

Internet-based Spaced Repetition Learning In and Out of the Classroom: Implementation and Student Perception

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Introduction

As our students become increasingly immersed in and connected by technology and the Internet, it is important that teachers embrace and explore this medium. Students are surrounded by numerous electronic distractions, competing for a limited amount of time and energy. How can we participate in this inevitable tide and take advantage of their interest in and access to technology to improve their learning?

This article describes the implementation of Anki, a spaced-repetition flashcard computer program, and its AnkiWeb study website into two similar university classes (46 students in total), over a fifteen-week semester. The main goals were to explore the possibilities of its application in and out of the classroom and to assess students' affective responses. Overall, students perceived Anki as an exceptionally useful learning tool that they would like to use again; although, the extent of usage varied significantly between the groups. Based on these results and our experiences using Anki in the classroom, recommendations for improved classroom implementation are proposed.

Rationale and Goal

As long time teachers of English and students of many languages ourselves, we have experienced both success and failure with a range of different methods and techniques: books, tapes, CDs, computer programs, tutors, classes, etc. Our current study of Japanese has been no different.

While independently researching how to effectively study kanji, we both became aware of Anki and its advantages. It quickly became our first choice for reviewing and reinforcing materials. To be clear, Anki is only one method of study and does not necessarily replace any of the above mentioned methods and techniques. However, its ease of use, efficiency of card scheduling, and mobility give it great potential as an educational tool. Most importantly, it has given us hope and motivation to continue the difficult process of learning a foreign language.

Based on our own success memorizing thousands of kanji using Anki, we wanted to explore the possibilities of incorporating it into the classroom and determine whether our students shared our perceptions of Anki as an enjoyable and effective study tool.

Overview of Anki

For the purpose of this article, the Anki flashcard program and its AnkiWeb study website will be referred to collectively as “Anki.” We would like to stress that because Anki is one of many kinds of spaced repetition software, any mention of Anki could also pertain to an alternative application of choice.

Described as a “friendly, intelligent flash card program,” Anki uses the principles of active recall testing and spaced repetition, combined with a digital interface, to allow users to efficiently and effectively study any material: text, audio, images, etc. Users can create their own cards and share them; they can also download decks created by other users.

The Anki desktop application, which is a free download, provides the user with the control and flexibility in creating cards and managing decks of cards. Anki can be synced to the AnkiWeb study website, allowing users to upload, access, and study their decks from any Internet-connected device. It is also possible to use an Anki application (‘app’) on ‘smart’ devices (such as iPhones, iPod Touches, iPads, Android phones, etc.) for offline study, providing the ability to study anywhere and at any time.

Because there are other flash card programs and study websites available that teachers may choose to use, this article will not provide a step-by-step description of how to use Anki. It will instead focus on the issues of implementing it into the teaching process and how our students reacted to it. The Anki website provides detailed instructions and videos on how to use Anki that explain the ‘nuts and bolts’ of creating cards and managing decks.

Principles of Anki

Flashcards can be an effective way to study, as repeated exposure to material is critical to retention. Active recall testing is another important aspect of flashcards. Instead of passively receiving or reviewing material through reading or listening, users are required to consider whether they actually know the material in question. Users must assess their own understanding and study accordingly. However, with traditional paper flashcards, there can be problems with managing cards and studying efficiently.

At first, a small deck of paper flashcards can seem quite handy and fits easily in a pocket or bag.

However, if the number of cards begins to grow to the hundreds, even thousands, then the deck can become quite difficult to handle and organize. By going digital, Anki gives users the ability to easily study large decks. Tags and filters also allow users to sort, separate and organize large numbers of cards quickly and efficiently, providing a great deal of control and flexibility in the learning process. This could be considered the “friendly” aspect of Anki: by making studying easy and less stressful, it becomes more enjoyable.

The intelligent component of Anki is what differentiates it from not only traditional flashcards, but also other flashcard software, both of whose users usually have only two choices after reviewing a card, based on how well it is known. The card can be put back in the deck to be seen again, or it can be set aside. Both options can result in inefficient studying: time wasted reviewing a card early or not reviewing a card before it is forgotten.

Anki uses the principle of spaced repetition to maximize efficient studying. Based on feedback from the user about how well a card is known and the study history of the card, Anki uses an algorithm to calculate the time interval between card reviews. As a card is studied and becomes easier, the time until the next review increases. A forgotten or difficult card will be reviewed again after a shorter interval. It perhaps can be best summarized as, “You only study *what* you need to study *when* you need to study it.”

