Final Report & Reflection for Peak Brain Training App

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Table of Contents

Section 1: Description of the Product

What is Peak?

Peak is a brain-training app that seeks to help users exercise different areas of the brain. Peak's foremost feature consists of varying games that are designed to encourage growth in cognitive skills. Users are able to tailor the app to their own individual preferences based on the cognitive skills they would like to work on. Peak is designed for users of all ages, but is most effective for those in their teens and beyond.

The Science and Contributors Behind Peak

Peak's developmental team is composed of experts in the fields of neuroscience, cognitive science, and education. The scientific advisory board includes Bruce E. Wexler, M.D., Professor Emeritus & Senior Research Scientist in Psychiatry at Yale School of Medicine and Founder & Chief Scientist of C8 Sciences as well as Professor Barbara Sahakian FMedSci DSc, Professor of Clinical Neuropsychology at the University of Cambridge (Peak). This developmental team uses scientific research, as well as knowledge from their individual fields of study, to guide the design of their games. Based on the premise that the brain is an ever-changing and evolving organ, "Findings have shown that critical parts of the brain and its operational mechanisms can and do change in ways that can impact our cognitive, professional, social, and personal developments, for better or for worse," (Peak). Based on this information, the designers of Peak found six contributors for cognitive training: persistence, motivation, challenge, surprise, adaptivity, and timing. Given these contributors, developers understand that

growth and development within the cognitive skill areas takes time, which is why they designed the app to be an on-going brain-training tool for users (Peak).

Cognitive Skills

In developing the brain-training games for this app, developers identified six key cognitive skills: memory, mental agility, problem solving, focus, language, and emotion skills (Peak). These are all skills that are important for day-to-day tasks. If one or more of these skills is lacking, performance in these daily tasks may be lower than it could have been had the brain been trained in order to strengthen those areas.

Memory is the process through which our brains store information to be called upon later. “There are many different types of memory storage systems. They differ from one another not only by the way in which they store information, but also the type of information they store” (Peak). Given what the developers of this app know about memory, they have designed a variety of memory games in order to address the varying memory storage systems.

The ways in which we are able to manage day-to-day tasks, changes in our lives, and ability to multitask are all encompassed by mental agility. “Planning,” “Response Control,” and “Task-Shifting,” are all products of mental agility. In order to exercise this part of the brain, the developers of Peak created a “Daily Workout” for users to strengthen these skills (Peak).

Problem solving is how our brain works to find solutions to a problem. Quantitative Reasoning and Logic skills are key players in problem solving. “Quantitative Reasoning helps you to estimate amounts and convert units of

measurement… Logic skills hone your line of argument by understanding the dependencies and relations between your views" (Peak). Knowing this information, the developers of Peak have also designed games to help practice these skills.

Focus is what helps to establish our attention capacity in any given situation. "Sustained Attention," Visual Attention," "Visualization Skills," and "Spatial Awareness," are all part of focus (Peak). Therefore, Peak has also included games to build on these skills.

Language is how we communicate with others and is vital in day-to-day tasks. As humans, we have to not only know vocabulary, but also be able to use it correctly and in ways that are the most effective for conveying ideas. "Verbal Fluency allows you to write and speak effectively and creatively, by recalling the right words at the right time" (Peak).

Emotion skills help us in building relationships and managing our emotions and reactions to the world. "These are the kind of skills that help us handle social situations, be good networkers, have more confidence, and generally be happier" (Peak). As such, these skills are also exercised through the Peak app.

How the App Works

Upon opening the app for the first time, users are given directions to pick which of these areas they would like to focus on the most. The app then tailors the user's experience to their own personal preference. From there, users have completed the initial stage of the app and are taken to their new home screen.

Users are given “Daily Workouts” that exercise the cognitive skills that they chose to work on in the initial setup of the app (Peak). These “Daily Workouts” consist of games that are intended to work different areas of the brain. In the free version, the user only gets to play 4 out of a possible 6 games in their “Daily Workout.” Each game is made up of four parts: 1. Game Intro (gives a short summary of the game as well as the user’s best score), 2. Game Tutorial (shows a video and written instructions for how to play the game), 3. Gameplay, and 4. Results (provides a summary of how the user performed as well as their success rate) (Peak). The games found in the “Daily Workout” can be played anytime and can be found in the Games tab at the bottom of the home screen.

Features

In addition to the “Daily Workout” and games included in this app, there are a variety of features that make Peak unique. These include statistics, training reminders, social networking, unique settings, in-depth app information, as well as a blog that is connected to the app (Peak). The wide variety of features on this app truly make it stand out from similar brain-training apps.

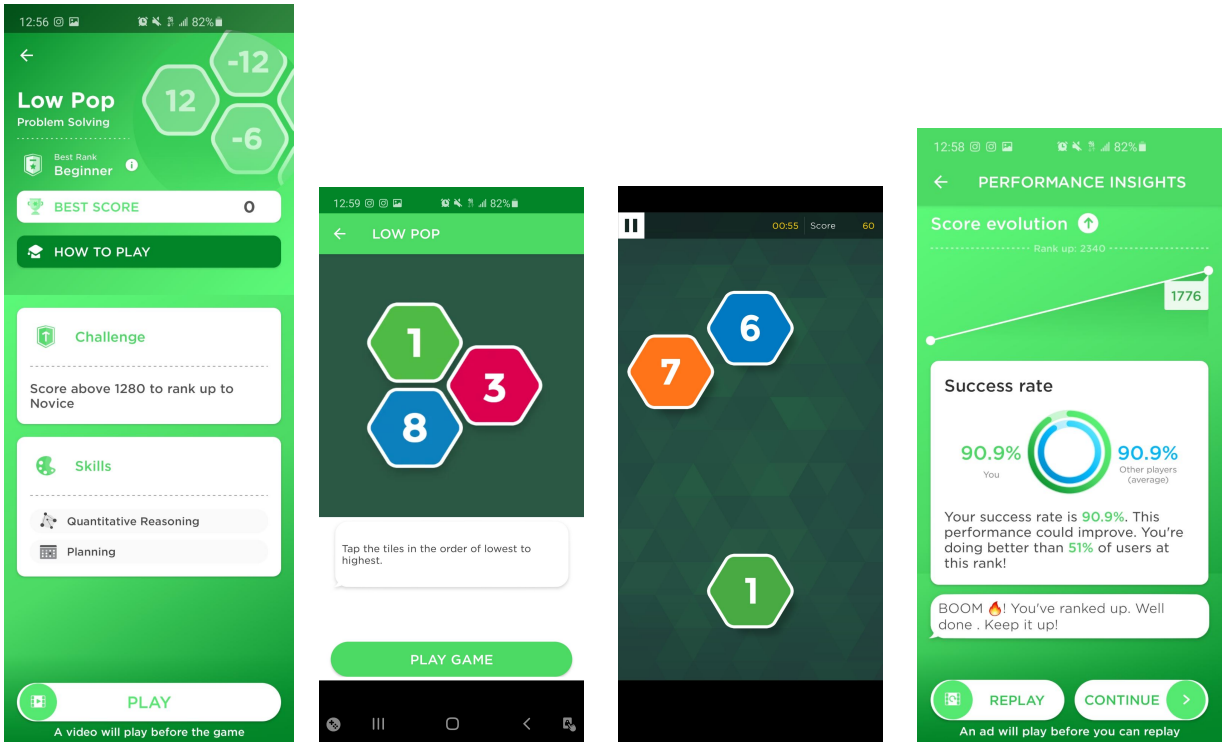
At the bottom of the home screen, there is another tab for Stats. This tab shows the user their brain performance statistics, brainmap, statistics over time, percentile, and performance ratings in each game type (Peak). This tab also provides the capability to compare your brainmap to other users in your age range, profession, and friends.

