

X-STEPS

DESIGN ASSISTANT

Deliverable Rough Draft

TEAM 8

Deuce Foutch | Kevin Rodriguez | Mina Fahmi | Yukino Nagai



TABLE OF CONTENTS

EXECUTIVE SUMMARY	3
BACKGROUND	5
DESIGN	6
SAMPLE INTERACTION	8
SKILL FLOW	11
USABILITY TESTS	12





EXECUTIVE SUMMARY

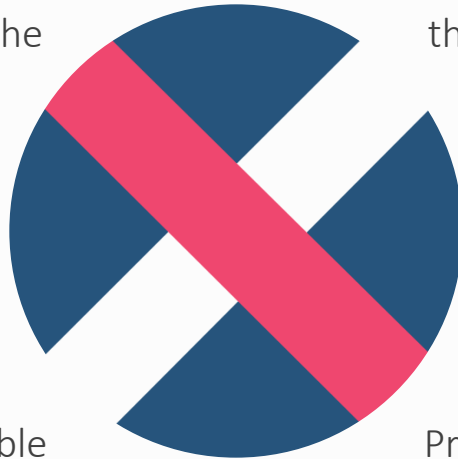
Engineering Innovation and Design (EID) is a course taught at MIT as part of the Gordon Engineering Leadership Program. Through this course, students learn to apply design-thinking principles to any domain and communicate their designs with high impact. A core aspect of EID is learning the **10-Step Design Process**, an iterative method for determining a problem, researching context, and designing solutions.

This process is an invaluable tool, but students often struggle to memorize the steps, or know how to apply them in a given situation. As a solution we have developed **Design Assistant**, an Alexa skill which helps students practice and internalize the 10-Step Design Process through verbal interactions. Design Assistant can help students memorize the process by reading steps to them, or quiz their knowledge by asking questions related

to a fictional design situation. Design Assistant has been optimized to understand natural responses and adjust based on a student's quiz performance.

Our research explored the response of EID students to Design Assistant.

Through usability testing, we found that despite limitations to our development platform, students found Design Assistant practical and beneficial. Design Assistant is a fun, effective tool for learning the 10-Step Design Process and developing design -thinkers.





BACKGROUND

The 10-Step Design Process ^[1] is the quintessence of EID. As such, it is of paramount importance that the future innovators that EID produces truly internalize the process. So, that they may put it into practice not only habitually, but also effectively. However, it has become evident that current students of EID have had difficulty achieving any sort of proficiency using the process.

50% was the average grade on the second quiz administered to this year's class. This fact is disconcerting for two reasons. Not only was half of the quiz content an enumeration of the 10-Step Design Process, but also this was not the first time the students were asked to describe the process on a quiz. This demonstrates the inability of the students commit the process to memory, let alone internalize its meaning and implications. This is why we, at **X Steps**, see the need to create an Alexa skill to assist students in EID in acquiring the skills necessary

to become innovators.

Our Alexa skill was developed utilizing **Sayspring**. Sayspring is an Alexa skill development platform that allows for rapid prototyping of speech interfaces. In exchange for its speed and ease of use, Sayspring has a number of limitations. The platform's structure lends itself to making programs that are linear, not dynamic. There is no accessible memory nor any ability to create or use variables. In turn, all possible interactions within our app had to be "hard-coded".

[1] THE 10-STEP DESIGN PROCESS

- | | |
|------------------------------------|----------------------|
| 1. Identify Needs | 6. Specifications |
| 2. Information Phase | 7. Creative Design |
| 3. Stakeholder Phase | 8. Conceptual Design |
| 4. Planning & Operational Research | 9. Prototype Design |
| 5. Hazard Analysis | 10. Verification |



DESIGN

Design Assistant was made specifically for current and future students of EID, but was also intended for any individual learning the 10-Step Design Process. Our **main design priorities** were:

1. Help students **memorize** the 10-Step Design Process
2. Help students **Internalize** the meaning and usage of the steps

Several options were considered when determining how to best meet our user's needs. These included skills where a user would provide a step's name given a step number, skills where a user would respond to descriptions of a step, or skills involving examples of a step in action. Ultimately we chose a hybrid approach such that Design Assistant met our two design priorities separately.

The first skill function is **Review**, which reads aloud each step of the 10-Step Design Process. The second function is **Quiz**, which was modeled after EID Instructor Blade Kotelly's method for teaching the process. During Quiz mode, Design Assistant walks users through a fictional design scenario, such as planning a picnic.

The skill then asks students questions about what situation corresponds to which step or sub-step. For example, Design Assistant can ask "During which step do you consider who will be affected by this picnic", with the answer being "stakeholder phase." During EID, we witnessed Mr. Kotelly employ this style and saw that it was an effective way of helping students understand the meaning of a step. Over the course of a lecture, students began to more actively brainstorm and correctly categorize design steps.

Students may respond to the same



DESIGN

question with a wide array of answers. Questions expecting “Stakeholder phase” could also be answered with “stakeholders”, “stakeholder step”, or even “stakeholder analysis.” Design Assistant was made with this in mind, and accommodates diverse responses. Design Assistant is also made to accept and speak with **natural language** (“Yeah” vs. “Yes”), which improves user enjoyment and immersion. Results from usability tests have been used to inform the design of Design Assistant’s word banks.

Quizzes can become frustrating if you get stuck. We included functions in Design Assistant to **restate questions, provide hints, and exit the quiz when asked** to improve the user learning experience. Hints were refined and validated through analysis of usability tests.

“Yeah” vs. “Yes”

Design Assistant is also made to accept & speak with natural language.



SAMPLE INTERACTION

Speaker	Action	Notes
User	Alexa, Design Assistant	
Alexa	Welcome to Design Assistant. I will help you learn the 10 Step Design Process. Say "Review" if you'd like to work on memorizing the process, say "Quiz" to test your knowledge, or "Exit" to quit.	This is the "Menu". "Review" would go to a flow where Alexa would count to 10 and provide the Design Process step.
User	Quiz.	
Alexa	Good choice. I will present a scenario, and you will answer questions with vocabulary from the 10 Step Design Process. Today you are planning a picnic with friends. When you are thinking about who will be affected by this picnic, what step are you in?	
User	Information phase	Incorrect response
Alexa	Try again. When you are thinking about who will be	
User	Stakeholder phase	User could also say similar phrases
Alexa	Correct! What kind of stakeholder would your friends	
User	Primary	
Alexa	Correct! What kind of stakeholder is the supplier for	
User	...	Says nothing
Alexa	I'm sorry, I didn't quite get that. What kind of stake-	
User	Secondary	
Alexa	Correct! What step do you start in, when you deter-	
User	Identify needs	



