



**T8** TEAM 8 DELIVERABLE

# Vocaby Your Language Study Buddy

PREPARED BY TEAM 8

ASHAAR FAROOQ  
CHERIE WANG  
LACTHU VU

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# Executive Summary



With the advent of much diversity of languages in the world, it is valuable to be multilingual. Communication across cultures is not only a practical skill to master in order to live, but it is also one that allows one to experience the different perspectives found in different environments. Learning foreign languages typically involves learning via online tools that don't replicate a natural setting for a natural real-life conversation. **Vocaby** takes this inspiration from a real-life conversation to another level. Users can review or learn various different vocabulary words with the Amazon Alexa virtual assistant system. Practicing with Alexa is meant to replicate the experience of practicing with another person, which is often a far more proven way of learning a new language.

## Vision

Our vision for **Vocaby** is to create a world where peer-to-peer transfer of language knowledge can be replicated by an Alexa-to-peer system of reviewing and learning a new language in an interactive manner away from the standard computer screens. Reproduction of the nuances of speaking a new language, such as misunderstanding, accents, etc., when trying to learn a new language fosters a productive and realistic environment.





# Our Goals

- Create a system that is easy and intuitive for individuals to navigate/manage
- Integrate **3** languages (Spanish, French, and Italian) with approximately **100** words each
- Users should be able to translate prompts from Alexa to practice their vocabulary and understand the pronunciation of words in a foreign language
- **90%** of users would choose to use this to practice a language again
- Users are able to demonstrate **60%** improvement over time
- Users are able to retain **80%** of the vocabulary that they learned using our Alexa system



## What We Offer

In order to accomplish our goals, we will ensure that our system is intuitive, easy to navigate, and valuable to the user's language learning experience. Our system should allow the user to learn ~100 new vocabulary words from early topics in the Spanish, Italian, or French branches, which are structured for new learners, and translate words between English and a foreign language. Furthermore, the system will be personalized to the user's needs (scoring mechanism, number of words they want to study, etc.). Overall, the combination of Duolingo-like capabilities and Quizlet-like capabilities will empower the user to practice new words in a certain language with Alexa.

## Design Considerations

In order to make the system as intuitive and easy to use as possible while adding value for the user, we curated different aspects of the system with intentionality. A design choice that was implemented included adding different checks on user input in order to make sure that the user was not misunderstood by Alexa. This was done by adding many different potential variations of the user input in addition to having different voice confirmations by the user. Another design consideration was how to best allow the user to actually learn the language. This was accomplished by having a feature for simply reviewing the vocabulary and having another feature for the assessment of learned knowledge.

The iterative process for these review or quiz sessions was intentionally simple, concise, and very much similar in order to make the system predictable for a new user without needing to complicate the user experience. In order to make the flow more immersive for the user, the system also featured various different formats of media, namely audio, different instructions, and of course the authentic pronunciation of different language words.





## Existing Market

The market for virtual assistants, such as Amazon Alexa, is quite strong. The valuation is hovering around \$5 billion as of 2020 and is only projected to increase in the next several decades. With this high prospect in mind, Vocabulary aligns well with the needs of the market. Besides virtual assistants, the target market also includes the online language learning market. This particular sector's valuation hovers around \$12 billion as of 2019 and is also projected to increase in the next several decades. Observationally, it is clear that the dispersion of new artificial intelligence technologies in new sectors of society is widespread.

The need to optimize and improve learning in different educational contexts is there for virtual assistants and other tools to meet. Specifically, Vocabulary is inspired by the ranks of Duolingo and Quizlet. Duolingo (worth ~\$2 billion in 2020) is a language-learning platform with options for doing exercises and assessments to achieve mastery. Quizlet (worth ~\$1 billion in 2020) is a flashcards-creating and flashcards-sharing platform designed to review different concepts.

Vocabulary is an interface that fosters a realistic environment of language learning in the form of quasi-flashcards as conveyed through the Alexa voice system.