Another feature that makes Peak so unique to other brain-training apps is the ability to change the way the app presents information. There are three settings that can

be changed that really set this app apart (Peak). The first is the ability to adjust games for colorblindness. The second is the ability to adjust the games for users who have dyslexia. The app adjusts for this by being more selective about the games it presents for the user to play. A third setting that can be changed for users is the language in which the information is presented (Peak). Users have the ability to go to the settings menu and select the language that works best for them.

Another unique aspect of this game is that it provides an in-depth informational section about the app. When going to the profile page, the user has the ability to scroll down and find a tab called, “The Science of Peak” The information that is provided in this tab is divided into four sections: 1. What is Peak? 2. The Scientific Stuff 3. Meet the Team, and 4. The Brain Skills (Peak). These tabs contain information about the app itself, why it was designed, how the developers used science to guide the creation of this app, who the developers are, and the cognitive skills included in the app (Peak).

In addition, Peak provides a link to their own blog within the app (Peak). Upon using the link, the user is taken to the website for this blog. According to the description, the blog is for, “Wellness tips and brain training insights from the team behind the Peak…” (Peak Blog). When scrolling through the blog, the user has access to many articles related to brain-training, brain psychology, brain tips, and beyond.



1.Game Intro 2. Game Tutorial 3. Gameplay 4. Results

Section 2: Peak Target Audience

Brain training apps boast a large target audience. The group of users is people aged 25-75 years old. Although when downloading Peak on the Apple App Store, anyone aged 13 and above can download the app. Dr. Gregory Bayer speaks of this large group of users as two subgroups: those aged 25-55 and those who are 55-65 years old (Bayer). The first group in the breakdown of the target audience is people of the working age. He goes on to say that many people in this age group work in offices or cubicle settings where distractions are everywhere. He says brain training apps specialize games to this age group to help build focusing abilities to fight the temptation of those distractions (Bayer). The latter group, people aged 55-65, are those individuals who are in the retirement age. Dr. Bayer talks about this audience as the group who

wants to enjoy their retirement years more so than their working years but memory is the key to training them. It helps build and maintain brain health and vitality for this subgroup during a time in their lives when it is of the utmost importance (Bayer).

Section 3: Peak Intended outcomes

Explicit Learning Objectives

The explicit learning objective in Peak is to continually improve the user's cognitive ability in eight skill sets: language, memory, problem-solving, focus, mental agility, emotion, and coordination (Peak). The app achieves this objective by focusing on a combination of specific sub skills in each brain training game's design. Some of these skills are used in more than one area of cognitive ability skill set. The games focusing on the language skill help the user expand their vocabulary and word fluency. For the memory games, the sub skills highlighted are working memory, planning, visualization, visual recognition, and task shifting. Problem-solving games are founded on quantitative reasoning, planning, logic, working memory, and visualization. The sub skills for the focus games are response control, task shifting, visual attention, visual recognition, sustained attention, and working memory. The mental agility games subskills are response control, sustained attention, task shifting, and hand-eye coordination. Emotion games are designed with the sub skills empathy, stress reduction, and emotional resilience in mind. Finally, the coordination brain games focus on precision, hand-eye coordination, and planning subskills.

Implicit Learning Objectives

One of the implicit learning objectives of Peak is improving social skills primarily through the games developed for the emotion subskill. For example, the emotion game “Smile on Me” displays a series of portraits of people displaying different emotions (Peak). The user must recognize the people smiling and select those photos to gain points. This game may help those who have considerable difficulty identifying emotions so that they can better empathize with others.

The app can also help rehabilitation after a brain injury, such as in the case of a soldier getting harmed during war that results in a level of brain damage. Essentially the game is physical therapy for the brain. Depending on the extent of the brain damage, different Peak games can be played to exercise the patient’s brain. If the patient is having issues with focusing, memory, or attention span then they can play the games in those cognitive ability skills. The longevity of the training program also depends on the extent of brain damage, as is the case with any muscle training program, but typically it is a few months.

Peak can also help with mental health disorders such as ADHD and depression, as well as many others. This app can help users with ADHD to focus their attention on a single task through all the games but especially the focus games. These games are very short so those with ADHD can focus on the games more effectively than an hours long game. As for depression, Peak games can act as a diversion from the daily struggles of those who have depression. This diversion is also calming and helps reduce anxiety that is commonly present in those who suffer from depression. People

with depression also tend to have trouble retaining information in their short-term memory so the memory and focus oriented games can aid in improving these areas. Engaging in these games on a daily basis also helps create a sense of daily structure and encourage motivation to complete a certain amount of games.

