



University of  
Massachusetts  
Amherst

## TALKING TO AI TUTORS: SPEAKING PRACTICE USING A JAPANESE LANGUAGE LEARNING APP TO IMPROVE L2 LEARNERS' FLUENCY

|               |                                                                                                   |
|---------------|---------------------------------------------------------------------------------------------------|
| Item Type     | Thesis (Open Access)                                                                              |
| Authors       | Nakayama, Ryo                                                                                     |
| DOI           | <a href="https://doi.org/10.7275/28641843">10.7275/28641843</a>                                   |
| Download date | 2025-07-16 06:16:49                                                                               |
| Link to Item  | <a href="https://hdl.handle.net/20.500.14394/32885">https://hdl.handle.net/20.500.14394/32885</a> |

TALKING TO AI TUTORS:  
SPEAKING PRACTICE USING A JAPANESE LANGUAGE LEARNING APP  
TO IMPROVE L2 LEARNERS' FLUENCY

A Thesis Presented

by

Ryo Nakayama

Submitted to Graduate School of the  
University of Massachusetts Amherst in partial fulfillment  
of the requirements for the degree of

MASTER OF ARTS

May 2022

Department of Languages, Literatures, and Cultures  
East Asian Languages and Cultures  
Japanese

TALKING TO AI TUTORS:  
SPEAKING PRACTICE USING A JAPANESE LANGUAGE LEARNING APP  
TO IMPROVE L2 LEARNERS' FLUENCY

A Thesis Presented

by

RYO NAKAYAMA

Approved as to style and content by:

---

Yuki Yoshimura, Chair

---

Bruce Baird, Member

---

Shely Vohra, Member

---

Amanda C. Seaman, Japanese Program Director  
East Asian Languages and Cultures Program  
Department of Languages, Literatures and Cultures

---

María S. Barbón, Chair  
Department of Languages, Literatures and Cultures

## ACKNOWLEDGEMENTS

I would like to express my tremendous gratitude to Professor Yuki Yoshimura. She has taught me the fascination of research up to this day, which led to the completion of this master's thesis. I would also like to express my gratitude to Professor Bruce Baird and Professor Shely Vohra for being members of my committee.

I would like to thank Stuart Barrass and Paddy Allen at Kaizen Languages. Thanks to their kind cooperation, I was able to execute fulfilling survey analyses.

I would like to extend my special thanks to the Program Officer of the East Asian Languages and Cultures department, Marc Cameron, the East Asian Studies Librarian, Sharon Domier, and the Japanese Program Director, Professor Amanda C. Seaman as well as all of the faculty and friends in the Japanese program at the University of Massachusetts Amherst. Their daily support as well as their heartwarming words of encouragement saved me many times.

Finally, I want to express my gratitude to my parents and two siblings as well as my sweet grandmother, Tami Masuzawa, and my adorable puppy, Cherry. I could not have made it this far without their support.

# ABSTRACT

TALKING TO AI TUTORS:

SPEAKING PRACTICE USING A JAPANESE LANGUAGE LEARNING APP

TO IMPROVE L2 LEARNERS' FLUENCY

MAY 2022

RYO NAKAYAMA, B.A., GAKUSHUIN UNIVERSITY

M.A., UNIVERSITY OF MASSACHUSETTS AMHERST

Directed by: Professor Yuki Yoshimura

This study examines (1) whether L2 learners' oral fluency and accuracy improve through conversation practice with AI tutors in a Japanese language learning app, (2) when fluency increases, and (3) which learning cycle is most effective. Ten participants joined the study and practiced conversations with Kaizen Languages' AI tutors for three weeks. Learners selected their preferred learning cycle: a group with fewer lessons to complete per day but more practice days per week or a group with more lessons to complete per day but less frequent practice days per week. After three weeks of self-study, participants took an oral test to show how much they improved their fluency and accuracy in new contexts.

The results of this study show that not only did learners' oral fluency improve with the use of the Kaizen app, but their oral accuracy also increased. In addition, learners who improved their fluency practiced repeatedly, and their fluency improved until three or four repetitive practices. Although this study did not find an effective learning cycle, it implies that the ideal

learning cycle requires at least three times of practice to improve fluency, while five to six times of practice produces higher accuracy.

## TABLE OF CONTENTS

|                                                                                             | Page |
|---------------------------------------------------------------------------------------------|------|
| ACKNOWLEDGEMENTS.....                                                                       | iii  |
| ABSTRACT.....                                                                               | iv   |
| LIST OF TABLES.....                                                                         | viii |
| LIST OF FIGURES.....                                                                        | ix   |
| CHAPTER                                                                                     |      |
| 1. INTRODUCTION.....                                                                        | 1    |
| 2. THEORETICAL FRAMEWORK.....                                                               | 3    |
| 2.1 L2 Oral fluency.....                                                                    | 3    |
| 2.2 Automatization.....                                                                     | 6    |
| 3. KAIZEN LANGUAGES.....                                                                    | 8    |
| 3.1 What is <i>Kaizen Languages</i> ?.....                                                  | 8    |
| 3.2 Functions of the Kaizen Languages app.....                                              | 9    |
| 3.2.1 Lessons.....                                                                          | 9    |
| 3.2.2 Flashcards.....                                                                       | 12   |
| 3.2.3 Writing.....                                                                          | 14   |
| 3.2.4 Progress.....                                                                         | 15   |
| 4. LITERATURE REVIEW.....                                                                   | 17   |
| 4.1 Precious studies of smartphone usage time.....                                          | 17   |
| 4.2 App-based learning and learning autonomy.....                                           | 19   |
| 4.3 Previous studies of oral fluency by applying digital game-based mobile application..... | 21   |
| 4.4 Previous studies on the frequency of practice to automatize L2 speech.....              | 23   |
| 4.5 Significance of This Study.....                                                         | 24   |
| 4.6 Research questions.....                                                                 | 25   |

|                                                                    |    |
|--------------------------------------------------------------------|----|
| 5. METHODS AND PARTICIPANTS .....                                  | 26 |
| 5.1 Research participants.....                                     | 26 |
| 5.2 Research design.....                                           | 26 |
| 5.3 Data collection procedures .....                               | 28 |
| 6. RESULTS AND ANALYSIS.....                                       | 32 |
| 6.1 Practice Frequency and Practice Fluency.....                   | 32 |
| 6.2 Practice Frequency and Test Fluency.....                       | 37 |
| 6.3 Test Fluency and Practice Fluency.....                         | 41 |
| 6.4 Practice Frequency, Practice Accuracy, and Test Accuracy ..... | 42 |
| 6.5 Timing of Fluency Increase.....                                | 44 |
| 6.6 Learning Cycle .....                                           | 50 |
| 7. CONCLUSION.....                                                 | 53 |
| APPENDICES                                                         |    |
| A: Screening Questionnaire .....                                   | 56 |
| B: Achievement Test Slides.....                                    | 57 |
| REFERENCES .....                                                   | 60 |

## LIST OF TABLES

| Table                                                                              | Page |
|------------------------------------------------------------------------------------|------|
| 1. List of learning cycles for Group 1 and Group 2 .....                           | 27   |
| 2. List of lessons that have vocabulary and expression used in the oral test ..... | 29   |
| 3. Practice Frequency .....                                                        | 33   |
| 4. Practice Fluency .....                                                          | 36   |
| 5. Test Fluency .....                                                              | 38   |
| 6. Learning Cycle Example: The First Week of Group 1 .....                         | 51   |

## LIST OF FIGURES

| Figure                                                           | Page |
|------------------------------------------------------------------|------|
| 1. Levelt's model of production (Levelt, 1989).....              | 5    |
| 2. Practice Frequency and Practice Fluency.....                  | 36   |
| 3. Practice Frequency and Test Fluency.....                      | 40   |
| 4. Test Fluency and Practice Fluency.....                        | 41   |
| 5. Practice Frequency, Practice Accuracy, and Test Accuracy..... | 43   |
| 6. S1's Practice Frequency and Response Fluency.....             | 45   |
| 7. S6's Practice Frequency and Response Fluency.....             | 46   |
| 8. S2's Practice Frequency and Response Fluency.....             | 47   |
| 9. S7's Practice Frequency and Response Fluency.....             | 48   |
| 10. S9's Practice Frequency and Response Fluency.....            | 49   |

# CHAPTER 1

## INTRODUCTION

According to the 2018 Japan Foundation survey on the state of Japanese language education by region, the number of Japanese language institutions and learners in North America decreased while the number of Japanese language teachers increased (between the years 2015 and 2018). The Japan Foundation (2020) analyzes that the number of Japanese language instructors has increased because part-time instructors and teaching assistants are being hired in place of full-time positions. This result reflects the severity of the educational finances surrounding Japanese language education. On the other hand, looking at the results by age group, the number of Japanese language students in higher education is on the rise due to an increasing percentage of students wanting to continue learning Japanese from high school. Based on data released by the American Modern Language and Literature Association (2019), while the overall number of students taking foreign languages at U.S. colleges and universities declined between the years 2013 and 2016, only Japanese and Korean showed increases. In fact, Japanese has now replaced Italian as the fifth most studied second language.

Since the COVID-19 pandemic across the United States in 2018, the environment for Japanese language education has changed drastically. The Japan Foundation has started a new survey in September 2020 and expects further cuts to education budgets to be inevitable due to worsening finances in each state. However, there is some positive news for the Japanese language education community: Duolingo's research shows that between March 11 (the day the World Health Organization officially declared the COVID-19 pandemic) and the end of April 2020, new Duolingo learners in the U.S. increased by 51% compared to the same period in 2019 when Japanese ranked third on the list of the world's fastest growing languages and sixth among

the world's most popular learned languages (Blanco, 2020). One of the countries with the largest number of Japanese language learners is the U.S. Similar to the growth in popularity of Portuguese during the 2016 Rio Olympics, based on a survey conducted prior to the 2021 Tokyo Olympics, the popularity of the Japanese language was not a temporary movement, but a result of global interest in Japanese culture stemming from video games, manga, and anime. This rise in popularity linked to interest in popular culture is thought to be a factor in the sustained and significant growth of Japanese language learners around the world.

Contrary to the movement to close or downsize Japanese language programs due to budget cuts for language education, interest in Japanese language education in the U.S. remains high, and free YouTube videos and language education mobile applications that allow learners to easily start learning Japanese are expected to grow. With 85% of the adult population in the U.S. now owning a smartphone (Pew Research Center, 2021), Technavio (2020) estimates that the online language learning market share will increase by \$2.17 billion between 2019 and 2024. With an expected increase of \$5.7 billion, the analysis suggests that the adoption of artificial intelligence (AI) in language learning will be a major challenge. Moreover, many students may feel uneasy about face-to-face classes due to Covid-19 circumstances. Mobile learning allows learners to learn Japanese not only in a comfortable environment where they can study anywhere and anytime (Wang, Shen, Novak, and Pan, 2009) but also, both at official and unofficial learnings (Hamidi and Chavoshi, 2017). Online teaching materials and applications are attracting a high level of attention, both in terms of the business market and the needs of Japanese language learners in the new educational climate that resulted from Covid-19. With online learning advancing, this study investigates how much L2 oral fluency is increased through online app-based learning, and how accurately the content learned can be used in real conversations.

## CHAPTER 2

### THEORETICAL FRAMEWORK

#### 2.1 L2 Oral fluency

The natural language term fluency is not well defined (Segalowitz, 2010) because expectations concerning what is appropriate in a communicative context vary according to the situation (Sajavaara, 1987; Kormos, 2006). Lennon (1990) defines fluency as, “an impression on the listener’s part that the psycholinguistic processes of speech planning and speech production are functioning easily and effectively.” In other words, oral fluency can be divided into three categories on the basis of the listener’s impression, the speaker’s cognitive process, or the speaker’s speech outcomes.

Segalowitz (2010) called the speaker’s impression of the listener as “perceived fluency.” Perceived fluency is defined as the “judgment made about speakers based on impressions drawn from their speech sample.” This fluency depends on the context, namely on the speaker’s evaluation of the hearer’s expectation (Rehbein, 1987; Kormos, 2006). Secondly, Segalowitz also defines the speaker’s psycholinguistic processes of speech planning as “Cognitive fluency.” Cognitive fluency is “a skill concerned with the selection of utterances (knowing what to say, to whom and when)”. Lastly, the speaker’s processes of speech production and easy and effective functioning is defined by Segalowitz as “utterance fluency.” Utterance fluency is “a skill concerned with the actual production of these utterances (producing them rapidly and smoothly, without hesitations and pause).”

Schmidt adds to the conversation the idea that fluency in speech production is an automatic procedural skill (Carlson, Sullivan, & Schneider, 1989). In other words, fluent speech

is automatic and does not require much attention or effort. In relation to and in support of this idea, Lennon (2010) adds that “a working definition of fluency might be the rapid, smooth, accurate, lucid and efficient translation of thought or communicative intention into language under the temporal constraints of on-line processing.” This statement indicates that the learner’s cognitive processes and speech have reached a level of automaticity. In other words, improving fluency requires automatization.

We must now consider the following question: How can we measure the improvements of learners’ fluency? As mentioned earlier, perceived fluency is difficult to measure because the listener’s expectations and evaluations change depending on the context and situation. Furthermore, cognitive fluency is also difficult to measure because it is related to various psychological aspects of the speaker. Researchers so far have measured learners’ utterance fluency in terms of the time before they uttered a word as well as the content of the resulting utterance.

Most of the studies measuring L2 oral fluency conclude that the best predictors of fluency are speech rate; that is the number of syllables articulated per minute (Kormos, 2006). Lennon (1990) divides the speech rate into two measures; unpruned and pruned. Unpruned speech rate includes all self-corrections, asides, etc. into speech rate. On the other hand, pruned speech rate excludes those hesitations. Towell et al. (1996) examined the oral performance of English-speaking university students learning French. Here are the items they used in the study:

- Speech rate (syllables per minute)
- Phonation/time ratio (percentage of time speaking/total time, i.e., with pauses included)
- Articulation rate (syllables per second without pause times included)
- Mean length rate (syllables per second without pause times included)

- Mean length of runs (mean number of syllables between pauses of .28 seconds or longer)

When measuring L2 fluency, researchers focus on objective data (Utterance fluency) such as the items listed above. In order to increase the level of utterance fluency, it is important to be able to smoothly carry out the cognitive process of producing the data (cognitive fluency). Levelt's speech production model (Figure 1) represents what is important when it comes to producing output in a second language.

