How to Enhance the User Experience of Language Acquisition in the Mobile Environment: a Case Study of Amkigorae(암기고래), a Vocabulary Acquisition Mobile Application

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Abstract. A vast majority of Korean students study secondary languages for various purposes: for certificates, college admission, or personal interest. Accordingly, immense amounts of paper vocabulary workbooks are consumed to fulfill these needs; however, it is recommended that students transition their learning experience to the mobile environment as the consumption of paper vocabulary workbooks may contribute to environmental deterioration. This study aims to research the user experience of Amkigorae(암기고래), which is a mobile secondary language acquisition app, developed by Beluga Edu(벨루가 에듀), in the context of college students. This is due to the fact that college students have higher autonomy over cell-phone usage compared to teenagers, and because they have higher digital literacy and required needs for language acquisition compared to other age groups. This project primarily aims to research, evaluate, and determine the means of creating an effective user interface that may serve as a reference point for vocabulary acquisition apps to increase user retention and secondary language acquisition. In order to gain insight on the further development direction, our team conducted multiple quantitative and qualitative research to comprehensively evaluate Amkigorae. We were able to highlight the positive and negative feedback regarding users' experience on memorization, usability, and aesthetics. Analysis on the limitations and future work that should be conducted related to this topic is provided to further invite stakeholders to expand research on this topic.

Keywords: Vocabulary Acquisition, Learning Habits, Amkigorae, Memorization, Usability.

1. Introduction

Foreign language acquisition is a major industry worldwide, especially in the context of the Republic of Korea. According to Kyobomunko(교보문고), a leading South Korean bookstore, English vocabulary workbooks are high in sales [1]. The high sales

in such books contribute to environmental deterioration as the fast consumption of these books is not in line with the following United Nations Sustainable Development Goal (UN SDG), No. 12 “Responsible Consumption and Production” [2]. Our team believes that the rise of mobile applications that allow users to shift their learning activity from books to mobile will be able to contribute to the aforementioned UN SDG article along with the article No. 4 “Quality Education” [2]. This is due to the fact that such applications allow a more interactive means of studying that is complimentary.

To promote this transition, we selected Amkigorae as our case study app to serve as the basis for finding user experience suggestions for language acquisition apps.

In this study, our team aims to provide perspective into how learners, college students in particular, acquire foreign language by probing into their learning styles and by analyzing what features of our case study app supports or hinders their experience as a user.

Our team speculates that this study will act as a reference for related educational application developers to consider when developing products to increase their user base and user retention rate as the arena of foreign language acquisition in the mobile environment has further potential to revolutionize the learning experience of users.

2. Research Questions

RQ1: Whether and how does Amkigorae fulfill the needs of its users in regards to their different language acquisition styles?

RQ2: How can the user interface of Amkigorae be improved to better serve the purpose of the app?

3. Existing Research

Existing research has revealed the following: 1) mobile learning can contribute to social innovation, 2) learning language through mobile applications is effective, and in some cases, more effective than paper workbooks, and 3) the user experience of the app is important for user retention of language acquisition applications [5-22].

Research further presented that mobile applications, thanks to its interactive features, were particularly more effective in enhancing the users’ pronunciation of foreign words, and more effective for students as they were more motivated to study in their spare time via their cell-phones. [12-14]

We also collected data on various learning styles to better contextualize our research findings in accordance with the multifarious learning habits people possess.

Out of the papers that were found, the classification of language acquisition strategies of O'Malley's was notable. According to O'Malley's study, language acquisition can be divided into three categories, which are metacognitive, cognitive, and socio-affective [3]. Metacognitive refers to learners who take ownership of their study and plan studying sessions and self-evaluate. Cognitive refers to learners who study directly by repeating words, translating, note-taking, and using imagery. Socio-affective refers to learners who enjoy learning in groups and enjoy asking questions. Based on this research, we conducted a survey to recruit representative participants and gain insight on the learning habits and user experience of users based on their learning styles.