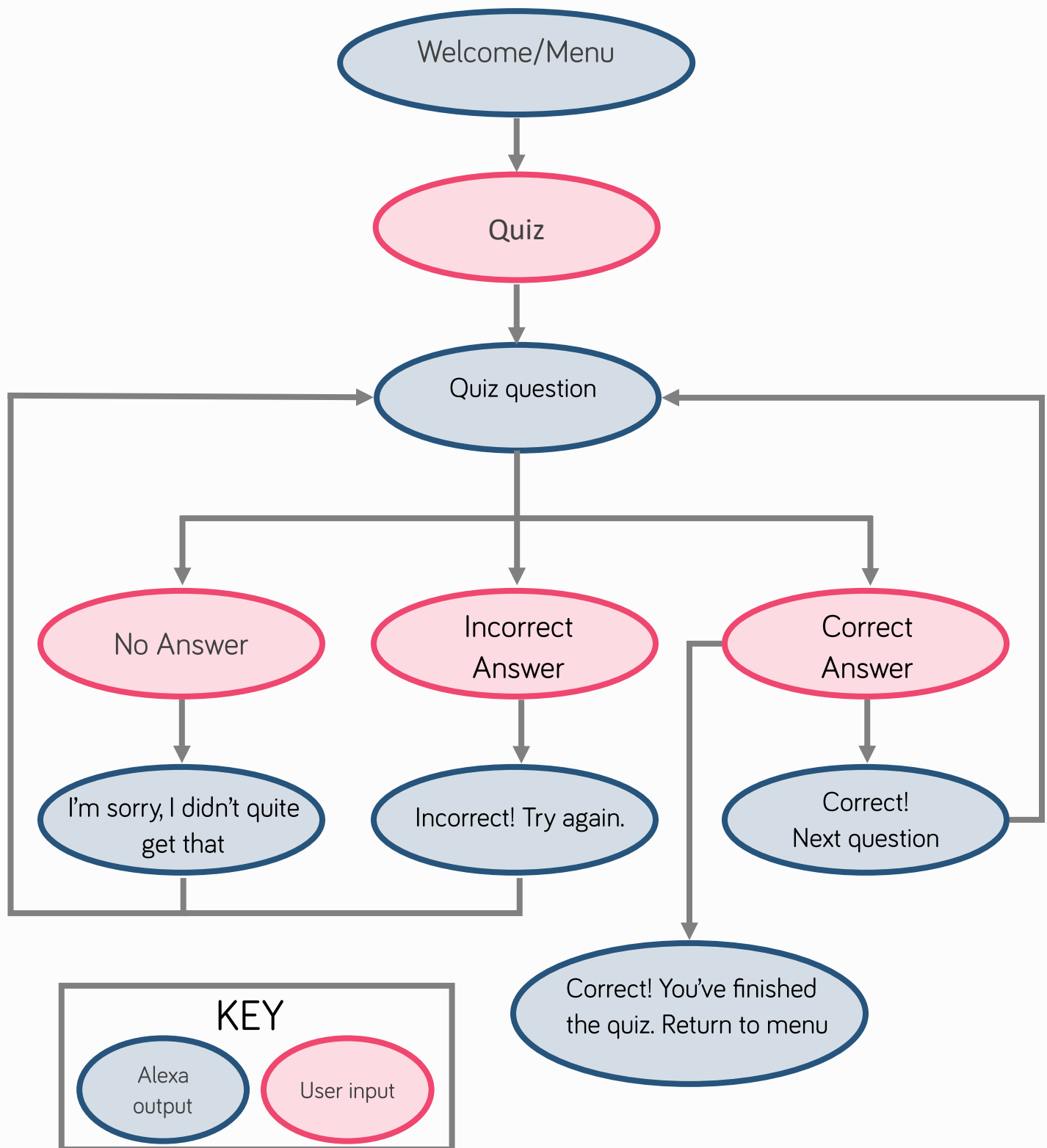
SAMPLE INTERACTION

Speaker	Action	Notes
Alexa	Correct! During what step will you research possible	
User	Information phase	
Alexa	Correct! During what stage will you consider limita-	
User	Planning Research	
Alexa	Correct! When you consider a response plan for an allergic reaction, are you in the specifications step, or	
User	Specifications	Incorrect response
Alexa	You are actually in the Hazard Analysis step, as you are evaluating the potential hazard of an allergic reaction. When you are sketching picnic blanket layouts, are you engaging in creative design or conceptual design?	
User	Creative design	
Alexa	Correct! During which step might you create a mock-	
User	Prototype design	
Alexa	Correct! During which step is the picnic held, and	
User	Verification	
Alexa	Correct! Good job, you have completed the quiz. Returning to menu. Welcome to Design Assistant. I will help you learn the 10 Step Design Process. Say "Review" if you'd like to work on memorizing the process, say "Quiz" to test your knowledge, or "Exit" to quit.	Return to menu
User	Exit	Application closes





TYPICAL FLOW



USABILITY TESTING

PHASE 1

X-Steps conducted usability tests on the first prototype of Design Assistant with four users, each currently enrolled in EID. All users had experience with the 10 Step Design Process and virtual assistants, and each user expressed varying degrees of comfort with technology.

Users were generally pleased with the prototype, indicating that it was both useful and that they would recommend it to other students.

The usability tests also revealed critical issues to be addressed in our next prototype. Multiple users forgot what question they had been asked, especially after giving an incorrect response. After providing multiple incorrect responses, users seemed frustrated or confused, as they did not know how to proceed with the quiz. In response to these issues, questions restatements and hints were added to

incorrect answer responses





In one instance, a user became stuck and said “Exit”, and seemed surprised when the skill terminated. This suggested that the user held a different mental model of what “Exit” would do, so the “Exit” command was more clearly explained in the skill menu.

















Another usability issue we encountered appeared roughly halfway through the quiz. Design Assistant begins to ask questions with 2 possible options. If a user provides an incorrect response, they are prompted to try again, despite the right answer being obvious via elimination. This caused users to seem amused or exasperated when answering again. After answering correctly, Design Assistant redefined both skills. This was done to help inform a user in case they answered incorrectly, but it appeared to bore and confuse users due to the change in pace. Therefore, the response architecture of Design Assistant was overhauled to provide



USABILITY TESTING

different responses depending on whether a user got a 2-option question correct. Design Assistant would now explain why the correct answer was correct only if an incorrect response was provided.