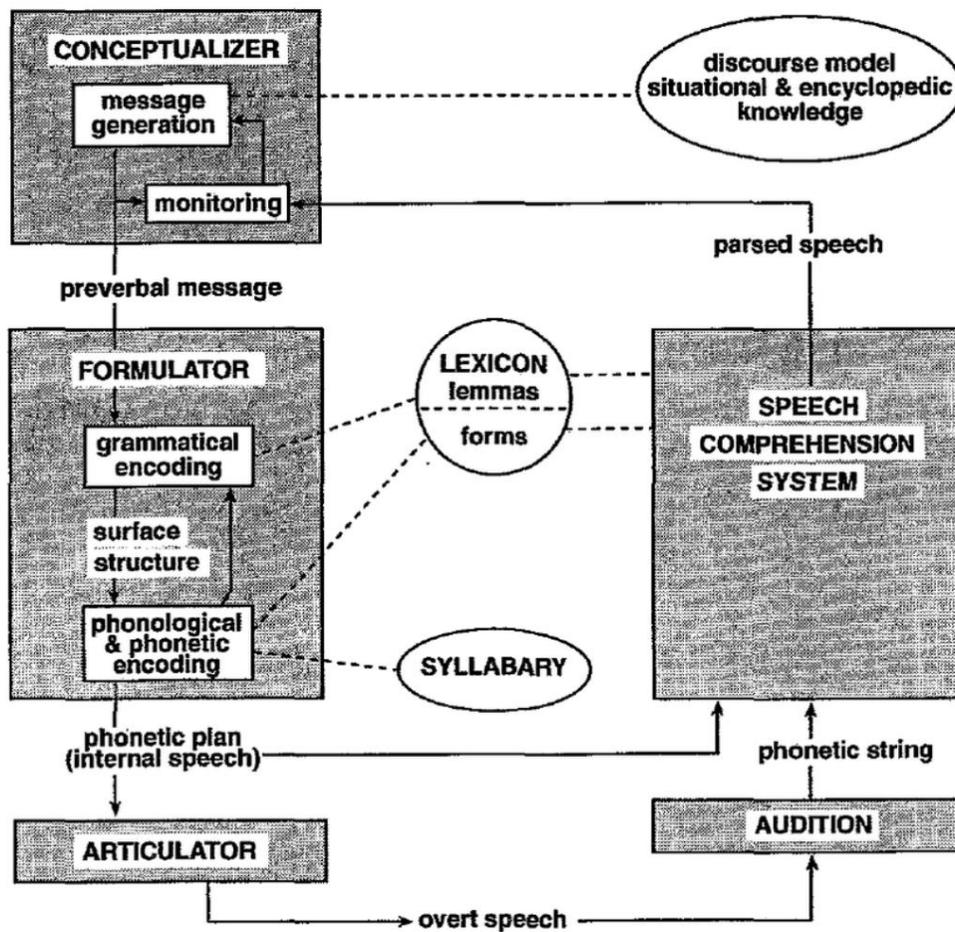


Figure 1: Levelt's model of production (Levelt, 1989)

Levelt's speech production model processes what you hear from the other person, and the Conceptualizer generates an image of the message you want to convey. The image can then be formed into words and sentences with the Formulator, and finally, the message can be spoken through the Articulator. Levelt (1989) mentions that automating this process increases the speed of speech.

## **2.2 Automatization**

Logan (1985) states in a study of skill and automaticity that skill is a term which is usually applied to the performance of a complex task. In language learning, in the context of conversation specifically, skill is the ability to speak with correct pronunciation and grammar, and this can be described as accuracy. On the other hand, automaticity is in contrast with skill, and refers to rather specific properties of performance. Gatbonton and Segalowitz (1988) state that automaticity is a component of fluency. Even if a learner has a high level of fluency in thinking about what to say to whom and in what situation, it does not necessarily mean that the learner has a high level of fluency in actually speaking the words smoothly and naturally. In order to strengthen these fluency skills, automation is necessary. Gatbonton and Segalowitz (1988) also argue that "automatization" can be thought of in at least two different ways. The first is speed and ease of handling; speakers' ability to respond without needing an inordinate amount of time to formulate an utterance and the ability to understand and produce sentences without undue grouping, hesitations, or pauses. The second is the operation of those mechanisms underlying performance that function quickly, without interference from other ongoing cognitive processes, and that draw relatively little or no attentional resources away from other concurrent processing activities. With this in mind, it is important to consider the question: how do learners

automatize tasks? Logan (1985) states that practice is important in producing automaticity, which suggests that automaticity may be learned while certain types of automatization may not be. Solomons (1899) added that speed increases more or less continuously with practice. LaBerge and Samuels (1974) also focused on the comparison of speed with practice, and showed that practice increases speed more so than does fluency. In this sense, we can say that processes became automatic as a result of a great deal of practice (Schneider & Fisk, 1982; Shiffrin & Schneider, 1977; Gatbonton & Segalowitz, 1988). Many previous studies have shown that learners need practice to acquire fluency and to automatize their speech.

In automating L2 speech, speed-up plays an important role (Yoshimura and MacWhinney, 2007), and speed-up is a core factor of automaticity (MacKay, 1982). Yoshimura and MacWhinney (2007) showed from their read-aloud experimental results that oral practice increases the fluency of Japanese L2 learners, and suggested that more repeated oral practice is needed to increase fluency. Furthermore, they argue for the need of a computer-based system that can enable learners to improve their L2 speech fluency through these oral exercises. With the achievement of technology in recent years, mobile applications that allow learners to practice conversations with AI tutors have been developed around the world. For example, *Andy*- users can practice real-life conversations with a friendly robot. *ELSA- AI Coach* gives you instant feedback to help you improve your English pronunciation. The *Kaizen Languages* app has a Japanese language learning course that provides oral practice with AI tutors.

## CHAPTER 3

### KAIZEN LANGUAGES

#### 3.1 What is *Kaizen Languages*?

Kaizen Languages (Kaizen) is a language learning app launched by AB Languages in 2019 that offers three language learning courses: Japanese, Mexican Spanish, and Castilian Spanish (as of January 13, 2022). The target age is over four years old, and the instruction language in the app is English. As of January 13, the app's Japanese course consists of 61 lessons of conversation practice, 61 lessons of flashcards, and Japanese character practice (hiragana, katakana, 1187 kanji). You can earn "streaks" when completing new lessons (you get new flashcards as you earn more streaks), set daily targets, set daily reminders, etc. You can download the free version from the App Store or Google Play. The free version of the Kaizen app gives you two lessons (or two flashcards) every day. If you subscribe to the premium version, you can take an unlimited number of lessons every day. The best feature of this app is that it allows you to practice conversation with AI tutors. Since there are three types of characters in Japanese: Hiragana (used in native words), Katakana (used in loan words), and kanji (Chinese characters), it takes time to learn to read them. However, Kaizen differs from other language learning applications in that it allows users to skip character practice and start with oral practice. Learners who do not know Japanese characters can start with conversation practice, and utilize the in-app function to also learn and practice Japanese characters. This means that learners can practice their speaking and writing skills at the same time.

## **3.2 Functions of the Kaizen Languages app**

### **3.2.1 Lessons**

Within each lesson, the AI tutors start a conversation, and the learner responds to it (Image 1). The instructions automatically appear at the bottom of the screen and include the lesson's learning objectives, grammar explanations, and explanations of what the learner should say (Image 2). In addition, by swiping right on the instruction, you can see a suggestion function (Image 3). This will show you a model answer when you do not know the answer from the instructions alone, or when you make a mistake in your answer. By tapping on the voice mark, you can listen to the correct pronunciation. Furthermore, when the AI determines that the learner's answer is wrong, it displays a correction message and explains the points where the learner is likely to have made mistakes (Image 4). It is important to note that this correction function is only applicable to the points where learners are thought to frequently make mistakes; it does not give advice on specific mistakes unique to each individual.

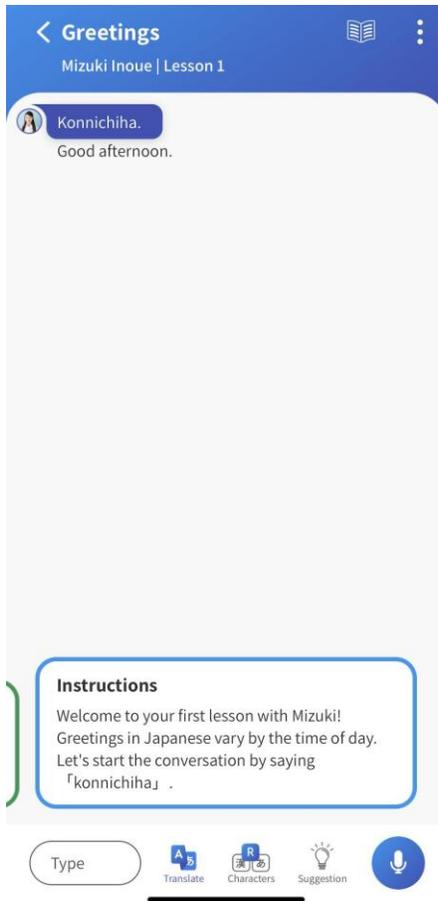


Image 1



Image 2



Image 3



Image 4

Among the 61 lessons, lessons 1 through 12 are practiced with a female voice AI tutor named Mizuki Inoue (a Japanese language teacher), lessons 13 through 19 with a male voice AI tutor named Satoshi Kobayashi (a chef), and lessons 20 through 28 with Miho Shinkawata (an actress). Lessons 1 through 28 are at the Beginner level.

Lessons 29 through 37 are conversational exercises with a female voice AI tutor, Maiko Nishimura, Lessons 38 through 53 with a male voice AI tutor, Takumi Kondo (a tour guide), and Lessons 55 through 61 also with a male voice AI tutor, Shun Yoshida. Lessons 29 through 58 are at the Elementary level. Each lesson has its own title, and all lessons begin with a lesson on self-introduction to get to know the AI tutor. For example, in lesson 13 we are introduced to Satoshi

(image 5) and in lesson 20 we are introduced to Miho (image 6). Lastly, the lessons work in a way so that you can repeatedly practice the same expressions from other lessons.



Image 5

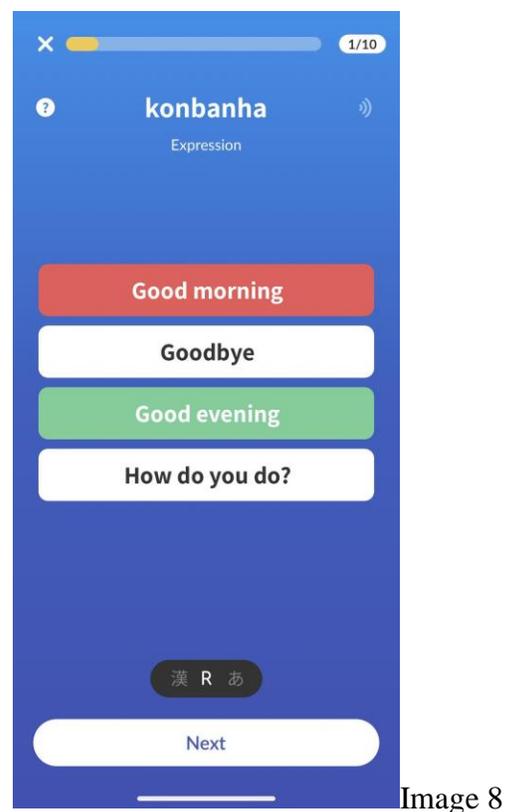
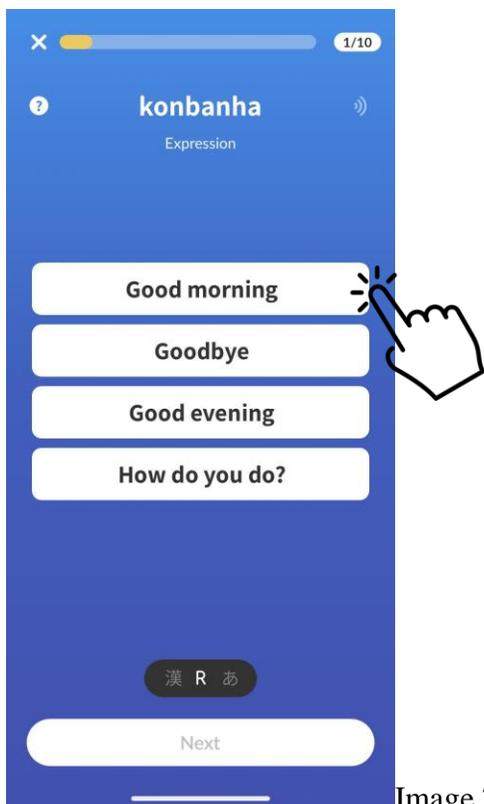


Image 6

### 3.2.2 Flashcards

There are two ways to access the flashcards: (1) you can start by pressing “review” on the screen that appears after each lesson, or (2) you can start by selecting a level from the flashcards at the bottom of the Kaizen home screen. The flashcards in the Review section after each lesson are based on the vocabulary and expressions from the previous lesson, and the flashcards from the home screen allow you to choose which level of flashcards you want to practice. When you

first start, many of the flashcards will be locked, so you will need to unlock them by completing the lessons and earning streaks. Each flashcard has ten questions in total, and you have to choose one correct answer from four options. At the top of the screen, the word in question and its role (auxiliary verb, noun, etc.) are displayed. Each time, the pronunciation of the word is automatically played, and you can listen to the sound as many times as you want by pressing the sound button. If you choose the wrong answer, that answer will be shown in red, and the correct answer will be shown in green (when you tap on the selection you have made, the correct answer is displayed, so you are not able to re-select a different option.) Lastly, the same question may appear more than once.