Section 4: Preliminary Evaluation – Product Critique

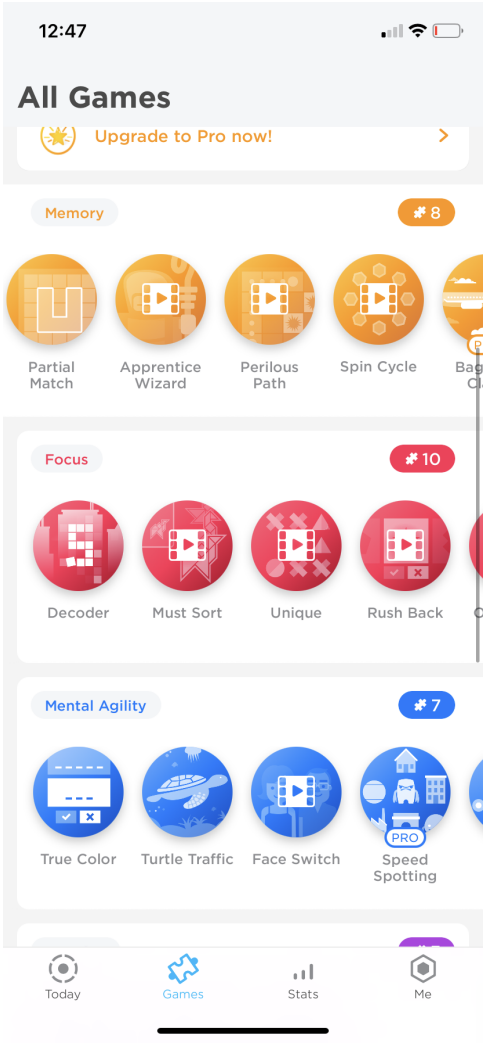
Appropriateness of the Materials

As mentioned in section two, the targeted audience for Peak is individuals aged 25-75 years old and is broken down into two subgroups: individuals aged 25-55 and individuals aged 55-65. While anyone above the age of 14 can download the app, Peak attempts to provide specialized games towards these subgroups. Given that users may pick their own personal goals for using Peak such as improving memory, linguistic skills, focus, problem solving, mental agility, and/or emotional processing, this app was deemed appropriate as a cognitive training app and the material is thoroughly created using science and education as a guide in its creation (Peak).

Ease of Use

The material located in Peak was relatively easy to read. Games are color coordinated in order to represent what type of skill they may be training. For example, the game “Decoder” is in the “Focus” skill category thus being represented in a red color. Peak does try to make this app come to life with its use of colors and vibrant illustrations. When selecting a game to play, users will sometimes be greeted by an ad that is required to be viewed in order to play. Once the ad is completed, users will be

allowed to play that particular game once. If a user has not played a particular game before, they will first view instructions on how to play before moving forward. If the user has played the game before, they will be able to bypass the instructions. While the navigation in this game is simple with only four tabs in the navigation area on the bottom, each tab consists of a large amount of information that is displayed all at once.



Color Coordination Based on Category

The concern of this design decision was that it may lead to cognitive overload. The reason this was an issue was because overstimulation causes users to take in more information than necessary which may lead to users feeling distressed (Krug). While this app may have a lot of information to process, it was overall consistent with the style of illustrations, language, and visual design.

Motivational Design

Peak uses gamification in order to provide cognitive training in a more engaging manner. A systematic review on the gamification of cognitive assessment and cognitive training done by Jim Lumsden et al. found that in over 33 relevant studies covering gamified cognitive tasks used across a range of disorders and cognitive domains, gamified training appeared to be highly engaging and boosted participant motivation but mixed effects of gamification on task performance were reported (Lumsden et al., 2016). This study may show that the gamified strategy used by Peak could motivate users to continue using this on a long-term basis (Peak).

When the team behind Peak create a new game, they follow a particular criteria which includes (Azam, 2020):

- The games have to be smart in order to challenge users
- Science must play a role in this stage by either having an element of science or using science as a base
- Games must be accessible with easy to follow rules
- The games must keep users entertained using rich content

- They must also be based on data, such as what kind of games user like and dislike

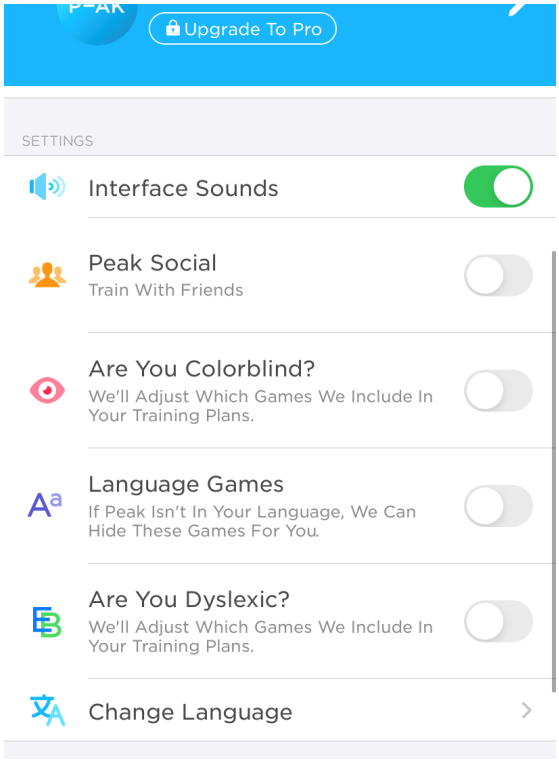
These games are designed in order to keep users engaged as they continue their brain training progress on Peak. A fascinating way Peak has allowed users to stay engaged is by allowing users to compare their brain map with those of other age groups, professions, and even Facebook friends.

Peak also includes over 224 different achievements in categories including Peak objectives, Language, Problem Solving, Memory, Focus, Mental Agility, Emotion, and Coordination which users can use as a way to keep track of how much they have progressed within the game (Peak).

Strengths

Peak strives to make this brain training app more accessible to typically underrepresented groups. In the settings of this app, users are greeted with options such as “Are You Colorblind?”, “Language Games”, and “Are You Dyslexic?”. The “Are You Colorblind?” setting allows users to adjust which games are included in their training plans. If a game is not in a user’s particular language, the “Language Games” option hides games that are not in that language. The “Are You Dyslexic” setting ensures that games which may be found difficult by dyslexic users are hidden. Peak takes this accessibility to another level by including over fourteen different languages, making it a multilingual app (Peak). An important design choice to note is that these language options are written in their respective language. For example, the Spanish

option for language is written as “Español”. This allows users to find their particular language with ease.