Participants and Materials Studied

Group 1 21 1st-year Economics faculty students

English proficiency level 10 out of 13, where 13 is the lowest

Four 45-minute classes per week

Cards were generated from situational dialogues from the textbook *Expressways* by Prentice Hall Press. Each line of dialogue was one card, with Japanese on the front and English on the back. Approximately ten to sixteen new cards were added each week. Class activities focused on the use and regular review of these dialogues.

Group 2 25 1st-year International Relations faculty students

English proficiency level 4 out of 12, where 12 is the lowest

Four 45-minute classes per week

Cards were generated from units of *Topic Talk* by EFL Press. Each unit consists of 13 questions on a specific topic, such as family, music, food, etc. Cards consisted of two types: a question in Japanese on the front and the same question in English on the back; the long form answer to a question in English on the front and the question to that answer in English on the back. 26 new cards were added each week. Class activities focused on the use and regular review of these

questions.

While the classes were similar on most counts, a crucial difference between the two groups was that the International Relations faculty students would be attending a study abroad program in the United States the next semester.

Methodology

In an ideal teaching situation, students and teachers would have access to technology both in and out of the classroom. This would allow the students full control of and responsibility for their Anki use, yet allow the teacher to guide the students through the process. The teacher would be able to participate in and monitor the students' use and progress. However, with no consistent access to a computer lab, it was decided that the teacher would create the cards and a shared class Anki account. The students would be introduced to the AnkiWeb study website in class via the teacher's notebook computer and class television. Students would then study their own Anki decks via the AnkiWeb study website outside of class.

Creating a Class Master Deck and Cards

The free Anki desktop application was downloaded to the teacher's computer, and a class master deck was created with its cards produced from the class materials.

Creating Anki Decks

Individual decks for each student were created, with a unique name; for example, "Econ 10 Miyuki." Then, the cards from the class master deck were imported to the students' decks. Within each class, the card sets were the same for all students. The study settings were also set (e.g. the number of new cards per day, whether new cards would be interspersed with reviews, etc.).

Creating an AnkiWeb Class Account

For each class, an AnkiWeb study website account was created with an email username and password that would be shared by the teacher and students. It is recommended that teachers create and use a new email account for this purpose, such as *econenglish@hotmail.com*. Also, a password that will be easy for the students to remember and type is important.

Syncing Decks to AnkiWeb Website

The Anki program on the teacher's computer was then synced to the class AnkiWeb study website account. Next, each student's deck was uploaded (synced) to the AnkiWeb study website account. After that, every time the teacher's computer was synced, any changes or additions to student decks and all statistical information regarding students use of Anki would be exchanged between the Anki program on the teacher's computer and the class AnkiWeb study website account.

Introducing Anki to Students

In class, using a notebook computer connected to the class television, students were introduced to the AnkiWeb study website. Using an example deck made from class materials, the basic principles and use of Anki were explained and demonstrated. Giving honest feedback about the ability to answer was stressed. The students were also shown the AnkiWeb study website account that listed all of their individual accounts.

The next day, students were given the shared username and password and shown how to log in to the AnkiWeb study website. Then, the students were shown how to find their individual decks and open them for studying. Again, proper use of Anki was demonstrated and modeled. Finally, students were instructed to study Anki via the AnkiWeb study website outside of the classroom on computers and smart devices. They were also told that quizzes and tests for the semester would be

based on the Anki deck materials.

Some words of caution are important here. These problems arose with Anki and may also be realities of similar systems and technology. The login page for the AnkiWeb study website can be confusing for new users. The username and password data fields, in the upper right-hand corner, are quite small and easily missed. Just below, in a large box, is a “Sign Up” area for new users with prominently labeled “Email” and “Password” data fields. At the beginning, students often mistakenly enter the username and password in the “Sign Up” area, which can cause some confusion and frustration. It is important to remind students to be aware of the difference and to only use the correct login data fields.

Another problem was that students forgot the shared password. There is a link above the password data field labeled “Forgot?” Clicking the link takes users to a “Reset Password” web page. If students enter the Anki class account username (email address), a new password will be sent to the class email account, deactivating the original password and stopping students from accessing the account. The teacher must obtain the temporary password from the email account and then access the Anki class account to reset the password.