Pre-Test Summary	User 1	User 2	User 3	User 4
Experience with 10-Step Design Process	✓	✓	✓	✓
Experience with virtual assistants	✓	✓	✓	✓
Comfortable interacting with tech-				

Post-Test Summary	User 1	User 2	User 3	User 4
Was your experience positive?				
Was the app easy to use?				
Are you likely to use the app again?				
Are you likely to recommend this app				



USABILITY TESTING

PHASE 2

During usability testing round 2, EID Team 8 (X Steps) conducted usability tests on the second prototype of our Alexa Skill, Design Assistant. This skill is designed to help students internalize the 10 Step Design Process taught in EID. The skill allows users to either review the design process, or take a quiz which walks through a design scenario. Because EID students are the primary audience of this skill, we asked four of our classmates to be usability testers.

Our pre-test questionnaire revealed that all of our test subjects were either 20 or 21 years old and were a member of the class of 2019. Because we specifically recruited test subjects from the EID class, all test subjects had experience with both the 10-Step Design Process and with virtual assistants. However, only two owned a virtual assistant themselves. Two

testers were somewhat comfortable with technology (4/5), while two said that they were very comfortable using technology (5/5).

One major update that was addressed between the first prototype and the second prototype was that Alexa will repeat the question and provide a hint if no response was given. This prompted a positive response from one of the users, who did not hear (or understand) the question the first time. She looked visibly frustrated when her command to repeat the question was met with “I didn’t quite catch that” but her frustration quickly turned to relief when Alexa repeated the question.

The usability tests revealed that some issues remained even after the prototype was updated. Most notably, once the user gave a known incorrect answer, Sayspring “exited” the



USABILITY TESTING

question and gave the same response for all incorrect answers. After this point, even if the user gave the correct response, the skill did not always register it as the correct answer. Furthermore, Alexa is no longer able to repeat the question at this point. Any answer given beyond this point elicits the same “try again” response. This led users to fall into an infinite discouraging loop, which caused users to prematurely terminate the program in frustration.

In further iterations of the skill, it may be necessary to switch to a programming platform other than SAYSpring. SAYSpring does not support the sort of “linear” progression of commands that is beneficial for a quiz-type skill like ours. By switching to a different platform we may be able to avoid the type of negative feedback loop that frustrated users. On a more versatile platform, we may be able to easily code the skill to skip questions

after 3 incorrect guesses, repeat the question, and/or implement other solutions to this problem.

Through our post-test questionnaire, we found little correlation between comfort with technology and completion of the task list. All 4 users were unable to complete the quiz, largely due to getting stuck on a question and being unable to proceed. Users 1 rated their experiences, the app’s ease of use, and their likelihood to recommend this skill to others all very disparately. Spanning the full ranking range of 1/5 to 5/5, it seems that user views are highly subjective to their individual skills and personalities, as simply not knowing the answer to one question was able to emotionally derail some users entirely. It seemed that some users were highly sympathetic to the limitations of the skill, while others rated the skill in a harsher context. To be appealing to a wide range of users,



USABILITY TESTING

the skill should try to not unsettle those who are easily frustrated.

Through round 2 of usability testing, we have identified several usability issues that could be addressed in further iterations of our product. Our questionnaires provided numeric data that can be used to assess future adjustments to the Design Assistant Skill.

“little correlation between comfort with technology and completion of the task”



USABILITY TESTING

Pre-Test Summary

User 1

User 2

User 3

User 4

Experience with 10-Step Design Process



Experience with virtual assistants



Comfortable interacting with tech-



Post-Test Summary

User 1

User 2

User 3

User 4

Was your experience positive?



Was the app easy to use?



Are you likely to use the app again?



Are you likely to recommend this app



Very



Somewhat



Neutral



Somewhat Not



Very Not





APPENDIX

FULL SKILL FLOW	A.1
-----------------	-----

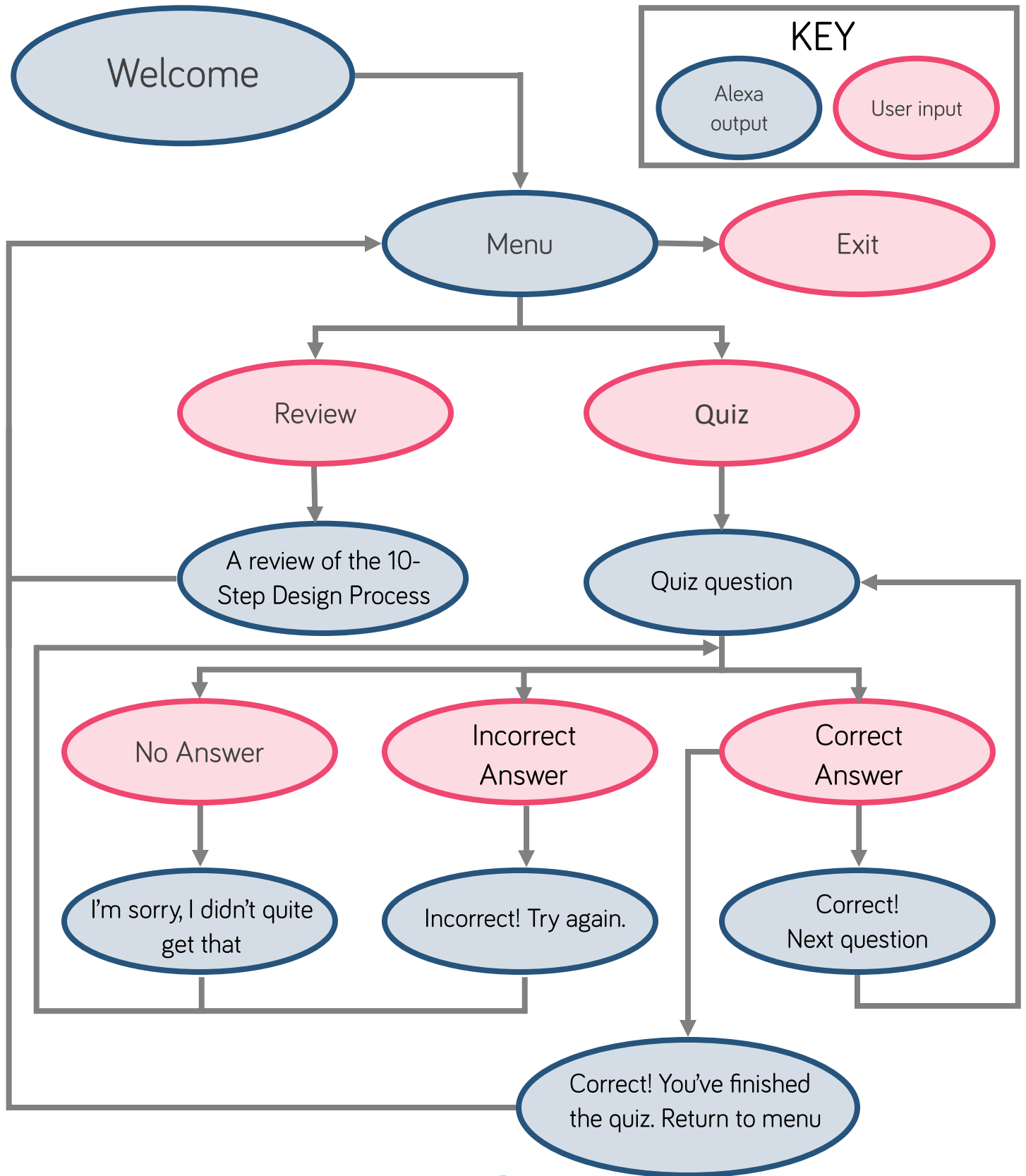
USABILITY TEST NOTES	A.2
----------------------	-----

