LearnAble

Getting the Right Design

Contribution Statement

Sarah Marshall: 25% - Wrote "Selected Design" section
Michele Miao: 25% - Revised previous assignments & formatted report
Sanjit Rajendiran: 25% - Wrote "Written Scenarios"
Max Tian: 25%- Wrote "Participant 3" and "Practices"

Team

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Michele Miao: Storyboarding, design, project management
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Max Tian: User research, task development, writing

Problem and Solution Overview

Dyslexia is a learning disability characterized by difficulties with languages skills, especially reading. About 5-17% of children in the United States have developmental dyslexia, making it the most common language-based learning disability. Children with dyslexia usually have difficulties learning in the classroom, so many students with dyslexia attend special education or receive one-on-one tutoring in order to receive instruction that is specifically targeted towards them. With effective intervention during the early stages of literacy, the gap between dyslexic and non-dyslexic students can be minimized. However, this intervention is usually not effective, because teachers for students with dyslexia have trouble personalizing instruction for each individual student. These students often end up feeling frustrated, unconfident, and socially disadvantaged because of their disability. There is a need for new and creative approaches to teaching dyslexic students.

Our proposed solution is a reading management system to support reading instruction for students with dyslexia. The system has a library of reading passages, categorized by their level of difficulty with regards to vocabulary and grammar. Teachers can easily assign passages at the appropriate difficulty level for their students on their interface. To determine an individual student's reading level, a student can record themselves reading their assigned passage out loud, and the application notes the words that the student struggled with and finds patterns between those words. The teacher can use this data to gain a deeper insight into their student's reading level, and structure their instruction accordingly.

Design Research Goals, Stakeholders, and Participants

Participant 1

John is a college student who went through individualized tutoring and special education at a young age because of his dyslexia. From his perspective, having to leave his classmates to receive "special education" was humiliating. He strongly felt that he would have been more comfortable in school if there had been a universal way to help all kids work on their language skills together.

We employed a directed storytelling method with John, as he is adjacent to our target audience, but not a part of it. We wanted John to reveal what he found to be the most memorable experiences from his childhood related to his dyslexia, and investigate why dyslexia had that kind of an impact on him. Directed storytelling allowed John to talk about a sensitive topic at his own comfort level.

Participant 2

Brandon is a researcher at the UW Brain Development & Education Lab. His team collaborated with Microsoft's Advanced Reading Technologies team on an educational tablet app that used icons underneath the text of passages to serve as phonemic clues while reading (e.g. a key for "ee"). This summer, Brandon conducted a study which mirrored the structure of regular intervention sessions to investigate how children interacted with the app, and how effective the app was in improving the children's reading fluency and accuracy.

Many of the tasks Brandon completed for his study are similar to tasks an actual teacher would complete, so we thought Brandon could be a suitable research participant. Since Brandon had already prepared a presentation covering his research, we employed a similar method to directed storytelling. Since this was a research study, Brandon had carefully documented his actions and results throughout the process, so his accounts should be accurate to his experiences.

Participant 3

Nicole is a special education teacher who teaches middle school students with learning disabilities to be able to read individually. Her students meet with her every day during the normal school hours in order to receive more one-on-one instruction, and she assigns daily homework. She not only teaches her students to read, but also encourages them to be excited about learning.

Nicole is the closest research participant we had to our target audience, though she teaches to an older demographic than our target audience. Because she is close to our target audience and she was our last research participant, we decided to interview her in order to get answers on specific questions we had throughout our research. Through we had prepared questions beforehand, Nicole also shared a lot of other details that we hadn't considered.

Design Research Results and Themes

Themes

While intervention can help children with dyslexia overcome their difficulties with reading, there are quite a few drawbacks. From the eyes of the child, special education does not just mean more hours of school and fewer hours of play; it means more hours doing something that is especially challenging for them. Children with dyslexia also experience social stigma and embarrassment when they leave their classroom or after school activities in order to go to special education. This can lead to a social divide between children with dyslexia and those without. From the eyes of the parent, special education is very expensive, and the extra reading practice that they have to do with their child is time-consuming.