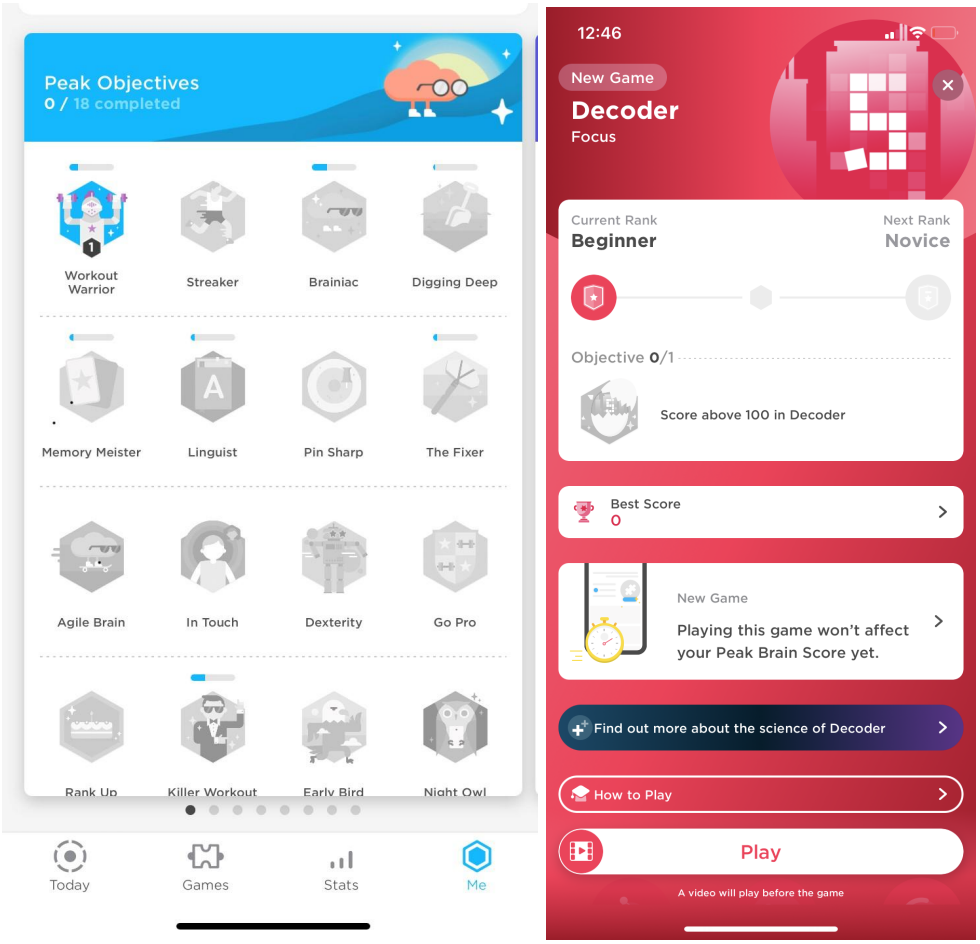


Accessibility Options in Peak

Peak also includes some important information on the science behind the app. In the settings, “The Science of Peak” includes information on what Peak is, the scientific information such as factors that have been identified as important contributors to good cognitive training, who the multidisciplinary team of scientists and educators includes, and succinct summaries on the cognitive skills that a user’s training plan will include (Peak). Peak has taken these perplexing topics and demystified them for the average user to comprehend.

Weaknesses

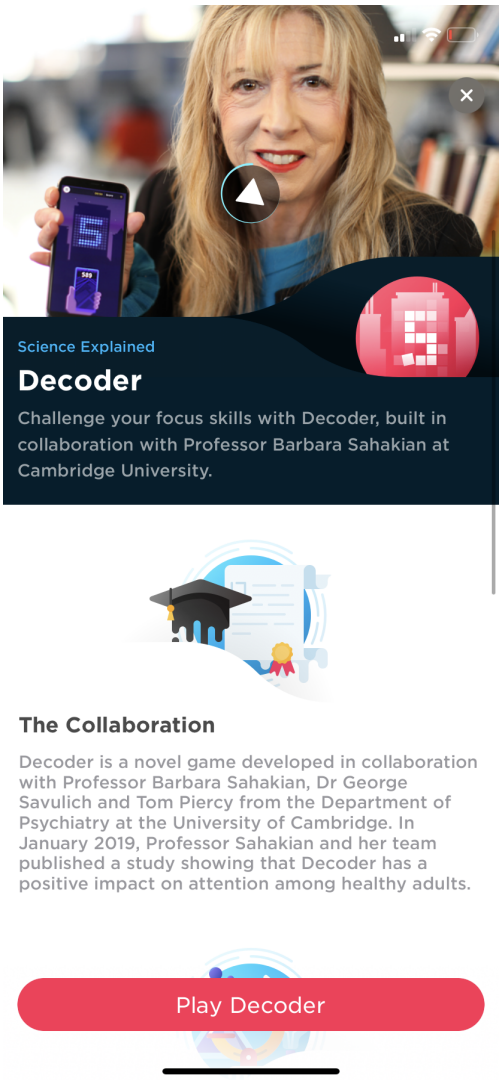
The cognitive overload was one of the more significant flaws to this app as mentioned in the Ease of Use section. The app was loaded with ads and information that may not be considered necessary to the specific task at hand.



Examples of Cognitive Overload in Peak

Considering there was so much on the dashboard, this app had some hidden gems all around which may be difficult for users to find due to the poor navigation. For example, the Peak blog provides a profound amount of helpful information that includes posts on personal development, sleep, brain training tips, and brain training tools (Peak

Blog). Another example can be found on the screen prior to playing a game. Users can find out in depth information on the science behind each game and who was involved in its creation.



Hidden Gem: Science Explained in Each Game

Some of the games available on peak may be seen as redundant at times. Users on Appgroove such as “Shiloh” noted that, “ I find however that the games can be

repetitive, they don't add new ones regularly / at all since I've been playing. A lot of the games aren't unique from the other ones" (Shiloh, 2020).

Preliminary Recommendations

The most significant recommendation for revision of this braining training app was to streamline navigation in order to minimize cognitive load. This can be done by decluttering the use of icons, images, and ads that are found in every page of this app. The most evident example of this can be viewed in the "Me" tab on the navigation bar. The achievements located in this tab may seem like great motivators for users to continue their use with Peak but when navigating through all 224 achievements, this may be overwhelming (Peak). In almost every achievement, there are a range of levels users must complete as well which adds to the daunting factor. For this specific issue, a dropdown option may be considered as a solution for users. This could be conducted using an A/B test that compares the original design to the new dropdown solution.

Another issue that has been causing cognitive overload for users was the instructions for the games. Not only are the instructions confusing at times, but they are also verbose and presented slowly. Users such as "sae-wat" on Appgrooves have noted that, "There were some games with instructions that were too long or went through too slow for me so I skimmed them, but then messed up on an aspect of the game so my overall performance summary shot down on certain skills" (Sae-wat, 2019). The instructions may have to be revised in order to provide a succinct understanding of what a game entails.

The redundancy of the games in this app had also been a significant issue noted. This can be revised by including different games in order to prevent repetition. However, given that this report only evaluates the free version of Peak, we were only allowed 23 out of the 48 games available.While this cognitive training app had some design flaws and the games were considered redundant, the thorough research put into creating these games deserved the recommendation of Peak being used as a supplementation to other cognitive stimulations, trainings, and rehabilitation.