USABILITY TEST DATA - PHASE 1	A.4
-------------------------------	-----

USABILITY TEST DATA - PHASE 2	A.9
-------------------------------	-----



FULL SKILL FLOW



USABILITY TEST NOTES

PHASE 1

User 1

Issue #	Description	UI Severity (1-5)	Tech Complexity (1-5)	Resolution
1	User said "I'll go ahead and quiz" when prompted, Alexa did not understand. User seemed mildly frustrated, and then restated simply "Quiz".	2	2	Include more natural phrases with which one might open a quiz, rather than simply saying "Quiz", such as "Open a quiz", "I'll do a quiz", "Let's do a quiz", etc.
2	User answered incorrectly twice, and then forgot the question.	4	3	Have Alexa restate the question given an incorrect answer.
3	User says "Exit", and then seems surprised when the skill closes	3	1	Clarify during intro that saying "Exit" will terminate the skill

User 2

Issue #	Description	UI Severity (1-5)	Tech Complexity (1-5)	Resolution
1	User did not know answer to final question, and looked to test administrator for a hint	4	4	Provide hints if user is solidly stuck.

User 3

Issue #	Description	UI Severity (1-5)	Tech Complexity (1-5)	Resolution
1	When the user failed to provide a response or provided a response not within our set of acceptable correct/incorrect answers, Alexa's response, "Sorry, I only understand a limited number of commands." induced frustration in the user.	4	4	We can vary our responses, add hints or review mid quiz, or include a way to fail the quiz or have it auto exit.
2	The user forgot the question after providing an incorrect answer multiple times	5	3	Make Alexa repeat the question on command or automatically.

USABILITY TEST NOTES

PHASE 1

User 4

Issue #	Description	UI Severity (1-5)	Tech Complexity (1-5)	Resolution
1	When at a 2 option question, the user answers incorrectly. The user then attempts to provide the other option, but is stopped by a Sayspring bug. Even without this bug, since there are only two options, the correct option is frustratingly evident after one incorrect response.	3	4	If an incorrect response is given for a 2 option question, redirect to a flow stating the right answer, and then continue.

PHASE 2

User 1-4

Issue #	Description	UI Severity (1-5)	Tech Complexity (1-5)	Resolution
1	User gave incorrect answer multiple times. When she finally gave the correct answer, the system did not give the response to the correct answer, and instead marked it incorrect.	5	4	Include common mispronunciations of the actual correct response as "correct" responses too
2	User forgot the question, but could not get system to repeat the question	4	2	Have the system repeat the question after an incorrect response, in addition to after a non-response
3	User forgot the question, but could not get User gave step number instead of step name, kept changing numbers and became increasingly frustrated as her answers were not accepted.system to repeat the question	5	1	Reword questions to be clear about what we're asking for
4	User didn't know an answer, and tried to say "I don't know" to progress	4	4	Allow the system to receive "I don't know" type responses and skip to the next question
5	User's inputs weren't received when they tried to talk over Alexa or included rambling in their response	3	2	Include clear instructions on waiting for Alexa and avoiding extraneous words in responses

USABILITY TEST DATA

PHASE 1

Pre-test Questionnaire Data

fig.1

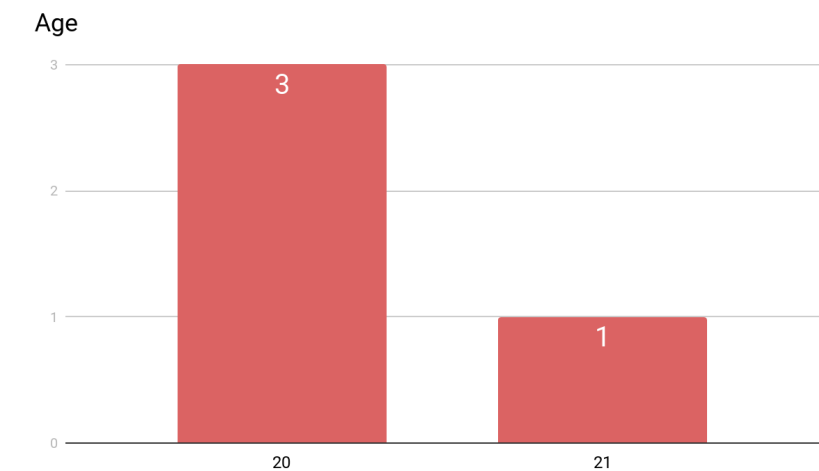
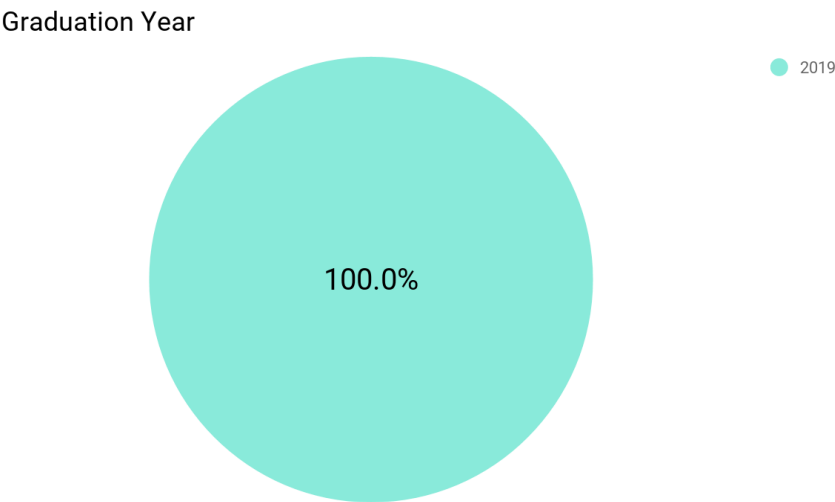


fig.2



USABILITY TEST DATA

PHASE 1

fig.3

Do you have experience with the 10 Step Design process?

