The Journal of Language Teaching and Learning™

2016 Volume 6/Issue 2 Article 1

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Recommended Citations:

APA

Byrd, D. R., & Lansing, B. (2016). Electronic flashcards inside the classroom: Practical and effective. *The Journal of Language Teaching and Learning*, *6*(2), 1-13.

MLA

Byrd, David R., & Branden Lansing. Electronic flashcards inside the classroom: Practical and effective. *The Journal of Language Teaching and Learning*, (2016). 1-13.

www.jltl.org

The Journal of Language Teaching and Learning, 2016(2), pp. 1-13

Electronic Flashcards inside the Classroom: Practical and Effective

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ARTICLE INFO

Article History:
Received November 24, 2015
Revisions completed Jan 8, 2016
Published June 30, 2016

Key Words:
Flashcards
Technology
Electronic Flashcards
Exploratory Practice
Vocabulary Acquisition

ABSTRACT

The use of both technology and flashcards has been shown to be effective in L2 vocabulary acquisition and retention. The purpose of this exploratory practice project was to evaluate the effectiveness of using computer- versus paper-based flashcards as a learning tool within the context of the secondary foreign language classroom in learning new vocabulary. Using a pre-/post-test design, quiz scores of beginning high school French and German students studying vocabulary under these two conditions were compared using a two-tailed t-test. Results showed a significant difference when students practiced with computerized flashcards, suggesting that computerized flashcards can be an effective teaching tool in the secondary classroom to aid students in learning vocabulary.

In second language (L2) classrooms, technology in its various forms is used to assist learning and acquiring concepts such as culture (Ashby & Ostertag, 2002; Kuttenberg, 2003), grammar (Chan & Kim, 2004), reading (Chun, 2006) and allowing students to explore and learn a wider range of language and social functions (Abrams, 2001, 2014). Such technology can also be effectively employed in L2 classroom to help facilitate the learning of vocabulary terms (Bern & Palomo Duarte, 2015; Cornillie, Jacques, De Wannemacker, Paulussen, & Desmet, 2011; Nakata, 2008; Neville, Shelton, & McInnis, 2009). Computer programs can track students' performance with the vocabulary and control the sequence in which the terms are viewed; thus helping students learn terms (Nakata, 2008).

Vocabulary is required for language comprehension and use in both the classroom and for fluent everyday speech in the language (Haratmeh, 2012; Schmitt, 2008), but beginning language students do not possess the skills *simply* to acquire vocabulary through inference through reading and/or listening (Nakata, 2008). In the classroom setting, particularly at beginning levels of language instruction, memorization of vocabulary is key to building a lexicon necessary for success both in and out of the

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classroom. Researchers (Haratmeh, 2012; Nation, 2011; Schmitt, 2008) have studied the importance and methods of vocabulary learning in a second language for years, but students are still failing to acquire the vocabulary necessary for communication. Therefore, research into improved aids for memorizing vocabulary is needed to implement best practices more effectively (Cornillie et al., 2011; Golonka, Bowles, Frank, Richardson, & Freynik, 2014).

One method of addressing this need is the use of flashcards. In the broader educational setting, flashcards have been shown to be an effective method for learning new information (Kornell, 2009; Nakata, 2008; Nation, 2011; Nist & Joseph, 2008). Although various methods or systems for flashcard use are available, one of the most effective is spaced rehearsal, where flashcards with desired information are viewed multiple times in the review process at specific intervals until mastered (Kornell, 2009). This technique involves a great deal of repetition of both known and unknown information. Many areas of L2 learning have utilized this method of learning, including the learning of new vocabulary from the target language (Nakata, 2008). Elgort's (2011) research suggests that spaced learning results in both explicit vocabulary knowledge, as well as implicit knowledge, both of which students need to be successful in their daily use of the language.