### 3.2.3 Writing

At the top of the writing section, there is a “How to learn to write” section that explains the three types of Japanese: hiragana, katakana, and kanji. Next, there are hiragana and katakana practice sets 1 through 26 (52 practice sets in total). Each set includes instructions on how to write correctly, writing practice, and reading practice, and there are either 30 or 49 steps per set. Below the hiragana and katakana sets, there are kanji exercises. You can practice kanji for the Japanese Language Proficiency Test (JLPT) from N5 (easiest test) to N1 (hardest test), and there are 2193 kanji in total. Each set has a “Study” function (kanji readings, vocabulary, and example sentences), a “Quiz” function (choose the correct kanji from four choices), and a “Write” function (a quiz on how to write the kanji). Kaizen provides the writing section, but the main practice on this app is conversation practice with AI tutors. When you open this app, the home screen shows the “Lessons” section which is oral practice.

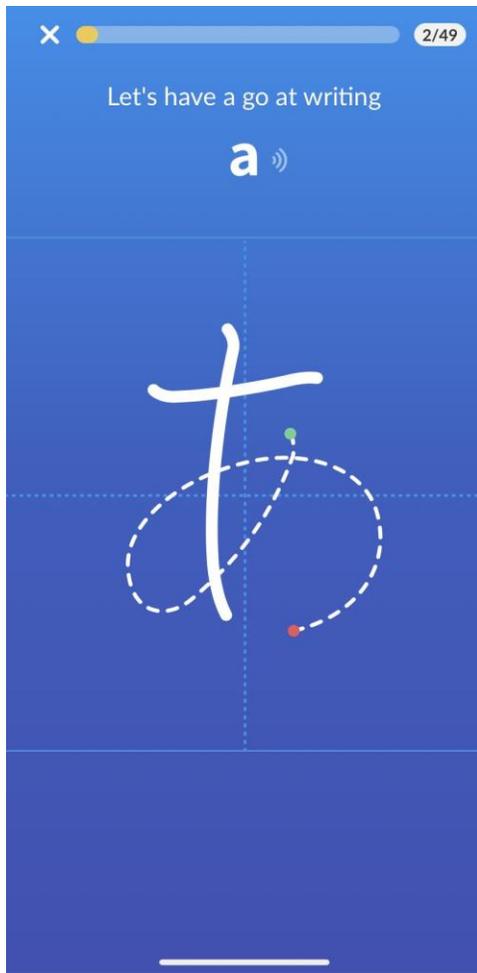


Image 9

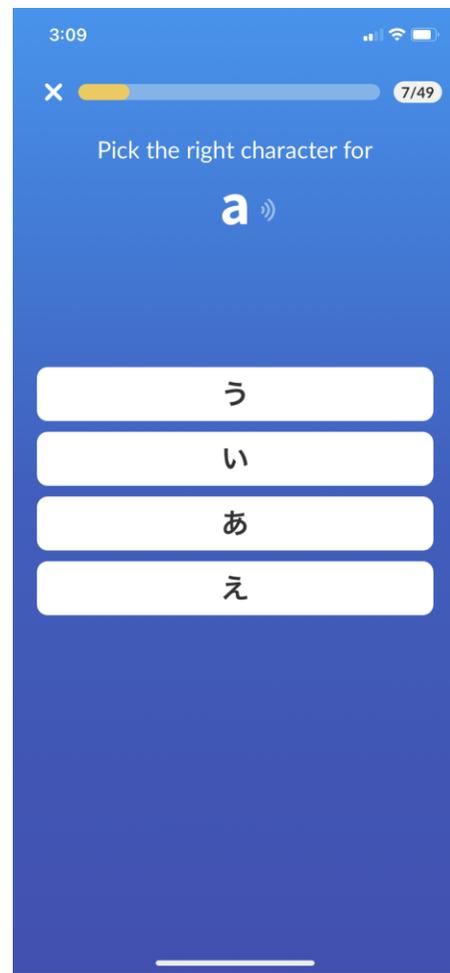


Image 10

### 3.2.4 Progress

Within the app, there are functions that help to support the user's learning. They are: "Streaks," "Set a daily target," and "Current daily reminder." You can set the "Set daily target" and the "Current daily reminder" by yourself. These features are useful for learners who have many apps on their phones. With so many hours a day spent on their smartphones and so many attractive temptations such as social networking, video streaming services, and so on, learners need to keep themselves motivated and in control of their own learning. Apps also need to be designed to encourage learners to spend as much time as possible of the time they spend using their smartphones on apps and to encourage them to learn.

Kaizen provides the writing section, flashcard practice, and progress function to help learning in Japanese. Compared to other language learning apps, the unique feature of Kaizen is that the main practice on this app is conversation practice with AI tutors. When you open this app, the home screen shows the “Lessons” section which is oral practice. Learners can start to study Japanese without knowledge of Japanese writing.



Image 11

## CHAPTER 4

### LITERATURE REVIEW

#### 4.1 Precious studies of smartphone usage time

According to research data from the Pew Research Center in April 2021, there are 89% of college students who have smartphones in the U.S, but how many hours do they use their phones each day? Roberts, Yaya, and Manolis (2014), in their research conducted to 242 college students, shows that female students spent 600 minutes (10 hours) and male students did 459 minutes (7.65 hours) a day on average. Penglee, Christiana, Battista, and Rosenberg (2019) investigated the time of smartphone use among U.S. college students, and they averaged 2.75 hours each day. Although there are differences in usage time depending on the research year and places where the study was conducted, if you look at other countries' research, Atas's and Çelik's study of 55 Malaysian college students found that 45.5% (25 students) used 3-6 hours, 27.3% (15 students) used 7-10 hours, and 11-15 hours was 10% (6 persons). In a study by Penglee, Christiana, Battista, and Rosenberg (2019), Thai university students averaged 3.4 hours per day. At the University of Massachusetts Amherst, which many of the participants were recruited for the current study, Yoshimura and Shiomi (2016) reported that out of 126 Japanese language learners, 56 students (45.2%) spent 1-3 hours per day, 36 students (29%) spent 4-7 hours, and 26 students (21 %) spent 8 hours or more per day. These results indicate that regardless of region or country, university students spend some hours at least using their smartphones every day.

Here is another question: what do college students use their smartphones for? According to the study by Fook, Narasuman, Aziz, Mustafa, and Han (2021), there are common usage

purposes of their smartphone: internet (98.2%), social media (90.9%), and applications (90.9%) in Malaysia. Another study by Penglee, Christiana, Battista, and Rosenberg (2019) also found that American college students use their smartphones for Communication (99.2%), Entertainment (98.4%), and Social Media (96.7%).

Fook, Narasuman, Aziz, Mustafa, and Han (2021) published data on how much time Malaysian college students use smartphones for studying. 24 students (43.6%) reported using their phones for 25 % of their daily usage time to study, 16 students (29.1%) used their phones for 50% of their daily usage time, and 6 students (10.9%) used their phones for 10-20% of their daily usage time. For many college students, smartphones are not only a tool for entertainment, but also for learning. This trend is likely to be common to U.S. college students, as college students around the world spend roughly the same amount of time using their smartphones.

Compared to textbooks and laptops, a small and lightweight smartphone is a big advantage in that you can carry it anywhere and anytime, and you can easily open the Internet or an application to study at your own convenience. In addition, when studying in a classroom with other learners, it is difficult to stop and review what you do not understand. On the other hand, app-based learning allows you to control your own learning. This kind of control over your own learning and keeping yourself motivated is called learning autonomy.

Yoshimura and Kobayashi (2018) mention that there are three elements to promote learning autonomy: (1) providing resources, (2) learning records, and (3) appropriate advising. The study also shows that blended learning (more online-like) is better helping learners develop learning autonomy than face-to-face tutoring methods. App-based learning is strongly associated with the development of learning autonomy because resources are provided and learning records

of how far learners have achieved are usually recorded automatically. App learning can be an important tool not only for immediate goals, but also for longer-term goals such as lifelong learning.

## **4.2 App-based learning and learning autonomy**

Many language learning applications have features and innovations that help learners to stay motivated and encourage learning autonomy. Duolingo, for example, uses a game-like approach to language learning and a device to form a habit of language learning with game-like features, as Duolingo official website claims. The following section looks at a previous study of language learning and motivation using one of the famous language learning apps called *Busuu*.

Busuu is a language learning app that has 100 million registered users (Business of Apps, 2022) and allows users to learn 12 languages including Japanese. It is available for both Android and iOS phones. This app allows users to practice reading, writing, and listening, as well as vocabulary practice and translation practice. Fernando (2018) surveyed 4095 Buss users and asked them 30 questions. The main research questions of the study were: (1) Who uses Busuu app? (2) What features do they like the most/ least? (3) Does the app meet the users' expectations? (4) What patterns of usage of the Busuu app can be identified from respondents? The aim of this study was not to look at the results of the learning that was forced to practice by researchers or teachers, but to look at the realistic pictures of autonomy users. The results of (1) question showed that English language learners were the largest group with 1585 users (40.5%) and French language learners were the second largest group with 531 users (13.6%). Japanese language learners came in fifth with 281 users (7.2%). The most common reason for learning

languages with Busuu is “personal interest” (29%), followed by “I want to use the language when I travel” (17.1%), “relevant to my career aspiration or profession” (16.1%), “I want to study/ liv overseas” (15.2%), “I want to use the language to communicate with family/ friends” (11.2%), “relevant to my current studies” (7.1%).

In response to Question (2), the top 3 most-liked features were vocabulary practice (20.3%), listening practice (16.6%), and grammar practice (15.1%), while the top 3 least-liked features were writing practice (14.8%), grammar practice (14.2%), and correcting other members’ writing (12.0%). Interestingly, grammar practice is ranked in both Top 3, but the other items indicate that learners are more interested in vocabulary practice and listening, and less interested in learning to write.

The response to Question (3) is most remarkable. The most common expectation of learners when they downloaded the app was to improve their speaking skills (15.6%). This was followed by listening skills (13.6%), reading skills (11.5%), and writing skills (11.1%). The findings in response to Question (2) and Question (3) indicate that many learners expect Busuu to be a communication tool for language learning.

Finally, in response to Question (4), the survey asked about the frequency and length of time users had devoted in learning the language, and categorized them into six groups below.

1. Consistent users: those who have been using the app for more than one month, and use it every day (or more frequently) (n = 415).
2. Enthusiasts: they use the app frequently (at least once every day), but have been using the app for less than one month (n = 679).

3. Committed users: they use the app several times per week and have used the app for a period of more than 7 months (n = 830).
4. Casual users: they have been using the app between once and six months and use it several times a week or fewer (n = 981).
5. Probing users: those who have been using the app for less than a month but have used it several times a week (n = 449).
6. Visitors: they use the app infrequently (once a week or less) and have been using the app for less than one month (n = 539).

Casual users in Group four were the most numerous, followed by Committed users in Group three. On the other hand, the number of visitors in Group six is not small, so language learning apps need to boost the motivation and learning autonomy of these visitors so that they will continue learning. To achieve this, a learning app needs to be a tool that enables learners to learn what they want to learn. This Busuu study demonstrates the majority of learners want to improve their speaking skills.

The Busuu app does not offer speaking practice, but looking at its counterparts around the world, “Liulishuo” which literally means “speak fluently,” a well-known English learning app in China, offers conversational practice.

#### **4.3 Previous studies of oral fluency by applying digital game-based mobile application**

Although there are not many apps to provide oral practice yet, the development of language learning apps is very active in China. In the GSV’s Global Of the EdTech 50 in 2020,

there are 16 apps from China-based companies, following 17 from the U.S. “Liulishuo” is one of the most well-known oral practice apps in the highly competitive Chinese English learning app market. The app won the Apple App Store’s “Best Apps 2013” award and the number of registered users reached 80 million in 2018.

Wang and Han (2021) investigated the effectiveness of the English learning app “Liulishuo” on the basis of complexity, accuracy, and fluency of English learners’ oral production. The subjects of the study were 30 college sophomores in China. They started learning English in the third grade and have been learning English for roughly 10 years. They are majoring in English education for children and have a basic knowledge of English. The participants played the “Imitation of English Monologues” game in the Liulishuo app twice a week for 30 minutes each time for 20 weeks. Using this game, learners practiced monotonous oral English. The Liulishuo app has cutting-edge speech recognition and it gives learners scores immediately in terms of (1) pronunciation, (2) stress, (3) intonation, (4) grammatical, (5) appropriateness of pragmatics, (6) coherence, and (7) fluency.

The participants were tested twice —before and after this study— to measure their oral progress. The test consisted of showing the subjects six pictures and having them talk about them in English; they measured oral production as a monologue, not conversation. In this experiment, they focused on the speech rate and the mean length of pauses to measure fluency. The speech rate was calculated by dividing the total number of words by the speech length (in minutes), while the mean length of pauses was calculated by averaging the length of all the pauses in a speech.

The researchers asserted that the longer the mean length of pauses, the less fluent the speech. In other words, The higher the speech rate, the more fluent the speech. In the pre-test, the

speech rate was 45.99 words per minute with a standard deviation of 14.37. In the post-test, the fluency was greatly improved to a mean of 60.84 words per minute with a standard deviation of 15.40. On the other hand, the mean length of pauses for the pre-test was 3.09 minutes with a standard deviation of 14.37. This was not too different from the mean length of pauses for the post-test which was 3.73 with a standard deviation of 2.09. From these results, Wang and Han (2021) argued that dramatic improvement of speech rate indicated that “learners were able to narrate the same story in English faster after 20 weeks using the “Liulishuo” mobile application.” On the other hand, no significant change in the mean length of pauses indicated that their “participants still used much cognitive effort in English oral production.” In other words, their speech has not been automatized yet.

In this research, participants practiced English using “Liulishuo” twice a week and researchers concluded that learners’ oral fluency has improved but it has not been automatized yet. How can we help learners increase their fluency level and further automate their L2 speech? This study does not address the discussion of how to make the L2 speech automatic, but as de Bot (1996) points out, second language learners’ continuous comprehension leads to the automaticity of their linguistic knowledge, which suggests that there is a need for more practice. Focusing on the number of practices, how many repetitions of the same speech production will increase learners’ fluency and further automate their speech production?