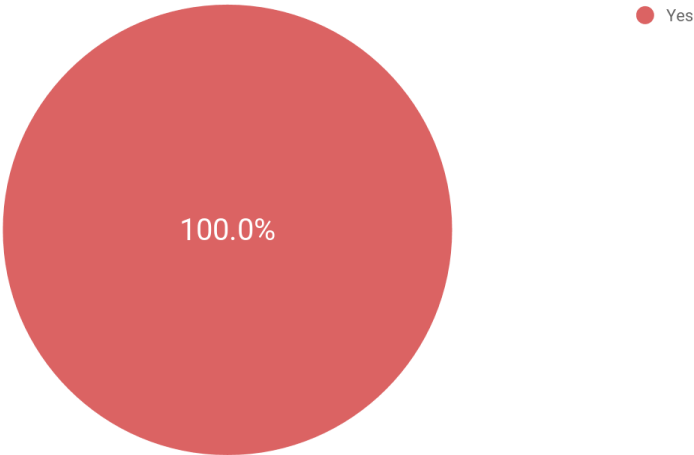
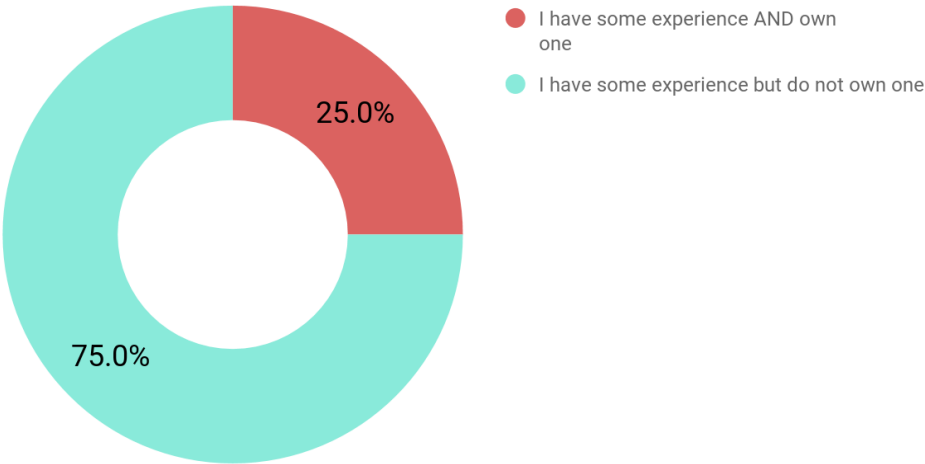


fig.4

Do you have experience with Virtual Assistants (e.g. Alexa, Google Home, Siri)?

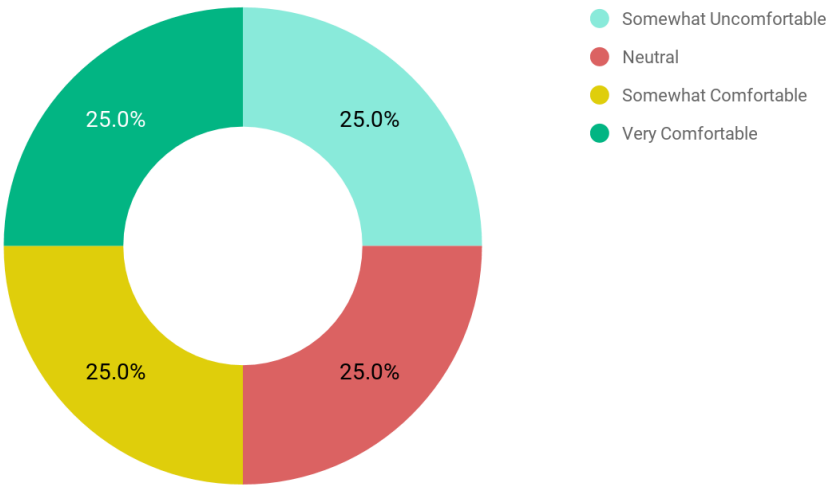


USABILITY TEST DATA

PHASE 1

fig.5

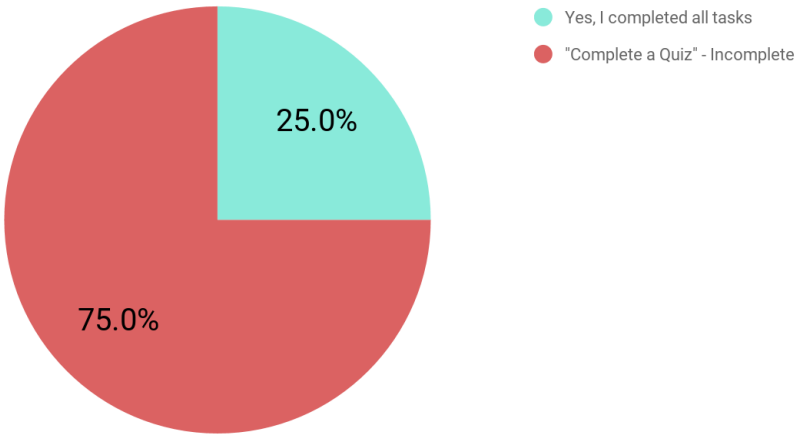
How comfortable are you interacting with technology?



Post-test Questionnaire Data

fig.6

Were you able to complete all the tasks described in the task list? If not, which tasks were incomplete?