Similarly, the use of both flashcards and of technology has shown to be effective in vocabulary acquisition and retention, but area of computer-based flashcards for studying vocabulary within the foreign language (FL) classroom setting is still lacking research (Nakata, 2008). Recent studies have begun to focus on devices students may have in their possession, such as cellphones. However, not all students have access to these devices. The present study is in response to Nation's (2011) call for work to move the increase in vocabulary learning research into practice in the classroom, along with Levy, Hubbard, Stockwell, and Colpaert's (2015) appeal to investigate ways that technology can effectively enhance pedagogy. To meet these twin goals, our study is a classroom-based exploratory practice project to determine whether paper or electronic flashcard use will aid students in learning vocabulary in the FL classroom more effectively.

2. Literature Review

2.1. The Importance of Vocabulary

The role of learning vocabulary in an L2 is seen by many researchers and educators as one of the most vital elements in becoming a successful L2 learner (Nakata, 2008; Peregoy & Boyle, 2013). Schmitt (2008) suggests that as many as 8000 word families (not just words) might be required for full fluency in the English language, with other languages often following similar patterns. Research (Peregoy & Boyle, 2013) suggests that a breadth of vocabulary can aid L2 learners as they encounter several known words in almost every sentence. While this may not always allow the learner to decipher meaning completely or accurately, it will help remove the sense of hopelessness often felt when a learner is unable to comprehend any words. The known words can also then be used to assist the learner in determining meaning of new, unknown words.

2.2. Types of Vocabulary Learning

Nation (2001) posits two types of vocabulary learning: intentional and incidental. Intentional learning focuses primarily on the development of vocabulary in and of itself; whereas incidental learning happens when vocabulary is a by-product of another activity, such as reading or writing. Both can play a major role in vocabulary learning. The latter tends to be seen as the preferred method of teaching vocabulary in today's L2 classrooms, where rote memorization with its connections to behavioral psychology is seen as an out-of-date model of learning (Hulstijn, 2001; Nakata, 2008). However, studies

suggest that learning by rote can be effective and efficient, especially at lower levels of proficiency (Erbes, Fokerts, Gegis, Pederson, & Stivers, 2010; Hunt & Beglar, 2005; Khoii & Sharififar, 2013; Waring, 2004). Sagarra and Alba (2006) suggest that rote memorization of L2 vocabulary is effective because it forces learners to make conceptual and form associations between the first and second language word/phrase. Mondria (2003) conducted a study that compared meaning-inferred vocabulary learning strategies versus meaning-given strategies among secondary-level French learners in Holland. The participants took part in either incidental, such as inferring conditioning; or intentional learning, such as meaning-given methods strategies. Mondria found that neither incidental nor intentional strategies showed a significant gain over the other, but that meaning-given tasks tended to be more time efficient. He recommended that memorization play an integral part in vocabulary learning, particularly after inferring (cf. Hulstijn, 2001; Mondria & Mondria-de Vries, 1994).

Likewise, educational psychology supports learning by rote. In order for information to become stored in long-term memory, effort must be made to move it from short-term to long-term (Martinez, 2010). Practiced rehearsal, such as flashcards, allows for this movement to take place and will be discussed in further detail in the next section. Further, Elgort's (2011) research suggests that such learning results not only in explicit knowledge of vocabulary, but also in implicit knowledge, which is the type needed for language use.

2.3. Flashcards and Vocabulary

The use of flashcards in vocabulary learning is still prevalent among foreign language learners (Baleghizadeh & Ashoori, 2011; Godwin-Jones, 2010; Nation, 2011). Flashcards provide a simple way for students to study and learn new vocabulary words and can be used by almost every student. Typically, students are introduced to new words in many ways: by an instructor, in a textbook, through a reading or from an extended discourse. After identifying unknown words, flashcards are created by writing the unknown vocabulary on one side and known words or phrases on the other. The cards are then "shuffled and the words are presented without teacher modeling" (Nist & Joseph, 2008, p. 295). Through this practice, students are provided with immediate feedback. By shuffling the cards, students learn using a phenomenon known as spaced learning, which tends to lead to a higher retention of material than learning in a session where vocabulary is learned en masse (Hulstijn, 2001). Nist and Joseph also recommend a variation to this type of learning where students intersperse new vocabulary into a mix of known terms, which allow students to be exposed to a small amount of new words and receive repeated practice drilled on them repeatedly.

