

Visualizing Vocabulary: the Impact of Images on Vocabulary Acquisition

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ABSTRACT

Mobile devices have been widely used in language learning, but applications for language learning use many different methods. In this paper, we evaluated the importance of image presence for vocabulary acquisition apps on mobile devices. We conducted an experiment on whether images would help participants learn French words. Our experiment result showed that there was no statistically significant effect from providing images with vocabulary, although 55% of participants said they found images helpful for their learning in a post-experiment survey.

Author Keywords

Vocabulary acquisition; computer assisted language learning; mobile application.

INTRODUCTION

The widespread proliferation of mobile devices has led to their use as an efficient tool for language learning [11]. There is a wide variety of mobile applications available to enable users to learn new language anytime at anywhere. These applications use different approaches to facilitate the learning experience. For instances, Duolingo provides language courses, Tinycards allows users make flashcards, and Fluent Panda allows users to play educational games. Many of these apps utilize images to enhance language learning, while others do not. After researching prior literature, we see a lack of evaluation on image presence for language learning tools, specifically for vocabulary acquisition, on mobile devices. Therefore, we conducted an experiment and a post-experiment survey trying to understand whether providing images with new words would increase vocabulary acquisition while learning a new language on a mobile device. Our statistical result indicated that there was no significant difference between the with-image condition and the without-image condition in learning new vocabulary. This finding revealed a failure to

reject the null hypothesis. We believe that further study with more participants and a more diverse educational level is needed to conclude if image presence has a significant impact on language learning.

RELATED WORK

Several studies demonstrate the importance of vocabulary acquisition to language learning [4, 5, 6, 10]. In order to assist the language learning process, many tools are used on digital devices to help teach vocabulary. A number of studies have evaluated the importance and increasing usage of language learning via mobile device. As Agnes[7] stated, mobile devices have been widely used in language learning as they provide close, everyday experience for people. LaBelle et al.[8] found in their experiment investigating whether iPads enhanced Arabic language learning that first graders who use technology had better cognitive and reading skill scores when tested.

In addition, several studies have proposed different ways to help with language learning on mobile devices. Edge et al.[2] presented a mobile application to help people learn new languages by providing contextually relevant content based on their locations. Wloka et al.[12] presented a ubiquitous application using current mobile devices to enhance translation and language learning environment. Edge et al.[3] proposed mobile opportunities for microlearning through adaptable flashcards that provide fast feedback and schedule future tests based on different learners' situations. Taken together, these studies provide valuable insight into the potential for mobile language learning but do not offer easy improvement advice for mobile apps seeking to teach vocabulary.

The work most similar to ours is a study of new words acquisition through "living wallpaper" on mobile devices by Dearman et al.[1]. In contrast to our work, the living wallpaper provided users with contextually relevant

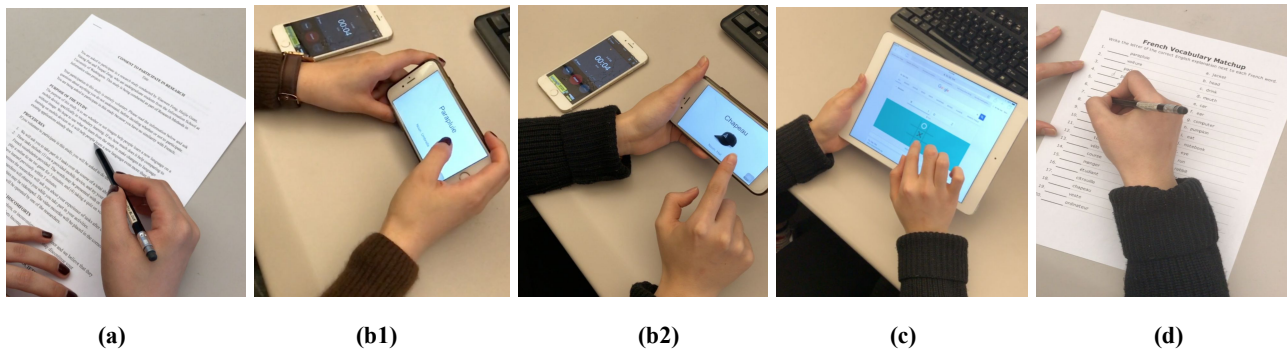


Figure 1. The general procedure: (a) signing consent form. (b1) without-image group (b2) with-image group (c) doing distraction task (d) taking mix-and-match quiz

vocabulary to give high exposure on mobile phone. In contrast, our work seeks to evaluate the overall importance of attached images accompanying vocabulary in order to provide solid data on whether or not such images are beneficial to vocabulary acquisition.

