3. Data collecting instruments

Vocabulary Size Test (VST) is designed to measure both first language and second language learners' vocabulary knowledge. Nation and Beglar (2007) pointed out three reasons for conducting VSL to investigate receptive vocabulary knowledge. The first reason is to see whether language learners with their vocabulary size can perform receptive tasks, such as watching movies, reading books, and listening to a conversation. VST also aims to measure the growth of learners' vocabulary size. Finally, VST can be used to compare native speakers with non-native speakers [23]. In addition, Laufer (2003) asserted that the vocabulary items learned through productive word-focused tasks were retained longer than learning from reading, even with using the dictionary [24]. Therefore, this study investigated receptive vocabulary knowledge and productive vocabulary capacity through three similar paper vocabulary size tests, including pretest, posttest and delayed posttest. All these tests have the same contents with the aim of comparing learners' progress on different occasions; however, the order of test items of three tests was different in order to avoid order effect - when respondents answer a question, there is a risk of being influenced by the previous questions in the questionnaire (Brinkman, 2009) [25]. The pretest was administered in the first week to determine learners' initial vocabulary size before the intervention. The posttest was used to record vocabulary knowledge after using the online flashcard strategy and then compared to the pretest to check students' improvement. The delayed posttest was implemented without prior notice a month after the posttest to examine whether the participants could remember learned words for a long time or not. All tests took place in 50 minutes under the control and guidance of the researcher in the classroom.

The vocabulary size tests (pretest/posttest/delayed posttest) (see Appendix B1 and B2) includes six parts with 40 lexical items purposefully extracted from Unit 1-5 of *Life-A2* (Pre-Intermediate) are as follows:

Table 1. The outline of three vocabulary size tests

No.	No. of questions	Inquiries	Aims
Part 1	5	Mark the letter A, B, C, or D on your answer sheet to indicate the word whose underlined part differs from the other three in pronunciation in each of the following questions.	Check the participants' vocabulary pronunciation.
Part 2	10	Mark the letter A, B, C, or D on your answer sheet to indicate the word(s) closest in meaning to the underlined word(s) in each of the following questions.	Check L2 meaning of the given words.
Part 3	5	Put the correct word form of the bold uppercase word into the blank of the sentence.	Check knowledge of derivation information of the given words.
Part 4	10	Match the numbered term in the left-hand column with the lettered synonym/antonym in the right-hand column.	Check knowledge of synonyms and antonyms of the given words.
Part 5	5	Make a meaningful sentence with a given word.	Check the learners' word collocation.
Part 6	5	Give the part of speech (n, v, adj, adv, prep) and Vietnamese meaning of the given words.	Check knowledge of L1 meaning and part of speech of the given words.

The pilot test papers were rated by two lecturers of DFL, then put into four different levels: level 1 means 'distinction' (9-10); level 2 means 'credit' (7-8); level 3 means 'pass' (5-6); and level 4 means 'failure' (under 5).

One month before the intervention, a pilot VST was conducted with the participation of 76 students of another class (class A). They had the same English proficiency level (A2) and did not participate in the actual study. To validate the researcher-made VST items, the researcher and HUNRE university colleagues had discussed the following: (1) the appropriateness of test items, (2) the possibility of ambiguity in the test items, and (3) the appearance and layout of the test. Subsequently, test specifications were designed to measure the VST measures accurately what it is intended to measure. In addition, data from the pilot test was then collected and analyzed with Cronbach's alpha coefficient (an SPSS indicator of internal consistency) to check its reliability. The findings showed that six parts of VST yielded consistent results across the different test items. Table 1 indicates that the Cronbach's alpha coefficient reports 0.79 for all six parts of pronunciation, meaning, part of speech, and collocation, which means 40 items were related to the same underlying construct. Nevertheless, there were some negative items of 5, 18, 33, 35, 36 with low reliability should be revised to increase the reliability of the VST. Additionally, the participants were not informed of the tests' results to avoid negative impacts on the posttest and delayed posttest so that the reliability of the tests could be kept confidential.