USABILITY TEST DATA

PHASE 1

fig.7

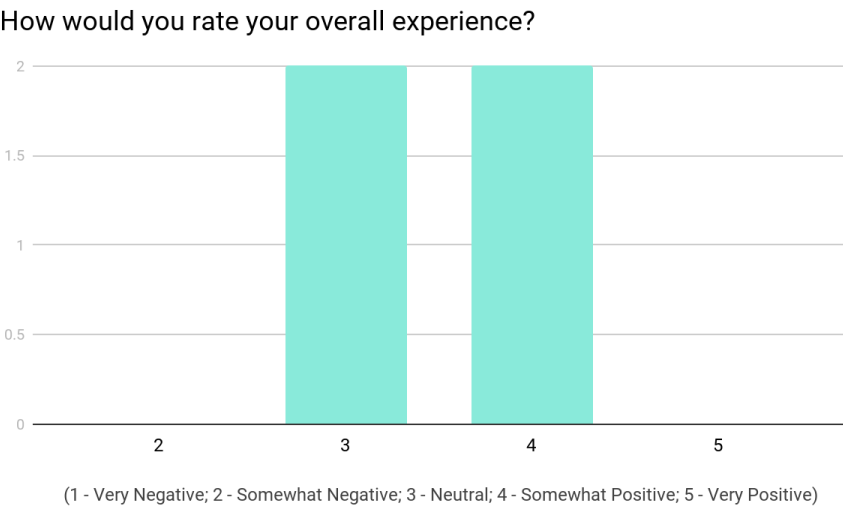
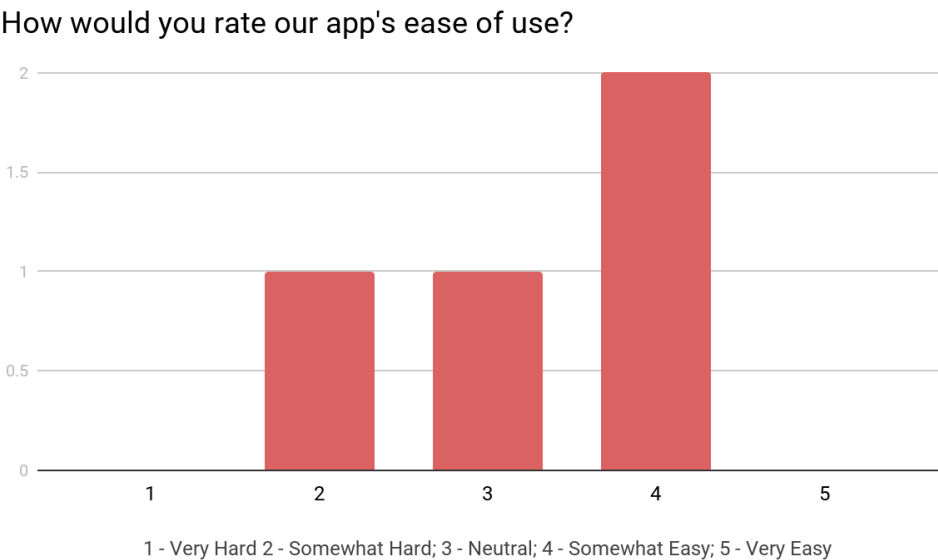


fig.8



USABILITY TEST DATA

PHASE 1

fig.9

How likely would you use this app again?

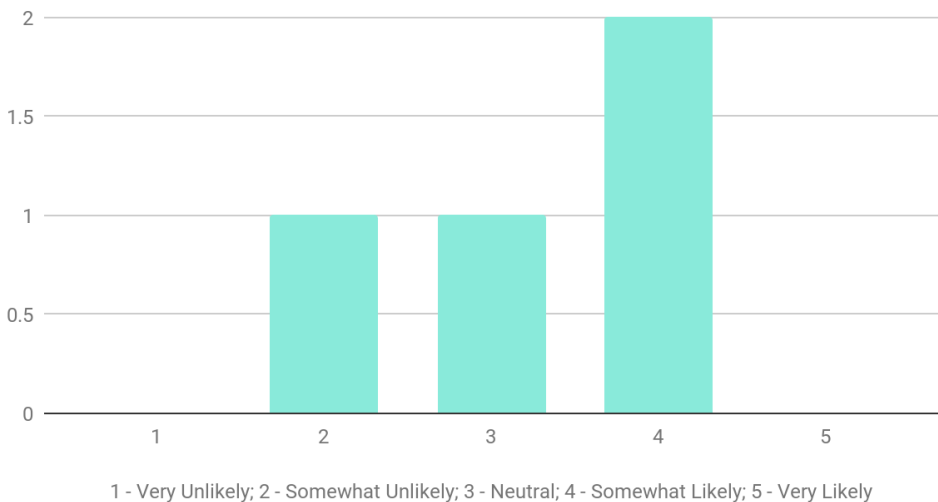
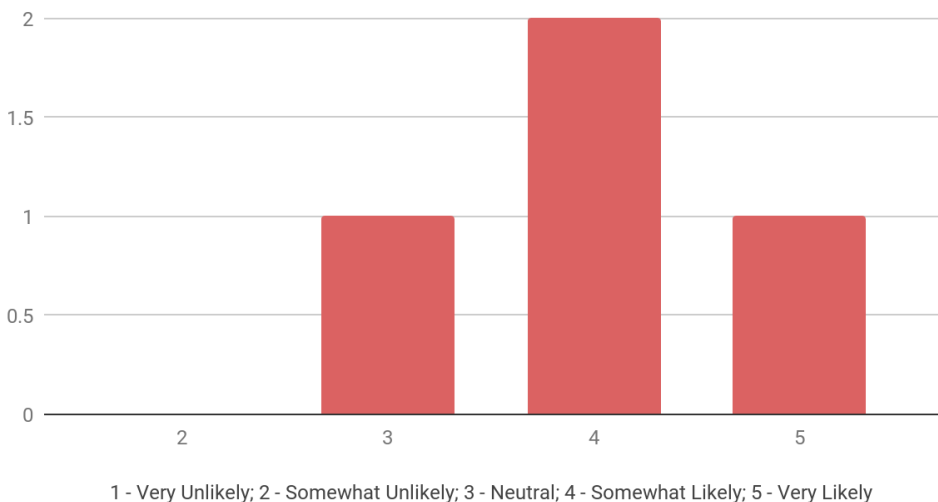


fig.10

How likely would you recommend this app to a friend?



USABILITY TEST DATA

PHASE 2

Pre-test Questionnaire Data

fig.1

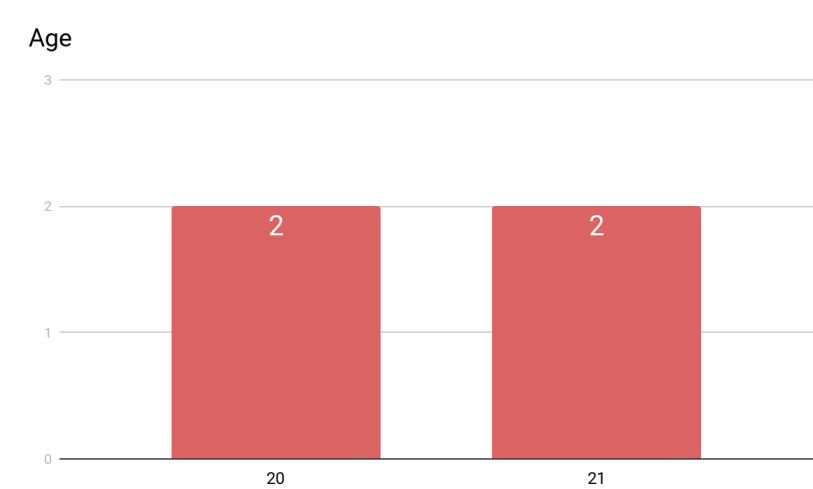
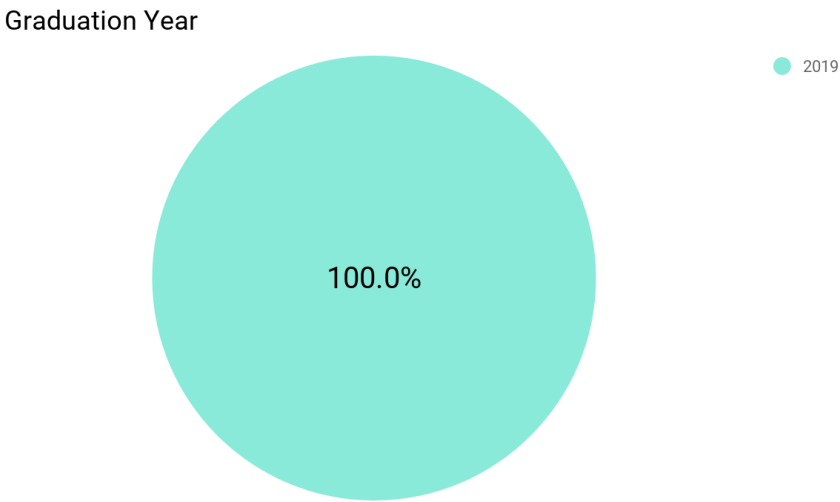