Time is a critical factor in the success of dyslexic children on a day-to-day basis as well as a long-term timeframe. Finishing assignments on time in class is an often used metric of achievement in school, and it has been proven that the older a dyslexic student gets the harder it is for them to get a hold on their condition.

Problems

The biggest problem we faced in our design research was finding participants that were in our target audience. None of us knew any dyslexic children personally, and there are many hoops to jump through in order to have a child participate in design research. We also did not receive a response from the special education school that we had planned to observe. Therefore, we had to restructure our design research and broaden our participant pool to beyond our target audience.

Practices

The common practice for children with dyslexia are having trouble to read. This could affect them in many ways such as cannot understand what is in the textbook; therefore, they cannot finish their assignments. Once they are stressed or struggled, they are discouraged to learn and mentally think that they are not as good as the normal students. Other common practice they have is that while they are stuck on a word, instead of figuring out what that word is, they will skip it. Since they think it does not really matter for understanding as a whole sentence; therefore, they are not be able to build new vocabulary.

Task Analysis

Who is going to use the design?

The primary target audience is English-speaking children with dyslexia at an elementary school age, which is when dyslexia can begin to be diagnosed and intervention can have a significant impact. These children are just as intelligent and excited to learn as non-dyslexic children, but they often feel discouraged academically, emotionally, and socially because of their dyslexia. Since most children do not have direct access to technology, they would have to access the design through technology from a secondary user, like a parent or a teacher.

What tasks do they now perform?

Currently, instruction for young children with dyslexia involves teaching the basics of language and literacy (such as sound-letter relationships) so that they improve reading comprehension and fluency. This process usually involves instruction and exercises during special education, and heavy reading practice at home. There are many educational technologies specifically targeted for young children learning to read: apps to change the visual-spatial representation of digital text, digital libraries with interactive and engaging books at the appropriate reading level, games to help children build their phonemic awareness, etc. There are also many general technologies to support reading: text-to-speech technology to read words aloud, flashcard apps to build vocabulary, etc.

What tasks are desired?

It is time-consuming for instructors to assess students' reading ability. Instructors must pick passages have an appropriate range of phonemes to adequately gauge the student's reading fluency, with enough depth to also gauge reading comprehension. Also, the instructor must carefully select difficult words and generate pseudowords to gauge decoding ability. After testing, the instructor has to go through the test data to determine what the student understands, and what the student is still struggling with. It is also difficult to personalize exercises and practice reading for the student based on the specific areas where they need to improve. For students, the practice material must be engaging and appealing enough to use voluntarily.

How are the tasks learned?

The assessment tasks for instructors would require a training to teach to dyslexic students. On the other hand, the tasks for students should require as little training as possible, since learning to read is already a steep learning curve.

Where are the tasks performed?

The tasks can be performed during instruction, or as practice at home. Usually, the instructor assesses and teaches during special education and assigns practice material for in between sessions. Students work on the practice material at home, with the help of their parents.

What is the relationship between the person and data?

The data comes from student assessments and practices as they occur over time. The data can be accessed on multiple devices such as phones, computers, or tablets.

What other tools does the person have?

Usually the assessments are manually generated by the instructor, and the data from the students is collected either digitally (through a platform like Google Forms or another app) or manually (through a paper test). The assigned readings may be physical, in which students and parents manually note their reading data, or digital, in which the technology keeps track of reading data.

How do people communicate with each other?

Instructors and students meet regularly, where the instructor teaches and works with the student. Instructors may also meet with the parents regularly as well, to check in with the student's progress. Parents may encourage students to complete their assignments and help them when necessary.

How often are the tasks performed?

Special education and assessments occur regularly, which may be daily, bi-weekly, or weekly. Reading practice should almost occur every day.

What are the time constraints on the tasks?

The time constraint for the special education is the length of the session, as predetermined by the parents and instructor. There is no strict time constraint on the reading practice, but students may get bored or tired after a long time. In the long term, there is no strict time constraint on learning to read, but the student should be able to keep up with their current grade level.

What happens when things go wrong?