METHOD

Participants

In our experiment, we recruited 40 participants aged 18-25 ($M = 21.3$, $SD = 1.4$), all of whom were students at the University of Washington. The participant group contained 20 females and 20 males, none of whom had previously experienced French, the language we utilized in our study. 21 participants reported Mandarin Chinese as their native language, 11 participants reported English, and 4 reported Korean. All participants were proficient in English as a native or second language. Four participants identified themselves as native bilingual. The tests were conducted at quiet locations to avoid possible distractions.

Apparatus

The experiment was primarily conducted on an iPhone 6 with a screen size of 4.7 inches. During the test sessions, the iPhone 6 was used horizontally to display 20 randomly chosen French words, with another iPhone 6 used as timer, as shown in Figure 1. We used the Google Slides App on iPhone 6 for displaying the words. An application called Timer+ was used to run multiple countdowns. After the learning phase, an iPad Air with a screen size of 9.7 inches was used to let participants play a tic-tac-toe game.

Procedure

Prior to every test session, we gave out a consent form to ensure our participants had complete understanding of our research purpose, general procedures, and their

confidentiality. The experiment proceeded after the participant signed the consent form.

Our recruited 40 participants were divided into two groups in order to conduct a between-subject study. We chose French as the language for our participants to learn because we had a short amount of time to conduct the study and we were only able to gather a small sample of participants. Because of this we excluded logogram languages and chose a Latin-based language, as it would be easier for our participants to sound out each new word. The first part of experiment was a learning session where each participant was asked to learn 20 new French words given on an iPhone 6. Each word was accompanied by its English translation, while one group saw a relevant image in addition to the translation. Each participant was given 30 seconds per French word to learn. The timer was in view for the participants, who were told to swipe to the next word when the time was up.

In order to minimize the effect of immediate short-term memory retention, participants were instructed to do task following the learning session: a 3-minute session of tic tac toe. After this distraction task, we asked our participants to do a mix-and-match quiz of the 20 vocabulary words. The quizzes were graded afterwards for further analysis. Words correct rate was indicated by the quiz score. A post-experiment survey was also sent out to each participant in order to gather demographic data and data on how they felt the images (or lack thereof) had helped.

Design and Analysis

In total, 40 trials were completed and recorded: (20 + 20) participants x 1 trial. In our data analysis, we concentrated on examining the words correct rate. We ran a two-way ANOVA with words correct rate as the dependent variable and *Image Condition* (2 levels; between-subjects)

and *Gender* (2 levels; between-subjects) as independent variables.

RESULTS

Words Correct Rate

Words correct rate results are shown in Table 1. The overall mean for words correct rate was 14.5. The statistical results were fairly similar for both groups. Our main hypothesis was that providing an image with the corresponding vocabulary word would increase vocabulary acquisition measured in words correct rate. However, the two-way ANOVA result revealed that there was no significant effect of Image Condition on words correct rate ($F(1,36) = 0.017, p=0.8982$).

Gender	Image Condition	Correct Rate.mean	Correct Rate.median	Correct Rate.sd
F	With	15.357	15.0	3.477
F	Without	12.833	12.0	2.639
M	With	12.833	11.5	3.061
M	Below	15.071	14.5	3.197

Table 1. Words Correct Rate means and standard deviation report

While *Gender* had no statistically significance on words correct rate ($F(1,36) = 0.039, n.s.$), surprisingly, there was a significant *Image Condition* \times *Gender* interaction ($F(1,36) = 4.61, p<.05$), shown in Figure 2. For female participants, words correct rate was higher when corresponding images were presented with words in the learning sessions. In contrary, male participants performed better on the mix and match quiz when images were absent in the sessions. We conducted post hoc comparisons using Holm-Bonferroni method, the result revealed that none of the pairs was significantly different.