2.3. Results and discussion

2.3.1 Results of pretest and posttest

Paired Samples Statistics

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Pronunciation1	.136	76	.167	.025
	Pronunciation2	.714	76	.351	.054
Pair 2	Meaning1	.761	76	.471	.072
	Meaning2	3.184	76	1.264	.195
Pair 3	Part of speech1	.244	76	.273	.042
	Part of speech2	1.232	76	.663	.102
Pair 4	Collocation1	.065	76	.124	.019
	Collocation2	.351	76	.292	.045
Pair 5	Pretest	1.208	76	.871	.134
	Posttest	5.482	76	2.419	.373

Table 2. Pair samples t-test for pretest and posttest

Paired Samples Test

		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower	Upper			
Pair 1	Pronunciation1 - Pronunciation2	-.577	.299	.046	-.670	-.483	-12.480	41	.000
Pair 2	Meaning1 - Meaning2	-2.422	1.005	.155	-2.735	-2.109	-15.618	41	.000
Pair 3	Part of speech1 - Part of speech2	-.988	.478	.073	-1.137	-.839	-13.396	41	.000
Pair 4	Collocation1 - Collocation2	-.285	.295	.045	-.377	-.193	-6.274	41	.000
Pair 5	Pretest - Posttest	-4.273	1.798	.277	-4.834	-3.713	-15.401	41	.000

A pair samples t-test was conducted to evaluate the impacts of using online flashcards on students' scores on the vocabulary size test. Table 2 illustrates a comparison between the figures for pretest and posttest.

As can be seen from Table 2, there was a statistically significant growth in the total score of pretest from Time 1 (Mean = 1.20, Std. Deviation = .87) to the total score of posttest from

Time 2 (Mean = 5.48, Std. Deviation = 2.41), $t(41) = -15.4$, $p = .00 < .05$). The mean increase in VST scores was -4.27 with a 95% confidence interval ranging from -4.83 to -3.71 . Additionally, the eta squared statistic (.85) indicated that there was a large effect, with a substantial difference in the VST scores obtained before and after the intervention. In other words, the student's vocabulary size climbed steadily after using online flashcards.

On the other hand, the results of paired samples t-test shown in Table 2 also reveals that there was a substantial discrepancy between pretest and posttest results in all aspect of word knowledge, namely pronunciation, meaning, part of speech, and collocation, the probability values of which are $.00 < .05$. Subsequently, the participants gained the higher pretest mean scores of .13; .76; .24; .06 in respective comparison to the posttest mean scores of .71; 3.18; 1.23; .35. What is interesting in this data is that collocation went up slightly whereas meaning, part of speech and collocation surged dramatically.

What stands out in Table 2 is there was a significant difference not only between pretest and posttest but also in their subcategories of test items.

2.3.2 Results of posttest and delayed posttest

Paired Samples Statistics

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Pronunciation2	.714	76	.351	.054
	Pronunciation3	.696	76	.351	.054
Pair 2	Meaning2	3.184	76	1.264	.195
	Meaning3	3.172	76	1.253	.193
Pair 3	Part of speech2	1.232	76	.663	.102
	Part of speech3	1.214	76	.666	.102
Pair 4	Collocation2	.351	76	.292	.045
	Collocation3	.327	76	.267	.041
Pair 5	Posttest	5.482	76	2.419	.373
	Delayed posttest	5.464	76	2.419	.373

Table 3. Pair samples t-test for posttest and delayed posttest

Paired Samples Test

		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower	Upper			
Pair 1	Pronunciation2 - Pronunciation3	.017	.065	.010	-.002	.038	1.776	41	.083
Pair 2	Meaning2 - Meaning3	.011	.053	.008	-.004	.028	1.432	41	.160
Pair 3	Part of speech2 - Part of speech3	.017	.065	.010	-.002	.038	1.776	41	.083

Pair 4	Collocation2 - Collocation3	.023	.074	.011	.000	.046	2.077	41	.044
Pair 5	Posttest – Delayed posttest	.017	.065	.010	-.002	.038	1.776	41	.083

Another pair samples t-test was implemented to measure students' capability of vocabulary retention for a long time (a month after the posttest happened). Table 3 presents the distinction in results of the posttest and delayed posttest.

