WPI

University of Massachusetts Medical School

Enhancing Mindfulness-Based Stress Reduction Through a Mobile Application

A Major Qualifying Project (MQP) submitted to the faculty of Worcester Polytechnic Institute in partial fulfillment of the requirements for the Degree of Bachelor of Science in Management Information Systems (MIS)

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Contents

Table of Figures

Abstract

The goal of this Major Qualifying Project (MQP) was to improve upon the initial design of a mobile application that would assist college students in the practice of Mindfulness Based Stress Reduction (MBSR). The purpose of this project is to build a foundation for UMass Medical so they can apply for a grant to have this project be fully funded and become a fully functioning mobile application. This MQP was a continuation of a previous MQP's work that explored some of the initial ideas on how to design the application. The team created functional mockups of the original idea and surveyed college students to get their feedback on the initial design. The feedback was then analyzed using qualitative data analysis software. Based on the results from the software, the team created a new mockup that incorporated the general consensus of features and changes that should be made to the application into a new design. A functional mockup was also created for the new mobile application. These results provide a more developed idea from which UMass Medical can work from.

Executive Summary

Mindfulness Based Stress Reduction (MBSR) is the clinically proven application of mindfulness to address stress, anxiety, depression, and other mental health issues. The project team continued the work of three students who previously started this project with the UMass Center for Mindfulness in Shrewsbury, Massachusetts. The prior project team used web surveying, interviews, and focus groups to determine how to best engage young people with the practice of mindfulness. In addition to creating social media pages to share images and quotes based in mindfulness, the prior team suggested the creation of a mobile application.

The prior team created mockups of what the proposed application would look like. The new project team imported these images into an interactive mockup platform called InvisionApp. Our team then gathered data from prospective users of the application by interviewing college students. The interactive mockup allowed interviewees to see how the application would actually look, on a real smartphone, rather than on paper. Interviews established a baseline of how familiar college students were with the practice of mindfulness, and gathered input on various aspects of the mobile application. Interviewees provided input on features they liked and disliked, as well as the appearance and functionality.

Interviewees made many suggestions about the original mockup; one recurring suggestion was that the appearance did not match the calming intent of the app. Many users also were very vocal about the 'College Room' feature, a chat room-type feature for college students to converse about mindfulness-related topics. While many users were supportive of the feature, we found that users envisioned that it could work many ways, ranging from more anonymous and short content, like YikYak, to pseudo-anonymous and longer content, like Reddit. The team used qualitative data analysis software to analyze the interviews to understand and prioritize

suggestions to the original mockup. Using the results, the team created a new interactive InvisionApp mockup, shown below in Figure 1.