# Sample Usage

A sample exchange of how a user can interact with [Vocaby](#) can be encapsulated in a layout below known as K-Script. This sample usage example constitutes the 80% use case for the entire product. The K-Script utilizes a column for stating the speaker of a particular statement, the particular statement in the conversation itself, and any pertinent notes about the current step of the entire program.

WHO	OBSERVABLE CONVERSATION	UNOBSERVABLE ACTION/NOTES
USER	"Alexa, Open Vocaby."	User is initiating the process for Alexa to begin the sequence for the Vocaby program
ALEXA	"Do you want to learn French , Spanish, or Italian today?"	Alexa is gathering user input of the language that the user wants to study/review.
USER	"Spanish."	Alexa listened to the user's response.
ALEXA	"Do you want to review Spanish or quiz yourself?"	The content of the study skill is being narrowed down as the user can review various words before quizzing oneself.
USER	"I would like to quiz myself."	Alexa gathers that the user is interested in quizzing themselves about different words and their meanings.
ALEXA	"How many words would you like to study today?"	Alexa prompts the user for their choice of words they want to get quizzed on.



WHO	OBSERVABLE CONVERSATION	UNOBSERVABLE ACTION/NOTES
USER	"Six"	The number of study words is being narrowed down as the system will only provide this many words out of all possible words to the user.
ALEXA	"Starting your Spanish quiz session now..."	There is a confirmation before the actual session starts to get the user primed for the quiz.
ALEXA	"The word is domingo. Please translate this word into English."	Alexa says a Spanish vocab word.
USER	"Monday"	User says the wrong answer.
ALEXA	"Not quite. Say anything to try again, say 'pass' if you don't know this word, say 'quit' if you want to quit, say 'repeat' to repeat the word.."	The user is given another chance at saying the right answer. In addition, the user also has the option of passing the word or quitting the current quiz session.
USER	"Sunday"	User says the correct answer
ALEXA	"Correct. The word is lunes. Please translate this word into English."	There is an audio confirmation of the response's correctness as the next word is said.
...	...	...
AFTER THE USER HAS FINISHED THEIR QUIZ STUDY SESSION:		
ALEXA	"Congratulations! You got a total of 5 words correct!"	The final message showcases the final number of correct words in the current study session to the user.



# Key Themes

## Simplicity

A large part of the system involves iterating through various words of a certain language. The overarching theme here is that our product is a very concise system that has a clear logic that can be conveyed via clear instructions on the different options that the user can say. For instance, after the first few iterations of quizzing or reviewing a language, the system shortens the instructions as the user gets an intuitive understanding of the workings of the system. There is no other extraneous logic that the user would have to dig deep on their own while trying to deal with words they know or are not fully comfortable with.



## Authentic Learning Environment

A large part of the system involves iterating through various words of a certain language. The overarching theme here is that our product is a very concise system that has a clear logic that can be conveyed via clear instructions on the different options that the user can say. For instance, after the first few iterations of quizzing or reviewing a language, the system shortens the instructions as the user gets an intuitive understanding of the workings of the system. There is no other extraneous logic that the user would have to dig deep on their own while trying to deal with words they know or are not fully comfortable with.





## Key Features

### Review a Language

In order to review a certain language, the user simply first selects a language of their choice, namely Spanish, French, or Italian, before proceeding to state their intention of reviewing a language. The following part of the system iterates over various random words from the vocabulary data as determined by the amount of words that the user can state. After the series of words and their definitions have been said, the user is able to quiz themselves or get more flashcards-based information given to them.

### Practice a Language

Quiz yourself on vocabulary words of your chosen language. The user can select a number of questions that the system will ask the user to translate into English. This function is similar to the review a language function, but gives the user an opportunity to quiz themselves in order to better learn new words. The consistency between the two key features of reviewing and quizzing a language establishes a pattern of familiarity and comfort for the user.