If the assessment or the assigned readings are not at the appropriate level for the student, the student might spend more time than expected, further adding to the burden and frustration of having dyslexia.
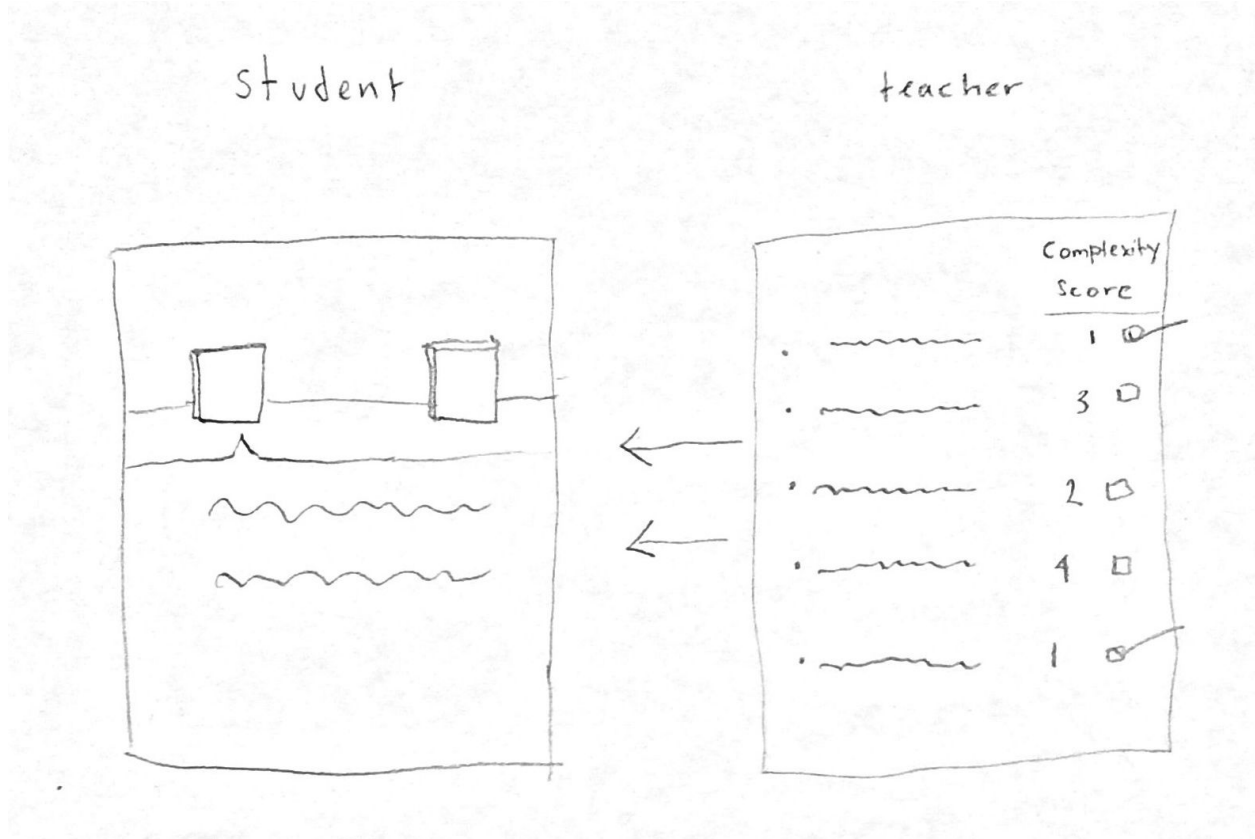
Proposed Design Sketches