Finally, Elgort (2011) showed that deliberate learning of vocabulary, such as studying flashcards, increases the acquisition of functional aspects of vocabulary knowledge. She had 48 advanced learners of English study pseudowords (i.e. pronounceable derivations of real words, where one letter had been changed from a real base word) using flashcards with three types of priming (form, masked repetition, and automatic semantic). Participants attended initial learning sessions, where they were introduced to the pseudowords and how to pronounce them. They then took the flashcards home and studied them for a week. At the end of the week, participants completed a series of tests, including dictation and a speeded lexical decision. On the latter assessment, participants were shown words on a computer screen and were required to decide if the word was an English word, including the pseudowords from the experiment, or a nonsense word. Her findings suggest that these pseudowords were processed by learners with a higher degree of automaticity when compared with non-words and low-frequency L2 words. Finally, Elgort calculated a coefficient of variability of the participants' responses as an indicator of automaticity of processing. The results suggest that "participants' responses to the pseudowords were significantly less variable than their responses to non-words or the low-frequency L2 words" (p. 397). Elgort concluded

that these results indicated that the participants were able to process the pseudowords with some degree of automaticity.

2.4. Technology and Vocabulary

Studies suggest that technology can play a positive role in learning vocabulary for L2 students of diverse ages. Parette, Boeckmann, and Hourcade (2008), in a review of studies dealing with technology and literacy with early childhood learners, described how computer programs can aid in many aspects of language skill development, including vocabulary using flashcards. The authors claimed that "graphically based software programs incorporating picture-supported text can help emergent readers develop a positive literate self-image, and acquire important concepts about print" (p. 162). These authors also posited that the use of such aids can help learners to engage in literacy activities even before being able to read and spell individual vocabulary words. Similarly, Segers and Verhoeven (2002) studied the effects of technology on the development of vocabulary in kindergarten aged learners of Dutch, using a pre-test-training-post-test design with the post-tests were administered a week after the completion of training. Twenty-five immigrant children with an average age of 65.4 months, were trained to use computers to read storybooks or play vocabulary games in three 25 minute sessions. A t-test showed a significant difference between the average pre- versus post-test scores.

Technology also affects the manner in which older L2 students learn vocabulary. Stockwell (2007) conducted an exploratory study looking at different technology formats to study vocabulary. Eleven college-aged Japanese learners of English chose to use either mobile phones or personal computers to complete vocabulary learning tasks. Stockwell reports that scores on the vocabulary tasks tended to be higher when using a personal computer and that students using mobile phones tended not to complete lessons. Due to the low number of participants, differences were not significant, but the trend was consistent among them. Likewise, Tabatabaei and Goojani (2012) conducted a study of 60 English learners in Iran. Participants were given a pre-test with vocabulary that focused on English for university students. Over a period of two months all participants attended the same classes. After being taught six to seven words in class, the members of experimental group (n=30) texted the researchers and three predetermined peers a sentence using the words before the next class session and received immediate feedback from each recipient. Meanwhile, the control group (n=30) wrote sentences on paper and shared them with a researcher and peers and brought them to class the next period. The control group did not receive feedback as quickly. Results comparing scores of a post-test found that participants in the experimental group performed significantly better than the control group. Other researchers have found similar results with texting and vocabulary learning (Alemi & Lari, 2012; Cavus & Ibrahim, 2008; Lu, 2008).

2.5. Technology-Based Flashcards

Researchers have conducted studies examining the various types of technology-based flashcards from computers to mobile devices. Most of these studies suggest that technology can enhance student learning. Başoğlu and Akdemir (2010) conducted a study of 60 learners of English in Turkey, who used either paper-based vocabulary studying techniques or electronic flashcards downloaded on mobile phones. The researchers used a pre-/post-test design, administering a 25 item vocabulary assessment to the participants. Participants studied a variety of vocabulary terms over a period of six weeks. Results showed both the paper-based and electronic-based groups' scores improved, but a comparison of the gain scores of the two groups indicated that electronic flashcard group's gain score was statistically significantly higher after conducting t-test. Further, interviews conducted with participants suggested that they found studying vocabulary on mobile phones to be "entertaining and effective" (p. 5). In a

similar pre-/post-test design study conducted in Japan, Spiri (2008) found that EFL learners who used electronic flashcards scored slightly better on the post-test. In his study, a paper-based vocabulary group (n=62) and an electronic-based vocabulary group (n=54) each studied a set of thirty high frequency English words for more than 60 minutes (self-reported) over a four-week period. The electronic flashcard group averaged 19.8 words correct versus 17.7 for the paper group. Although the difference was not significant, the author suggests that the intentional study of vocabulary using electronic means can be seen as more effective.