#### **4.4 Previous studies on the frequency of practice to automatize L2 speech**

Yoshimura and MacWhinney (2007) studied the effects of repeated speech practice on fluency in sentences containing novel words. The study was conducted among 30 participants in

an intermediate Japanese class at Carnegie Mellon University. The researchers showed the participants four sentences, each consisting of 25 to 31 syllables. Each of the sentences contained zero to three words that were new to the participants. In other words, the participants were given new words that the participants had not learned in their textbooks or during the Japanese language classes. Participants were asked to perform three tasks: listening, reading out loud, and retrieving the sentences based on the memory. First, participants listened to the target sentence three times, then read the sentence out aloud six times, while the target sentences were displayed. Then, after 1,000 seconds, they were asked to repeat the sentence without looking at the target sentence. The results of the experiment demonstrated that out of the six repetitions, the reduction in lower case time for cycle 2 to 3 and cycle 4 to 5 was notably less than for cycle 1 to 2, cycle 3 to 4, and cycle 5 to 6. Also, the results confirmed that repetitive practice is necessary to achieve better L2 oral fluency. Such a result also aligns with outcomes of some earlier studies, such as Logan (1985), whose studies mentioned that repetitive practice is important in producing automaticity.

#### **4.5 Significance of This Study**

The number of oral fluency studies using mobile learning apps has increased in recent years, and many studies have demonstrated that learning with apps improved learners' fluency, especially speech rate, arguing for the effectiveness of learning with apps. Researchers have also shown that practice is essential for fluency improvement. However, there are not many studies that mention the effective usage of mobile app learning in terms of the duration and frequency of the study. Additionally, while there are many studies on English learning apps, there are much

fewer studies on Japanese learning apps. If we focus on conversational fluency in Japanese, the number becomes even smaller. This study investigated *Kaizen Languages*, an app that allows students to focus on conversational practice, in order to examine the effectiveness of the app in improving fluency, and to analyze when fluency levels improve during repetition, focusing on the frequency of learning. The results of this research will be helpful to the development of more effective app features as well as add to the knowledge of how to use language learning apps effectively. This paper has explored the effective frequency of use of the mobile learning app to figure out the points by dividing the participants into a group that practices daily and a group that practices three times a week (with the same total learning time per week).

#### **4.6 Research questions**

This study examines the relationship between frequency and fluency in app-based learning. *Kaizen Languages* app, which allows learners to practice oral conversation with AI tutors, is the best to see the relationship in terms of L2 oral conversation. The research questions for this study are as follows:

1. How does the frequency of app use and practice performance enhance fluency and accuracy in oral speech?
2. When do learners start improving their fluency? How many repetitions enhance fluency?
3. Which learning cycle is more effective to improve oral fluency?

## CHAPTER 5

### METHODS AND PARTICIPANTS

#### 5.1 Research participants

There were 10 participants, all of whom were adults over the age of 18 and their first language was English. All of them had never studied Japanese before. The Institutional Review Board at the University of Massachusetts Amherst approved this research and advertisement to the public. The study was advertised only in the United States. The participants were introduced to the study either by their friends who had studied Japanese or by seeing the flyer and becoming interested in the study. They had no experience in learning Japanese, but according to the screening questionnaire, they had been interested in Japan through anime and Japan-related YouTube videos. The study period was from December 2021 to March 2022, and the learners were asked to use the Kaizen app to learn Japanese for three weeks.

#### 5.2 Research design

Participants studied Kaizen lessons 1 through 19 as well as the corresponding flashcards for three weeks. In order to observe the growth of speaking skills only through speaking practice, the writing section was not used in this study. The participants chose one of two groups and practiced according to their assigned lesson schedule. Group 1 had five lessons at a time, seven times a week. Group 2 had 11 lessons three times a week. In this study, five participants chose Group 1 and five chose Group 2. The total time to practice in a week was expected to be 70 to 75 minutes for both Group 1 and 2, and the time was set to be roughly equal. The lesson schedule for each group was as follows:

Table 1: List of learning cycles for Group 1 and Group 2

| Group 1      |                       | Group 2      |                                |
|--------------|-----------------------|--------------|--------------------------------|
| Week 1 Day 1 | Lesson 1,2,3,4,5      | Week1 Day 1  | Lesson 1,2,3,4,5,6,7,8,9,10,11 |
| Week 1 Day 2 | Lesson 1,2,3,4,5      |              |                                |
| Week 1 Day 3 | Lesson 1,2,3,4,5      | Week 1 Day 2 | Lesson 1,2,3,4,5,6,7,8,9,10,11 |
| Week 1 Day 4 | Lesson 1,2,3,4,5      |              |                                |
| Week 1 Day 5 | Lesson 1,2,3,4,5      |              |                                |
| Week 1 Day 6 | Lesson 6,7,8,9,10     | Week 1 Day 2 | Lesson 1,2,3,4,5,6,7,8,9,10,11 |
| Week 1 Day 7 | Lesson 6,7,8,9,10     |              |                                |
| Week 2 Day 1 | Lesson 6,7,8,9,10     | Week 2 Day 1 | Lesson 1,2,3,4,5,6,7,8,9,10,11 |
| Week 2 Day 2 | Lesson 6,7,8,9,10     |              |                                |
| Week 2 Day 3 | Lesson 6,7,8,9,10     | Week 2 Day 2 | Lesson 1,2,3,4,5,6,7,8,9,10,11 |
| Week 2 Day 4 | Lesson 11,12,13,14,15 |              |                                |
| Week 2 Day 5 | Lesson 11,12,13,14,15 |              |                                |
| Week 2 Day 6 | Lesson 11,12,13,14,15 | Week 2 Day 3 | Lesson 12,13,14,15,16,17,18,19 |
| Week 2 Day 7 | Lesson 11,12,13,14,15 |              |                                |
| Week 3 Day 1 | Lesson 11,12,13,14,15 | Week 3 Day 1 | Lesson 12,13,14,15,16,17,18,19 |
| Week 3 Day 2 | Lesson 16,17,18,19    |              |                                |
| Week 3 Day 3 | Lesson 16,17,18,19    | Week 3 Day 2 | Lesson 12,13,14,15,16,17,18,19 |

|              |                    |              |                                |
|--------------|--------------------|--------------|--------------------------------|
| Week 3 Day 4 | Lesson 16,17,18,19 |              |                                |
| Week 3 Day 5 | Lesson 16,17,18,19 | Week 3 Day 3 | Lesson 12,13,14,15,16,17,18,19 |
| Week 3 Day 6 | Lesson 16,17,18,19 |              |                                |
| Week 3 Day 7 |                    | Week 3 Day 4 | Lesson 12,13,14,15,16,17,18,19 |

**5.3 Data collection procedures**

All the participants attended the Kaizen orientation and were given instructions on how to use and set up Kaizen in order to avoid differences in results due to differences in participant settings. For example, whether to display AI tutors in Japanese in romaji or hiragana, and whether to add a translation function or not. After filling out a screening questionnaire and signing a consent form the participants started a three-week study using the Premium Version of Kaizen. The researcher provided the learners with lesson plans and supported the participants with weekly check-in emails as well as a check-in meeting via Zoom during the second week.

After three weeks, the participants took an achievement test. This test was a speaking test to see if the learners could apply the expressions they learned in the Kaizen app to other everyday situations. This test was conducted with the goal of answering research question 1. The current study sees fluency and accuracy in oral speech in both learning context and new context. Researchers prepared four different situations based on the assumption that the participants went to Japan as international students: 1) first greeting with the host family at the airport, 2) first self-introduction at the Japanese school, 3) introduction of one’s family to the host family at dinner, and 4) conversation with your host mother about your daily plans. Part 1 is based on Kaizen lessons 1, 2, 3, 5, 6, 9, and 13 as well as part 2. Part 3 consists of lessons 4, 8, 9, and 11. Part 4 is

composed of lessons 7, 15, 18, and 19. The following Table 2 shows the titles of each lesson and expressions that the speaking test had.

Table 2: List of lessons that have vocabulary and expression used in the oral test

|          |           | Lesson title                 | Vocabulary and expressions used in the test                                                                                                                          |
|----------|-----------|------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Part 1&2 | Lesson 1  | Basic greeting               | わたしは__です。(I am __.)                                                                                                                                                  |
|          | Lesson 2  | Introduce yourself           | わたしは__です。(I am __.)                                                                                                                                                  |
|          | Lesson 3  | Asking questions             | はじめまして。(How do you do?)<br>お名前は何ですか。(What is your name?)<br>わたしは__です。(I am __.)<br>よろしくお願ひします。(Nice to meet you.)                                                    |
|          | Lesson 5  | Talk about where you're from | __は__の出身ですか。(Is he from the U.K.?)<br>__は__の出身です。(He is from the U.S.)<br>__は__人ですか。(Is he Japanese?)<br>__は__人です。(He is American.)                                  |
|          | Lesson 6  | Confirming and rejecting     | __は__人ですか。(Is she Brazilian?)<br>__は__人です。(She is Japanese.)                                                                                                         |
|          | Lesson 9  | Expression on professions    | お名前は何ですか。(What is your name?)<br>わたしは__です。(I am __.)<br>__は__の学生ですか。(Is he a _'s student.)<br>わたしは__の学生です。(I am _'s student.)                                        |
|          | Lesson 13 | Learn about Satoshi          | はじめまして。(how do you do?)<br>よろしくおねがひします。(Nice to meet you.)<br>__さんは学生ですか。(Are you a student?)<br>わたしは学生です。(I am a student.)<br>__さんはイギリスの出身ですか。(Is _ from the U.K.?) |

|        |           |                             |                                                                                                             |
|--------|-----------|-----------------------------|-------------------------------------------------------------------------------------------------------------|
|        |           |                             | わたしは__の出身です。(I am from __.)                                                                                 |
| Part 3 | Lesson 4  | Tell someone what you do    | __さんは日本語の学生ですか。(Is __ a Japanese student?)<br>__さんは日本語の先生です。( __ is a Japanese teacher.)                    |
|        | Lesson 8  | Talking about family        | __のお父さんは__ですか。(Is your father __?)<br>わたしの父は__です。(My father is __.)                                         |
|        | Lesson 9  | Expression on professions   | __のお姉さんは日本語の学生ですか。(Is your sister a Japanese student?)<br>わたしの姉は日本語の先生です。(My sister is a Japanese teacher.) |
|        | Lesson 11 | Talking about ages          | __のお父さんは何歳ですか。(How old is your father?)<br>__歳です。( __ years old.)                                           |
| Part 4 | Lesson 7  | Asking and telling the time | __時です。(It's _ o'clock.)                                                                                     |
|        | Lesson 15 | Habits and routines         | 何時に起きますか/帰りますか/ねますか。(What time do you get up/?come home/?go to bed?)                                        |
|        | Lesson 18 | Japanese etiquette          | コンサートに行きます。(I go to a concert.)                                                                             |
|        | Lesson 19 | Invitation                  | 週末はたいてい何をしますか。(What do you usually do on weekends?)                                                         |

Almost all the conversational expressions and vocabulary are from Kaizen lessons from 1 to 19. However, some expressions are not from the “Suggestion” section, or are combined with expressions from different lessons to see if learners can apply their oral speech learned in the Kaizen app into new contexts. In part 2, participants had a presentation style test in which there is not the same style practice in Kaizen. This content is also what UMass does in its beginner

level classes, and the questions were designed to see how well learners who have studied at Kaizen can do what a general beginner level Japanese class can do.

After they take the oral test, AB Languages provides participants' learning log data in Kaizen. All participants have agreed to a Consent Form and signed their signatures on the form to permit for AB Languages to share the learning data with the researchers of current study. The data log from AB Languages has following data: (1) Time started: time when a student has started a lesson, (2) Time ended: time when a student has finished a lesson, (3) Duration: how many seconds a student spends in a lesson, (4) User Locale (Region), (5) Activity: for example, Chat Lesson, (6) Level/ Tutor: for instance, Mizuki or Satoshi, (7) Set/ Lesson, (8) User message count, (9) Correction count, (10) Suggestion count, (11) Swiped to "Suggestion" count (12) Listened to "Suggestion" audio at normal speed count, (13) Listened to "Suggestions" audio at slow speed count, (14) Tapped on "Grammar Notes" count, (15) Character set in use ("romaji" "hiragana" "mixed"), (16) Number of items (Writing/Flashcards only). Based on the learning data provided by AB languages, the number of practice, oral fluency and accuracy were measured based on learning data log provided by AB languages. The learner's oral speech recording in the test was measured by using the Audacity 3.1.3, which is a free and open-source digital audio editor and recording application software.

## CHAPTER 6

### RESULTS AND ANALYSIS

#### 6.1 Practice Frequency and Practice Fluency

This study had two practice groups: Group 1 which practiced five lessons each day for seven days per week, and Group 2 which practiced eleven lessons each day for three times a week. Students 1, 3, 5, 9, and 10 chose Group 1. Students 2, 4, 6, 7, and 8 selected Group 2. Learners were instructed to follow the learning cycles prepared by the researcher and to practice conversation in Kaizen for three weeks. Learners were asked to complete lessons 1 through 19 five times each, for a total of 95 times. According to their Kaizen learning logs; however, there is a notable difference among students in the number of practice sessions completed. The following chart (Table 3) illustrates the number of times all of the participants — from student 1 (S1) to student 10 (S10) — practiced each lesson — from lesson 1 (L1) to lesson 19 (L19) — as well as the total sessions they completed.