Design 1

Figure 1

Our first design (Figure 1) is a digital library of readings that are categorized by their complexity in vocabulary, sentence structure, and word count. On the teacher's interface, a teacher can filter through this library based on an individual student's reading level, and assign readings in the library that are suited for the student. The teacher can view stories within a certain range of a student's reading level, and select specific stories to assign to their students. The stories are pushed to the student's interface, where the student can view the readings that they have been assigned to do. By implementing this two-step interaction, we hope to make allow instruction to be more individualized.
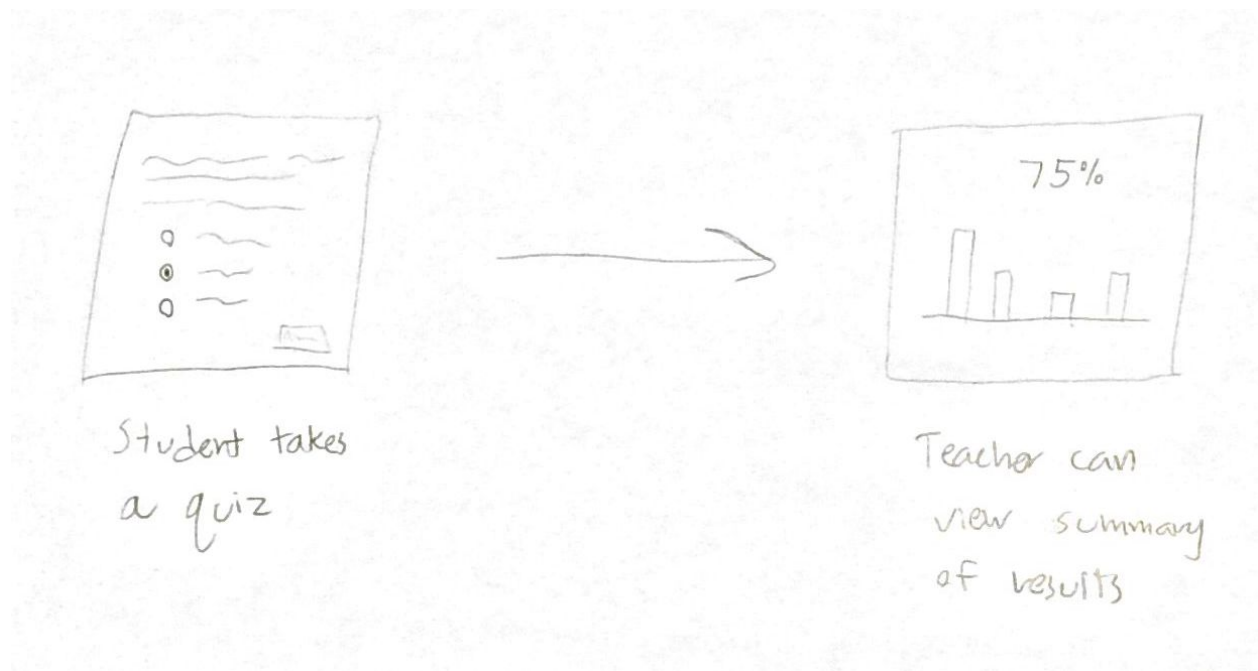
Design 2