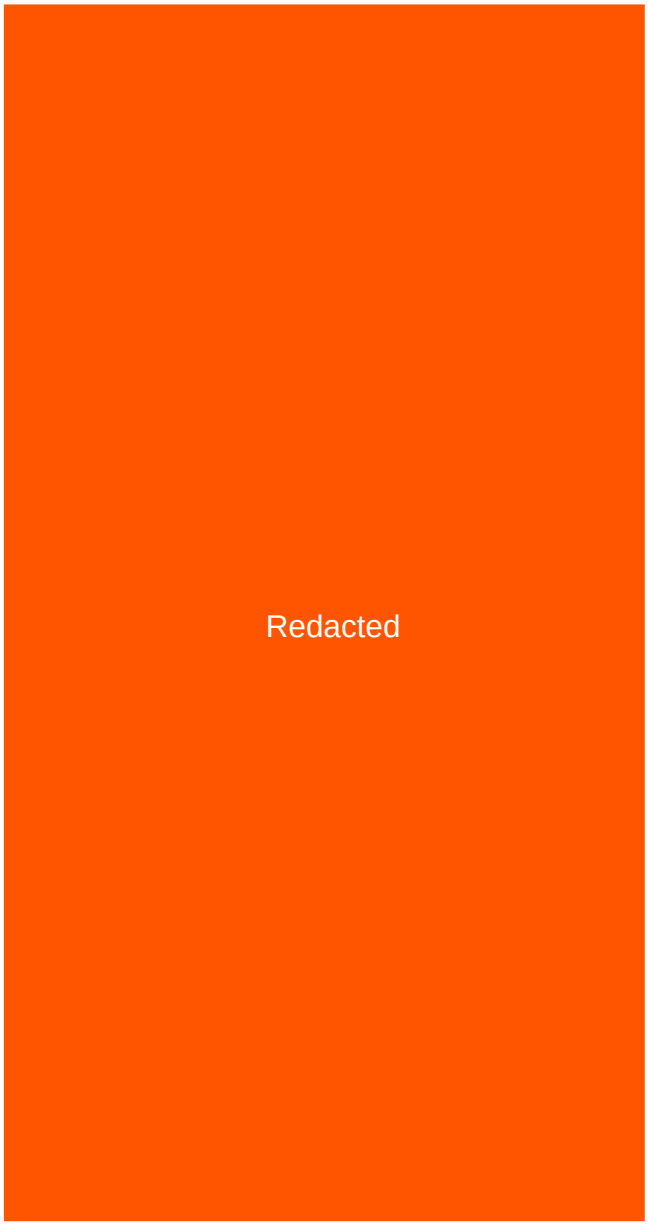


Figure 1. The New 'Do You Mindful' App Prototype

Acknowledgments

The MQP team would like to extend its sincere thanks to all those who made this project possible by contributing their time and resources, including:

- Professor Eleanor Loiacono for advising the project team and providing crucial feedback throughout the duration of the project.
- Dr. Maryann Davis and Dr. Carl Fulwiler of UMass Medical School, and the UMass Center for Mindfulness for sponsoring the project and providing feedback along the way.
- Fellow students who participated in our interviews, providing the team with valuable data and insight into the design of the proposed app.

Authorship Statement

The following section details contributions made by each team member during the course of the project. While members focused on different aspects, it should be noted that all members worked collectively on the overall project goals.

Richard Falzone: Richard focused on developing the new interview protocol. He identified major areas that user feedback should be focused on and tailored the interview protocol to touch on those issues. He also played a major role in background research and team understanding of mindfulness.

Andrew Mahn: Andrew's focus was on data analysis and revising the mobile application design. He performed qualitative data analysis on the interview transcripts using the NVivo software package; using the insight gained from the results, Andrew assisted in determining how to improve the existing app mockup. Andrew created the new app mockup images using the Moqups platform, and then brought them into an interactive and mobile format using InvisionApp.

Nick Pataky: Nick's goal was to analyze the different methods of identifying our user's needs and how best to implement those methods. He determined which sets of users would be assigned to a specific method. Through the use of one on one interviews, focus groups, and surveys the group was able to obtain a substantial set of data of which to analyze. Additionally, Nick used the results from the data analysis to build a House of Quality which will assist the next group of researchers in turning our qualitative data into functional features.

Juan Rodriguez: Juan Rodriguez's main focus was data analysis. He analyzed the interview transcripts utilizing NVivo as a Qualitative data analysis software. Following the methodology established by the group, Juan compared and contrasted two independent analysis in NVivo and created a final analysis by reorganizing and merging the independent files. Additionally, Juan extracted, processed and summarized the findings from the NVivo analysis.

1. Introduction

The goal of the project was to expand the framework of the Mindfulness Based Stress Reduction (MBSR) app conceptualized by the previous Major Qualifying Project (MQP) team. Our plan was to investigate how college-aged people, and those with mental health issues would use mindfulness apps; the team tested the proposed design of the app to further refine its design. The revision process ensured ease of use, and identify key features that users desire to have on a daily basis. In addition, the team refocused the app's layout and content structure to create a format that is conducive to MBSR course applications. The app reinforced the teachings of MBSR by reminding and aiding young adults in applying mindfulness to everyday activities.

The team accomplished our above goals through analyzing similar apps that are already available today. In addition, the team conducted surveys with potential users of the app to obtain feedback on the proposed design and features. The team worked closely with our sponsors at University of Massachusetts Medical School and at Worcester Polytechnic Institute. The insights gained from surveying potential users was used to further refine the app's proposed design and feature set.

In the following sections, background information on mindfulness, research methods for data collection and analysis, and best practices for app design are covered. Following this are sections covering the process of collecting data and analysis, then results and conclusions drawn from this analysis.

2. Background

In order to develop a better understanding of mindfulness and MBSR, the team conducted a literature review on relevant background topics, including the history of mindfulness, the development and medical application of MBSR, and existing technological solutions implementing MBSR and/or mindfulness.