Table 3: Practice Frequency

| Students (S)<br>Lesson (L) | S1        | S2         | S3        | S4        | S5        | S6 <sup>1</sup> | S7        | S8        | S9        | S10       |
|----------------------------|-----------|------------|-----------|-----------|-----------|-----------------|-----------|-----------|-----------|-----------|
| <b>total</b>               | <b>76</b> | <b>108</b> | <b>34</b> | <b>30</b> | <b>38</b> | <b>106</b>      | <b>68</b> | <b>18</b> | <b>71</b> | <b>37</b> |
| L1                         | 9         | 6          | 3         | 1         | 6         | 6               | 8         | 1         | 7         | 4         |
| L2                         | 9         | 6          | 2         | 1         | 4         | 6               | 5         | 1         | 4         | 4         |
| L3                         | 5         | 6          | 2         | 1         | 3         | 6               | 5         | 1         | 11        | 3         |
| L4                         | 6         | 6          | 2         | 1         | 4         | 6               | 4         | 1         | 7         | 4         |
| L5                         | 6         | 6          | 2         | 2         | 3         | 6               | 4         | 1         | 7         | 3         |
| L6                         | 5         | 6          | 3         | 2         | 4         | 6               | 3         | 1         | 4         | 2         |
| L7                         | 5         | 6          | 2         | 1         | 1         | 6               | 3         | 1         | 4         | 3         |
| L8                         | 4         | 5          | 2         | 2         | 1         | 6               | 3         | 1         | 2         | 2         |
| L9                         | 4         | 5          | 2         | 1         | 1         | 6               | 3         | 1         | 3         | 2         |

<sup>1</sup>According to the data provided by Kaizen, S6 was recorded as practicing four times for lessons 1 through 4, three times each for lessons 5 through 10, and twice for lesson 11. However, due to the overlap between S6's study period and the time of Kaizen's system update, there were no records of practice from January 7 to January 19, when S6 had begun practicing. The researcher asked S6 how many times he practiced lessons 1 through 11, and after confirming that he had enough strike points when he practiced more, this study assumed that S6 practiced lessons 1 through 11 five times each.

|     |   |   |   |   |   |   |   |   |   |   |
|-----|---|---|---|---|---|---|---|---|---|---|
| L10 | 5 | 5 | 2 | 2 | 1 | 6 | 3 | 0 | 1 | 3 |
| L11 | 2 | 5 | 1 | 2 | 1 | 6 | 4 | 1 | 4 | 2 |
| L12 | 1 | 6 | 1 | 1 | 1 | 6 | 4 | 1 | 5 | 2 |
| L13 | 1 | 6 | 2 | 2 | 1 | 5 | 3 | 1 | 2 | 1 |
| L14 | 1 | 6 | 2 | 2 | 1 | 5 | 2 | 1 | 2 | 1 |
| L15 | 0 | 6 | 2 | 1 | 1 | 5 | 3 | 1 | 2 | 1 |
| L16 | 2 | 6 | 1 | 2 | 1 | 5 | 3 | 1 | 0 | 0 |
| L17 | 4 | 5 | 1 | 2 | 1 | 4 | 4 | 1 | 2 | 0 |
| L18 | 4 | 6 | 1 | 2 | 1 | 5 | 2 | 1 | 2 | 0 |
| L19 | 3 | 5 | 1 | 2 | 2 | 5 | 2 | 1 | 2 | 0 |

As shown in Table 3, two participants (S2 and S6) practiced each lesson at least five times, and one participant (S1) practiced lessons 1 through 10 at least four times each. On the other hand, some learners only practiced each lesson a couple of times.

This study examined the relationship between the participants' total number of practice and the variance in time spent on each practice. By comparing these two sets of data, it is possible to see whether repeated oral practice in Kaizen decreases the time spent for a lesson. A

decreased time of practice means the improvement of learners' fluency levels. Since there are lessons that several participants did not complete, and the length of time spent and the difficulty level of each lesson differs, it is necessary to normalize the data for proper analysis. The researcher, a native Japanese speaker, performed lessons 1 through 19 twice, at a natural speed of spoken Japanese that was also close to the spoken speed used in Kaizen by the AI tutors. In this chapter, the average from the two-time performance by the native Japanese speaker was used as the "standard response time." The most recent practice session is not necessarily the best performance-wise, because factors such as the distraction level of the participant have an influence on the results. In this study, a learners' practice that took the least amount of time for each lesson was taken as their best performance. After finding the best attempt for each lesson, this study calculated the excess time for each lesson, compared to the standard response time. Then, the average of the excess time for the completed lessons was calculated. For example, for those who only practiced 18 lessons out of the 19 lessons, the average of the excess rate for each of the 18 lessons was noted in Table 4 below. This chapter has compared the participants' best performance for each lesson with the standard response time of each lesson time as 1. If a participant's time took longer than the standard time, it exceeded 1. For example, when a participant's time takes twice as long as the standard response time in a certain lesson, such time is described as 2. When a participant's time takes three times longer, such time is described as 3. This study named the exceedance rates for each participant as "Practice Fluency." See Table 4 below for a list of each participant's practice fluency.

Table 4: Practice Fluency

| Standard Response Time | S1   | S2   | S3   | S4   | S5   | S6   | S7   | S8   | S9   | S10  |
|------------------------|------|------|------|------|------|------|------|------|------|------|
| 1                      | 1.71 | 1.15 | 2.80 | 3.33 | 3.34 | 2.10 | 1.64 | 4.31 | 4.05 | 1.77 |

S2 has an excess rate of 1.15 and speaks Japanese almost as fluently as native speakers. S1, S7, and S10 have an excess rate of just less than 2, indicating that they can speak Japanese within twice the time of native speakers. Figure 2 below shows Table 3 and Table 4 as a single graph.

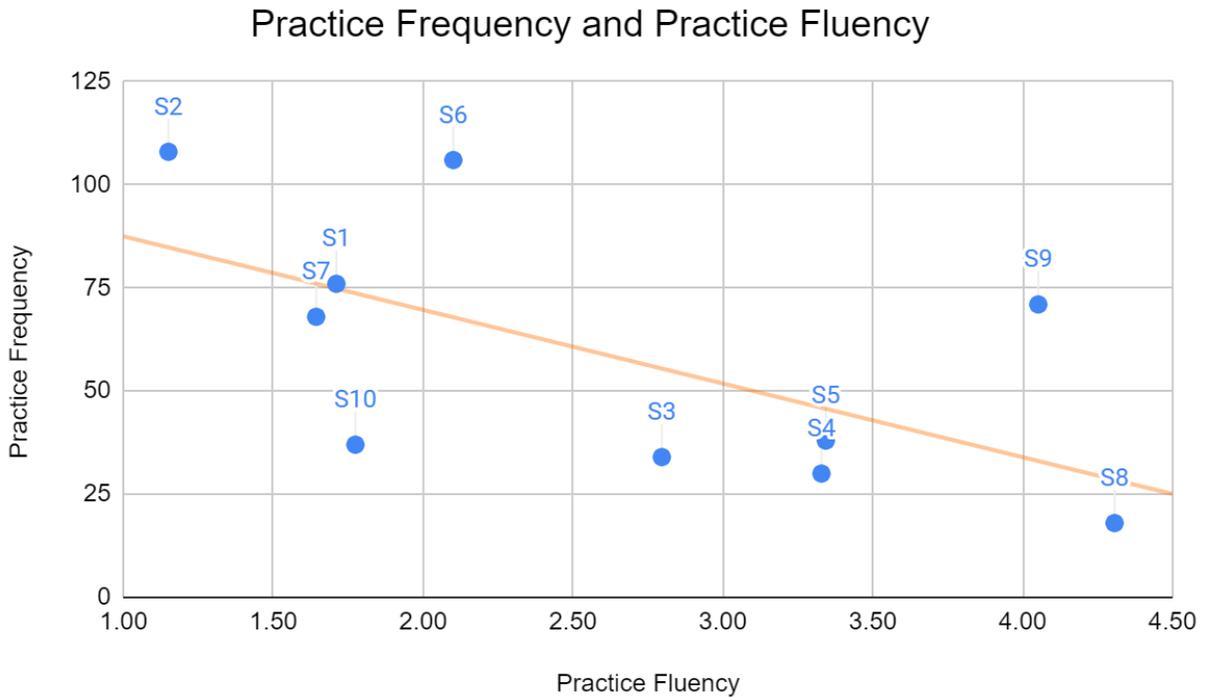


Figure 2: Practice Frequency and Practice Fluency

Looking at the practice fluency on the x-axis, smaller values indicate higher fluency in practice; S2 and S6 are students who have done each lesson at least five times, and S1 is also a student who has done lessons 1 through 9 for at least five times. These students had the shortest best time for each lesson, which means that they were able to speak Japanese fluently in Kaizen practice. It is also evident that most of the students who completed a larger number of practice sessions were able to speak Japanese fluently in Kaizen.

As Figure 2 shows, the more frequent students practice, the higher their fluency, as recorded in Kaizen. This may be true; however, an important question to consider is: Do students who practice more often show higher fluency not only in Kaizen practice, but on the test as well?

## **6.2 Practice Frequency and Test Fluency**

Participants took a conversation test after three weeks of Kaizen learning. The test examined conversational fluency in four situations within the setting of visiting Japan as an international student. This conversation test is different from the conversation practice with AI tutors in Kaizen in that it is a conversation in a realistic situation and with a native Japanese speaker. Most of the Japanese used in the test were taken from what the participants learned in Kaizen.

To determine the participants' fluency, this study referred to Kormos's research in 2006 and Lennon's study in 1999. Kormos used the number of mora per minute to measure L2 oral fluency. However, the current study used the number of mora per second to determine learners' fluency because the speech response time was short. The higher this number, the higher the fluency level. This study used one of the two speech rate measurements by Lennon (1999),

which was unpruned speech rate. The unpruned speech rate contains all self-corrections, asides, etc. in speech rate. This study also contains those self-corrections except for fillers before they produce the first meaningful vocabulary because some people use fillers immediately while others think of what they hear and respond without saying any fillers. Learners took the oral test twice, and the score of mora per second was calculated for the mean of all twenty-three questions in the speaking test. Compared to the first-round score and the second-round score, this study used a better score of mora per second as data for analysis. This study calls the mora per second in the test session as “Test Fluency.” Table 5 shows the score for each section as well as the overall average number of test fluency.

Table 5: Test Fluency

|             | S1          | S2          | S3          | S4          | S5          | S6          | S7          | S8          | S9          | S10         |
|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|
| <b>Mean</b> | <b>5.03</b> | <b>4.49</b> | <b>4.61</b> | <b>3.49</b> | <b>3.80</b> | <b>5.03</b> | <b>2.94</b> | <b>2.44</b> | <b>3.46</b> | <b>3.38</b> |
| Part 1      | 6.69        | 5.98        | 6.86        | 4.64        | 5.10        | 6.26        | 4.67        | 2.78        | 4.40        | 4.01        |
| Part 2      | 5.72        | 5.88        | 5.54        | 3.42        | 5.29        | 7.29        | 4.85        | 1.55        | 3.88        | 4.89        |
| Part 3      | 1.56        | 2.86        | 3.60        | 3.34        | 2.22        | 3.58        | 1.14        | 4.59        | 2.69        | 2.90        |
| Part 4      | 6.16        | 3.27        | 2.42        | 2.57        | 2.59        | 3.01        | 1.09        | 0.86        | 2.86        | 1.72        |

Taking a closer look at the results for each part, in Part 1 — the self-introduction conversation when first meeting the host family at the airport — 90% of the participants were able to speak more than 4 mora per second. In Part 2 — when participants introduced themselves in front of their classmates at their Japanese university — 70% of the participants spoke 4 mora or more per second, and 20% spoke 3 to 4 mora per second. On the other hand, in Part 3, which asked participants to answer questions asked by their host family in a role play, 10% of the participants spoke 4 mora or more, and 30% spoke 3 to 4 mora per second. Finally, in Part 4, which asked questions about participants' daily schedules, 10% of participants spoke more than 4 mora per second, 20% spoke 3 to 4 mora per second, and 40% spoke 2 to 3 mora per second.<sup>2</sup>

In terms of the average number of mora per second across the four parts, 20% of participants had more than 5 mora, 20% had 4 to 5 mora, 40% had 3 to 4 mora, and 20% had less than 3 mora. Figure 3 shows a comparison between the practice fluency (Table 4) and the test fluency (Table 5).

---

<sup>2</sup>Please see Appendix B for a better understanding of all four parts of the achievement test, which have been summarized in the paragraph above.

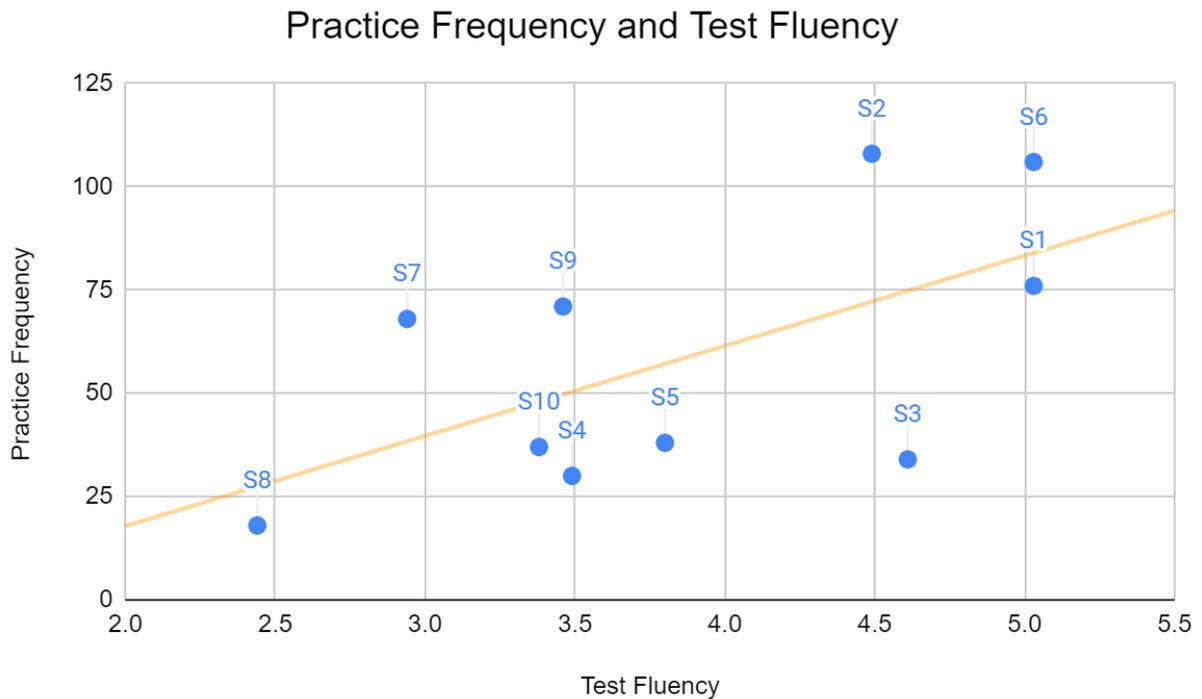


Figure 3: Practice Frequency and Test Fluency

In this graph, points that are located further to the right indicate a higher test fluency. For example, S6, S1, S3, and S2 displayed high fluency in the test. All four of these participants, except for S3, had more practice compared to other students. This indicates that, the more a participant practiced, the higher their test fluency was. As expected, test fluency also tended to be low when the frequency of practice was low. This tendency is similar to the relationship between Practice Frequency and Practice Fluency.