Section 5: Matrix of Evaluative Questions and Instruments of Data Collection

Evaluation Questions		Instruments		
Areas to Understand	Questions to Ask	Background Questionnaire	Usability Test Think-Aloud	Post-Test Survey
Intuitiveness of the app's navigation	Are the game results clear and easy to understand?		X	X
	Is it easy to find and play a game?		X	X
	Does the user get stuck completing a task?		X	X
Efficacy of Peak as a cognitive training app	Does the app provide helpful measurements for the user to assess their progress?			X
	Do the games vary and and are appropriate for the cognitive skill they are designed under (i.e. emotion, memory, focus)?		X	X
	Does the user's previous experience with cognitive training apps have any effect on the efficacy of Peak?	X		

Matrix Development Process

Resources Used

The resources used in designing this matrix were as follows:

- “Program Evaluation: Alternative Approaches and Practical Guidelines” by Jody Fitzpatrick et al.
- “Universal Methods of Design” by Bella Martin and Bruce Hanington
- “Handbook of Usability Testing” by Rubin, J. & Chisnell, D.

Design of Evaluative Questions

In writing the context report (including the research necessary for said report) for the Peak app in addition to testing the app ourselves, we found that the app needed two areas of evaluation:

1. Intuitiveness of Design
2. Efficiency of a Brain Training App

These two identified areas of evaluation helped to guide the development of questions to be used for evaluation purposes.

Instruments

The instruments used, as well as reasons for choosing each one, were as follows:

1. Pre-test questionnaire: These instruments establish a type of criteria and gather demographic data. They helped the researcher(s) learn about the knowledge and experience that the user held prior to testing. The user’s backgrounds informed

their actions and opinions as they interacted with the product (“Usability Testing Questions”, 2020).

2. Post-test Survey: This type of instrument provided a good debrief of what the user felt and thought about the app after completing the entire task.
3. Usability Testing: Think-Aloud: This type of instrument helped the researchers to learn about how users felt about Peak, understand how much they knew about it, and determined what issues they may encounter. Think aloud was used to understand how participants interacted with the product and the goal was to encourage them to keep a running stream of consciousness as they progressed through the tasks (“Running a Usability Test”, 2015).

Each instrument was chosen after careful consideration as methods that would provide the most beneficial information for the study of the Peak app.

Instruments Used to Support Reliability and Validity

Overall, the instruments used were chosen because each was thought to be the most beneficial in collecting data on this particular app. There were several reasons that each individual instrument was chosen.

Background Questionnaire

This questionnaire given to participants before they use the app provided information about the participants’ backgrounds. “The background questionnaire provides historical information about the participants that will help you to understand their behavior and performance during a test” (Rubin and Chisnell, 2008, p. 162). Specifically for this learner’s try-out, this questionnaire indicated participants’ prior knowledge, their

previous experiences with brain-training apps, and what they already knew about the Peak app.

Post-Test Survey

This survey was given to participants after they tested the Peak app and had completed the tasks assigned to them. “The main purpose of the written post-test questionnaire is to gather preference information from the participants in order to clarify and deepen your understanding of the product’s strengths and weaknesses” (Rubin and Chisnell, 2008, p. 192). For the purposes of this learner try-out, the post-survey supplied information on the following: what participants thought of Peak as an overall app, the ease of use of the app, the ease of navigation of the app, the visual appeal of the app, and whether or not they found the app useful for brain training.

Usability Testing: Think-Aloud

While participants were testing the Peak app, they were asked to talk through their thinking process. This yielded more information about the overall usability of the app as well as how the participant interacted with the tool. “...having a running commentary (something researchers call a “verbal protocol”) from participants as they “think aloud” while they perform tasks offers many insights to why a problem exists and how someone tries to work around it” (Rubin and Chisnell, 2008, p. 54). In addition, this pointed to areas of the app that were particularly difficult to navigate. We speculated that it would have pointed to areas that may not have been thought of as difficult by researchers or other participants before.

Section 6: Pilot Test

The participant for the pilot test fell within the target audience age at 32 years old. Daphnie was the moderator, Megan Kelly was the note taker, and Jessica Mouchka and Susana Ruiz were the observers. The first order of business was asking the participant to read and sign the consent form. The moderator gave a quick brief on what to expect in the usability test and answered any questions that the participant had. Next, the participant filled out the pre-test questionnaire that was emailed to her. After that, the participant was instructed to use the think aloud protocol while completing the four tasks in the usability test. She used her own smartphone to download and use the Peak app to ensure there is no added frustration or anxiety that may have been present if using an unfamiliar phone. The moderator timed the appropriate tasks outlined in the *Usability Test Tasks* form (see Appendix D). The participant could have been encouraged more to use the talk aloud protocol. After the usability test was complete the participant then filled out the post-test questionnaire and demographics survey. This concluded the test session and the team thanked the participant for her time.

Results

Overall, the pilot test went very well. The evaluation team discovered that the participant really enjoyed the graphics and animations in the app, such as the countdown animation to the start of a game. However, The participant felt like the games could have utilized more audio to make them more engaging. She also pointed out that having a competitive aspect to the game would be fun, as well, like having a multiplayer mode. The game does currently have the ability to compare game scores with friends on Facebook. As expected, the participant did not find some of the “hidden gems” of the

app, such as it's inclusive settings that aid those who are color blind and have dyslexia. The participant was dyslexic and mentioned that one of the games was more challenging for her than it would have been otherwise. Being able to find that setting would have been incredibly helpful and reduce her frustration level with the app. Despite Peak's navigation lacking in some areas the participant was able to complete the fourth task of finding and comparing a brain map with a teacher very quickly, in less than 18 seconds. The evaluation team expected this task to take significantly longer to complete.

Changes

A last minute change was made to the usability test plan before the pilot test; initially the third task was one minute but upon further consideration that time limit was too short to allow the participant to adequately explore Peak's navigation so the time limit was increased to five minutes. After the test session we decided to cut it down to three minutes to shorten the overall test session time and that time still allowed the participant to explore thoroughly. Also, in future test sessions the moderator should remind and encourage the participant to think aloud more. Another change we made after the pilot test is making the post test questionnaire a Google Forms document instead of a Google Sheets document because we discovered that the background questionnaire and demographics survey administered through Forms was very convenient and quick. It provided better analytics since all of the data will be in one place. The post test questionnaire also had an additional question about the clarity of the game instructions since that is something the evaluation team personally noticed as a pain point when exploring the app themselves.

Section 7: Data Collection Process

Overview

Prior to testing, participants were sent out an email containing:

- An overview of the test procedure, equipment, and software
- Informed Consent Form
- Link to the Background Questionnaire on Google Forms
- Usability Test Tasks
- Link to the Post-Test Survey on Google Forms
- Link to Demographic Survey on Google Forms

Participants were required to use the following equipment:

- Zoom
- A computer
- A smartphone
- Peak App

Peak boasts a large target audience ranging from individuals ages 25 to 75 years old. However, for the purpose of this evaluative project, our team decided to test participants aged from 25-35 years. We chose four participants who had never used Peak before, but may have had some prior experience using other cognitive training apps in the past.