2.1 Mindfulness

Mindfulness is a practice historically strongly associated with Buddhism, but it can be practiced secularly. Jon Kabat-Zinn is credited for bringing about the popularity of mindfulness in the western world during the 1970s. He is the founder and executive director of the Center for Mindfulness at the University of Massachusetts Medical School. Mindfulness is the state of being aware of one's self, one's surroundings, and the present moment. Mindfulness is frequently achieved through mediation, a process of quiet contemplation where one focuses only on the physical present and their own state of being. Meditation is not about phasing out, reflecting on your day, or listing to calming music. In fact, many of these things which people might associate with mediation in fact achieve the opposite effect of mindfulness. The state of being mindful is a state where one is very awake and aware, simply focusing on the present and real.

Nonjudgmental awareness is a key component in all approaches to achieving mindfulness. Different meditation practices have one focusing on internal sensations, feelings within the body, on breathing, and on the immediate present. Others focus on external stimuli and occurrences. All approaches encourage nonjudgmental acceptance, meaning that anything that comes into one's awareness should simply be closely observed as it is, not judged as bad or

good, happy or sad, true or false, or any other prescriptive label, simply accepted for what it is (Baer, 2003). Jon Kabat-Zinn has famously developed an exercise in mindful eating. In this exercise, a tape or instructor narrates the actions of eating a raisin in discrete steps to help the person experience every sensation of eating the raisin. The raisin is examined, felt, and smelled before it is ever tasted. The sensation of putting the raisin in one's mouth, tasting, swallowing, and the sensation left after the raisin are swallowed are all noticed. Through this, mindfulness is achieved, and complete non-judgmental awareness of the raisin is achieved (Kabat-Zinn, 2007).

2.2 What is MBSR?

Mindfulness Based Stress Reduction is the application of the practice of mindfulness to address symptoms of stress, anxiety, and other mental ailments. Mindfulness and meditation are heavily featured in Buddhism, but they are unto themselves secular activities. MBSR is the clinically proven application of mindfulness to address stress, anxiety, depression, and other mental health issues. To judge the relative scale of this effect, the team looked at a meta-analysis of MBSR studies.

2.3 Effectiveness of MBSR

To judge the relative scale of this effect, the team looked at a meta-analysis of MBSR studies. This meta-analysis of studies conducted on the effectiveness of MBSR found it consistently had an effect on anxiety and depression in individuals with somatic diseases (Bohlmeijera et al., 2010). In this meta-analysis eight studies were selected from a list of studies fitting a strict list of criteria. The study found an overall effect size of .24 on depression .26 on anxiety, and .32 for psychological distress, indicating a small but measurable improvement

caused by MBSR. Effect size is a general statistical measure of change in meta-analyses. An effect size of .1-.3 is small, .3 to .5 is medium, and .5 and greater is large (Cohen, 1988).

2.4 Technology and MBSR

The popularity of smartphones and the growth of mobile applications geared toward health and lifestyle have been growing steadily throughout the past several years. It is estimated that mobile health applications, often stylized as "mHealth" applications, will reach a total of 3.2 billion downloads worldwide in 2016, up from 3 billion and 2.3 billion in 2015 and 2014, respectively (research2guidance, 2016). Of the mobile health applications downloaded in the prior year, fitness apps were the most popular by share at 36%, followed by lifestyle and stress apps at 17% (IMS Health). There are a number of apps which incorporate the principle of mindfulness; two such apps which you can find on the iOS App Store include "The Mindfulness App: Meditation for Everyone" and "Headspace: Guided Meditation and Mindfulness." There are even a small number of apps which contain audio recordings specifically for MBSR, such as the Jon Kabat-Zinn, or JKZ Series 1, 2, and 3 apps on the Apple and Google Play stores. However, the latter have limited functionality in terms of enhancing the MBSR teaching experience beyond what is covered in the audio series. Both of these types of apps are illustrated in Figures 2 and 3.

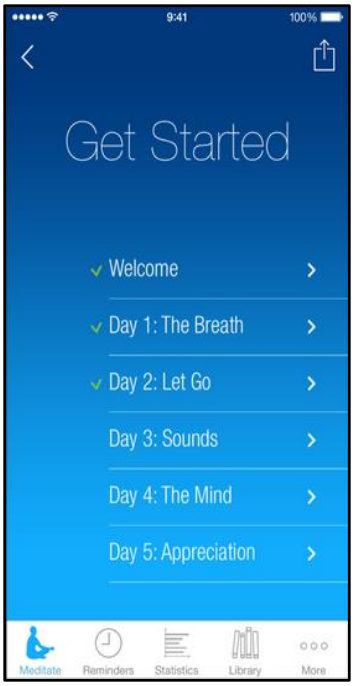


Figure 2 The Mindfulness App. Reprinted from *iTunes Store*, Retrieved from https://itunes.apple.com/us/app/the-mindfulness-app-meditation-for-everyone/id417071430.