Figure 2

Our second design (Figure 2) is an assessment platform that allows teachers to easily design reading assessments, and allows students to complete those assessments. Assessments are usually difficult to design and therefore are given rarely, which gives the teacher little information on their students' progress. A teacher can easily generate specific exercises that are proven to be useful for assessing reading ability, varying the difficulty of these exercises based on previous assessments of the student. The teacher assigns the assessment for the students to take, and the platform uses the student's answers to gauge specific areas of progress and improvement.
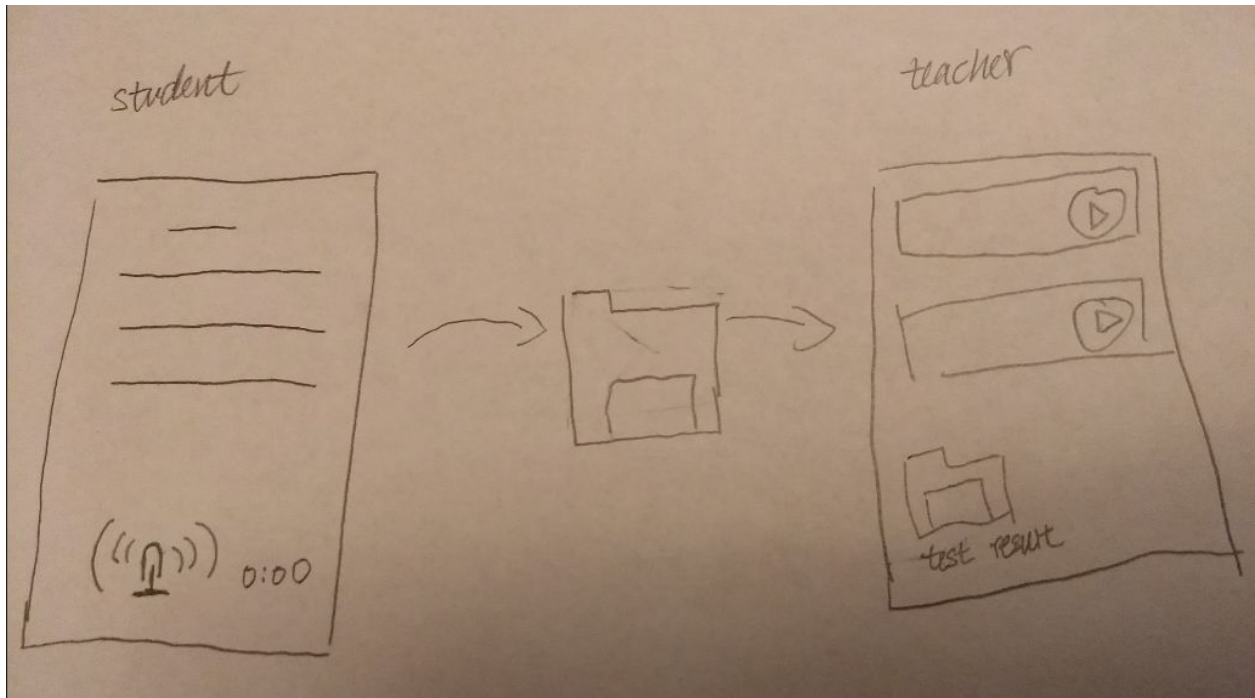
Design 3

Figure 3

Our third design (Figure 3) is a recording mechanism that transcribes audio of a student reading out loud. Students read a passage from the application out loud, which the application can record. The application keeps track of words that the student struggles with. The recording and the transcription (with the denoted words) are sent to the teacher. The teacher can not only monitor if the student has completed their at-home assignments, but also track their reading progress over a period of time. The teacher can also use this data to restructure their instructional plans to cover material that the student struggled with.

Selected Design

After we received feedback on our three proposed designs, we realized that they were essentially three different features that could be part of the same design for a tablet app. Because of time constraints, we weren't able to go back and develop additional designs for our project. We decided to move forward with the tablet design since it's our most well-developed concept and it has the potential to support all of the tasks we are interested in designing for. Our initial design will focus on two tasks: helping the teacher select and assign readings that are appropriate for each student's reading level, and recording the student as they read the text out loud so their teacher can assess their performance. Other tasks we may add in the future include the student taking quizzes, and enabling the student to read their assigned texts more comfortably.

Written Scenarios

Scenario 1 (Figure 4)

Brandon is a hardworking teacher on the go. He knows each of his reading disabled students personally, but there are simply not enough hours in the day for him to assign readings and quizzes on an individual basis. Furthermore, it is challenging for Brandon to keep track of the progress and skill levels of every student due to their variability over time. Luckily for Brandon, our project will allow him to easily monitor the reading aptitudes of his students and assign readings/quizzes to them remotely based on their skill levels, combining his personal offline approach with a computerized online approach. A machine learning algorithm determines complexity scores for each reading in Brandon's "library" by analyzing phonemes, sentence structures, vocabulary, etc. and calculates corresponding scores for his students based on their assignment progress and quiz grades. By pre-sorting the readings, our platform lets Brandon pick stories that will appeal to children's individual tastes (genre and topic) without risking demotivation.

Janet is a young reading disabled child in kindergarten. She has a basic grasp on tablet interfaces and occasionally plays games on her mom's iPad. Outside of school and Brandon's tutoring sessions, there is not much she can do to improve her learning situation; her parents want her to succeed but there is no one solution to nudge her towards. By using our platform, Janet can improve her reading abilities through a gamified design that rewards her for passing teacher-approved readings and quizzes. The details of her "bookshelf" are worked out behind the scenes, all she needs to do is click and go.