Lastly, Nakata (2008) examined students studying vocabulary with both paper and computer assistance. The researcher looked at 226 Japanese students learning English vocabulary, who were assigned to one of three groups: (1) the List group, (2) the Card group, or (3) the Personal Computer (PC) group. The List group studied ten words on a standard (30 cm x 21 cm) paper that matched English nouns with their Japanese equivalents. The Card group used 6 cm x 10.5 cm cards with the English word on one side and the Japanese equivalents on the other. The PC group had the Japanese word presented and the students were required to provide the English equivalent by typing it into an answer box; if they missed the word, the correct English word would appear on the screen as corrective feedback. It was found that the PC group outperformed the other two groups in delayed post-test scores.

The literature suggests that studying vocabulary can help to establish a foundation for students at the beginning levels of learning, which is essential in all contexts, including L2 learning (Coady, 1997; Godwin-Jones, 2010; Hunt & Beglar, 2005; Mondria, 2003; Nation, 2011; Waring, 2004). Likewise, a large body of evidence – within L2 and broader educational contexts -- supports both flashcards and the assistance of technology for the improvement of vocabulary (Palombella & Johnson, 2005; Segers & Verhoeven , 2002; Stockwell, 2007).

Although technology appears to be prevalent in the world today, not all students have access to either the hardware (ie computers, pads, phones) or the internet or both (File & Ryan, 2014; Winke & Goertler, 2008). File and Ryan (2014) report that only 83.8% of households in the US owned a computer and 74.4% had access to the internet in 2013. These researchers also posit that handheld devices follow a similar pattern overall. Throughout the world, the availability of internet access is rapidly growing, but does not approach population numbers (Miniwatts Marketing Group, 2015). Whereas populations in areas such as Europe and Oceania/Australia report 73.5% and 72.9% access to internet, the Middle East, Asia and African populations report only 49.0%, 38.8% and 27.0% (each respectively). Researchers are mixed in reporting the number of people in the world who own computers or other electronic devices ("Where the devices are," 2015). Similarly, reports on the pervasiveness of technology in schools are inconsistent, but the call for language teachers to use computers (and other electronic devices) more effectively is common (cf. Cummings, 2008; Thoms, 2012).

In the present study, the authors wanted to investigate how electronic flashcards can play a role in the classroom, even if the students did not have ready access to electronic devices outside. Likewise, the authors desired to investigate how the theory of implementing flashcards for vocabulary building could be best integrated into practice in the secondary foreign language classroom, which lacks a substantial research base and to add to knowledge base of technology-enhanced L2 learning (Levy, et al., 2015). This exploratory practice project was designed to determine if students would perform better using a computerized flashcard program than when using a more traditional, paper-based flashcard system (Allwright, 2005; Allwright & Hanks, 2009). The framework of exploratory practice fits the present study because it was our goal to understand methods of vocabulary study as a primary part of the L2 classroom (Allwright, 2005). The research questions were: (1) Is there a statistically significant difference in the mean scores of foreign language vocabulary quizzes based on the method of vocabulary flashcard delivery, when limited to the classroom setting? and (2) Based on the findings from the first question, are computer-based flashcards feasible for classroom use? The H_0 of the first research question assumed participants would score the same using paper-based flashcards as when they studied with a computer

program; H_1 assumed that participants studying with paper-based flashcards would score higher on vocabulary tests; and H_2 assumed that participants studying with the computer program would score higher on vocabulary tests.