### 6.3 Test Fluency and Practice Fluency

The next section examined whether students who had high fluency in the test were also highly fluent in practice. Figure 4 below combines Table 4 (Practice Fluency) and Table 5 (Test Fluency).

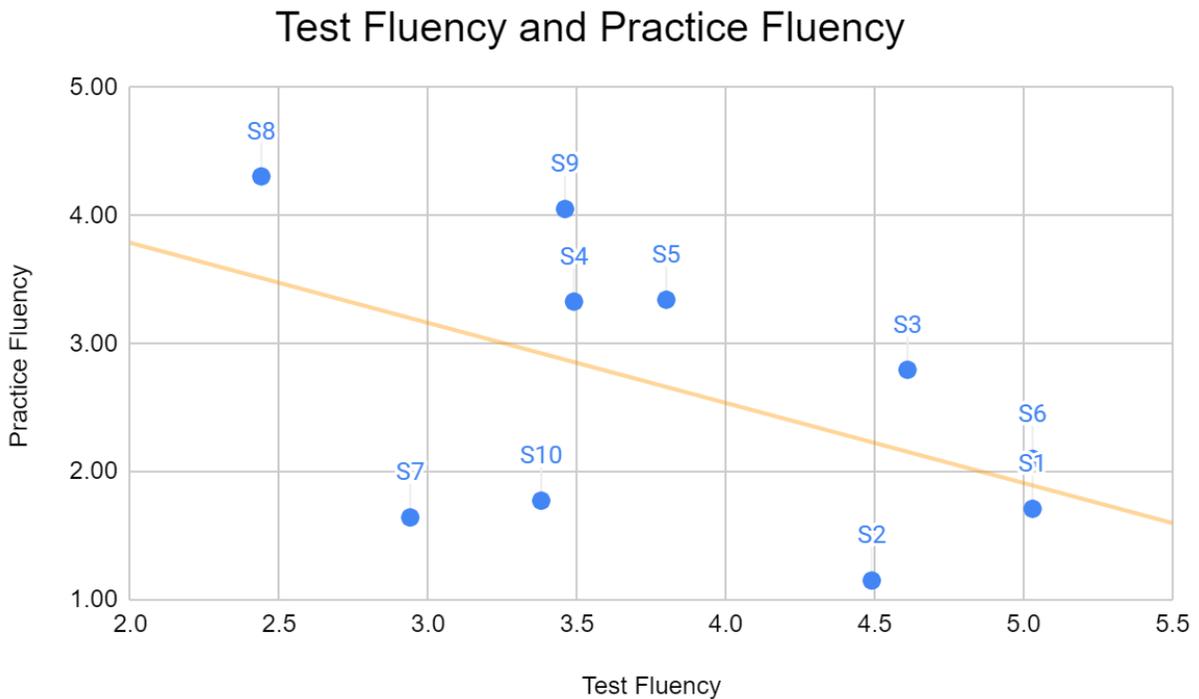


Figure 4: Test Fluency and Practice Fluency

In this graph, the bottom right shows the highest fluency, both in practice and in testing. This result is more spread out because the practice fluency was measured from the duration that students took to start and finish learning each lesson, not the mora per second of their oral productions. However, this data shows a tendency that the more fluent a student speaks in Kaizen practice, the higher the student's fluency in the conversation test.

This study applied one of Lennon's measurements of speech rate: unpruned speech rate. Unpruned speech rate includes all self-correction, asides, and so forth. If a student uses a large quantity of self-correction, the test fluency would be measured to be high. To see if the learners' oral productions included what they learned in Kaizen, this study also investigated accuracy.

#### **6.4 Practice Frequency, Practice Accuracy, and Test Accuracy**

Accuracy is one of the most important factors for smooth communication as well as fluency. This section compares the percentage of correct answers in Kaizen practice with the percentage of correct answers in the test. Figure 5 below shows the comparison of practice accuracy and test accuracy. In order to measure fluency in practice sessions, this study compared the data of User message count in Kaizen data provided from AB Languages to the number of times learners are required to speak to AI tutors. For example, although in lesson 1 learners needed to pronounce the four correct answers to complete the lesson, the Kaizen data from the User message count recorded five pronunciations, which means they made one mistake. The average of the best performance in each lesson was used as the measure of accuracy. For example, if there was a student who practiced seven times in lesson 1, this research took the best score out of the seven times, and averaged the accuracy from lesson 1-19. This study names the score as "practice accuracy."

To measure the accuracy of the oral test, the researcher created a rubric for the test. Mora was used as the basis for scoring, and points were deducted for incorrect answers. Students' responses in the test were compared to the rubric's scoring criteria to determine a score of each

question. The mean of total scores is called “test accuracy” in this study. Figure 5 below shows comparisons between the practice accuracy, test accuracy, and practice frequency.

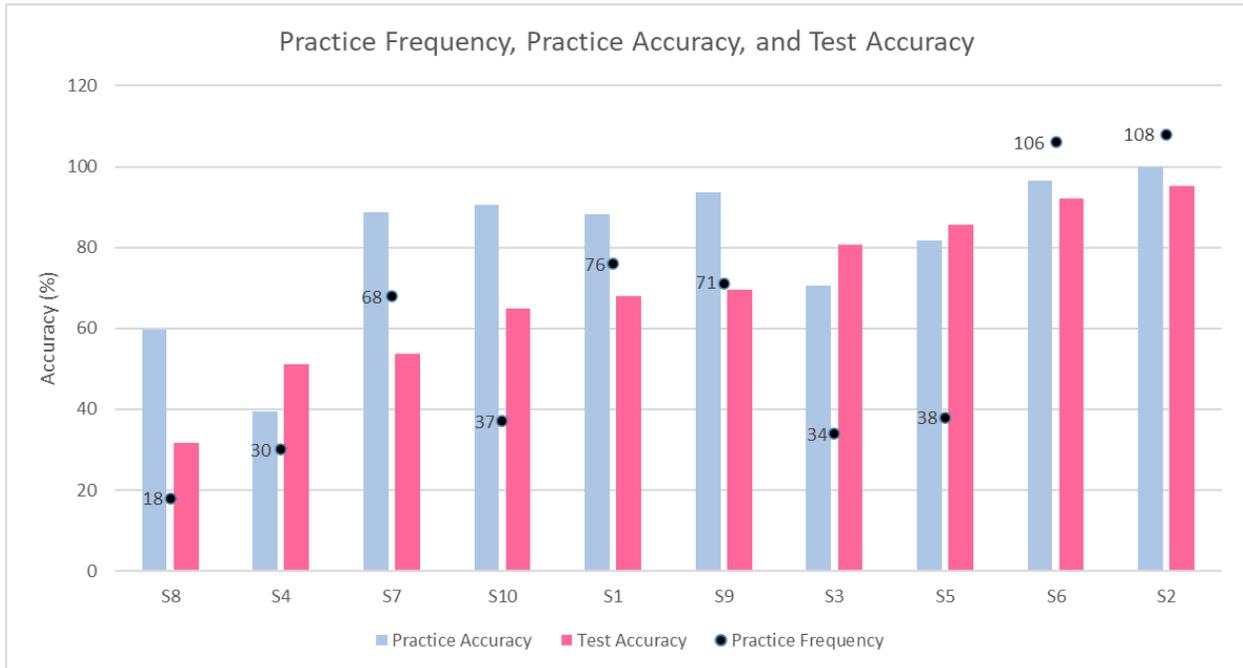


Figure 5: Practice Frequency, Practice Accuracy, and Test Accuracy

This graph shows that students who had a high percentage of correct answers in practice tended to also have a high percentage of correct answers on the test. In looking at accuracy, the more students practiced, the higher their accuracy was in practice. Also, the more students practiced, the higher their accuracy was on the test (except for S3 and S5 which were outliers). For example, S10 had a high accuracy in practice sessions and the fifth-highest number of practices among the participants, but not a very high accuracy in test sessions. According to Table 3, S10 only did the second half of the lesson one to three times, and S10’s high percentage of correct answers can be attributed to the fact that the participant did the relatively easy practice in the first half of the lesson about four times.

Looking at the data of S3 and S5, they also had less practice frequency, but were highly accurate in the test. The reason for S3's high test accuracy is that the student spoke a lot in the test. The student did not have to give a complete answer, but only the part the student knew, which resulted in higher test accuracy than for other students who did not say anything when asked about a question they did not know. S5 practiced lessons 1 through 6 at least 3 or 4 times. From the data in Table 3, it can be hypothesized that S5 was able to make a high score on the test because all parts of the test, except for part 4, contained what students learned in lesson 1 through 6.

According to Figure 5, the data indicates that S7, S10, S1, and S9 have high practice accuracy without as much practice as S6 and S2. However, the graph shows that S7, S10, S1, and S9 did not show high test accuracy. These results suggest that students may be able to improve their practice accuracy with about two repetitions, but have difficulty producing high test accuracy with limited repetitions.

This study shows that practice frequency and repeated practice of the same lessons are necessary to improve fluency and accuracy of what participants have learned. Figure 5 shows that fluency increased gradually through repeated practice, but at what point in the repetition process did fluency increase? This study investigates the timing of improving oral fluency.

## **6.5 Timing of Fluency Increase**

Figures 3 and 4 show that the more often learners practiced, the more fluent they became. Additionally, the more often students repeated the same practice, the more fluent they became. This section looks at how much repetition practice is needed to improve L2 oral fluency. In order

to examine the relationship between the number of lessons and the time spent in a lesson, this study takes a closer look at the data of participants who practiced three or more lessons in a row four or more times — S1’s data is from lessons 1 through 10, and S2’s and S6’s data is from lessons 1 through 19. The current study also analyzes S7’s data from lessons 1 through 5, and S9’s data from lessons 1 through 7. Figure 6 below shows the data for S1’s practice frequency and “response fluency.” Response fluency means how many seconds students spent practicing in each less

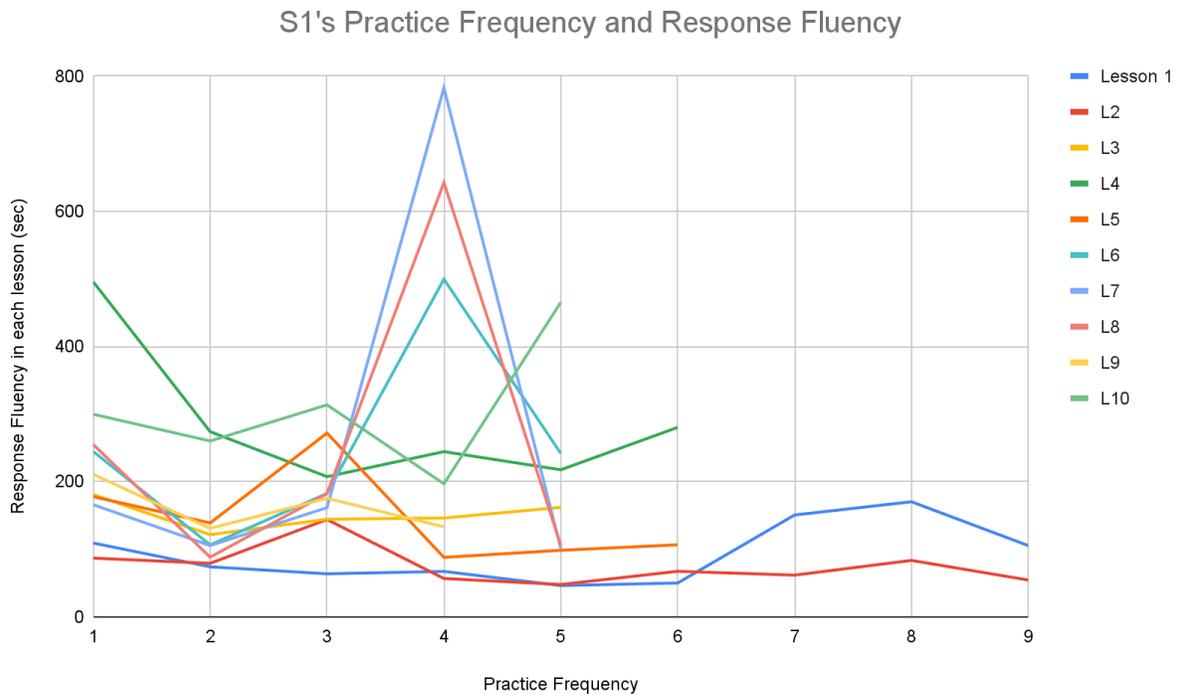


Figure 6: S1’s Practice Frequency and Response Fluency

S1 practiced lessons 1 through 10 at least 4 times, and lessons 11 through 19 less than 4 times. Figure 6 shows the change in the number of practices and how long S1 spent in each lesson from lessons 1 through 10. It shows that the response time decreased remarkably from the first lesson to the second lesson, then continued to decrease until about the fourth lesson, but did

not show a notable change after that. For lessons 6, 7, and 8, the fourth practice took a long amount of time, but the fifth practice took around the same time as the third one, indicating that there was likely some distraction during the fourth practice of lessons 6,7, and 8.

My discussion above was on the analysis of S1’s data for lessons 1 through 10, but the following part analyzes and discusses S6’s data for lessons 12 through 19 (see Figure 7).