Scenario 2 (Figure 5)

Brandon also needs a way to monitor his students' speaking abilities alongside their reading abilities. Our platform fully supports this: by hitting a record button, students can read aloud and have their voices recorded in the context of each reading. When Brandon reviews the individual progress of his students, he can see which parts of the readings each student struggled with and their overall improvement (or lack of improvement) over time.

Janet often struggles with word pronunciation, which in a public setting can be stressful and even humiliating. By allowing her to work on these skills virtually, this task targets some of the social aspects of dyslexia.
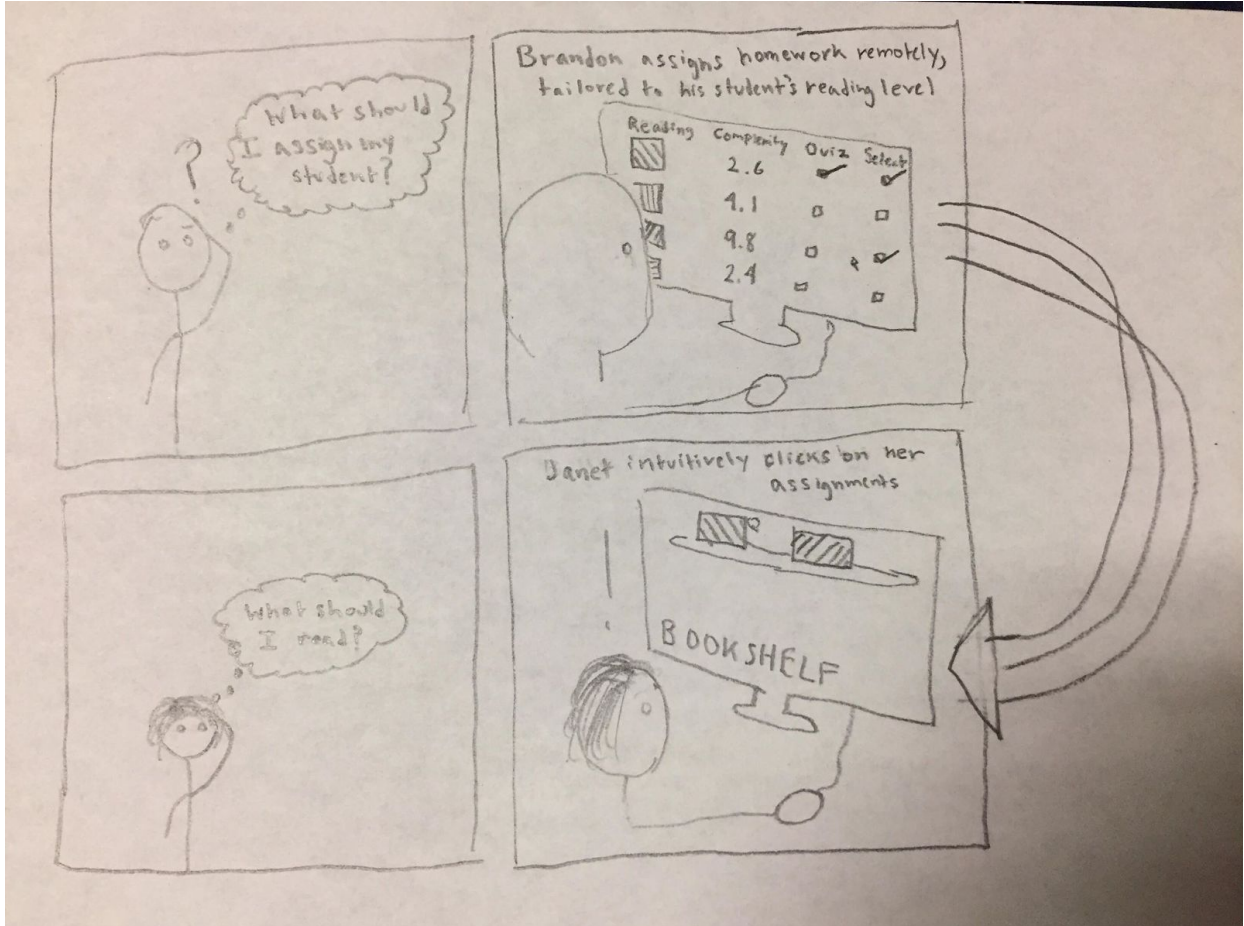
Design Storyboards