fig.2



USABILITY TEST DATA

PHASE 2

fig.3

Do you have experience with the 10 Step Design process?

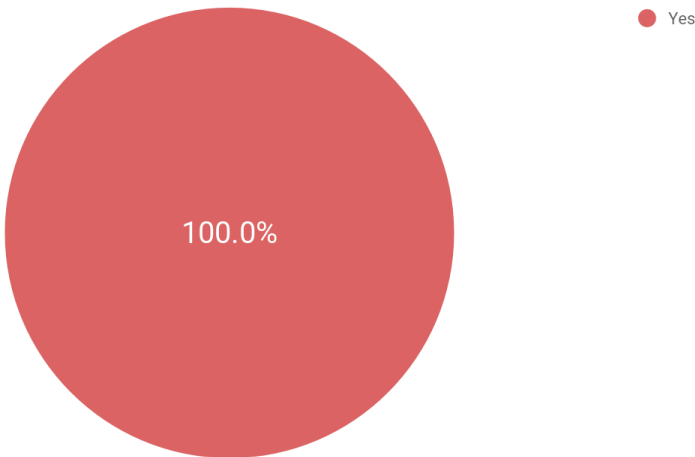
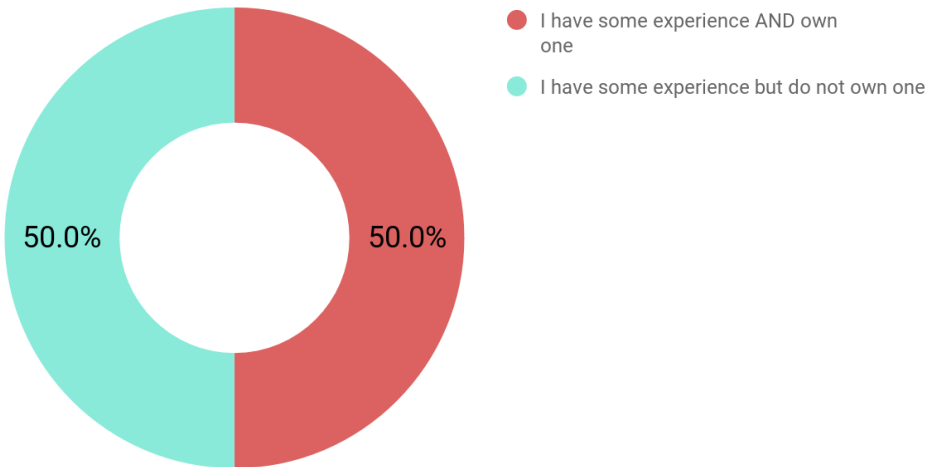


fig.4

Do you have experience with Virtual Assistants (e.g. Alexa, Google Home, Siri)?

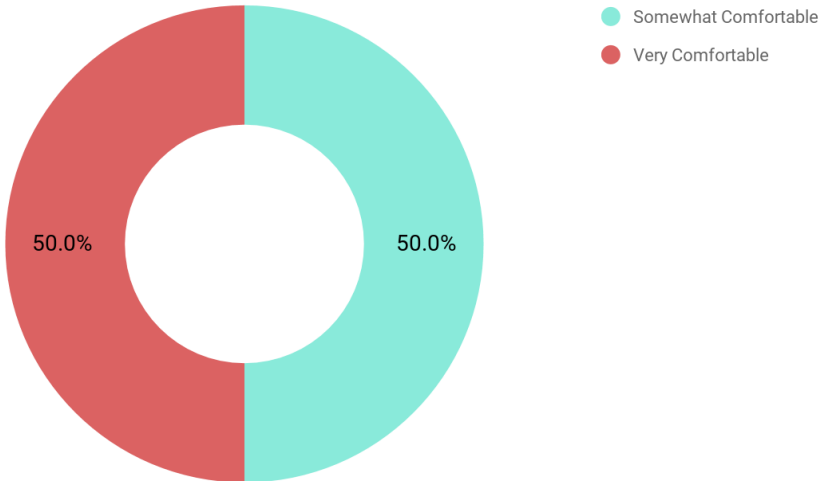


USABILITY TEST DATA

PHASE 2

fig.5

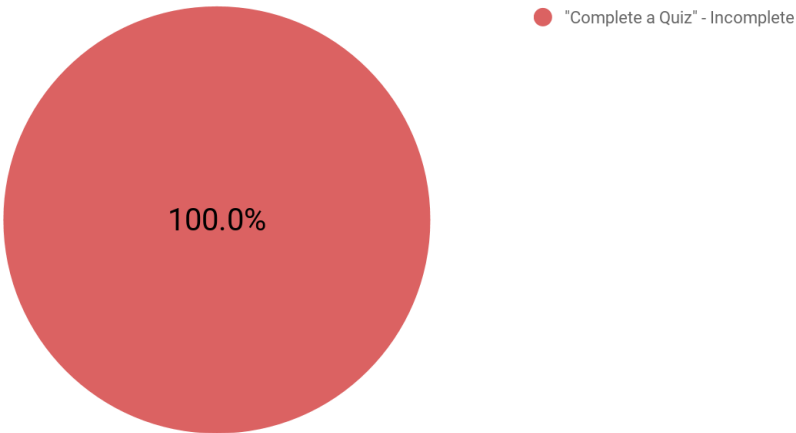
How comfortable are you interacting with technology?



Post-test Questionnaire Data

fig.6

Were you able to complete all the tasks described in the task list? If not, which tasks were incomplete?