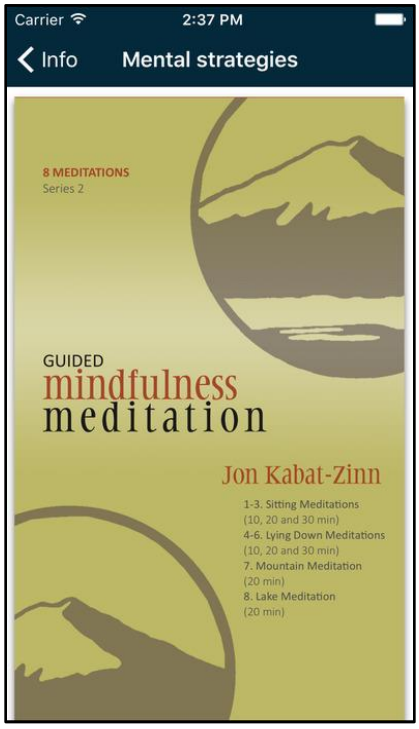


Figure 3: JKZ Series 2 App (right). Reprinted from *iTunes Store*, Retrieved from https://itunes.apple.com/us/app/jkz-series2/id700523885.

Furthermore, in 2014, mobile device ownership rates among college students reached a robust 86%, and this number was expected to increase on further years (Dahlstrom, Eden, and Jacqueline Bichsel, 2014). With the undeniable penetration of smartphones in the market and the ever-increasing impact of mobile applications in society, developing user-friendly applications that create a pleasant user experience (UX) is important to promote and retain use. The following section discusses some best practices of user interface design, since it plays an important role in UX.

2.5 User Interface (UI) design best practices

One of the most critical functions of a well-designed application is its presentation logic: How the information and resources are presented to the user and how can he interact with such data. Akin any product or service, the final metric to determine its success is simple: Whether the user's interaction provided a satisfactory user experience (UX) or not. According to Garret (2010): "…it is user experience that determines whether your customer will ever come back." The relationship that Garret (2010) makes between a commercial website and its customers is the same one that the team can assume between any application and its users. A well-designed User Interface (UI) should allow the user to successfully utilize all the system capabilities and accomplish all of his tasks and needs. As Garret (2010) says: "The world's most powerful functionality falters and fails if users can't figure out how to make it work.". It is important to clarify that this literature review is not about UX, and that UX is not the same as UI design. In fact, the UI is one component of a system helps to achieve a good UX if well designed.

While the process of developing, a UI can take multiple paths, there are certain steps and processes that have to be considered to avoid and overcome the pitfalls normal to the development process. First of all, it is crucial to fully understand who your users are identifying

their needs. It is important to observe the situation from the user's point of view, since the gap in knowledge and expertise between both parties can skew the designer's understanding of what the requirements are away from what the user actually expects. Consequently, involving users during the entire development phase is important. Second, the application's UI should deliver a pleasant interaction between the users and its content. An appropriate interface can be achieved through the use of UI design principles, as seen in Table 1, and adopting design methodologies further into the process. Finally, performing rapid prototyping and testing is useful to identify and solve problems throughout the development process. The team further discussed these steps to explain why and how they contribute to the design and development phase of a system. There are several other steps and design principles to consider when developing a UI; however, for the scope of this project the team only discussed the topics mentioned above in this literature review.

UI Design Principles

Principle	Definition	Improves
Consistency	Uniformity of appearance, placement and behavior of each element or feature.	Learning curve, user acceptance
Simplicity	Gradual introduction of less-common, more specific system components	Complexity of system
Aesthetics	Visual appeal of UI through color scheme, screen alignment and element grouping	User acceptance, functional perception

Table 1: UI Design Principles

2.5.1: Including users during the design process

Including users in the development process of a UI brings several advantages to the design. According to Galitz (2007), involving users can help obtain a more accurate set of requirements, and it can also increase the user acceptance of the system. This is also known as user-centered design: "Take the user into account every step of the way as you develop your

product" (Garret, 2010). Early in the process, users are the best source of information to discover the system requirements and specifications because they are the ones who will be using it. Later on, users can participate in the testing of prototypes to give valuable feedback on them. While user (the ones who will interact directly with the system) are the ones with the most knowledge of the tasks and system goals, there are other parties that should be included in the design phase as well. The sponsor of the project, or whoever is paying for it, usually has a solid understanding of the objective of the system they are paying for. Furthermore, third parties that might be affected or influenced by the functionality of the system can provide insight on the design as well. The main advantage of user involvement during the design of a system is, after all, the constant feedback they provide.