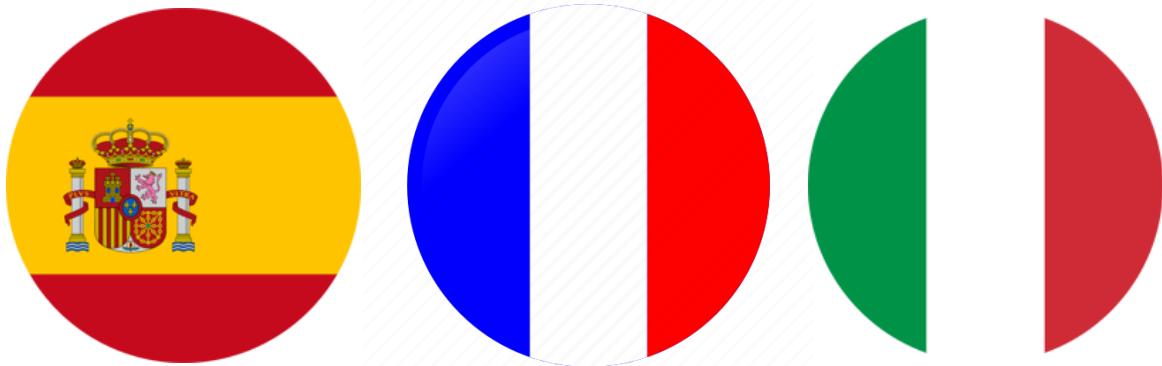


# System Flow



# General Program Flow

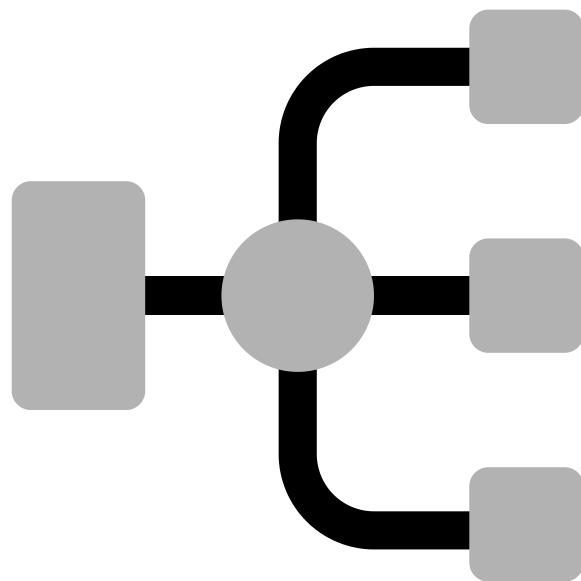
The general programmatic flow of the system involves choosing a language that is supported by the system, namely Spanish, French, or Italian.



There is a check to make sure that a supported language is chosen as the program moves forward and establishes the right vocabulary data that will be used for the quiz or review sessions. Afterwards, the system determines whether the user would like to review language or simply practice the language in the form of a flashcards-based quiz in addition to asking for the number of words that the user would like to proceed with. There is also a user input check in order to make sure that a valid number is chosen by the user. With an audio confirmation of the quiz or review session starting, the program branches into a quiz or review flow, which is the abstraction of the appropriate logic.



For the quiz flow, the program determines the choice of language that the user has selected. With that, the program iterates over randomly selected words of the length specified by the user. Each iteration consists of saying the word in the appropriate language in addition to having conditional checks on if the user has said pass, quit, or tried a guess to the word in question. There is also logic flow for when to perform these checks within the context of the user getting a word correct or incorrect in addition to keeping track of the number of words correct. The ending state of this quiz iteration flow leads to the end of the program with the user having an option to start over again. For the review flow, it is symmetric to the quiz flow except for the removal of keeping track of scores and the user input for an answer with its associated logic. The ending state of this review iteration flow also leads to the end of the program with the user having an option to start over again.





# Stakeholders

## Language Learners

Beginner language learners are our largest stakeholders and our primary target audience. We hope our system will support them in their journey of expanding their knowledge in the language(s) of their choice.