3. Methodology

3.1. Participants

Upon receiving Institutional Review Board approval, the instructor/researcher instigated the study using intact classes. Participants were seventeen high school novice level freshmen and sophomores (ages 14-16) at a small, private K-12 school in the western United States (see Table 1). Twelve of the participants were students enrolled in one section of a beginning level French class (ie French I) with the remaining five enrolled in a single beginning German course (ie German I). Three other students (two French and one German) did not complete all of the quizzes and were omitted from the final analysis. None of the participants had had any prior language learning experience.

The study took place in the spring and the courses were taught every other day with class sessions lasting 90 minutes each. The students had previously taken vocabulary quizzes similar to the ones being used in the study and had similar levels of achievement on those quizzes throughout the previous seven months of coursework. During the course of the study, all students studied vocabulary from their respective textbooks, using one of two flashcard study methods and completed vocabulary quizzes. Both courses were taught by the same instructor/researcher.

Table 1
Participants' grade levels and language of instruction

Participant	Grade Level	Language	Participant	Grade Level	Language
1	9	French	10	9	French
2	9	French	11	9	French
3	10	French	12	9	French
4	10	French	13	10	German
5	9	French	14	9	German
6	9	French	15	9	German
7	9	French	16	10	German
8	9	French	17	10	German
9	9	French			

3.2. Instruments

The vocabulary quizzes created by the classroom teacher were based on vocabulary introduced in the text and were used to evaluate student achievement. The textbooks used in the courses were C'est a toi! (Fawbush, Theisen, Hope, & Vaillancourt, 2002) and Deutsch Aktuell (Kraft, 2004), level one for each course. As mentioned before, the method of assessment for the study followed the pattern established from the beginning of the school year. For each unit, there were two lists of 30 words for a total of four lists and quizzes for each group. The vocabulary quizzes were paper-based and each term in English needed to be replaced by its corresponding term in the target language. In order for a word to be counted as correct, the word had to be the correct French or German equivalent and had to be spelled correctly. If the word was a noun, the correct article also had to be provided. Using a quiz format that is familiar to

students corresponds with the tenets of exploratory practice (Dar & Gieve, 2013), which allows researchers to use documents and routines that already exist in the classroom context. The format also meets the needs of ecological validity in that all aspects of the instruments are part of the natural setting of the classroom and involves everyday objects found therein (Bernal, Bonilla, & Bellido, 1995; Bronfenbrenner, 1977).

The computer-based program used for this study is called *Before You Know It* (Byki). Byki is a computerized flashcard program made available by Transparent Language (2006). The focus of the program is based on the declarative system of learning words in a new language. Byki consists of five distinct flashcard review modes that move students from passive (Review It, Recognize It) to active (Know It, Produce It, Own It) stages. Review it allows participants to view flashcards with the word displayed in both the target language and English and with a participant selected visual. Recognize It allows learners to see only the target language word and are required to click a button to flip the card over. If a card is known, the program displays the next card in the list. If not, the card is repeated. Know It requires the user type the word into the program. Produce It and Own It lists the term in English and the user is required to produce the target language term. In the Finally, Know It requires that the participant supply the words, and they must be spelled correctly, including any accent marks, in order to be considered correct. The instructor/researcher input the vocabulary from the texts for student use.

For the paper flashcard portion of the study, participants created flashcards using 3 x 5 index cards. On one side they wrote the English term and on the other side they wrote the target language equivalent and drew an image intended to remind the participants of the term. This was done because Byki's computerized flashcard program mimicked the concept of the traditional, paper-based flashcard, in that the program has the ability to include pictures.

3.3. Procedure

The participants were divided up into two groups: Group A consisted of French I students and Group B was comprised of students in the German I class. During the first vocabulary unit, Group A used paper-based flashcards while Group B used electronic flashcards. For the second unit, flashcard study methods were reversed, with Group A using the computerized flashcards and Group B using the paper-based flashcards.

In unit one, Group A participants were given 30 minutes in class to create all of their flashcards for the first unit vocabulary. Participants were given 30 minutes per period for next three days to study and review their flashcards for the first list of terms in unit one. All flashcards were left at school. Immediately following the study session on the third day of flashcard studying, the cards were collected by the instructor, and participants were given ten minutes to complete the quizzes.