4. Methodology

Participants profile
In the screening survey, we included a questionnaire to distinguish learning types of the respondents. Based on the survey, our team recruited a total of 9 people. Participants recruited were Korean college students who are studying or have studied secondary language at least once, and their ages ranged from 20 to 25 years old. After the interviews, we recruited 20 college students from the same age range to participate in the AB Testing based on prototypes we devised.

Survey
The survey was conducted from October 4th to Oct 9th, 2019; the survey was distributed online to about 1,000 students, and it received 99 responses. The main purpose of the survey was screening and recruiting adequate participants for further interviews and diary studies. The contents of the survey included demographic information, respondent's language learning habits, and diagnostic questions based on O'Malley's learning types.

Interview 1
The first interview was conducted on October 11th, 2019. It was in the form of a fully structured interview. In order to observe whether there is a difference of app usage habits or difference in feedback between different learning types, a total of 9 participants with various learning styles were recruited: 3 for Metacognitive, 4 for Cognitive, and 2 for Socio-affective.

Diary Study
After Interview 1, a Diary Study was conducted on the 9 interviewees of Interview 1. Users were given a direction to use the 3 modes available on Amkigorae for 2 days each, for a total of 6 days. The purpose of the diary study was to explore the day-to-day experience of the user interactions with the app to decipher the perceptions of the users, the motivations of the users, and the factors that affect user retention.

Interview 2
The second interview was conducted after the diary study. Interview 2 was conducted as a semi-structured interview for diary study participants. The purpose of Interview 2 was to gain a more detailed insight about the experience from diary study.

Affinity Diagram
After gathering a sufficient amount of qualitative data, our team analyzed the data by using the affinity diagram method. The raw data included the quotes from the scripts of 6 days of Diary Study and transcripts of Interview 2.

The data was categorized into memorization, usability, and aesthetics, and divided the data based on positive(+) and negative(-) feedback for each category to further understand our participants.

AB Testing
AB Testing was conducted from November 22nd to December 3rd, 2019 on a total of 20 college students to 1) examine the efficiency of start screen, 2) explore the intuitiveness of the memorization screen, 3) gauge whether the inclusion of haptic feedback would be preferred.

2 prototypes and 3 tasks in total were created to compare the prototypes to the original interfaces of the Amkigorae app.

A scale of 1 to 5 was provided to analyze the satisfaction rate of the original interface and prototype to gain data to validate via statistical analysis in order to gauge the significance of the data we collected.

Open Coding
We conducted Open Coding on the AB Testing scripts that we have garnered. We color-coded our findings like the following: 1) Aesthetics - Pink, 2) Usability - Orange, 3) Effectiveness (in learning) - Yellow, and also extracted meaningful quotes that could help us better understand the perceptions regarding the original interfaces and the prototypes we devised.

T-Testing
We conducted T-Testing, specifically the Wilcoxon Signed Rank Test, to determine whether there is a considerable difference in the means that we have calculated based on the satisfaction rates of the original interfaces and the prototypes that we developed.

5. Implications & Prototype

Our team has categorized our findings in the following categories: 1) Usability and 2) Examining User Experience Propositions.

5.1. Usability

Although users acknowledged that the app is rife with content, the users stated that the content gave off the impression that the app is clustered, unorganized, and hard to navigate. Users seemed to desire the addition of haptic functions that would enable them to retrieve data in a more intuitive way. We were able to discern the following themes and categories regarding usability:

Rich with Functions

Amkigorae is rich with function. We were able to detect that the richness of functions within the app was the most frequently mentioned positive factor when discussing the usability of the product. The users stated multiple functions that were useful; for example, dark mode, secret mode, and the hiding function were some of the functions that were mentioned.

"The dark mode is useful to utilize before sleeping" - C01

"The group mode's secret mode function is nice" - C02

Smooth

User satisfaction was found with the smoothness of Amkigorae in the context that there is no delay when it comes to providing feedback regarding user input. Seamless user feedback is critical for a vocabulary flashcard app because some users still prefer paperback vocabulary workbooks. The participants in our research, who are college students, said that they are used to looking at paper text, which is important to note as there is no lag when studying via a paperback vocabulary workbook as there is no need for the content of the paperback workbook to load or have a connection failure.