Roles

Depending on everyone's schedule, individuals were required to take on multiple roles.

Moderator

- Sent out email containing all required documents to participants
- Defined the purpose of the usability test to participants

- Assisted the participant through the test and observed for user behavior and thoughts during the session

Note Taker

- Recorded the participant's behaviors and thoughts

Observer

- Silently observed the session
- Assisted note taker in identifying concerns
- Also recorded data

Participant

- Completed a set of task scenarios presented during the session
- Provided feedback regarding the usability and efficacy of the application

Procedure

Participants signed an informed consent that acknowledges: the participation was voluntary, the test could stop at any time, the session could be recorded but their information will remain anonymous. At this time, the facilitator asked the participant if they had any questions.

Participants were sent a background questionnaire to fill out prior to initiating the usability test. This was done using Google forms and did not take more than five minutes to complete. This was necessary to our research so that we could collect data on their previous experience with brain training apps.

Once the background questionnaire and the consent form were filled out, the facilitator initiated the usability test of Peak. Participants took part in the remote usability test via

Zoom and a meeting room was sent out to the participant's email. When the participant arrived, the facilitator briefed them by reading the introduction script to ensure that each participant received the same information. This introduction script informed the participants that they would be a part of a usability test where they were required to think aloud as they completed the tasks required. The script asked one more time for their verbal consent to be recorded. The facilitator explained that the duration to complete each test task was measured but it does not reflect upon the user's ability to complete the task. The facilitator explicitly ensured the participant that the researchers were not testing the participant but rather the design of the app and their honest input was necessary to guarantee accurate data.

At the start of each task, participants read aloud the task description from their copy of the tasks and began the task. The facilitator reminded the participant to think aloud and proceed to observe and take note of any user behavior, user comments, and opinions. After each task, the participant was asked a few questions and asked to elaborate on their thoughts regarding the tasks. After completing all the tasks in the session, participants completed a post-test survey to supply information on what they thought of the Peak app, the ease of use of the app, the ease of navigation of the app, and whether or not they found the app useful for brain training.This survey did not take more than 10 minutes.

The session ended with participants completing a post-test demographic and background information survey. This was done at the end of the session to prevent stereotype threat. This took no more than 5 minutes.

Usability Tasks

The tasks were reviewed by the researcher and were considered representative of real use and evaluate both the efficacy and usability of the app Peak:

1. Create profile and select training goals
2. Play initial onboarding games
3. Take five minutes to go through Peak's navigation
4. Compare "Brain Map" with a teacher's "Brain Map"

The usability test objectives for this evaluative project were:

- To determine areas of improvement and usability problem areas within the user interface and games. Potential sources of error may have included:
    - Navigation errors – inability to locate features
    - Presentation errors – failure to locate and interact with desired information due to feature bloat, instructions are not clear within the games
- To determine the efficacy of Peak as a cognitive training app. Potential issues included:
    - Measurement issues - the app may not have supplied measurements that were helpful for the user when assessing their progress
    - Game appropriateness & Variance issues - the app may not have provided a wide enough variety of games that were appropriate to the cognitive skill (i.e. emotion, memory, focus, etc.) for which they were designed
    - Previous user experience issues - the user's prior experiences with brain training apps may have had a negative impact on their testing of the Peak app

Section 8: Data Analysis Plan

The purpose of this study was to identify any usability issues and evaluate the efficacy of Peak. Our main targets of interest correspond to the tasks involved in the usability test. These included navigation, searching for a particular item, and the actual gameplay experience within the app. Prior to analysis, our team reviewed each testing session individually by watching the recordings, reading the transcripts, and assessing our notes (“Usability Testing”, 2020).

We initiated our evaluation of the data by comparing the user data by:

- Actions taken by participants
- Issues encountered by the participants
- Comments made during the session including both positive and negative remarks

The appropriate methods have been determined by the data types: qualitative and quantitative data. The data analysis will determine if our preliminary evaluation was in line with the experiences of an average user.

Quantitative Data Analysis Plan

The quantitative data metrics include:

- Duration to complete task four
- Satisfaction rankings from the post-test survey

Based on the data metrics, we determined that the most appropriate method for quantitative data analysis is descriptive statistics which include the use of mean and

frequencies (Bhatia, 2018). The data source will be from the usability test and the post-test survey. This will be done utilizing an Excel spreadsheet where data will be collected and organized by task then tallied in order to see the most significant issues (“Usability Testing”, 2020). Any outlier will be assessed to see what caused the abnormal data point.

Qualitative Data Analysis Plan

The qualitative data metrics include:

- User insights
- User behaviors
- Observational findings

The qualitative data was analyzed by developing a framework on Excel where it will be indexed in categories based on the tasks and both positive/negative responses. Our team then began to identify themes such as common responses to questions. Content analysis was determined to be the most appropriate qualitative data analysis method for this project (Bhatia, 2018).

Section 9: Results and Findings

Background Questionnaire Results

Most participants had intermediate experience with smartphone technology. Although 75% of the participants had no experience with a brain training app, one participant mentioned that they have tried Luminosity in the past. The participants wanted to specifically train memory with Peak. When asked how many days a participant would be able to dedicate to exercising with a brain training app, the results ranged from two to

six days a week.

Usability Test Results

During the initial onboarding process, the participants found the process to be simple and easy to fill out with the exception of one participant who had a confusing onboarding experience because he had to input his email after already signing in. That participant thought the issue arose due to the possibility of already trying Peak in the past, but they could not recall if and when they did.

The instructions of the games were clear for the first and third onboarding game while there were difficulties during the second game because the instructions did not specify how quickly tasks needed to be completed. Although the games used in this study were similar to other brain training games, they were enjoyable to the participants. The clear results encouraged them through personal charts and stats that indicated room for improvement and their progress. There were mixed feelings in regard to the question “Do you think the games you played would help you better train the cognitive area they cover?” While some believed that the first game did not help train the specific cognitive area it covered, the participants unanimously believed that the second game would be great for working memory and that the third game could help with spelling.

The participants thought that the layout of Peak’s content was user-friendly, informative, and colorful which made it easy to navigate. While all the participants felt they were able to find what they were looking for in a reasonable amount of time, they were unsure what tab was considered the home screen.

One of the areas to understand for this study was the intuitiveness of Peak's navigation. Accordingly, the last task of the usability test was to find the "Brain Map" feature and have the participants compare their "Brain Map" to that of a teacher. To our surprise, the participants were able to find it rather quickly; many of them completed the task in under thirty seconds. The participants found the "Brain Map" feature to be motivational to an extent because there is no indication as to what the numbers on the graph mean. This issue was also found within the games. One of the participants mentioned that during the third game, they noticed a "rank up" mention but were unsure what it meant or what the highest possible score was.