### Duolingo/Quizlet



Our system revolves around testing users on their language vocabulary skills. Thus, we hope we can integrate Duolingo and Quizlet's systems and provide a more comprehensive vocabulary and a more personalized experience for our users. Our systems are mutually beneficial as our program can help the users gain more practice and overall improve their language skills.

## Language Teachers

Language teachers can have their students use our program to practice vocabulary skills in preparation for their classes. This system gives the students a more fun and interactive experience. Thus, we designed our system to cater to their experience and how to best support user learning.





# Target Audience

Our intended audience is English speakers (14+ years old) looking to fast-track their language learning with an Alexa app. Our system currently caters to learners of Spanish, French, or Italian, and is meant to supplement other forms of learning a foreign language, such as in-class learning or textbook learning by providing users with a convenient way to practice their listening and comprehension in the language of their choice with a voice system analogous to a real human being.





# Risks: Boundary Limits

## Data

The system relies on a curated data structure consisting of a list of English and other language words that are used during the iteration of various words in quiz or review sessions. There is an inherent limit on the number, quality, and access of these words that are used in the system. The number of words is gained randomly from external static sources and then mutated into the appropriate data structure. Finding a quality external static source of words is a limitation given the extreme decentralization of online data sources and Application Programming Interfaces. In addition, various such platforms require complicated authentication measures that make it harder to access quality words. The alleviation to this limitation was to curate the data structure via the manual search of words and then using the programming language Python to populate the right form of data.

## Time

Given the nature of the product and the widespread features that were available to be implemented, the timing of the implementation of the system was not sufficient. In particular, the research, specifications, usability testing, prototype design, and iterating the design innovation process in just weeks was a limitation in addition to the learning curve of various different external tools like Voiceflow. The alleviation to this limitation was creating a simple product that was the result of some prioritization, as defined by a flow of the user reviewing or quizzing a language through interacting with Alexa.



# System Language Limitations



Vocaby uses Alexa voice capture in order to process users' answers to quiz questions. At the moment, this is limited to the system asking the user to translate a foreign word into English, as in our implementation Alexa was unable to understand answers in Spanish or French. Further development into Vocaby could see different types of questions, such as full sentence translation, which would provide a more diverse learning experience for the user.

## Risks: Hazards

### User Learning Curve

Since our system relies on a large word bank to deliver questions to the learner, new users may more often than not come across new words that they don't know when starting out. In order to address this risk, one possible future improvement to our system would be providing topics of learning similar to the vocabulary curriculum of a textbook, allowing the user to have a more focused learning experience that better accompanies a language class or other form of study.

### Abundance of Language Learning Resources

Due to a wide amount of available online language learning programs such as Duolingo, Babbel, and Rosetta Stone, it may be difficult to find a distinct user base for Vocaby. Currently, our system differentiates from other language learning systems in that it provides the user with a simple, focused, and streamlined way to study a language without requiring a screen.



# Usability Testing

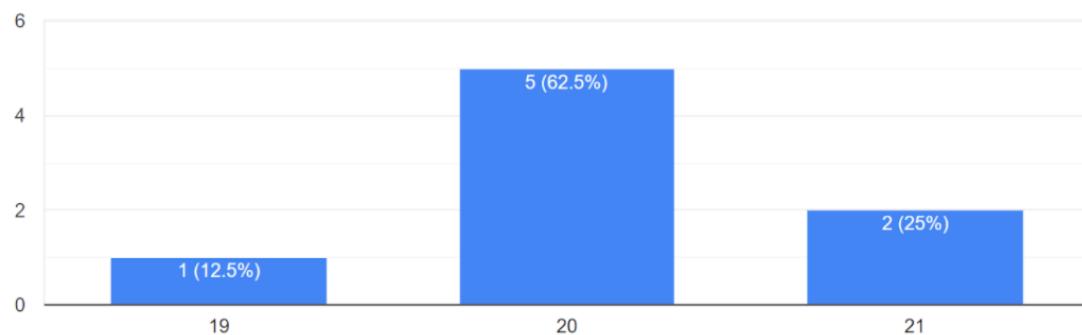
Our team conducted two usability tests wherein each test we had the user complete a series of tasks using our system. We also had them fill out pre-test and post-test questionnaires to gauge a better understanding of our test users.