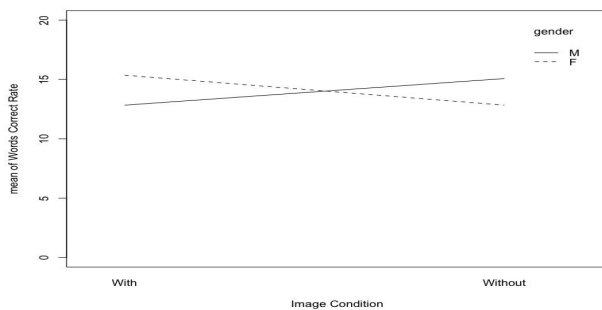


Figure 2. Interaction plot of Image Condition and Gender on Words Correct Rate

DISCUSSION

Originally, we did not expect that *Gender* \times *Image Condition* would have a main effect on words correct rate. Our ANOVA result revealed some interesting findings: female participants who were given images with vocabulary performed better in the mix and match quiz than the females who were not. The result was the opposite for male participants; the male participants who did not see images performed better on the quiz. Post hoc comparisons indicated the difference among the six comparisons was not statistically significant. The contradiction between ANOVA and post hoc comparisons was caused by the sensitivities of the two analysis. ANOVA is a statistical method to compare the means of two groups, in our case, comparing the means in words correct rate across *Gender* \times *Image Condition* interaction effects [9]. The pairwise comparisons were used to measure the difference between different pairs, and barely detect the mean between pairs. In the experiment design, our intention was to have the same number of participants for both gender, we neglected to control the number of male and female participants in each control group. In the 'with image' group, we had 14 females and 6 males, and 6 females and 14 males for the 'without image' group. We believe that a larger sample size experiment with an equal number of female and male participants in each group is needed to significant justification for this relationship.

The statistical result failed to confirm our main hypotheses showing that *Image Condition* had no main effect on words correct rate. However, from the results of the post-experiment survey, we found that among the 20 participants in the with-image group, 11 believed that images helped them with learning vocabulary, as shown in Figure 3. Moreover, three strongly believed that images helped.

6. If you select "Yes" in #4, on the scale of 1 to 5, how much do you think images helped with you learning vocabulary?
(20 responses)

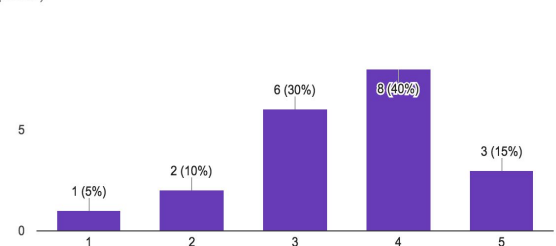


Figure 3. Survey result

Through other data we gathered from the post-experiment survey, we were able to discover possible reasons why the experiment results showed no significant difference between the two groups. For example, some of the participants thought that the distraction task was not sufficient enough. Additionally, some participants felt that the images used were did not correspond well with the vocabulary. We also learned that the participants' familiarity with other Latin-based languages may have affected the effectiveness of memorization, as shown from a direct quote of one of the participants stating "[f]or me, since I have studied Spanish before, some of the words in French sounded similar.

CONCLUSION

In this paper, we evaluated whether providing images with new words would increase vocabulary acquisition when learning a new language on a mobile device. Our results revealed that image condition did not have a statistically significant effect vocabulary acquisition. A larger sample size is needed to confirm the main effect of image condition. Second, since we recruited all the participants from the University of Washington, more diverse educational levels would may provide more valuable data. We believe that a wider variance of participants' education level might help obtain a more significant result. Finally, resolving issues in our experiment design, such as uncorrelated images and distraction task control, would also be needed to further verify the results.

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