2.5.2: UI Design Principles

There are many factors that need to be considered when analyzing the use of a screen as a system. These include how much information is displayed and how it is grouped and organized, the consistency between the elements across different screens, the color code used and many others. Although the design of a UI is ultimately defined by the needs and requirements of its users, following basic UI principles help achieve effective, usable UI's; regardless of the specific requirements. These design principles are compiled from several different research documents on UI design (Galitz, 2007). For the extent of this literature review, the team only examined four important principles that are the most relevant for the scope of our project: Consistency, simplicity and aesthetics.

2.5.2.1: Consistency

Consistency states that the appearance, placement and behavior of each and every element of the UI is uniform. As Galitz says, "It is the cardinal rule of all design activities" (Page

48, Galitz, 2007). Understanding the importance of consistency is simple: Users think of the system as one single entity, not as a conjunction of different functions and interfaces. To provide a clear sense of general navigation certain elements' position, such as menus and navigation buttons, should remain unchanged. Likewise, similar component should look akin, have similar uses and operate in the same manner in order to ease the learning requirements for new users. In a consistent UI, users can learn the behavior of the system in one scenario, and apply it in similar ones (i.e. swiping right takes you back to the previous screen until you hit the main screen, regardless of what screen you are, etc.). When inconsistencies are present in the UI, the user is discouraged to use the system because of the burdens imposed to him and is likely to negatively influence user acceptance. The amount of thinking time user spends when using an inconsistent UI almost doubles (Galitz, 2007), and users are more prone to commit errors. To achieve consistency, clear design standards can either be developed or an existing guideline can be chosen. In these days, almost every major Operating System (OS) has its own design guidelines.

2.5.2.2: Simplicity

Another important principle, which goes along with consistency, is simplicity. The aim of this principle is to make the UI easy to understand and utilize for any user, regardless of their familiarity with the system. Simplicity can be achieved by using progressive disclosure, providing an obvious visual hierarchy, making common actions simple, between others. With progressive disclosure, the system components are gradually introduced to the user. At the main screen, only the most common and necessary features are displayed, and more sophisticated functions can be reached by navigating through the interface. The main goal of simplicity is to mask the complexity of a system through a simple interface (Galitz, 2007).

2.5.2.3: Aesthetics

The aesthetics of a UI plays an important role in the user acceptance of the system. Visually pleasing interfaces make a system accessible and inviting. Conversely, lack of visual appeal can cause disorientation and confuses the user (Galitz, 2007). In order to achieve aesthetic interfaces, designers can provide appropriate contrast between screen elements by selecting appropriate color pallets. Additionally, they can create meaningful groupings and aligning screen elements to present relevant data in an easier, more clear format.

2.5.3: Design Tradeoffs

As mentioned before, there are several other principles on which a system can be evaluated on. It is important to understand that not all of the principles can be implemented into a single system. More often than not, the tradeoff is decided by the designer after evaluating how important certain requirements and features are compared to others. For example, a bank's mobile app will try to provide the user with a highly secure application that protects sensitive information. The tradeoff that the designer has to make is usability and simplicity, since information that the user will most likely want to have access to right away, such as account numbers and balances, will probably be either partially displayed or hidden until further authentication. UI design is not an exact science; it is a field that that is constantly evolving with the advancement of technology. As newer technology becomes available, designers should not rely solely on their experience and knowledge UI design principles; they should think creatively to come up with innovative interfaces that maximize the usability of a system while still delivering a pleasant user experience.