Group B participants were given 30 minutes to familiarize themselves with the Byki program and the vocabulary terms on the first day of the unit one. The subsequent three days Group B spent 30 minutes per day reviewing their electronic vocabulary cards. Similar to Group A, following the final study session, participants were given their first vocabulary quiz, having ten minutes to complete the assessment.

During the second half of the study, the two groups switched methods of flashcard creation and studying, with Group A starting with electronic and Group A with paper flashcards. A new, unique set of vocabulary was provided to each group.

3.4. Analysis

The quiz scores were recorded and analyzed with each participant receiving a score out of a possible of 30 points for each quiz. The scores were then paired. Participants' first score after studying

with paper flashcards was compared to their first score after studying with the program. Second quiz scores were paired in the same manner. The pairings created a total sample size of 34.

The data were analyzed using Microsoft Excel. The participant scores after studying the paper-based flashcards were compared with participant scores after studying the computerized flashcards. A t-test was used to determine if score differences were statistically significant. Because the two groups studied with the two methods in a different order, the t-test was two-tailed, with $\alpha = .05$ (Peters, Hulstijn, Sercu, & Lutjeharms, 2009).

4. Results

The purpose of this study was to evaluate the effectiveness of using the computer program in reviewing new vocabulary in the foreign language classroom, specifically when compared to the use of traditional, paper-based flashcards when both are limited to the classroom setting. The effectiveness of each method was evaluated based upon student performance on in-class vocabulary quizzes given by the instructor. Table 2 indicates the participants' raw quiz scores for each quiz.

Table 2
Student raw test scores

Participant	Paper 1	Paper 2	Byki 1	Byki 2
1	30	29	29	30
2	30	30	29	30
3	18	18	28	29
4	14	8	26	29
5	21	23	29	30
6	7	30	29	30
7	11	8	17	22
8	27	26	29	30
9	26	28	29	30
10	28	29	30	30
11	9	9	26	28
12	29	30	30	30
13	28	29	30	29
14	3	3	11	8
15	26	26	28	29
16	27	28	30	30
17	15	8	28	29

The mean quiz score (see Table 3) after studying with the paper-based flash cards was 20.91176 (69.71%). The mean quiz score after studying with electronic flashcards was 27.38235 (91.27%). There were two instances where a participant's score was lower on the quiz after studying with electronic flashcards than it was after studying with the paper-based flashcards. In all other instances, the participants' scores were either the same or higher after studying with computer-based than they were after studying with the paper-based flashcards.

Table 3
Mean test scores

Participant	Paper 1	Paper 2	Byki 1	Byki 2
1	100.00%	96.67%	96.67%	100.00%
2	100.00%	100.00%	96.67%	100.00%
3	60.00%	60.00%	93.33%	96.67%
4	46.67%	26.67%	86.67%	96.67%
5	70.00%	76.67%	96.67%	100.00%
6	23.33%	100.00%	96.67%	100.00%
7	36.67%	26.67%	56.67%	73.33%
8	90.00%	86.67%	96.67%	100.00%
9	86.67%	93.33%	96.67%	100.00%
10	93.33%	96.67%	100.00%	100.00%
11	30.00%	30.00%	86.67%	93.33%
12	96.67%	100.00%	100.00%	100.00%
13	93.33%	96.67%	100.00%	96.67%
14	10.00%	10.00%	36.67%	26.67%
15	86.67%	86.67%	93.33%	96.67%
16	90.00%	93.33%	100.00%	100.00%
17	50.00%	26.67%	93.33%	96.67%
Overall M	68.43%	70.98%	89.80%	92.75%
Combined M	69.71%		91.27%	

While many of the participants (1, 8, 10, 12, & 13) received a quiz score that was only a few points higher after studying on the computer, other participants (3, 4, 6, 11, & 17) scored much higher after studying electronic flashcards. Several participants made significant gains. Participant 11, for example, scored 17 and 19 points higher (respectively) after studying using computer flashcards. While participants 8, 9, and 10 achieved more modest gains, they were gains nonetheless. Participant 6 scored 22 points higher after using the computer-based study method. However, this same participant's score difference on the other pair of tests was not nearly as dramatic with his receiving a perfect score on both of those tests, which may indicate that there may have been other factors involved in participant 6's score difference on the first group of tests.