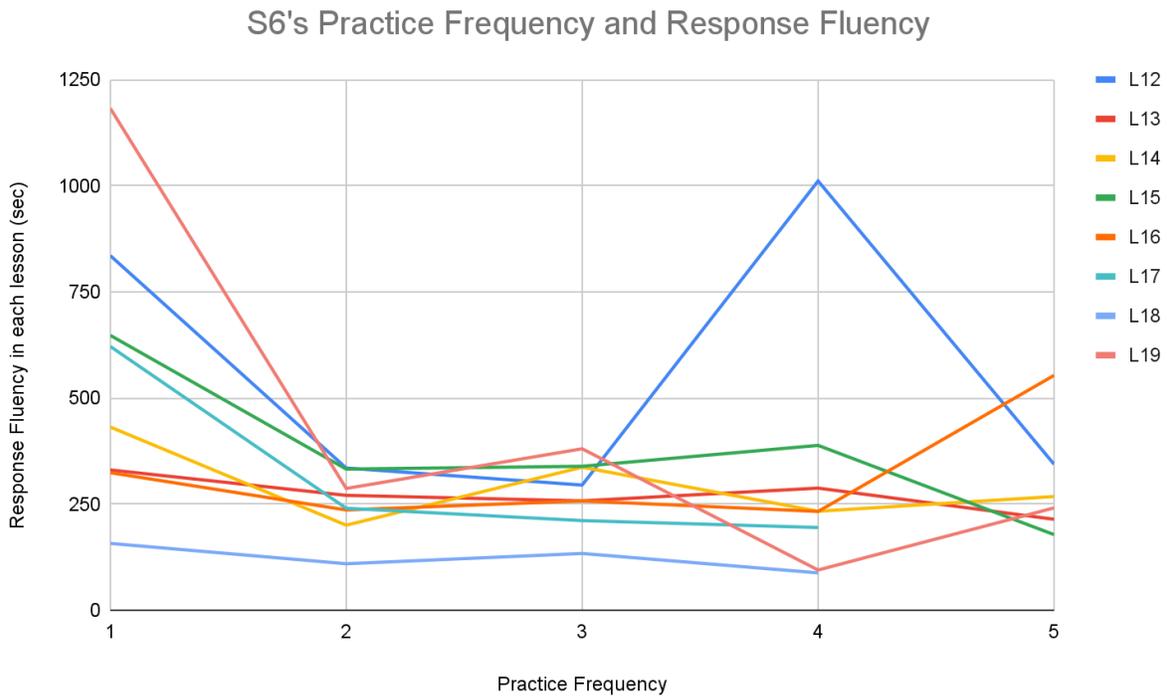


Figure 7: S6’s Practice Frequency and Response Fluency

S6 practiced lessons 1 through 19 five times each, except for lesson 18 (four times). However, due to the overlap between S6’s study period and the time of Kaizen’s system update, there were no records of practice from January 7 to January 19, when S6 began practicing. The researcher asked S6 how many times he practiced lessons 1 through 11, and after confirming that he had enough strike points when he practiced more, this study assumed that S6 practiced lessons 1 through 11 five times each. This section looked at changes in the amount of practice and

response fluency from lessons 12 to 19 because data for S6's practice frequency from lessons 1 through 11 was deemed unreliable. S6 had a large decrease in practice time from the first to the second practice and kept decreasing in practice time until the third and fourth practice. The data for S6 is similar to the S1's data from lessons 1 through 10.

There is one student who has data for all the lessons. Figure 8 below shows S2's data for lessons 1 through 19.

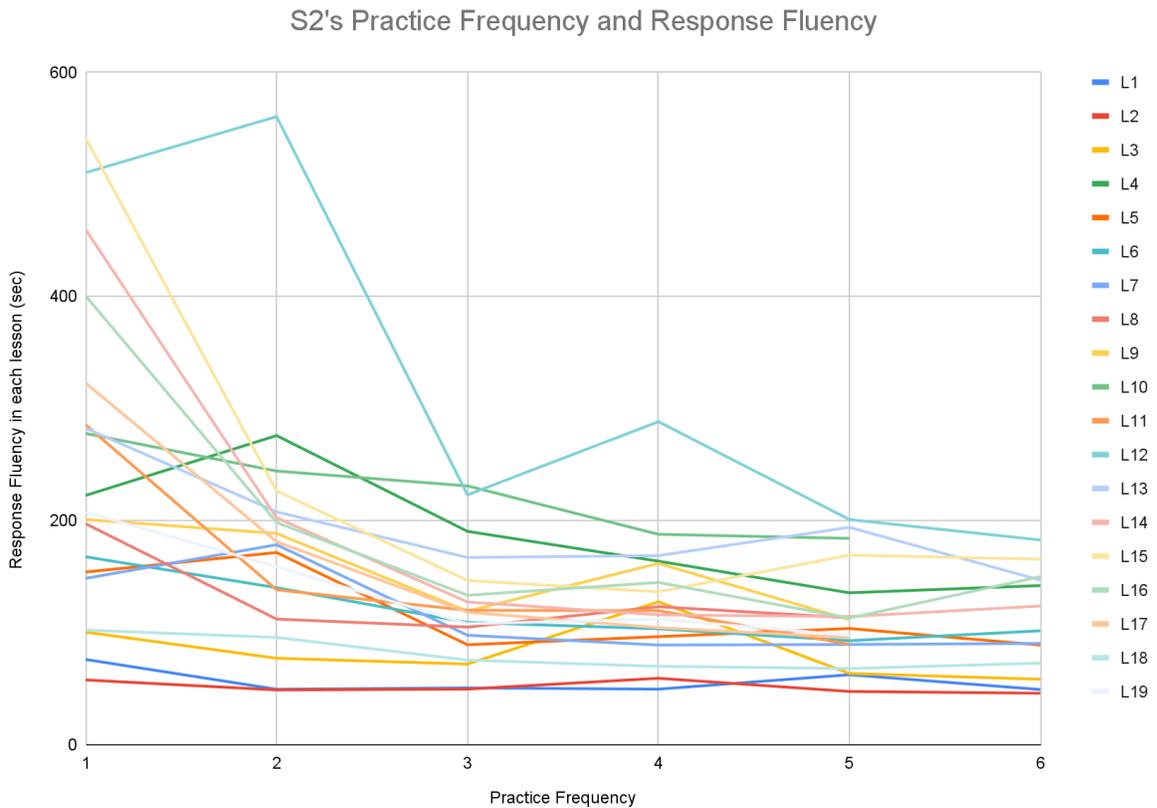


Figure 8: S2's Practice Frequency and Response Fluency

S2 practiced at least 5 times in all lessons from lessons 1 through 19. S2 practiced six times in lessons 1 - 7 and 12 - 18, and five times in lessons 8 - 11 and 19. Figure 8 shows that the

practice time became shorter from the first to the second practice, and that the practice time continued to decrease until the third and fourth practice. After the fourth practice session there was no notable change in the speed of practice, which is the same result that was arrived at for S1 and S6.

There were two more students who practiced three or more lessons in a row, four or more times. While these students do not have as much practice compared to S1, S6, and S2, similar results of comparison between the practice frequency and practice fluency were found. Figure 9 below shows S7's practice frequency and response fluency from lessons 1 through 5.

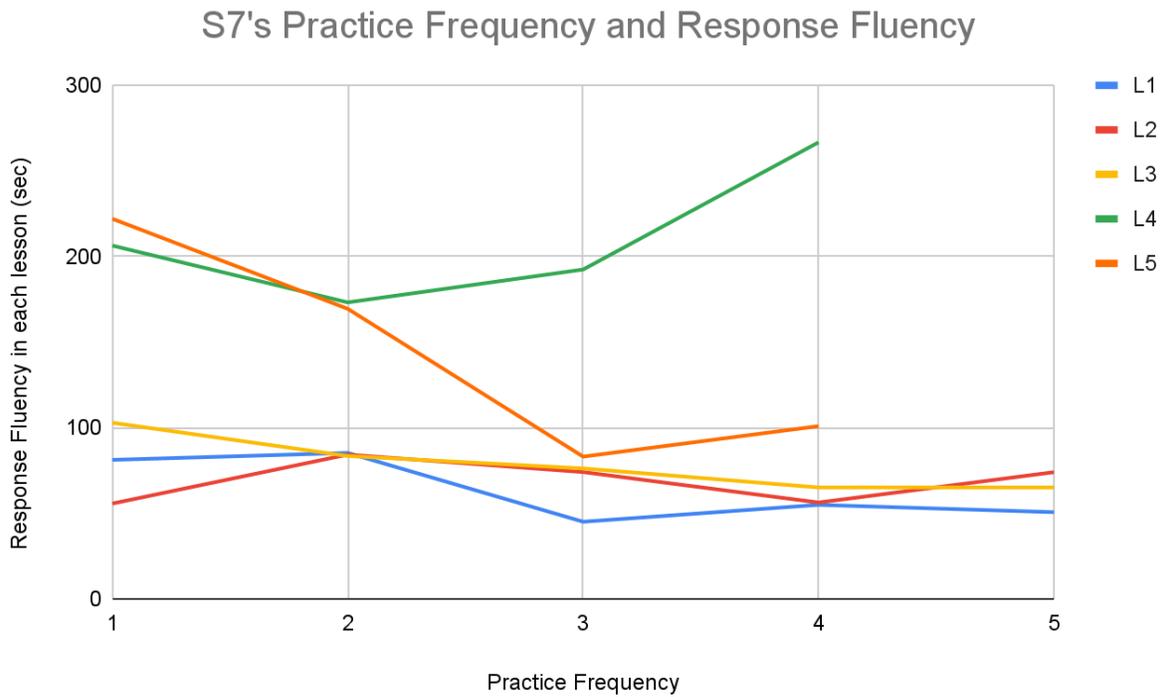


Figure 9: S7's Practice Frequency and Response Fluency

S7 repeated the practice at least four times each from lessons 1 through 5. For all lessons except lessons 1 and 2, the time decreased from the first to the second practice, and then to the third; similar to the data for S1, S6, and S2, some lessons have a large increase in practice time at the fourth repetition. It can be hypothesized that it is around the fourth repetition of the lesson that the students become accustomed to learning and do something else during the practice. The last data of this section is S9's data for practice frequency and response fluency (see Figure 10 below).

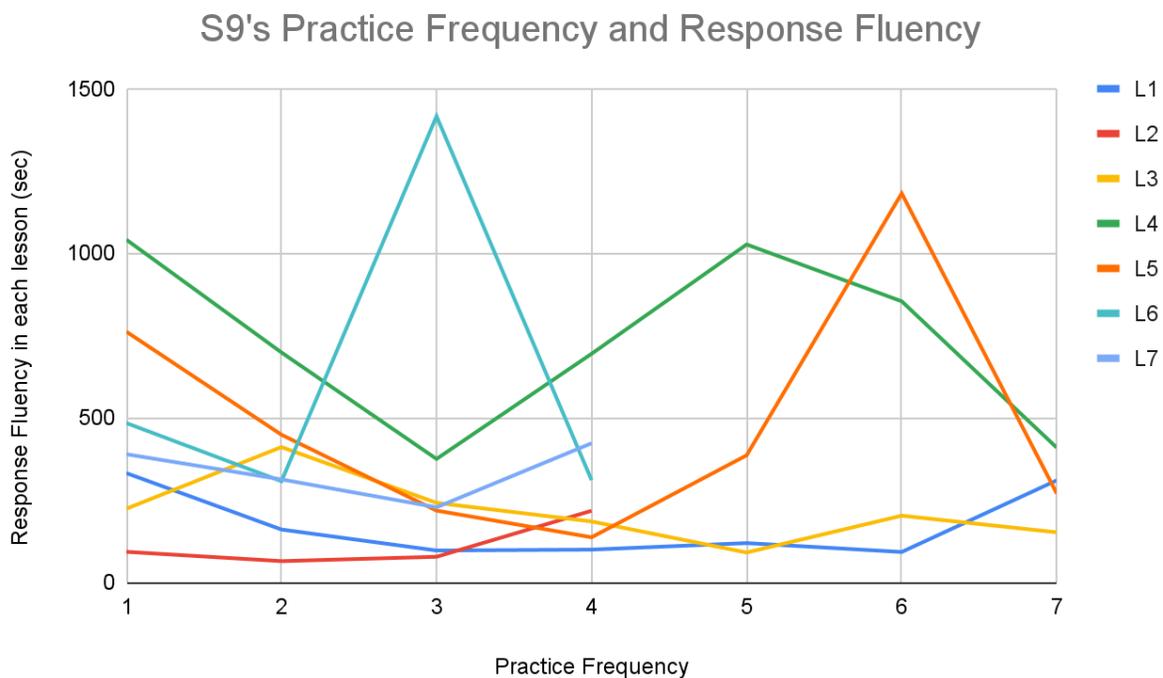


Figure 10: S9's Practice Frequency and Response Fluency

S9 practiced at least four times from lesson 1 through 7, except for L2 and L3 and L6. The practice time decreased largely from the first to the third lesson. The decrease in time continued until the fourth attempt; lessons 3 and 1, for which data were available after the fifth

attempt, did not show much of a decrease in time after the fifth attempt. S9's result of timing of increase in fluency is close to the results of S1, S6, S2, and S7.

This section answers the research question: *When do learners start improving their fluency? How many repetitions enhance fluency?* According to the results of Figure 6, 7, 8, 9, and 10, which is about the practice frequency and response fluency for S1, S2, S6, S7 and S9, practice duration decreased notably from the first to the second practice. It is hypothesized that this is due to students concentrating on reading and understanding the instructions and suggestion functions in the first practice, and concentrating on speaking in the second practice.

In addition, for all five participants, the time spent on each lesson decreased from the second to the third and fourth lessons, but there was not much difference in the change in speed after the fourth repetition of practice. From these results, repeated practice around the third or fourth time was effective in improving learners' L2 oral fluency. The results of RQ2 indicate that practice with the Kaizen app increased speech fluency within Kaizen practice. This section suggests how many repetitive practice learners are encouraged to do in order to improve learners' fluency. However, it is unclear how often and for how long learners find the repetitions effective. For example, either learners should continue to practice some lessons each day, or they should practice less frequently and more lessons at a time.

## **6.6 Learning Cycle**

In order to find a more effective learning cycle, this study prepared two separate learning groups. The difference in weekly frequency was seven days per week for Group 1 and three days

per week for Group 2<sup>3</sup>. Another difference is the number of lessons per day, which was five times for Group 1 and eleven times for Group 2. The commonality between Groups 1 and 2 is that both groups practiced the same lesson slot five times in a row. The following table 6 shows the learning cycle for Group 1 during the first week.