2.6 Data Gathering

Our project was a continuation from a team that started the initial process of designing an MBSR app from August 2016 to December 2016. The initial idea came from UMass Medical, who wanted a mobile application developed that would assist college students in being more mindful in their day to day lives. After talking with Dr. Carl Fulwiler (Medical Director of UMass' Center for Mindfulness), it was determined that UMass would benefit more from having an app that extended the teaching at MBSR courses to the students' personal lives through the use of a mobile application. The previous group's work laid the foundation for what the team would plan to use to begin designing an app of that particular nature. Additionally, the team received a list of needs from interviewees from the previous groups project which gave us valuable insight as to which features to keep, remove, or expand upon. One particular complaint of the interviewees was the lackluster design of the previous UI of the mobile application. As such, the team plan on overhauling the original UI, so the team will still need to collect additional information from the users make sure the new design captures their needs. When it comes to obtaining this information, the team decided to use three different methods to identify needs: One-on-One interviews, focus groups, and surveys. The team decided it would be best to first speak directly to the users to obtain this information, which ruled out the usage of surveys as a main source of data collection. Surveys would be used specifically to gain quantitative data from interviewees. Knowing this, the team had to research when either a one-on-one interview or focus group would yield the best results and then conduct their research accordingly.

Benefits	One-on-One Interviews	Focus Group	Survey
Flexible Answers	✓	✓	
Anonymity			✓
Time Effective		✓	✓
Collaborative Thinking		✓	
Personal Answers	✓		✓

Table 2: Comparison of 3 Different Methods of Identifying Customer Needs

2.6.1 One-on-One Interviews vs. Focus Groups

A proven method for identifying relevant user needs is through the use of a focus group (Griffin, Abbie, and Hauser 1993). The authors conducted an experiment where they obtained customer needs for a piece of office equipment from eight two-hour focus groups and nine one-hour interviews. The data was plotted and can be seen in **Figure 4**. From the data, it can be concluded that focus groups can identify more user needs per session when compared to One-on-One interviews. “The data in [Figure 4] suggest that while a single two-hour interview focus group identifies more needs than a one-hour one-on-one interview, it appears that the two one-on-one interviews are about as effective as one focus group (51% vs. 50%)” (pg. 7, Griffin and Hauser, 1993).

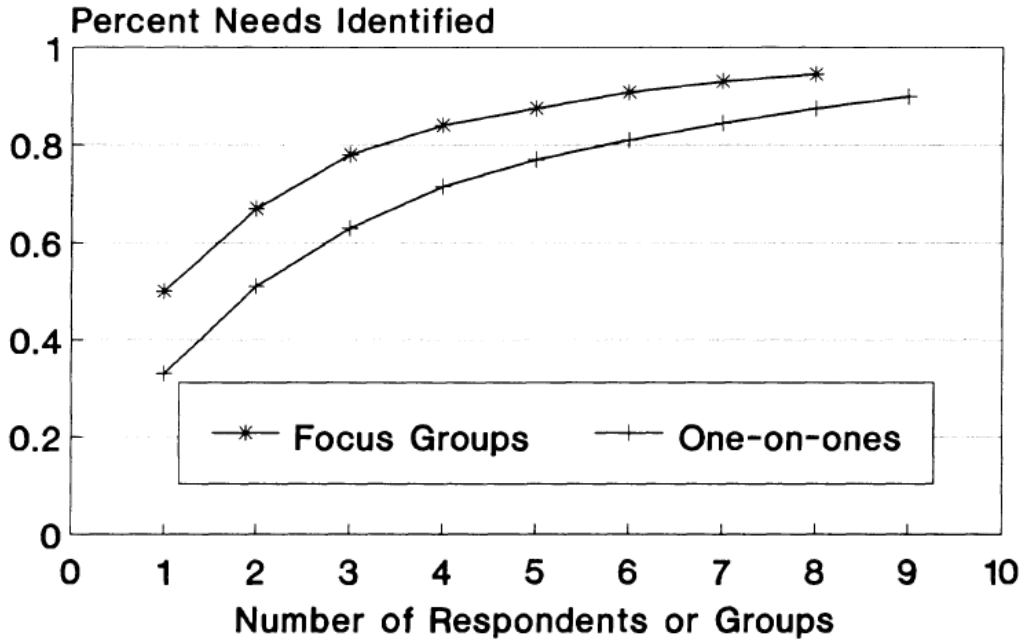


Figure 4: Number of respondents or groups plotted against percent of needs identified. Adapted from "Total Needs Identified" by Griffin and Hauser, 1993, *The Voice of the Customer* p.8