"I'm used to looking at paper text." -S02

"It was definitely different (from) what I experienced before with Anki (a different app)… (Anki) was buggy (and laggy)." -C02

One user from the interview mentioned that she used a flashcard app, Anki, that was recommended by her teacher. She said she used it during the year 2013 to 2015 because her teacher made students use it for a class that she was taking at the time. She said that she is more prone to using physical flashcards; this can be attributed to the negative experience that she had regarding the application that she used before. Because the experience of using Amkigorae was positive this time because there was no lag, she said that she was willing to try the app in the future if she was under the case where she had to acquire a new language.

Clustered

Participants said that the organization of the application gives the impression that the app is clustered. When starting the app, a long video appears. This kind of function may deter the user from further using the app because it gives off the impression that the application may be irrelevant, laggy, or heavy.

Moreover, one participant noted that the dashboard should be more organized in order to attract more users. It is speculated that this may be due to the fact that the mobile environment allows less space than a paper workbook when it comes to displaying content.

"I didn't like a video popping up when starting the app." -M01

"The dashboard is a bit too chunky." -C02

Hard to Navigate
Users said that some integral functions of the application were hard to find. For example, users mentioned that the action of going back, creating a word list, or finding a button to stop the audio was confusing. This may be related to the fact that the user interface is clustered. A more simple user interface could help the user easily navigate through the app.

Furthermore, participants mentioned that it was hard to find some functions that they were likely to use if they knew the existence of the function. For instance, one participant could not find the audio stop button while another participant mentioned that she was oblivious of the fact that there was a notification function.

"It was hard to find the audio stop button." -M02

"I didn't know that there was a notification feature." -C01

Lack of Intuitiveness
Participants contended that some features of the app lacked intuitive aspects as they found some of the integral functions within the app complicating. For example, one participant noted that she found difficulty in creating a word list. This is critical as paper workbooks are intuitive. When creating a word list in a paper workbook, users of paper workbooks simply have to flip around the textbook to find a space to write the word list and write a word and a sentence within the blank space. However, in Amkigorae, users have to click a floating 'add' button on the bottom right of the screen, and then go through a stage of trial-and-error in order to discern which of the two buttons that pop up when the floating add button is touched upon leads to the creating word list function. After the user grasps which function leads to a space that creates a word list, the user has to touch the second button on the top left to edit the word list in order to type in a word, meaning, and an example sentence. This is confusing as paper workbooks and most popular apps allow users to write in the blank space by simply touching into the blank space.

"It is hard and complicated to make a word list." -S02

Importance of Haptic Feedback
One notable thing that we deduced from the interviews is that users stated they thought the hand, to a certain extent, memorized the words for them. This is important to note as the usability of the app may be evaluated by the users based on how the app allows the users to utilize their hands. Participant C02, a female participant that used a vocabulary memorization app named "Anki," stated that she did not like using the app because the app did not allow her to write the words. She would write down the words on paper because she said that the act of writing the words on paper would help her hands memorize the words for a test. When asked whether it would be useful if there was a function that enables users to write within Amkigorae, Participant C02 said that she would not find the function that useful as the amount of space that the user can utilize to write the word was limited compared to a paper workbook. She said the space would have to be larger in order for her to freely utilize her hands so that the hands would 'memorize' the words.

"I'm more used to writing in hands… The pro is that I personally think your hand remembers the moment you write that word. But maybe con is that it takes a lot of time. It takes so much time." -C02

5.2. Examining User Experience Propositions

AB Testing and statistical analysis revealed that the prototypes that were focused on rendering the interface to be more clean, intuitive, and haptic were preferred amongst users. Users expressed that the prototypes were comparatively lean, customizable, controllable, and helpful regardless of whether they would use the additional haptic features. They stated that the features would be utilized based on the users' different learning habits.

Efficiency of Start Screen

We designed a prototype that customizes the app so that the user does not need to view language options that are not of the user's interest. We also focused on making the interface more clean and organized.