Lastly, teachers should note that there is an inactive subscription feature of Anki, which in the past allowed teachers to more easily share decks and deck updates with individual Anki accounts held by students. While this article will not delve into how to use this feature, it may be a better implementation method once it is restored in a future version of Anki.

Student Exposure to Anki

It was difficult to create opportunities for students to use Anki because there was no access to computers in the classroom. The initial plan was, perhaps somewhat naively, to introduce the students to Anki and hope they would see its value and use it to study outside of the classroom. Although students were not directly evaluated on the basis of their use or non-use of Anki, they were told it was a required form of study and that they would be tested on the Anki content prepared for them by the teacher.

Because both classes met four times a week, it was possible to engage the students with Anki despite the lack of technology for individual students. One approach was to have the AnkiWeb study website on the class television and a class deck open at the beginning of class. As students came into the room, they were asked to answer a card, with correction and feedback given by the teacher.

Another approach was an Anki competition once a week. The students were randomly divided into two lines in front of the television screen. With the teacher operating the computer, the students at the head of the lines competed to answer a card from a class material deck. Knowing that an incorrect answer brought the card up again soon, the other students in line watched carefully. When students successfully answered the question, they were allowed to go to the end of the line. The losing student had to stay at the head of the line and compete again for the next card. Students who lost twice in a row were allowed to go to the end of the line. If both students were unable to answer correctly, they had to stay until a card was successfully answered. As an incentive, the teams competed for a food prize, usually a package of cookies; the winning team was allowed to sit down and share the prize. The losing team had to remain standing in line and continue to answer cards. Each student was only allowed to sit down after successfully answering a card.

Monitoring Usage

As stated earlier, it was decided the students' decks would be controlled and synced to the Anki

program on the teacher's computer. This allowed the teacher to create cards that were consistent and correct from the class materials. Another benefit was the ability to monitor students' Anki usage.

By syncing the teacher's Anki program with the AnkiWeb study website, the students' current deck information is downloaded to the computer. Within each deck, under the "Tools" drop down menu, it is possible to view information about the decks and cards. The "Graphs" option shows the information about the students' studying behavior and results in a visual format. The "Deck Statistics" option shows a large amount of information about the deck: number of cards, repetitions (number of cards viewed) per time interval, etc. The "Card Statistics" option shows detailed information about an individual card.

For the purpose of this study, the teacher regularly checked students' decks for progress. On a weekly basis, students were recognized for their efforts and encouraged to continue or, in some cases, start.

Assessing Student Perceptions

In order to assess student perceptions of Anki, an anonymous questionnaire was given in Japanese and English to the students at the end of the semester (see Appendix A).

Questions were selected to ascertain students' affective responses to Anki. The goal was to know whether students perceived Anki to be an exceptionally effective method of study, whether they enjoyed using it, and why. To that end, questions were selected to measure the affective response of students to their Anki experiences. Questions made no attempt to measure the tangible effectiveness of Anki in terms of students' ability to acquire or retain English.

Results and Analysis

Anki use outside of the classroom was mixed, with the Economics group ranging up to 246 total repetitions (cards viewed) throughout the semester, with a mean of approximately 60. The International Relations group ranged up to 695 repetitions, with a mean of approximately 252.

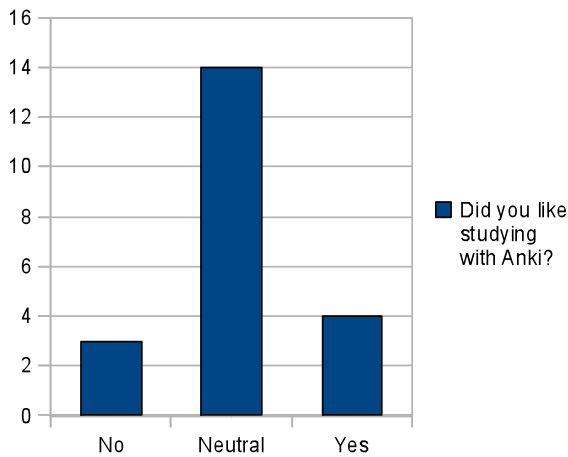
Students were not given a specific number of repetitions to complete in a set time frame. Anki is designed to be used by exhausting all repetitions scheduled by the program in a day; since the program's algorithm has already decided exactly which cards are in danger of being forgotten, to set an arbitrary target number of repetitions for a time frame would be detrimental. Additionally, there was some concern that students would approach their Anki use by simply clicking through the required number of cards without focusing on whether or not they truly knew the information. It was hoped that the students would study the cards because they perceived it as an effective way to learn the class material.