USABILITY TEST DATA

PHASE 2

fig.7

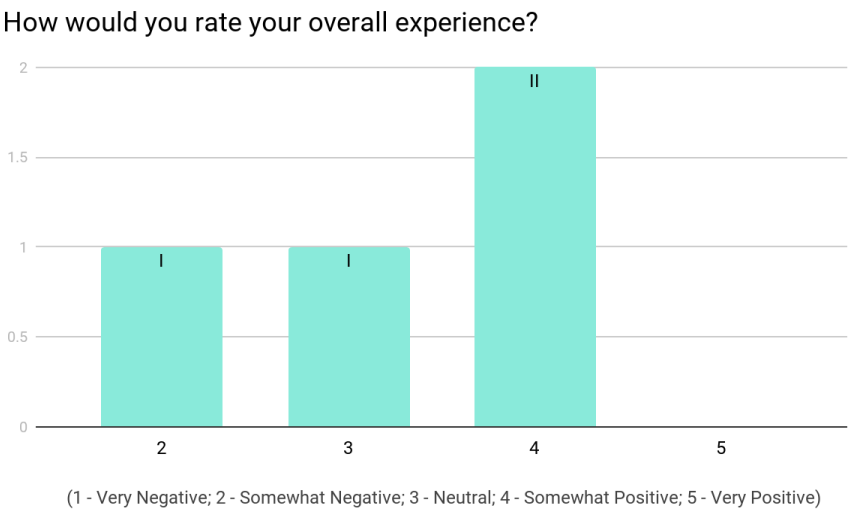
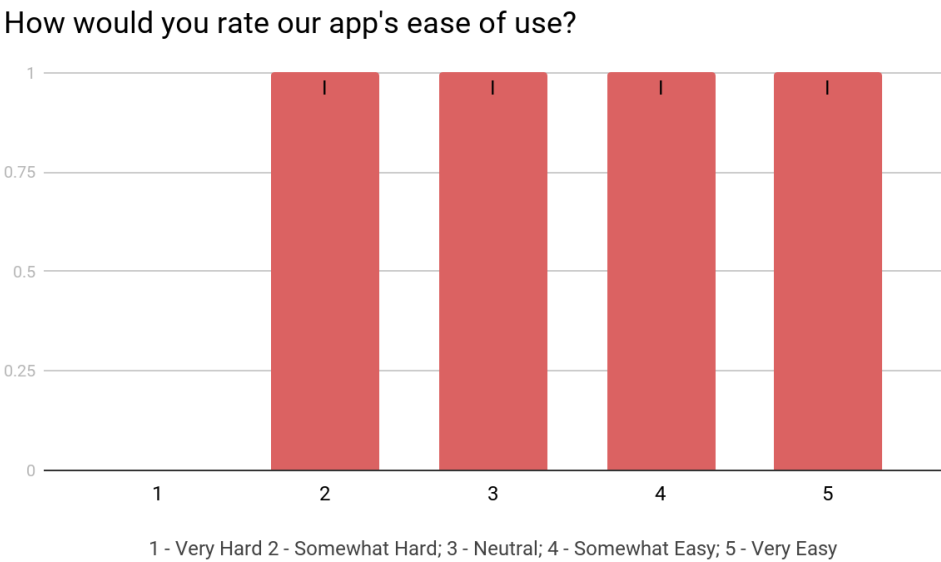


fig.8



USABILITY TEST DATA

PHASE 2

fig.9

How likely would you use this app again?

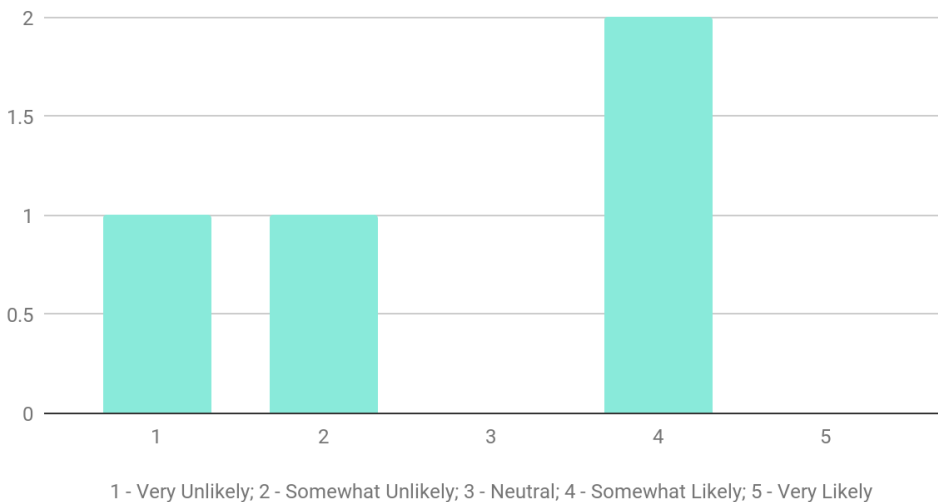
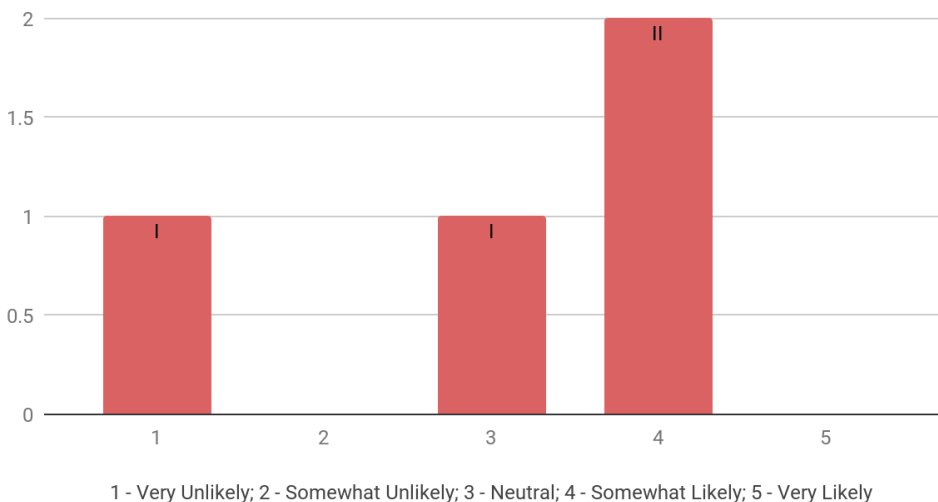


fig.10

How likely would you recommend this app to a friend?





STEPS

All graphics & templates were provided by Kevin T. Rodriguez of *KTR Designs™*



DESIGNS