There seem to be certain motivators that were mentioned by several participants which include the daily streak feature which shows how many consecutive days a user has played games. The graphs within the games and in the "Stats" tab also encouraged players to continue their use of Peak.

Post-Test Survey Results

Since one of our four participants was unable to complete the first task and, consequently, the remaining three tasks of the usability test only three participants filled out the post-test survey.

In regards to the onboarding process, 66.7 % of the participants were neutral towards it while 33.3% were very positive about the experience. Those who answered neutrally said it was because the process was "straightforward and simple" but "not really an attention grabber" and it's "nothing too exciting" because it is an onboarding process.

For the positive feedback, the participant's reason is that the onboarding process was "easy".

The second question in the survey asked what the participant liked about Peak. All participants liked how easy it was to navigate through the app when they wanted to find something. Two participants commented on the games and how fun they were. One participant offered a suggestion for better explanations during the game tutorials.

Questions 3-5 focus on each of the three onboarding games the participants played: Low Pop, Perilous Path, and Word Fresh, respectively. For the game Low Pop 66.7% of the participants felt very positive about completing the game because it was simple, easy to play, and got them thinking more than they thought they would. 33.3% of the participants responded neutral to this question because it was "not their type of game". For the game Perilous Path, 66.7% of the participants were very positive about completing the game while 33.3% were somewhat positive. The participants said that the game was easy to play with simple instructions, fun, and challenging. For the third game Word Fresh, two participants said completing the game was somewhat positive because it was similar to other games like "Words with Friends" and "Scrabble" and they generally like word search games. One participant commented that this game was "too easy for a brain enhancer". Another participant had a somewhat negative reaction to completing this game because the UI was "too cramped".

Question six referenced task four, finding their brain map and comparing it to a teacher's brain map. One of the participants found it somewhat easy while the other two found it very easy.

Question seven asks if and how does Peak motivate the user to play the brain training games. The answers were:

- “The ‘compare; feature works really well, and can keep thing competitive which many will like, and people will come back to beat others’ scores
- “The competitive aspect is nice. Everyone likes to challenge their friends so that’s aplus.”
- “It shows you previous scores and how they trend on a graph. It can motivate you to keep going and you can see how it improves. I like the streak count because that would motivate me more to not see it drop to zero.”

Question eight asks what is the one thing the participant is most excited about in this app. One participant liked how very little effort was needed to use the app but it helps keep the brain active, Another participant liked the ability to compare themself to other users. The third participant liked the games and feels that they do help exercise their brain.

The ninth question asks how frequently the participant would play this game. One answered sometimes because it would be just to pass time, another said daily, and the third said frequently.

Question ten asks how likely the participants would recommend this app to a friend. 33.3% said very likely while 66.7% were neutral.

The final question asks the participants what they would change about Peak. One participant recommended that the app offer a dark mode, another said to add music,

and the third participant said to add more tips on how to improve the user's score in games.

Demographic Survey Results

There were three participants via convenience sample:

- Two females, one male, ages 25-34
- Two participants had some college experience with no degree while one had a bachelor degree

Participant occupations include:

- Student
- Project Engineer
- Payment Processing Assistant

Outlier Participant

The outlier participant had issues with Peak quickly after downloading. This user was the last in our group and experienced different questions than the first participants. The user was asked to get started and then was shown different questions compared to the other participants. These questions were more complex and in-depth in problem solving. He made a comment about being surprised about the level of difficulty. The participant even gave up trying to answer the questions wholeheartedly and began guessing. He stated this during the test session. The user answered the prompt about setting a reminder affirmably then was taken to a screen where the only option for the user was to download the PRO version. This turned into a loop between asking for the reminder and prompting for the PRO version. The user quit shortly after.

Findings

This study was conducted to evaluate the intuitiveness of the app's navigation and the efficacy of Peak as a brain training app. The findings revealed that the results were more positive than we originally had anticipated based on our initial experiences. During the outlier participant's session, we noticed that there is a potential bug in earlier versions of the app that pushed users to download the PRO version of Peak. Participants found that not only was Peak easy to navigate but also that the games were engaging and appropriate for the cognitive skill they were designed to train. Peak's games provided clear and easy to understand results which also include personal stats for the users to see their progress as they continue to train. inst.

Section 10: Recommendations

Based on the findings of this study we recommend that:

- Peak offers support for older versions for a longer period of time (at least three OS versions older than the current one).
- Instructions in the game tutorials should be reworked in order to provide clarity in what a user is required to do during a game.
- Bigger UI design should be used during gameplay. For example, during the Word Fresh game, a participant found the letters to be cramped while playing, hindering their gameplay.
- The app should provide an option for dark mode. The dark mode option is a common feature in many apps because it improves visibility for users with low vision and reduces eye strain.

- Peak should include tips on how to improve one's score and explain what the stats and charts mean.

Section 11: Results Comparison to Preliminary Evaluation

In the initial product critique, there were many aspects of the app itself that were thought to be weaknesses. Although these aspects were thought to be weaknesses of the app, the usability test proved these observations wrong. For example, one initial concern was that the bright colors and design of the app would cause cognitive overload for the user. Upon observation from the try-out though, most participants found the overall design of the app to be aesthetically pleasing. Another concern was the navigation within the app itself. Initial observations of the app showed that the home screen was cluttered with icons, images, and ads, all of which hindered the user's navigation of the app. However, findings from the learner's try-out showed that participants had little to no difficulties in navigating the app.

While there were some initial observations of the app that did not align with the findings from the learner's try-out, there were a few that did. For instance, in both the initial observations of the app and the findings through the try-out, the statistics tab was found to be both interesting and useful to the user. In addition, participants were able to find what were initially dubbed as "hidden gems." These "hidden gems" included behind-the-scenes information about the design of the app as well as app customization options such as the following: the ability to adjust the games within the app for colorblindness, dyslexia, and language. While it was originally thought that participants would have a difficult time in finding both the statistics tab and the "hidden gems,"

(which can be located in the settings tab) it became evident through the learner's try-out that these aspects of the app were not as difficult to find as originally anticipated.

In terms of expertise, our group was able to take away some valuable lessons pertaining to usability testing. For example, we were quickly able to identify the need to assign roles based on who was hosting the participant(s). It became clear to us after the pilot test that it was far easier, and made more logistical sense, for the role of observer to be assigned to the group member who was hosting the participant. This way, the observer could monitor and observe what the participant was working on in the app throughout the duration of the usability test. Another example lies with the use of Google Forms. This tool allowed us to easily share questionnaires and surveys not only with each other, but with our participants as well. This was a far more efficient way of designing and distributing the background questionnaire, the post-test survey, and the demographic survey to our participants.