Questionnaire Results

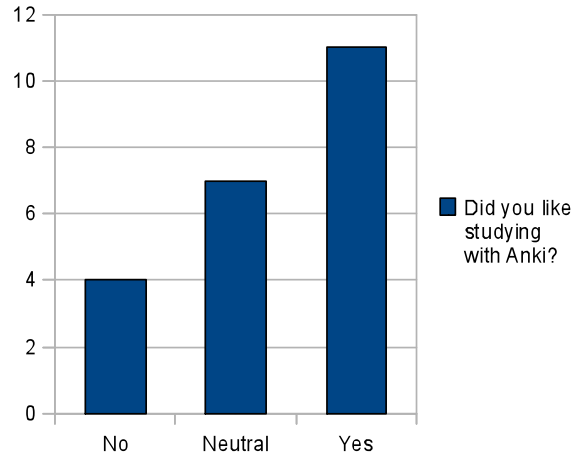
Overall, students reported neutral to positive impressions of Anki, its effectiveness and a desire to use it again in the future. Relative to the Economics group, the students in the International Relations group used Anki far more, enjoyed it more, attached more positive and fewer negative adjectives to their Anki use, perceived Anki as more effective, and indicated a slightly higher desire to use Anki again.

Both groups exhibited a preference for Anki relative to other study methods they had used in the past, though this preference was slight in the case of the Economics group. This correlates with the extent to which students reported liking Anki:

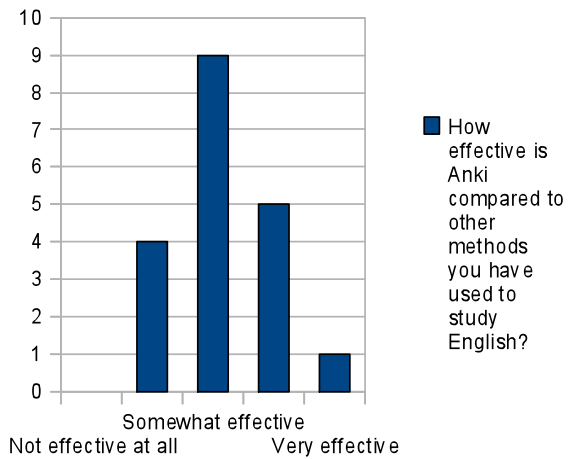
Economics



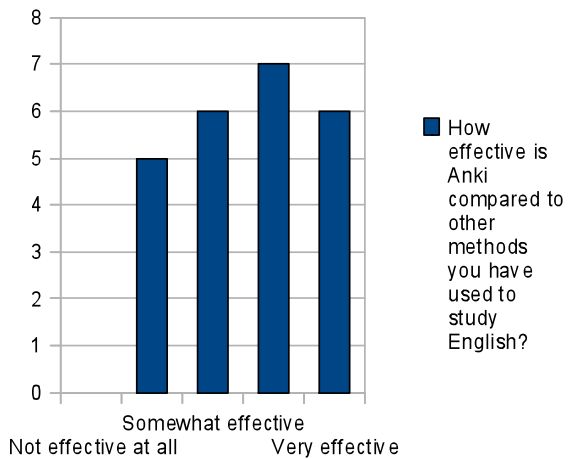
International Relations



Economics

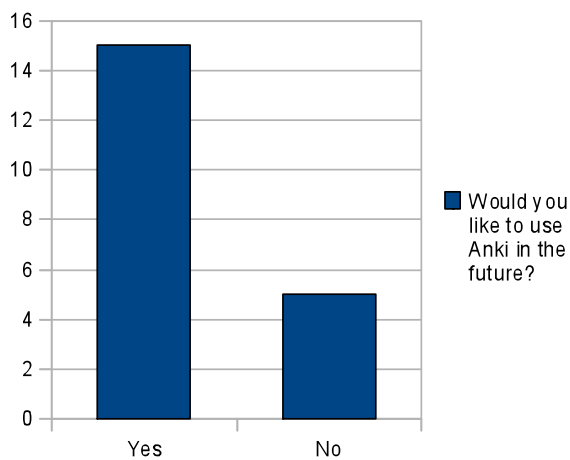


International Relations

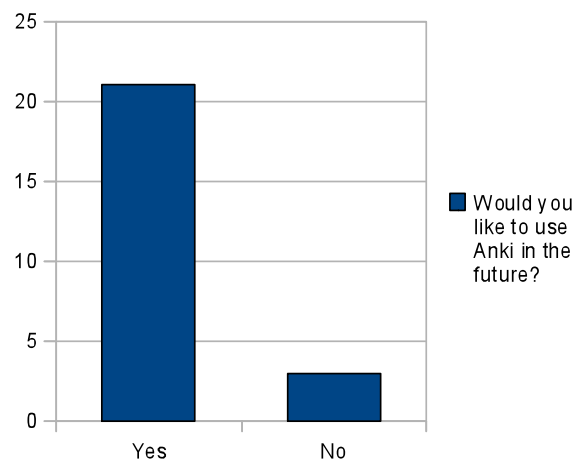


However, even though the Economics group reported low use, both groups indicated a majority desire to use Anki in the future:

Economics



International Relations



This suggests that the Economics group's low usage of Anki is not the result of a negative impression of its effectiveness. It should be noted that in the case of the Economics group,

impressions of Anki's effectiveness must have been based largely on students' in-class exposure to Anki, since about half of the group did not use Anki outside of class.

Some observations can be made based on the questionnaire results and teacher reflection on the class experience. First, there is clearly a correlation between the extent of independent Anki use and positive affective response to Anki, with the International Relations group using Anki often and reporting a robustly positive affect and the Economics group using it significantly less while reporting only a slightly positive affect. However, it is unclear what the causal relationship is between use and perception of Anki. Furthermore, it is important to address the impact of the impending study abroad experience on the International Relations group. The motivational effect on students knowing they would soon be conversing with native speakers should not be understated. We speculate that students in the International Relations group used Anki more because they could envision themselves using the content they were studying in the near future.

By way of contrast, the Economics group had no immediate real-world application for the content they were studying. Furthermore, they were tested on the content only on the midterm and final exams, which meant they were not evaluated for long-term retention, which is the goal of Anki. Since 'cramming' would have been sufficient to pass the evaluations, this test schedule may not have instilled in students a feeling that Anki was the most suitable study method to succeed in the class.

Conclusion

The study was successful in exploring the use of Anki in teaching and assessing student perceptions. It should be noted, however, that it is subject to the limitations of sample size and self-reported data, and that the groups compared probably differed in overall motivation to study English and did not study exactly the same content. Lastly, since some students did not use Anki on their own, their reported impressions of Anki must have been based on their classroom exposure to it, which differed in character from serious, long-term Anki use by the individual (as the software is intended to be used).

From the questionnaire results, combined with our own experiences and observations in the classroom, it is clear that there are many areas for improvement, as well as the possibility of great success. It is also encouraging to us that even though the Economics group appears to have used Anki significantly less, they nevertheless wanted to use Anki again in the future. We propose that increased in-class exposure to Anki could result in better perception and more out of class use, though to be sure of this, a study would have to correlate proper individual Anki use over the long term with a positive affect.

At the same time, the question arises about how to motivate students to use Anki in the absence of external motivators, such as the International Relations group had. Although the broader question of how to motivate students in general is beyond the scope of this article, we suggest that a better understanding of Anki and the principles behind it could motivate students to study more. Students must believe that Anki is a better solution to succeed within the class's evaluative framework than other methods. In particular, they must know that long-term retention will be evaluated, and they must be shown that Anki is a better method of achieving this than the 'cramming' to which many are accustomed. Along these same lines, students must understand that Anki itself is not a tool for 'cramming.'

To increase both students' exposure to and understanding of Anki, we suggest devoting considerable class time to making the unique character of spaced repetition systems well understood to the students. One method is increased modeling of proper Anki use, in particular honest self-

assessment of answer correctness, by the teacher upon Anki's introduction and at intervals throughout the class. A second method is monitored use with the aims of increasing exposure to Anki and ensuring honesty in self-assessment during Anki use. As this could be difficult for the teacher to personally provide in a large class, one idea is to have students working in pairs with one student quizzing the other, evaluating the answer, and inputting the correct feedback to Anki.

While we feel optimistic about the results of this study, as educators we have a higher goal of enabling students to become successful and independent learners. Unfortunately, even the students who fully embraced Anki and successfully used it to master class materials were not necessarily able to take this positive experience and carry it over to other classes due to their dependence on the teacher to create the Anki cards and decks. This, in our opinion, represents a failure to impart our own Anki success to our students. Because they did not choose and create their own content, students may have lacked a feeling of ownership of or investment in their own Anki use. With the above in mind, future work will include the goal of creating independent users of Anki. While this will create a different set of logistical issues to be solved, we believe the higher goal of liberated and empowered learning warrants further efforts to improve implementation.