The lowest overall performing participant (14) also improved after studying with electronic flashcards, having received a score of only 3 on each of the tests after studying with paper-based flashcards, but receiving scores of 11 and 8 after studying with the computer-based method. When the t-test was performed, a p-value of .000772932 was found using a two-tailed test, showing a strong statistically significant difference between learners' performance in the two flashcard methods: the computer-based flashcard was more effective for vocabulary learning than paper-based flashcards were.

5. Discussion

The first research question for this project asked, "Is there a statistically significant difference in the mean scores of foreign language vocabulary quizzes based on the method of vocabulary flashcard delivery?" Based on the results described above, the H_0, which assumes no difference between quiz scores and the H_1, which assumes higher paper-based flashcard quiz scores must both be rejected and the H_2, which assumes higher computer-based flashcard quiz scores must be accepted, due to the p-value of .000772932.

This p-value suggests a significant difference in the mean scores of foreign language vocabulary quizzes based on the method of flashcard delivery. In general, participants performed better after having studied with electronic flashcards than they did after studying with paper-based flashcards. In fact, some participants showed enormous gains in their score after using electronic flashcards, scoring as many as 22 points higher, as participant six achieved.

Generally, the results of the present study support the use of technology in the study of the foreign language classroom (O'Hara & Pritchard, 2008; Segers & Verhoeven, 2002; Stockwell, 2007). Specifically, these results agreed with the findings of Nakata (2008), whose research suggests that students who studied using computer-based flashcards achieved significantly higher vocabulary quiz scores than their paper-based flashcard or vocabulary list studying peers.

The second research question is directly connected to the first and asked "Based on the findings from the first question, are computer-based flashcards feasible for classroom use?" Because the results of the t-tests were found to be significant the answer to this question is yes. The findings of the present study also support Spiri (2008) who posited that intentional study of electronic-based vocabulary study can be an effective method of learning. Further, the current findings support the work done by Parette, Boeckmann, and Hourcade (2008), who showed that using computers in the classroom (although with much younger learners) can be an effective tool in teaching an L2. The purpose of exploratory practice study is to understand classroom practices (Allwright, 2005). In the area of vocabulary learning, where establishing a strong base of words and phrases in an effective manner, electronic flashcards appear to be a more effective use of time and energy than their paper counterparts. This finding holds true at least once the instructor has taken the time to set up the lists for students to use, which only needs to be done one time. This is often the case for many teaching tools used in any classroom.

6. Conclusions and Recommendations

Nation (2011) recommends that flashcards be incorporated as one part of systematic approach to vocabulary learning in the L2 classroom. It may be interesting to see how participants would perform if the audio-recording feature of the program were used. Possibly, adding another source of input would help to further bolster participant gains when using the program (see Acha, 2009). Because that study was conducted with teens, we have no information as to whether older learners are capable of incorporating more forms of input in a more effective manner. Mondria (2003) posits that having beginning L2 students work with a vocabulary study method that gives the students the meaning of the word is more time efficient than having them try to infer meanings of the words. With the increase of technology options available to teachers, more avenues must be explored and empirically tested to help bolster student learning outcomes that move beyond traditional approaches (O'Hara & Pritchard, 2008; Stockwell, 2007). Based on the present study, electronic flashcards can provide a method that is shown to be academically effective. The results also show that incorporating computer-based flashcards does not distract from teaching time and that they may also appeal to technology-savvy students often found in today's L2 classrooms (Kern, 2014; Levy, 2009).

Lastly, due to the size limitations of the study group, the author recommends conducting the research with a larger number of participants. It would also be interesting to see the long-term results of the study methods (how students would perform on the same quizzes a month later). It would certainly be useful for computer-based learning programs to have the ability to pull vocabulary from previously mastered word banks when students are continuing to study new words. This strategy would be a more complete application of vocabulary practice using a long-term incremental rehearsal study method (Bunn, Burns, Hoffman, & Newman, 2005; Burns, 2004, 2005) with vocabulary being recycled over the long term.

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