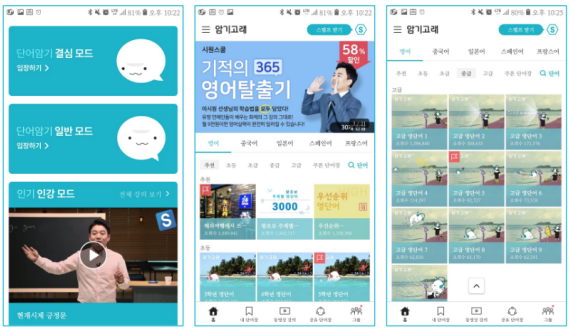


Fig. 1. Original interface of start screen

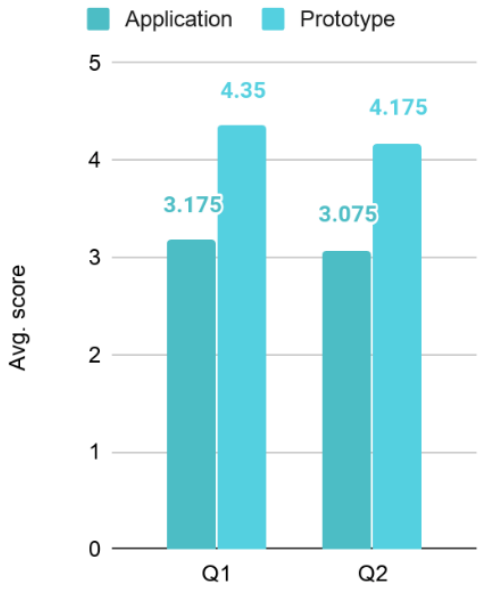
Participants provided generally negative responses to the original interface by stating that the original interface is confusing, clustered, and childish.

"It seems like an app for children" - P13

Fig. 2. Prototype of start screen

In comparison, participants had generally positive responses for the prototype as they liked thought that the customization feature in a clean and organized interface is more efficient since they do not have to view information or languages they are not interested in.

"Customizing my feed is great. It's efficient." - P12



Graph. 1. Q1 & Q2 Means Comparison

When asked about the efficiency of each version (Q1), the application scored an average of 3.17 points and the prototype scored an average of 4.35 points. Through Wilcoxon signed rank test, we found the p-value to be less than 0.001, smaller than 0.05, meaning that the difference is significant.

When asked about the satisfaction level of the interface design on each version (Q2), the application scored an average of 3.075 points and the prototype scored an average of 4.175 points. We found the p-value to be less than 0.001, smaller than 0.05, meaning that the difference is significant.

Intuitiveness of Memorization Screen

The second prototype we designed aimed to improve the intuitiveness of the icons and included basic haptic functions.

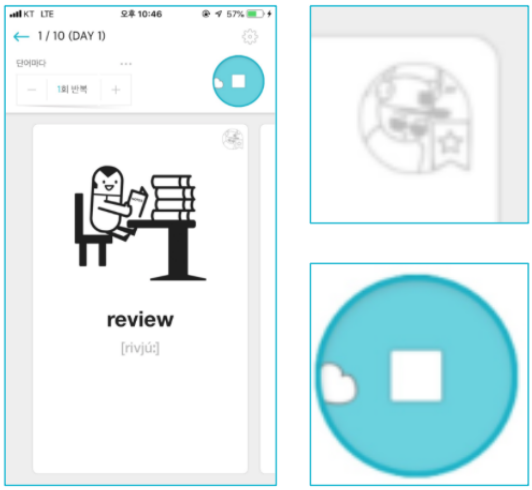


Fig. 3. Original interface of memorization screen and buttons

Participants provided generally negative responses by stating that the bookmark is confusing as it does not like a bookmark; nonetheless, some participants claimed that the location of the bookmark is intuitive since they would expect a bookmark to be in the location where the icon is.