Table 6: Learning Cycle Example: The First Week of Group 1

| Group 1 |                   |
|---------|-------------------|
| Day 1   | Lesson 1,2,3,4,5  |
| Day 2   | Lesson 1,2,3,4,5  |
| Day 3   | Lesson 1,2,3,4,5  |
| Day 4   | Lesson 1,2,3,4,5  |
| Day 5   | Lesson 1,2,3,4,5  |
| Day 6   | Lesson 6,7,8,9,10 |
| Day 7   | Lesson 6,7,8,9,10 |

} Five times in a row

---

<sup>3</sup> In order to reach a total of five repetitions of practice for each lesson, Group 2 practiced four times in week 3 only, despite the usual number of three times.

There are two main reasons for repeating this same exercise five times in a row. First, by repeating the same practice in a short span of time, it was thought to be easier for the students to remember what they have learned in Kaizen. Second, since this study takes a closer look at the timing of fluency increase (in RQ2), repeating the same lesson over a short span of time was thought to focus on learners' fluency improvement as much as possible. If the interval between the first and second practice sessions was longer, it is likely that the students would forget what they learned in the first session.

As a result of this experiment, as Table 3 (Page 33) shows, only a couple of students followed the learning cycle prepared by this study. Due to this result, a sufficient amount of data was not able to be collected to derive the answer to RQ3: *Which learning cycle is more effective to improve oral fluency?*

In order to automatize what has been learned, repeated practice is necessary. If apps indicate to learners how many repeated practice sessions are necessary, the learners will be better able to plan their learning cycle by themselves. In addition, it is preferable that language learning apps have fun and exciting elements such as various game features because these help to keep users motivated to learn.

## CHAPTER 7

### CONCLUSION

This study investigated whether learners' fluency and accuracy grow (RQ1) when they practice conversations with an AI tutor in Kaizen, a language learning app that allows learners to practice conversations. In addition to Kaizen practice, the current study examined if students use what they learned in Kaizen in other contexts to see a difference between practice fluency/accuracy and test fluency/accuracy. Ten participants with no prior Japanese language learning experience participated in this study, had three weeks of Kaizen learning, and then took an achievement test.

Whether or not there was a growth in fluency, as well as how many repetitions caused a growth in fluency was analyzed on the basis of data collected from five selected participants.

Analysis of participants' learning records provided by Kaizen in addition to the results of conversation tests and achievement tests indicated that learners' fluency and accuracy improved with conversation practice with Kaizen's AI tutors. It also found that learners who practiced more often reached higher levels of fluency and accuracy (answer to RQ1). In comparing the practice fluency to the test fluency, this study found that participants who were able to speak fluently with the AI tutor in Kaizen practice also tended to speak fluently with a native Japanese speaker in the new context of the achievement test. In addition, students who were fluent in practice also had a higher fluency in a speech style in which they introduced themselves in front of their classmates, as well as in a conversational style in which another person spoke to them and they responded.

Analysis of the learning records of the five learners who practiced the same lesson repeatedly and showed notable improvement in fluency, revealed that repeated practice was effective in improving fluency until about the fourth lesson, after which there was little change (answer to RQ2).

The results of the above research question revealed that participants can develop L2 oral fluency through conversation practice using a language learning app, and that about three to four repetitions of the practice are effective in developing fluency. While Wang and Han (2021) investigate learners' conversational skills in English by app-based learning, the current study reveals that an app for conversation practice in learning Japanese also increases learners' L2 oral fluency. Additionally, this study confirmed that repetition improves learners' oral fluency and memory retention, as described in Yoshimura and MacWhinney's previous study (2007) on repetition practice, and newly revealed that repetition practice in learning with an app can increase L2 oral fluency. Logan (1985) and Yoshimura and MacWhinney (2007) state that repeated practice is necessary to automatize the learner's speech. This study further elaborates on the effectiveness of such practices, and suggests that about four repetitions are necessary for app-based learning to improve L2 oral fluency. To recall the learned information and to apply it to the new context accurately, more repetitions may be necessary, which we would like to investigate in future studies.

Since there was a small number of participants who followed the lesson plans in the current study, and a small sample of participants who repeated the exercises, another study with a larger sample size is expected in the near future. Furthermore, learners practiced lessons 1 - 5 or lessons 1 - 11 consecutively in this study. Future studies should create new groups that repeat the same lessons in a row in order to compare which learning cycles better improve learners'

fluency and accuracy. Trying different methods of repetition practice will lead to the discovery of more effective repetition practice. Also, although this survey concluded that about four repetitions of practice are necessary to improve L2 oral fluency, there is a difference between fluency growth and the completion of automaticity in speech production. Future research will focus on conducting a long-term study to determine how many repetitions of practice are necessary to make speech automatic.

# APPENDICES

## Appendix A

### Screening Questionnaire

Screening questionnaire

Date \_\_\_/\_\_\_/\_\_\_\_\_

Thank you for coming in/ speaking with us today. Before you officially enroll in this research study, I will be asking you to complete a screening questionnaire. It should take you no more than X minutes to complete. If you are determined ineligible to participate, your completed questionnaire will be destroyed. If you are determined eligible to participate, the completed questionnaire will become part of the study materials, and we will protect your information as confidential and safeguard it from unauthorized disclosure. Only research personnel will have access to the information contained in your screening questionnaire. If the screening questionnaire indicates that you are eligible to participate, we will proceed to obtain your written informed consent for participation in the study. Do you have any questions?

1. Name

2. UMass email address

3. Have you ever taken a Japanese class before?

Yes  No (→go to 5.)

4. If yes, how many classes have you taken?

less than 1 class  1  2  more than 3

5. Have you studied Japanese on your own before?

Yes  No

6. If yes, how long have you studied?

less than 1 month  1  2  more than 3

7. I have \_\_\_\_

watched anime/manga  been to Japan  learned Japanese culture/history  listened Japanese music  met Japanese friends  watched YouTube

## Appendix B

### Achievement Test Slides

# Achievement Test

You are going to Japan to study abroad from UMass. You will go to a university and live with a host family in Japan.

## Part 1:

Situation: At Narita airport, you meet your Japanese host family for the first time. Your family will talk to you first, so please respond naturally and continue the conversation as you learned in Kaizen.



## Part 2:

Situation: You are an international student. When you go to your Japanese university for the first time, you introduce yourself in front of your classmates. Please include the following information in your self-introduction.

1. Name
2. Occupation
3. Where you are from
4. Nationality



## Part 3:

Situation: You are having dinner with your host family. They ask you questions about your family. You will find your family-information in the table. Please answer the questions based on the information below using the Japanese you learned from Kaizen.



| Your family member | Father   | Mother  | Elder sister              | Elder brother | Younger brother     | Younger sister           |
|--------------------|----------|---------|---------------------------|---------------|---------------------|--------------------------|
| Occupation/school  | engineer | painter | Japanese language teacher | artist        | High school student | Chinese language student |
| Age                | 62       | 58      | 38                        | 20            | 17                  | 9                        |

## Part 4:

Situation: After dinner, your host mother asks you about your daily schedule. Please look at your schedule below and answer her questions.



### Weekdays

8:00 AM Get up  
9:00 AM Go to university  
1:00 PM Eat lunch  
4:00 PM Come back home  
5:00 PM Play video games  
8:30 PM Go to bed/sleep

### Weekends

Around 8:00 AM Get up  
12:00 PM Go to a concert

## REFERENCES

- Ataş, A. H., & Çelik, B. (2019). Smartphone use of university students: Patterns, purposes, and situations. *Malaysian Online Journal of Educational Technology*, 7(2), 54–70. <https://doi.org/10.17220/mojet.2019.02.004>
- Blanco, C. (2020, December 15). *The 2020 Duolingo Language Report: Global Overview*. Duolingo Blog. Retrieved April 13, 2022, from <https://blog.duolingo.com/global-language-report-2020/>
- Busuu Revenue and Usage Statistics (2022)*. Business of Apps. (2022, January 11). Retrieved April 13, 2022, from <https://www.businessofapps.com/data/busuu-statistics/>
- Carlson, R. A., Sullivan, M. A., & Schneider, W. (1989). Practice and working memory effects in building procedural skill. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, 15(3), 517–526. <https://doi.org/10.1037/0278-7393.15.3.517>
- de Bot, K. (1996). The psycholinguistics of the output hypothesis. *Language Learning*, 46(3), 529–555. <https://doi.org/10.1111/j.1467-1770.1996.tb01246.x>
- Duolingo*. BM Education. (n.d.). Retrieved April 13, 2022, from <http://www.bmeducation.in/DUOLINGO/>
- Engber, C. (1989). Applications of cross-language analysis. Karl Sajavaara (ed.). Jyväskylä, Finland: University of Jyväskylä, 1987. pp. 72. *Studies in Second Language Acquisition*, 11(1), 123–123. <https://doi.org/10.1017/s0272263100008068>
- Gatbonton, E., & Segalowitz, N. (1988). Creative automatization: Principles for promoting fluency within a communicative framework. *TESOL Quarterly*, 22(3), 473. <https://doi.org/10.2307/3587290>
- Global EdTech 50: GSV Ventures*. Global EdTech 50 | GSV Ventures. (n.d.). Retrieved April 13, 2022, from <https://gsv.ventures/global-edtech-50/>
- Hamidi, H., & Chavoshi, A. (2018). Analysis of the essential factors for the adoption of mobile learning in Higher Education: A case study of students of the University of Technology. *Telematics and Informatics*, 35(4), 1053–1070. <https://doi.org/10.1016/j.tele.2017.09.016>
- Kormos, J. (2006). *Speech production and Second language acquisition*. Lawrence Erlbaum Associates.
- Lennon, P. (1990). Investigating fluency in EFL: A quantitative approach\*. *Language Learning*, 40(3), 387–417. <https://doi.org/10.1111/j.1467-1770.1990.tb00669.x>

- Logan, G. D. (1985). Skill and automaticity: Relations, implications, and future directions. *Canadian Journal of Psychology/Revue Canadienne De Psychologie*, 39(2), 367–386. <https://doi.org/10.1037/h0080066>
- Looney, D., & Lusin, N. (2019). Enrollments in languages other than English in United States institutions of Higher Education, Summer 2016 and Fall 2016. *Modern Language Association of America*.
- M., L. W. J. (1989). *Speaking: From intention to articulation*. Massachusetts Institute of Technology.
- McKay, S. (1982). Literature in the ESL classroom. *TESOL Quarterly*, 16(4), 529. <https://doi.org/10.2307/3586470>
- Penglee, N., Christiana, R. W., Battista, R. A., & Rosenberg, E. (2019). Smartphone use and physical activity among college students in health science-related majors in the United States and Thailand. *International Journal of Environmental Research and Public Health*, 16(8), 1315. <https://doi.org/10.3390/ijerph16081315>
- Pew Research Center. (2021, November 23). *Mobile fact sheet*. Pew Research Center: Internet, Science & Tech. Retrieved April 13, 2022, from <https://www.pewresearch.org/internet/fact-sheet/mobile/>
- Roberts, J., Yaya, L., & Manolis, C. (2014). The invisible addiction: Cell-phone activities and addiction among male and Female College students. *Journal of Behavioral Addictions*, 3(4), 254–265. <https://doi.org/10.1556/jba.3.2014.015>
- Rosell-Aguilar, F. (2018). Autonomous language learning through a mobile application: A user evaluation of thebusuuapp. *Computer Assisted Language Learning*, 31(8), 854–881. <https://doi.org/10.1080/09588221.2018.1456465>
- Samuels, S. J. (n.d.). Toward a theory of automatic information processing in reading, revisited. *Theoretical Models and Processes of Reading*, 1127–1148. <https://doi.org/10.1598/0872075028.40>
- Schmidt, R. (1992). Psychological mechanisms underlying second language fluency. *Studies in Second Language Acquisition*, 14(04), 357. <https://doi.org/10.1017/s0272263100011189>
- Schneider, W., & Fisk, A. D. (1982). Concurrent automatic and controlled visual search: Can processing occur without resource cost? *Journal of Experimental Psychology: Learning, Memory, and Cognition*, 8(4), 261–278. <https://doi.org/10.1037/0278-7393.8.4.261>
- Schneider, W., & Shiffrin, R. M. (1977). Controlled and automatic human information processing: I. Detection, search, and attention. *Psychological Review*, 84(1), 1–66. <https://doi.org/10.1037/0033-295x.84.1.1>

- Segalowitz, N. (2010). *Cognitive bases of Second language fluency*. Routledge.
- Solomons, L. M. (1899). Communications from the psychological laboratory of Harvard University: Automatic reactions. *Psychological Review*, 6(4), 376–394.  
<https://doi.org/10.1037/h0074593>
- Survey report on Japanese-Language Education Abroad 2018*. The Japan Foundation - Survey Report on Japanese-Language Education Abroad 2018. (n.d.). Retrieved April 13, 2022, from <https://www.jpf.go.jp/e/project/japanese/survey/result/survey18.html>
- Technavio. (2020). Online Language Learning Market by Product, language, and Geography - Forecast and Analysis 2020-2024. <https://www.technavio.com/report/online-language-learning-market-industry-analysis>
- Towell, R., Hawkins, R., & Bazergui, N. (1996). The development of fluency in advanced learners of French. *Applied Linguistics*, 17(1), 84–119.  
<https://doi.org/10.1093/applin/17.1.84>
- Wang, M., Shen, R., Novak, D., & Pan, X. (2009). The impact of mobile learning on students' learning behaviours and performance: Report from a large blended classroom. *British Journal of Educational Technology*, 40(4), 673–695. <https://doi.org/10.1111/j.1467-8535.2008.00846.x>
- Wang, Z., & Han, F. (2021). Developing English language learners' oral production with a digital game-based mobile application. *PLOS ONE*, 16(1).  
<https://doi.org/10.1371/journal.pone.0232671>
- Yoshimura, Y., & Shiomi, Y. (2016) Skritter wo tsukatta onrain zyo deno kanji gansyu no hokoku" [A report of online Kainji learning using Skritter], (Presentation, Annual Conference of Japanese Language Teachers' Association of New England 2016).
- Yoshimura, Y., & Brian, M. (2007) The effect of oral repetition on L2 speech fluency: an experimental tool and language tutor. *SLaTE-2007*, 25-28
- Yuen Fook, C., Narasuman, S., Abdul Aziz, N., Syed Mustafa, S. M., & Tau Han, C. (2021). Smartphone use among university students. *Asian Journal of University Education*, 17(1), 282. <https://doi.org/10.24191/ajue.v17i1.12622>