Storyboard 1
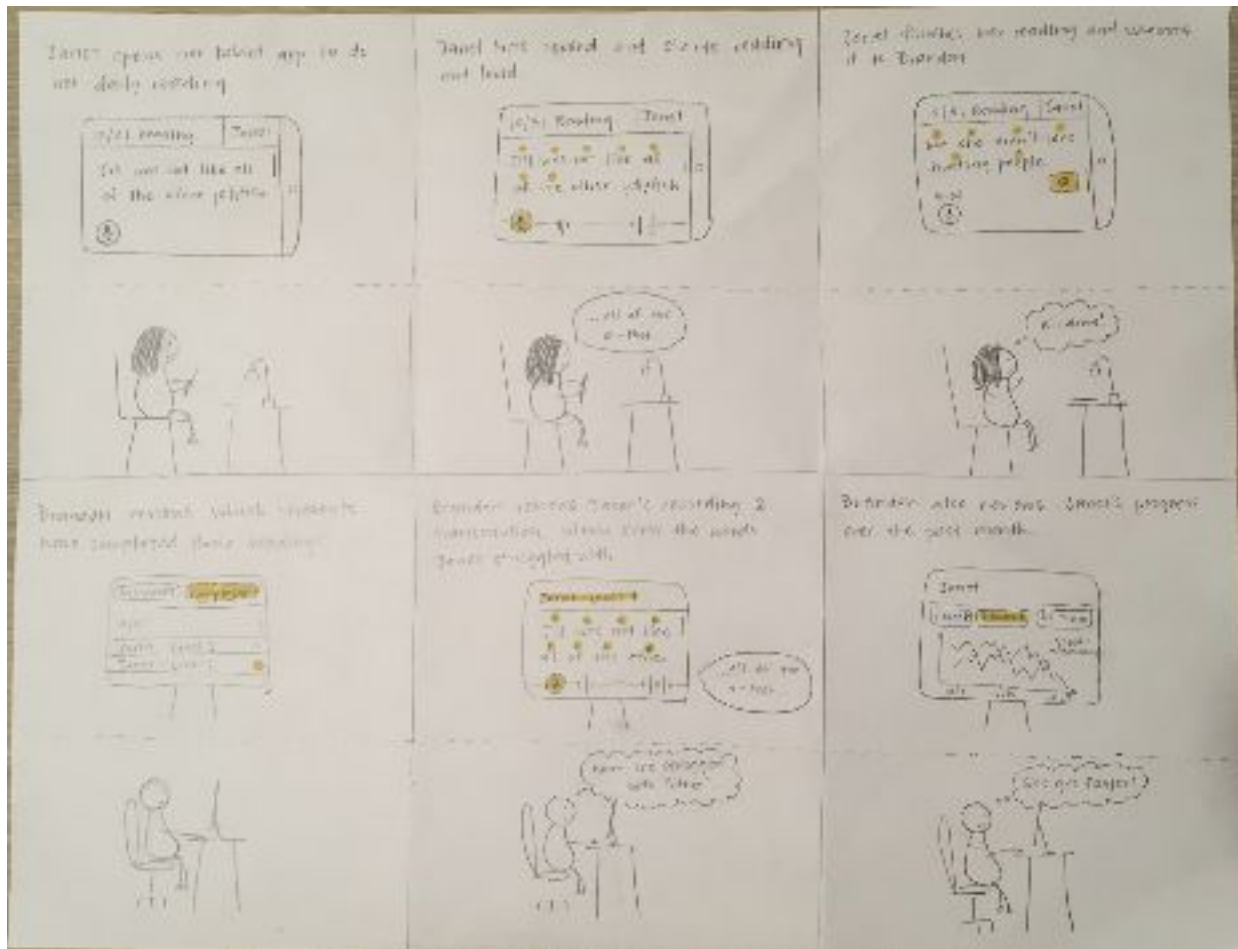

Figure 4

Storyboard 2

Figure 5