It can be noticed from Table 3 that no statistically significant differences were found between the total score of posttest from Time 1 (Mean = 5.48, Std. Deviation = 2.41) and the total score of delayed posttest from Time 2 (Mean = 5.46, Std. Deviation = 2.41), $t(41) = 1.77$, $p = .083 > .05$. The mean decrease in VST scores was .17 with a 95% confidence interval ranging from -.002 to .038. Additionally, the eta squared statistic (.07) indicated that there was a moderate effect, with a substantial difference in the VST scores obtained before and after a month. In other words, the student's vocabulary size remained nearly unchanged a month after the posttest. On the other hand, the results of paired samples t-test showed in Table 3 also demonstrate that the results between posttest and delayed posttest were not extremely varied in all aspects of word knowledge, namely pronunciation, meaning, part of speech, and collocation with two probability values are .16 and .83 $> .05$. Respectively, the posttest mean values of .71; 3.18; 1.23; .35 dropped slightly to the delayed posttest mean values of .69; 3.17; 1.21; .33. Hereby, all mean values are rather approximate.

What is striking about the figures in Table 3 is that there was no remarkable discrepancy between posttest and delayed posttest performance, which means that the participants might recall most of the learned vocabulary for a long time.

2.3.3. Discussion

About the first research question, "To what extent does the use of online flashcards increase language learners' vocabulary size at HUNRE?", the findings of pretest, posttest, and delayed posttest prove that language learners using online flashcard strategy to retain new words at Hanoi University of Natural Resources and Environment had higher achievement scores of vocabulary size tests than themselves without using this strategy and that students can retain vocabulary for a long time.

The pair samples t-test of pretest and posttest indicated statistically significant growth in the total score of pretest from Time 1 to the total score of posttest from Time 2 after using online flashcards. The current study supports the idea of past studies (Nakata, 2008; Kilickaya & Krajka, 2010; Altiner, 2011) that a significant increase in receptive and productive vocabulary knowledge was due to the use of online flashcards [5] [6] [7]. It is also in line with those of previous studies that show that semi-decontextualized study is an efficient way to increase vocabulary over time (Nakata, 2008; Bauer, 2015) [5] [26] and that computer-mediated instruction seems to be beneficial in vocabulary learning (Browne & Culligan, 2008; Nakata, 2011) [10] [27]. Furthermore, the findings of sub-categories of pretest and posttest showed that collocation went up slightly whereas meaning, part of speech, and collocation surged dramatically.

This study applied posttest and delayed posttest to measure long-term retention because Quizlet does not offer expanded rehearsal to increment their vocabulary knowledge. Results of the pair samples t-test of the posttest and delayed posttest demonstrated that the participants could recall most of the words that they learned for a long time. These findings seem to be consistent with other research (Karpicke & Roediger III, 2007; Logan & Balota, 2008), which found that expanded rehearsal had little effect on long-term retention [28] [29].

2.3.4. Recommendations

Based on the research results, the following recommendations are made:

Firstly, in order to ensure that as many students as possible benefit from technology-enhanced language learning, teacher intervention is imperative in motivating students to engage with online learning activities. Fryer and Bovee (2018, 229) suggest that teachers should explain the importance of e-learning component in the course and understand their critical role in motivating the students' learning autonomy inside the classroom [29]. Accordingly, this study suggests teachers can help students expand their vocabulary size by integrating online flashcards into teaching vocabulary via Quizlet live sessions inside classrooms regularly.