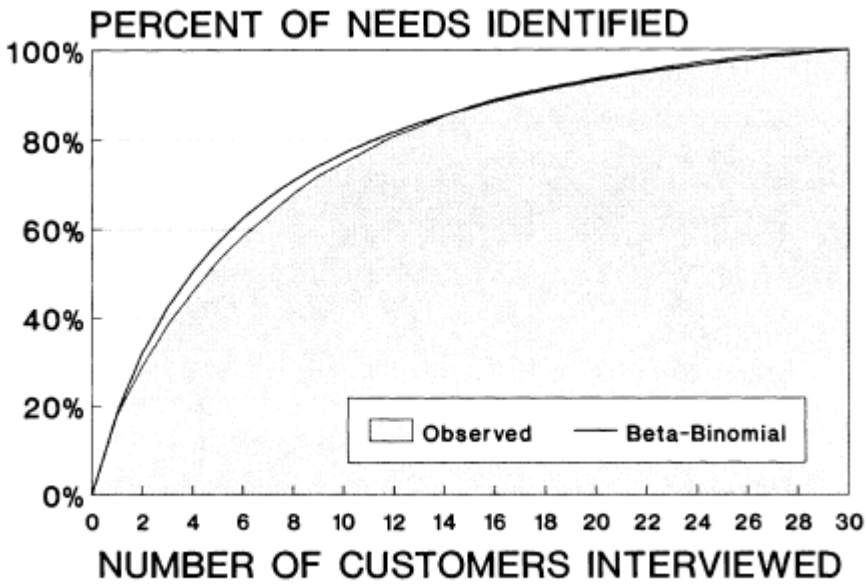
2.6.2.1 Identifying the Number of Users Per Focus Group

Once it is understood what the format of the interviews will be, the number of users needs to be defined. *The Voice of the Customer* also asked this question as well and they ran another experiment to determine what the appropriate number of users per focus group would identify the majority of their needs. They used the data from the previous experiment, in which they assigned thirty users to each focus group. They used the following model to determine the answer to their question:

$$E_n = 1 - \frac{\gamma(n+\beta)\gamma(\alpha+\beta)}{\gamma(n+\alpha+\beta)\gamma(\beta)}$$

They solved for α and β and plotted their resolves in a bar chart that can be seen in **Figure 5**. The figure also plots the normalization of the equation above for the percentage of 30 customers and

their needs. This is to coincide with their previous survey data but to also show how accurate the data is. The team concluded that, the results are not perfect but fairly accurate based on a comparison of the graphed observed and beta-binomial needs. They conclude the range at which you gain the most amount of information falls between two and twelve participants. After twelve participants, the amount of new information you obtain starts to plateau.



Percent of the Customer Needs Identified by *N* Customers (where 30 customers = 100%).

***Figure 5*:** Number of customers interviewed plotted against percent of needs identified. Adapted from "Number of Customers per Focus Group" by, Griffin and Hauser, 1993, *The Voice of the Customer*, p. 11

The team acknowledged that 100% of the needs were not extrapolated from the interviews, and consequently adjusted the above graph to take error into consideration. The new graph can be seen in **Figure 6**. The new graph predicts that about 89.8% of all customer needs were identified by interviewing thirty participants. However, the amount of needs you identify begins to peak at 16 participants, where you obtain about 80% of all customer needs. At 16 participants, you would need to almost double the amount participants to get a 10% increase in customer needs.