## Round 1

We recognized from the pre-questionnaire that most individuals we ran tests on were college students and are better knowledgeable on educational technology tools. All of the users knew English and most of them knew another language fluently that wasn't either Spanish or French (data from our pre-questionnaire).

Age

8 responses

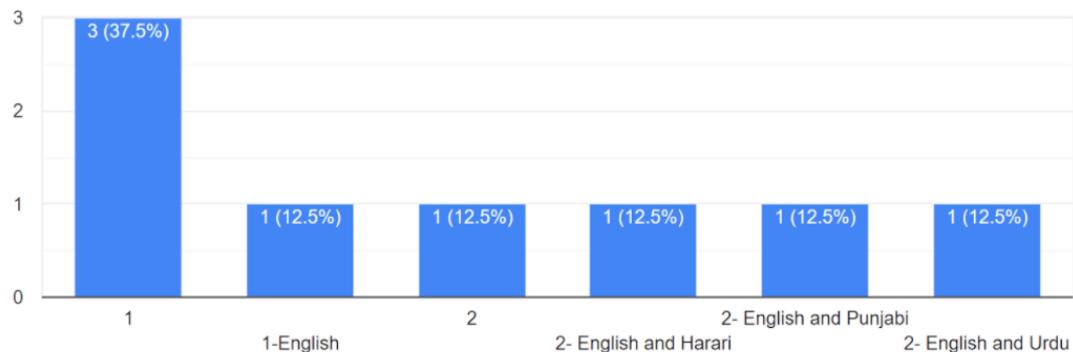


**Figure 1:** This graph is an accumulation of usability test 1 and 2. The graph displays that the users are relatively young, meaning they are well-versed in the latest new educational technology tools.



How many languages do you speak regularly?

8 responses



**Figure 2:** This graph displays the number of users that know either one or two languages from both user testing. There were more users who knew one language instead of two during the second usability testing (3 users who speak one language and 1 user who speaks two).

This is a measure of the experience of the users from learning another language.

## Round 1 Issues

### Issue:

Lack of Variation in User Response Consideration

There was a major issue where the user was trying to move past a word and Alexa would not be able to understand what the user said. This was caused by not adding variations of the user response, thus the system was looking for one explicit word in order to progress. This led to various repeated statements that compromised the usefulness of the language studying tool.

### Resolution:

Add variation to what Alexa is listening for in each user response. Also add a fail-safe repetition for each response so that the system will never abruptly stop due to misunderstanding of user response.



### **Issue:**

#### Limited List of Words

Alexa also provided the users with fairly hard words that the user was unlikely to have seen before, particularly for French. This was caused by not having a variety of words. This means that they were frustrated and weren't able to review them before. The resolution philosophy here is that users will be able to learn by making educated guesses and then checking to see if they were right, thus remembering the solution. After many iterations after many iterations, the user would start to internalize and memorize the words in another language, even if they were not provided an explicit definition/reviewing stage.

### **Resolution:**

Add more variety of words and more words in order for the user to get a better understanding of their knowledge and to have more exposure to the language they are learning.

### **Issue:**

#### No Terminating Condition

Another issue that we ran into was not creating an ill terminating condition so that the user can quit the entire program during the test. The user had to either pass on every word or get every word correct.

### **Resolution:**

Add a "quit" command as an option to terminate the program and run the score command (tells the user their total score - will also add a counter to keep track of how many words the user has gone through regardless of correctness).



### **Issue:**

#### Lack of Clear Instructions

One of the main issues was the lack of clarity in initial instructions. The cause for this issue was we did not include a list of instructions the user can listen to (and that might also be overwhelming). Thus, the user sometimes didn't know they could say pass or other commands at the beginning.