Section 12: Team Members' Responsibilities

Brief description of contributions made to the different parts of the project by each team member.

- Megan:
    - Section 1, 5, 11
    - Editor
    - Moderator for one session
    - Notetaker for two sessions
    - Observer for one session

- Jessica:
    - Section 2
    - Prepared Post-Test Survey
    - Outlier Participant section
    - Helped with some revisions
    - Notetaker during two test sessions
    - Moderator for one session
    - Observer during one test session
    - Organizer of zoom meetings
- Susana:
    - Prepared initial frameworks for some documents
    - Section 4, 7, 8, 9
    - Prepared initial drafts for appendix B and D
    - Helped with some revisions
    - Notetaker for three test sessions
    - Qualitative data analysis
- Daphnie:
    - Prepared initial frameworks for some documents
    - Section 3, 4 (Strengths and Weaknesses), 5 (collaboration), 6, 9 (Post-Test Survey Results), 10 (collaboration)
    - Created forms for appendix A and E
    - Helped with some revisions
    - Notetaker for three sessions

- Moderator for one session and the pilot test
- Observer for one session

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Appendix A: Informed Consent Form

Title of Project: Peak Evaluation

Project team members directly involved: Megan Kelly, Jessica Mouchka, Susana Ruiz, and Daphnie Salvador

Supervising faculty member: Dr. Evrim Baran

Email: ebaran@iastate.edu

Dear Participant,

You are electing to participate in a research study conducted by graduate students at Iowa State University for a course project. The title of the course is EDUC/HCI 504: Evaluating Digital Learning Environments and the purpose of the project is to evaluate the brain training app, Peak.

Your Role:

If you voluntarily agree to be in this study, you will be asked questions related to and given four tasks on the brain training app Peak. The entire process is expected to take no more than one hour. We are not evaluating you or your performance in any way. As you perform various tasks with the system, your actions and comments will be noted and you will be asked to describe verbally your process using think aloud protocol.

Risks, Benefits and Compensation:

There are minimal risks associated with this experiment. There are no identified benefits to participants and no compensation will be given.

Please note that the supervising faculty persons will have access to individual data and/or summarized results.

Extent of Anonymity and Confidentiality:

The results of this study will be kept strictly confidential. Your written consent is required for the researchers to release any data identified with you as an individual to anyone other than personnel involved in the study. The information you provide will have your name removed and only an initial will identify you in any written reports of the research.

The session may be recorded. If it is recorded, the recordings will be stored securely and only viewed by the project team members and the class of EDUC 504. The researchers will be taking notes during the entirety of the process.

Freedom to Withdraw:

Participation in this study is completely voluntary. You may skip any parts and any questions and you can terminate the study at any time. This project has not been approved by Iowa State University's Institutional Review Board (IRB).

Statement of Consent:

I have read the above information and received answers to any questions I may have. I hereby acknowledge the above and voluntarily consent to take part in this study. In addition to participating in this study, I also agree to have the tasks I complete recorded and reviewed by all members of the evaluation team, including the supervising faculty at Iowa State University.

_____ _____

Signature Date

_____

Name (Printed)

Appendix B: Introduction Script

(Adapted from https://methods.18f.gov/usability-test-script/)

Hello, my name's [MODERATOR] and I will be walking you through this session. [OBSERVER and/or NOTETAKER] will also be joining us. Our team is currently conducting an evaluative applied study for EDUC 504 at Iowa State University.

I'd like to begin by thanking you for making time to speak with us. Your feedback is very important and will help us determine if Peak functions as intended. The purpose of this study is to identify any usability issues and evaluate the efficacy of Peak. Just to confirm, the entire process is expected to take no more than one hour. Does that still work for you?

Great. If you need a break or to stop at any time, please let me know.

During this session, I'll start by asking you a few questions about your previous experience with brain training apps. Later on, I'll ask you to use your smartphone to complete a few tasks using the app we're evaluating and lastly you will be given a survey about your experience.

Please be aware that there are no wrong answers: you are not the one being tested; you are testing the app. As you go about using the app, I'll ask you to think aloud as much as possible: to describe what you're looking at and what you're trying to do. This will be very helpful.

Also, please don't worry that you're going to hurt our feelings or offend us. We're doing this to evaluate the app, so we need to hear your honest reactions.

If you have any questions as we go along, just ask. I may not be able to answer them right away, since we're interested in how people do when using Peak on their own. But if you still have any questions when we're done I'll try to answer them then.

With your permission, I'd like to record this session. The recording will only be used to help us evaluate this app, and it won't be seen by anyone except those involved. Do I have your permission to record this session?

Finally, I want to confirm that you've received and had a chance to review the informed consent form? Did you have any questions? If you have signed the agreement, please send me a copy.

Great. Do you have any questions for me at this time?

Appendix C: Background Questionnaire

https://forms.gle/S3Cu4HpXVHR3FtdDA

Appendix D: Usability Test Tasks: Think Aloud Protocol

1. *Create profile and select training goals:*
   - Have participants create a profile on the Peak and select training goals that best fit their needs.
     - “How was the onboarding process?”
     - “How do you think Peak will aid in the training goals you chose?”
2. *Play initial onboarding games:*
   - Normal operation will be unlocked once participants complete those initial onboarding games to allow them to complete them.
   - When they are done with each game, have them discuss their thoughts on what they just played.
   - Ask participants to check their scores and discuss what they think the score means in terms of their training
     - Before gameplay, are the instructions clear?
     - “What did you think about the games you just played?”
     - After gameplay, are the results clear and concise?
     - Do you think the games you played would help you better train [area]?
3. *Take five minutes to go through Peak’s navigation:*
   - As Participants navigate through the app, allow them to talk about their initial thoughts on the app.
     - “What do you think about the layout of the content?”
     - Is the layout of the home screen clear?
     - Do you feel you can find what you are looking for in a reasonable amount of time?
4. *Compare “Brain Map” with a teacher’s brain map:*
   - Participants will be asked to compare their “brain map” with the brain map of a teacher.
   - It is imperative to time this task in order to see if they had difficulties finding it.
   - Brain map is located in the Stats tab under the section “Your Brain In A Nutshell”.
     - “What do you think of the “Brain Map” feature? How easy is it to find?”
     - “Do you think this feature would motivate you to continue your brain training app through Peak?”

Appendix E: Post-Test Survey

https://forms.gle/oQ2ah8LwfRFYa46M8

Appendix F: Demographic Survey

https://forms.gle/DRW67vaoefYcQGzB6