Works Cited

Elmes, Damien, *Anki*, n.p., n.d., Web. 14 July 2011.

Appendix A: Questionnaire document

Anki Questionnaire

1. How much did you study with Anki?

- a. None b. A little c. Some d. A lot

2. How did you use Anki? (Circle all that apply.)

- a. PC b. Cell phone c. Other d. I did not use Anki

3. Did you understand your teacher's instructions about how to use Anki?

- a. Yes b. No

4. Did you like studying with Anki?

- a. Yes b. No c. Neutral

Why or why not? _____

5. Which of the following describe Anki? (Check all that apply.)

- | | |
|--|---|
| <input type="checkbox"/> Effective | <input type="checkbox"/> Ineffective |
| <input type="checkbox"/> Easy to use | <input type="checkbox"/> Difficult to use |
| <input type="checkbox"/> Convenient | <input type="checkbox"/> Inconvenient |
| <input type="checkbox"/> Fun | <input type="checkbox"/> Boring |
| <input type="checkbox"/> Matches my learning style | <input type="checkbox"/> Does not match my learning style |
| <input type="checkbox"/> Interesting | <input type="checkbox"/> Not interesting |
| <input type="checkbox"/> Other _____ | |

6. How effective is Anki compared to other methods you have used to study English?

- a. Not effective at all
b. A little effective
c. Somewhat effective
d. Effective
e. Very effective

7. Would you like to use Anki in the future?

- a. Yes b. No

8. Do you have any additional comments about Anki? (Please continue on the back side.)

Appendix B: Questionnaire results

	Economics	International Relations
How much did you study with Anki?		
None	12	2
A little	7	12
Some	2	8
A lot	0	2
How did you use Anki?		
PC	8	21
Cell phone	3	5
Other	0	0
I did not use Anki	11	1
Did you understand your teacher's instructions about how to use Anki?		
Yes	21	23
No	0	1
Did you like studying with Anki?		
No	3	4
Neutral	14	7
Yes	4	11
Which of the following describe Anki?		
Effective	12	19
Easy to use	8	14
Convenient	12	14
Fun	4	9
Matches my learning style	5	12
Interesting	4	8
Ineffective	0	1
Difficult to use	1	2
Inconvenient	1	0
Boring	0	1
Does not match my learning style	2	3
Not interesting	1	0
How effective is Anki compared to other methods you have used to study English?		
Not effective at all	0	0
A little effective	4	5
Somewhat effective	9	6
Effective	5	7
Very effective	1	6

Would you like to use Anki in the future?

Yes	15	21
No	5	3

Appendix C: “Did you like studying with Anki?” question answers with write-in responses

Economics Faculty

Yes It’s fun because it uses a computer

Yes By using it many times, I felt that I could improve

Yes Easy

No I forgot

Neutral It’s good and easy for studying English, but sometimes I forgot to use it

Neutral I don’t remember it

Neutral I didn’t use it

Neutral I didn’t use it

Neutral I didn’t use it

Neutral I didn’t study

Neutral I never used it

Neutral I don’t have much time to use it

Neutral I never used it

Neutral I never used it

International Relations Faculty

Yes It’s fun by just clicking!

Yes Only useful English vocabulary will be shown, and can use this programme in the train, before go to bed, very convenient

Yes I could understand it gradually, so it was fun.

Yes It was fun to see the card number go down

Yes Easy

Yes I like it because it’s going to be beneficial to me

Yes I don’t need to bring heavy cards so I can use it easily when I want to study

Yes Can study thoroughly; easy to use

Yes I understand it day by day

Yes It’s not heavy like textbook; can study on train

Yes We can learn good pronunciation

No It took time, and I couldn’t memorize it

No So many word difficult

No I don’t like it much. I just use it when I have time

Neutral It was difficult to use because I had to type the password every time

Neutral If I have to use it every day, I don’t like it. But if I see it as something good for me, I will like it

Neutral Because I forgot the password

Neutral Couldn’t study because couldn’t connect to the Internet

Neutral I study a little, but I don’t know if I can get knowledge or not

Neutral I didn’t feel like I could memorize even though I used it many times

Neutral It makes me frustrated because it is difficult