### **Resolution:**

Add explicit instructions at the beginning of the program to let users know of the precise commands the tool has.

## Round 1 Key Takeaways

In terms of key takeaways from the Usability Testing process, it is important to not assume how the user would interact with the product, and let their intuitive mindset drive the process. Another takeaway is to make sure to accommodate user preferences and to reassure users that all their actions in the grand scheme of the test are completely okay. We also want to make sure that the users feel that the time they invested into this test is well worth it.



## Round 2

This test was taken after we implemented the fixes to our problems from the first usability test, and overall, we saw that the user experience was overall better as measured by the increased percentage of words that a user was able to correctly answer. In addition, we saw that the user was able to select a new language in a more streamlined manner with the added factor that the user was able to be understood better by Alexa. The user's rate of repeating or being confused about the set of instructions needed for the system went down significantly after we made the changes of adding more conditions. In this manner, the changes that were inspired by the first round of usability testing precipitated the positive retention/learning rate of the second round of usability testing.

## Round 2 Issues

### **Issue:**

#### Limited Difficulty of Words

The issue of not having enough sophisticated words was caused by the manual setting of French and Spanish words as there were a limited amount of elements in the list.

### **Resolution:**

This issue can be alleviated by adding more generic vocabulary words for both Spanish and French. More specifically, we will utilize a repository of these vocab words that we can organize into specific categories and topics and format them appropriately for the data structures that store them in our system.



### Issue:

#### Lack of Personalization

In addition, there were issues that made the system feel more like a homework/chore rather than a fun learning system that was personalized to the user. The issue of the lack of personalization for the user was seemingly caused by the fact that the system immediately started to ask what the user wants to study without adding some (fun) context. In other words, there was no sense of curiosity, excitement-building, audio feedback, etc. that made the initial experience unique and different.

### Resolution:

This issue can be alleviated by asking or utilizing some more user information from Alexa in order to make the user feel connected to Alexa/system.

## Round 2 Key Takeaways

In terms of key takeaways from the Usability Testing 2 process, it is important to note that the user experience and perception of difficulty in using the language study buddy was dependent on their previous experience in studying a language. In the second round of testing, most users believed that the product was a lot easier to use (rating them 1-3, corresponding to "low difficulty"), and didn't really find the product that useful as a result. In later usability tests, we may want to better target our tests towards a better audience that fits our scope (first time language learners) or alter our dictionary of words to be difficult enough for our intended user base.

Overall, the first and second rounds of usability testing helped to narrow down the issues of not having enough words, not having an intuitive flow for the user, and not making adjustments that align with the user's intuitive process when trying to learn a new language (review and then quiz). These issues are largely resolved as the system will benefit from minor upgrades to the user interface, user experience, and some more extraneous features that can make the system really come alive.



# Our Test Users



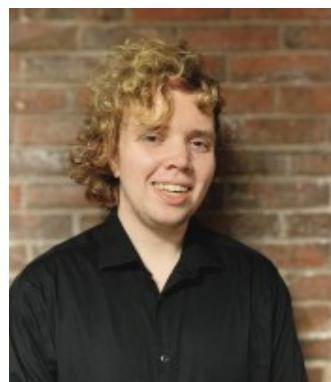
## Billal, 20, Intermediate Italian

Billal is a busy international MIT undergraduate who rarely has the flexibility in his schedule to accommodate trying to fit in a different country and pursue his interests of not only learning new languages, but also retaining some, such as Italian.

**"Having another person to just practice Italian with at any time would give me so much flexibility and motivation"**

## Joules, 21, Intermediate French

Joules is an MIT undergraduate who has studied French in high school. They haven't had the time to study the language in their time as a college student, but hope to be able to maintain their skill in the language.