Secondly, language learners can boost up their vocabulary size outside classrooms as well by exposing to all aspects of word knowledge and word use through interactive exercises and interesting games via Quizlet online flashcards software as much as possible because that generates the depth processing (imaging, association, analysis) and frequency of use in vocabulary retention. Fryer and Bovee (2018) indicates that e-learning may be divergent among learners at different levels of language proficiency. Platzer, H. (2020) also concludes that A1/A2 learners tend to overuse the engaging but ineffective, Match activity, while C1/C2 students were more likely to use the more effective, recall-based tasks [30].

In her major study, Sanosi, A. B. (2018) argues that as an e-learning application, the study sets of Quizlet are designed to meet the need of autonomous learners. Learners can perform different learning tasks, assess their vocabulary acquisition, and gamify the vocabulary learning process. However, the results of this research point out that a small proportion of participants do not gain benefits from Quizlet online flashcards, so further work is required to determine which factors reduce participants' learning autonomy and motivation towards using online flashcards for vocabulary acquisition [31].

3. Conclusions

Overall, the present study was designed to determine the effects of using online flashcards on language learners' vocabulary size. The findings show that Quizlet has a significant influence on the pre-intermediate participants' vocabulary size. The quantitative results of pretest and posttest revealed that most of the participants using online flashcard strategy to retain new words gained higher scores of vocabulary size tests than when they did not use this strategy. Additionally, the delayed post-test results indicated that the participants could recall the words that they learned for a long time.

Although there were some positive results, this study still has its shortcomings. First, the small sample size limits the generalizations that can be made about the effects of using Quizlet online flashcards on language learners' vocabulary size. There still is a small proportion of language learners who did not take advantage of using Quizlet flashcards due to unknown reasons.

REFERENCES

- [1] Ghazal, L., 2007. Learning vocabulary in EFL contexts through vocabulary learning strategies. *Novitas-Royal*, 1(2), 84-91.
- [2] O'malley, J. M., Chamot, A. U., Stewner-Manzanares, G. L. O. R. I. A., Russo, R. P., & Küpper, L., 1985. Learning strategy applications with students of English as a second language. *TESOL Quarterly*, 19(3), 557-584.
- [3] Nation, P., 2001. *Learning vocabulary in another language*. Cambridge: Cambridge University Press.

- [4] Hulstijn, J. H., 2001. Intentional and incidental second language vocabulary learning: A reappraisal of elaboration, rehearsal and automaticity. In P. Robinson (Ed.), *Cognition and second language instruction* (pp. 258-286). Cambridge: Cambridge University Press.
- [5] Nakata, T., 2008. English vocabulary learning with word lists, word cards and computers: implications from cognitive psychology research for optimal spaced learning. *ReCALL*, 20(01), 3-20. DOI: 10.1017/S0958344008000219
- [6] Kilickaya, F., & Krajka, J., 2010. Comparative usefulness of online and traditional vocabulary learning. *Turkish Online Journal of Educational Technology-TOJET*, 9(2), 55-63.
- [7] Altiner, C., 2011. *Integrating a computer-based flashcard program into academic vocabulary learning*. (Master's thesis), IOWA State University. Retrieved from <http://lib.dr.iastate.edu/etd/10160> (10160).
- [8] Dodigovic, M., 2013. Vocabulary learning with electronic flashcards: teacher design vs. student design. *Voices in Asia Journal*, 1, 15-33.
- [9] Schmitt, N., 2010. *Researching vocabulary: A vocabulary research manual*: Palgrave Macmillan.
- [10] Browne, C., & Culligan, B., 2008. Combining technology and IRT testing to build student knowledge of high-frequency vocabulary. *The JALT CALL Journal*, 4(2), 3-16.
- [11] Komachali, M. E., & Khodareza, M., 2012. The effect of using vocabulary flashcards on Iranian pre-university students' vocabulary knowledge. *International Education Studies*, 5(3), 134-147. DOI: 10.5539/ies.v5n3p134
- [12] Allum, P., 2004. Evaluation of CALL: Initial vocabulary learning. *ReCALL*, 16(2), 488-501. doi:10.1017/S0958344004001624
- [13] Kornell, N., 2009. Optimizing learning using flashcards: Spacing is more effective than cramming. *Applied Cognitive Psychology*, 23(9), 1297-1317. DOI: 10.1002/acp.1537
- [14] Kuo, Y., & Ho, H.-Y., 2012. Effects of word card strategy versus word list strategy on Taiwanese EFL junior high school students' vocabulary retention. *Electronic Journal of Foreign Language Teaching*, 9(1), 26-45.
- [15] Nation, P., 2001. *Learning vocabulary in another language*. Cambridge: Cambridge University Press.
- [16] Fryer, L., & Bovee, H., 2018. *Staying Motivated to E-Learn: Person- and Variable-Centred Perspectives on the Longitudinal Risks and Support*. Computers & Education, 120, 227-240.
- [17] Deutsch, T., Herrmann, K., Frese, T., & Sandholzer, H., 2012. Implementing Computer-Based Assessment - A Web-Based Mock Examination Changes Attitudes. *Computers & Education*, 58(4), 1068-1075.
- [18] Winters, F., Greene, J., & Costich, C., 2008. Self-Regulation of Learning within Computer-Based Learning Environments: A Critical Analysis. *Educational Psychology Review*, 20(4), 429-444.
- [19] Tondeur, J., Van Braak, J., Ertmer, P. A., & Ottenbreit-Leftwich, A., 2017. Understanding the relationship between teachers' pedagogical beliefs and technology use in education: a systematic review of qualitative evidence. *Educational technology research and development*, 65(3), 555-575.
- [20] Derakhshan, A., & Khatir, E. D., 2015. The effects of using games on English vocabulary learning. *Journal of Applied Linguistics and Language Research*, 2(3), 39-47.
- [21] Mertler, C. A., 2013. *Action research: Improving schools and empowering educators* (4 ed.): Sage Publications.