"The bookmark icon doesn't look like a bookmark" - P11

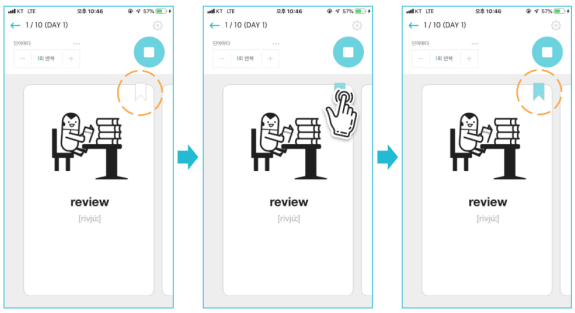
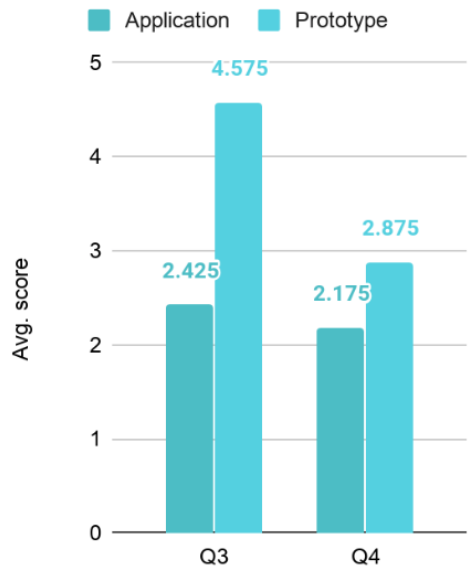


Fig. 4. Prototype of memorization screen and buttons

Participants provided generally positive responses about the prototype by stating that the bookmark was much more intuitive as it resembled a bookmark compared to the icon of the original interface.

Participants also appreciated that the color of the bookmark changes by stating that this kind of interactive element makes the app more favorable than a textbook.

"It is intuitive that the bookmark looks like an actual bookmark" - P12



Graph. 2. Q3 & Q4 Means Comparison

When asked about the intuitiveness of the bookmark icon on each version (Q3), the application scored an average of 2.425 points and the prototype scored an average of 4.575 points. We found the p-value to be close to zero less than 0.001, smaller than 0.05, meaning that the difference is significant.

When asked about the interesting-ness of the bookmark icon on each version (Q4), the application scored an average of 2.175 points and the prototype scored an average of 2.875 points. We found the p-value to be in between 0.02 and 0.05. While bigger than 0.02, as the p-value is smaller than 0.05, the difference is still significant.

Preference on Haptic Feedback

The prototype enabled users to highlight vocabulary and scribble on the vocabulary card like they would be able to in a textbook.

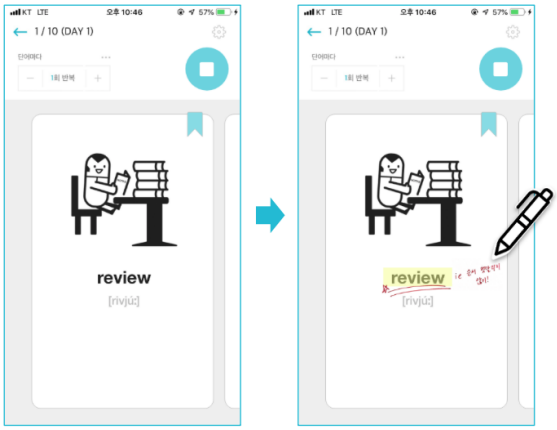


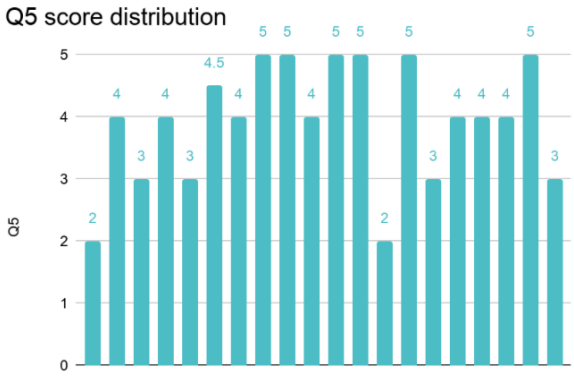
Fig. 4. Prototype of memorization screen and buttons

There were various responses regarding the prototype; some of the participants stated that they would not use the highlighting function because they do not normally highlight when memorizing words whereas some stated that they would not use the scribbling function as they usually solely highlight words that they are having difficulty memorizing.