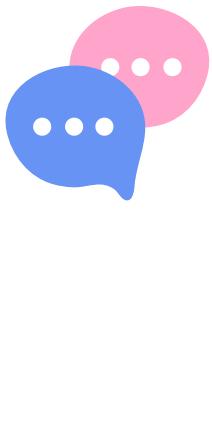
**"I want to effectively and quickly practice my French for a few minutes a day"**

## Cathy, 20, Beginner French and Spanish

Cathy is an economics and international relations double major at Wellesley College and hopes she can spend some time practicing new languages. She's an international student and wants to practice more of her native language as well.



**"I want an easier way to quickly study vocabulary in my spare time"**



# Conclusion

## Future Considerations



Based on user feedback from the two rounds of usability testing that we ran, we came across some common features that could be implemented in the future to improve our system:

### Integrated Duolingo Service

- Implement different categories or topics to study from
- Have an expanded set of languages

### Personalized Experience for the User

- Have a record of the words that the user has previously studied

### Variety of Question Types

- Fill in the blank questions
- Sentence translations
- English to foreign language translation



## Reflection

The initial brainstorming and down-selection phases of the innovation process revealed that the team had several categories of ideas in mind, namely organizational tools, food, music, events, and languages. The ideas seemed to have been rooted in the combination of several different entities as well since the inclusion of a variety of features is partly what turns an idea into a product. To this effect, the team centered on the combination of Duolingo and Quizlet as those separately have much intuitive familiarity to the entire team. The combination of these tools hinted at the fact that language learning happens best with practical practice via speaking and listening to different words. With these themes in mind, the team decided to create a speech system that allowed a user to study a language of their choice with Alexa. Alexa can describe the word in English or another language of the user's choice (Spanish, French, or Italian), and the user has to translate the word.





The progress of the system overall was done in various different sprints as the work had to be additive since there were different pieces to the puzzle from getting a basic skeleton implemented in Voiceflow to getting and parsing the right user data. These different tasks were done by all members of the team when appropriate as the singular system in Voiceflow forced the implementation of one aspect at a time. The system initially started out being rather complicated and some prioritization needed to be done to ensure that the key aspects of the design were implemented in the final system. This included the integration with external data sources as linking them and establishing a data flow involved more extra details that would require substantial more research and implementation. The Voiceflow system already was large in scope, thus we had to abstract some logic into different flows in order to make the system more readable and efficient. The addition of different variations of user input and other smaller features that added to the robustness of the system was done in parallel among the team members, especially after the 2 rounds of usability testing. Overall, the quality of the Alexa skill is high in order to gain some good value to any user at any time of the day who wants to learn or practice a language.





# Appendix

## K-Script

[https://docs.google.com/document/d/1rA3raGRCAHKAH7CsIZyiCYZexe0EHkhmTBRUNP\\_tOH4/edit?usp=sharing](https://docs.google.com/document/d/1rA3raGRCAHKAH7CsIZyiCYZexe0EHkhmTBRUNP_tOH4/edit?usp=sharing)

## Usability Write-up 1

[https://docs.google.com/document/d/1zQron6HASyoj\\_QoLoBVTpKaoECoBh3tqTAKfA2MkR18/edit?usp=sharing](https://docs.google.com/document/d/1zQron6HASyoj_QoLoBVTpKaoECoBh3tqTAKfA2MkR18/edit?usp=sharing)

## Usability Write-up 2

<https://docs.google.com/document/d/14itVAT4QBr44qmei8rdGiL4xl2iuXq3drM91cFy2lOA/edit?usp=sharing>

## System Specifications

<https://docs.google.com/document/d/1ogySOja2RHlrB-nX5dd5o9hHoCD4YdfKDt01xZDFrNQ/edit?usp=sharing>

## Team Contract

[https://docs.google.com/document/d/1WJDz5Jnk5nMBnbygCni4OYdplwWJ2n0iTb\\_IhOXI/edit?usp=sharing](https://docs.google.com/document/d/1WJDz5Jnk5nMBnbygCni4OYdplwWJ2n0iTb_IhOXI/edit?usp=sharing)