- [22] Mertler, C., & Charles, C., 2011. Experimental, quasi-experimental, and single-subject designs *Introduction to educational research* (7 ed., pp. 286-317): Pearson.
- [23] Nation, I., & Beglar, D., 2007. A vocabulary size test. *The language teacher*, 31(7), 9-13.
- [24] Laufer, B., 2003. Vocabulary acquisition in a second language: Do learners acquire most vocabulary by reading? Some empirical evidence. *Canadian Modern Language Review*, 59(4), 567-587. DOI: 10.3138/cmlr.59.4.567
- [25] Brinkman, W., 2009. Design of a questionnaire instrument. In S. Love (Ed.), *Handbook of mobile technology research methods* (pp. 31-57): Nova Science Publishers Inc
- Sanosi, A. B. (2018). The effect of Quizlet on vocabulary acquisition. *Asian Journal of Education and e-learning*, 6(4).
- [26] Bauer, C. R., 2015. *Action research: Using Quizlet for mobile vocabulary learning and retention*. Paper presented at the TESOL 2015 International Convention & English Language Expo.
- [27] Nakata, T., 2011. Computer-assisted second language vocabulary learning in a paired-associate paradigm: A critical investigation of flashcard software. *Computer Assisted Language Learning*, 24(1), 17-38. DOI: 10.1080/09588221.2010.520675
- [28] Karpicke, J. D., & Roediger III, H. L., 2007. Expanding retrieval practice promotes short-term retention, but equally spaced retrieval enhances long-term retention. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, 33(4), 704-719. DOI: 10.1080/13825580701322171
- [29] Logan, J. M., & Balota, D. A., 2008. Expanded vs. equal interval spaced retrieval practice: Exploring different schedules of spacing and retention interval in younger and older adults. *Aging, Neuropsychology, and Cognition*, 15(3), 257-280. DOI: 10.1080/13825580701322171
- [30] Platzer, H., 2020. The Role of Quizlet in Vocabulary Acquisition. *Electronic Journal of Foreign Language Teaching*, 17(2).
- [31] Sanosi, A. B., 2018. The effect of Quizlet on vocabulary acquisition. *Asian Journal of Education and e-learning*, 6(4).