Additionally, some participants stated that the scribbling function would be hard to utilize on a phone screen and easier to use on a tablet PC screen because phone screens are small.

Nonetheless, participants agreed that it is preferred to have the haptic function of highlighting and scribbling as they welcomed the inclusion of more options to choose from.

"Everyone has their own way of marking for memorization, so I think it's nice to have highlighting and the scribbling function" - P14



Graph. 3. Q5 score distribution

When asked about the helpfulness of the haptic features added (Q5), the prototype scored an average of 3.925 points and the median was 4 points, which means that the overall helpfulness of the additional haptic features were recognized despite there being varying responses on whether the users would regularly use the functions.

6. Limitations

Before proceeding to the discussions and implications, we would like to point out a few limitations. The main issue our team encountered was due to the lack of resources; this research included only a part of the Amkigorae users' demographic. Our participants were all Korean college students in their 20s. In addition, the duration of our study was 6 days, which may be insufficient to verify the long-term memorization of vocabulary.

We also recognize that there are limitations to the prototypes we developed as we lack the technical capability to create a working prototype for advanced features such as scribbling; we invite more researchers to conduct research on this topic to foster the transition into the mobile environment regarding language acquisition.

7. Discussions & Implications

In contrast to the general perception of the participants that mobile apps may lack content compared to paper workbooks, most participants were pleasantly surprised with the app content-wise as many participants mentioned that the app was rich with functions and content.

We could deduce that the usability of the app is decreased when the app attempts to list an excessive amount of content (e.g. videos, illustrations, tabs) in a single page; a more lean layout with minimal and intuitive icons that respond to haptic feedback is recommended in order to resolve this issue.

Via AB Testing and statistical analysis, we were able to infer that the app should 1) provide users more control over customization, 2) devise minimal and intuitive icons and interfaces as they increase user concentration, 3) note that the inclusion of more haptic features is recommended since although users may not use all the haptic features, users are delighted to have the option to choose based on their learning style. This would render the app more user-friendly for those in their 20s; this is important as people in their 20s is a demographic that has purchasing power and in many cases a required demand for language acquisition; they are used to apps that are easy to navigate, and sensitive about the aesthetics of the app based on insights derived from our research.

In order for apps to be favored over paper workbooks, they should accommodate the benefits of using a paper workbook while heightening the learning experience of the user by providing haptic functions such as highlighting and scribbling.

The incorporation of advanced technology such as AI/ML (Artificial Intelligence / Machine Learning), VR/AR (Virtual Reality/Augmented Reality) could render vocabulary memorization apps to increase user traffic by providing the aforementioned aspects in the previous paragraph.

Although we were not able to test AI/ML, AR/VR functions due to limitations in technology, we were able to conclude that haptic features do give a positive impression to users.

8. Conclusion & Future Works

Our goal was to form an understanding to serve as the basis for the formation of a user experience guideline that vocabulary memorization apps can refer to so we can transition users from the paper workbook to the mobile environment by dissecting Amkigorae as a case study. Although we have found that most participants were pleasantly satisfied with the content of the app, we concluded that the app could adopt more intuitive and aesthetic layouts and icons, exclude indiscreet usages of the whale image and out-of-context illustrations, and include a re-designed mascot character and a simple, minimal interface.

Through our research, we concluded that the incorporation of haptic functions utilizing advanced technology could increase user traffic as users enjoyed having more options regardless of whether they would use all functions because of their learning style.

Therefore, we invite researchers to conduct further research on the topic in, but not limited to, the following arenas; apps could utilize AI/ML to recommend a word list for users and exclude meaningless word lists for the user to streamline the experience of the user as word lists for “Basic English” is useless for those who are preparing for “Advanced English” exams. Moreover, AR could allow users to have more space to utilize their hands to write words in open space while VR could provide rich visual content that could render the user to understand the context of the vocabulary better.

We invite interested stakeholders regarding the issue of sustainable development in regards to the access to quality education and means to ameliorate the current state of environmental protection by furthering research regarding this area to transfer the demographic that purchase paper workbooks to the mobile environment.

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