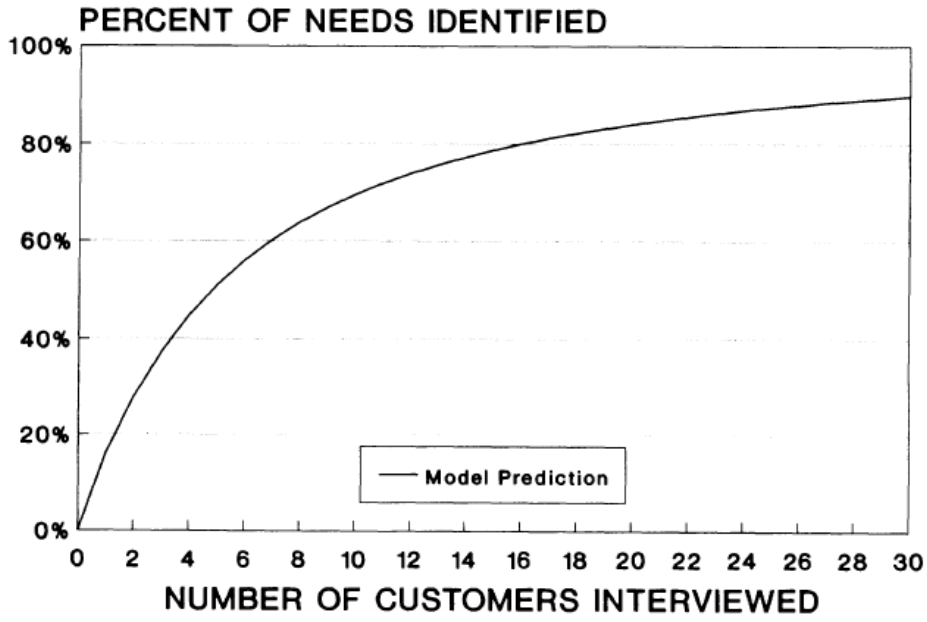


Figure 6: Number of customers interviewed plotted against percent of needs identified adjusted. "Number of Customers per Focus Group Adjusted" by Griffin and Hauser, 1993, *The Voice of the Customer*, p. 11

2.6.2 Qualitative Data Analysis

As mentioned before, including users in the design process to gather an appropriate set of requirements and specifications is essential. The data collected through the different research methods discussed before contain extensive, valuable unprocessed (raw) data. Once gathered, the researcher has to analyze, organize and utilize the data to extract significant facts, patterns and relationships to fully understand the material collected and make it useful for the research in progress (Casterle et al., 2012). These goals can be achieved by coding the data, a process that will be discussed in the following paragraph.

Coding, in Quantitative Data Analysis (QDA), is the process of organizing and sorting qualitative data (Stuckey, 2015). In its simplest sense, coding can be thought of as a way of tagging text with codes to facilitate its retrieval for later use (Bazeley & Jackson, 2013). A code is used to categorize data that is similar either by meaning or by the context in which it appears

so that the researcher can quickly find and cluster segments of data related to each other (Stuckey, 2015). Generally, when analyze a data set multiple codes with underlying instances are common. The structure of the categories of themes analyzed, or coding frame, starts with a predetermined set of codes defined before the analysis begins (Stuckey, 2015). Through the analysis, the coding frame changes by either adding new codes or by modifying its structure based on the findings from the dataset. In the end, the coding frame should allow the researcher to explore the data and draw conclusions that answer certain research question.

Nowadays, analyst rely on computer software to ease the burden of managing the large volumes of data common to qualitative research (Fortune et al, 2013). This type of programs, called QDA software, facilitate the task of organizing, grouping and coding the data and provide powerful searching and querying tools. It also makes team-based analysis more practical and supports multimedia files, thus extending the scope of the analysis tools used (Fortune et al, 2013). While the coding process has to be done by an individual with knowledge on the subject, the efficiency, productivity and reach of his analysis can be empowered through the use of software.

2.6.3 NVivo

To complete the analysis of the qualitative data, following the practices mentioned above, the team utilized NVivo as the QDA software of its choice. NVivo serves as a platform that allows its users to integrate the entire analysis process, where they can import their data sets in different formats (include Twitter and Facebook feeds) and proceed with the coding process. It provides analyst powerful querying tools and graphical reports to find relationships in their data. NVivo also supports team collaboration, and it is supported in both Windows and Mac operating systems.

2.7 Comparing Customer and Technical Requirements

After analyzing our user's needs using NVivo, the team decided to use a House of Quality (HOQ) to identify how these needs would translate into the actual coding of the application. A House of Quality is a diagram used in organizing large sets of customer needs and how they relate to the technical requirements to create a product. The diagram is broken up into six sections: customer requirements, technical requirements, a planning matrix, an interrelationship matrix, a technical correlation matrix, and a technical priorities/benchmarks and targets section (Tapke, Muller, Johnson, and Sieck, n.d.).

Customer requirements (1 in Figure 7) are gathered directly from the user of the product. To collect this information, interviews and surveys are utilized to interact directly with the users. The customer needs must be translated into tangible values that can be addressed by the developers to make the product more desirable to their market. Each customer need is also given an importance weighting which can be used to identify which needs should have a higher priority of being addressed than others. Customer needs are then compared to other competitors in the market, known as the **planning matrix** (**2 in Figure 7)**. Each customer need is given a score from 0-5 (0 being bad, 5 being good) for each competitor.

Once the customer needs are gathered, they are addressed by implementing technical requirements. The **technical requirements (3 in Figure 7)** are actions the developers can do to make the product better. Technical requirements are the specific actions that your developers can do to address the customer's demands. Each technical requirement is also ranked for direction of improvement. A ▲ symbol is used to denote a push to maximize improvement, a ▼ symbol is used to denote a push to minimize improvement, and the cell is left blank if it should stay the same. Each technical requirement is then also compared to each of the other technical

requirements to check for correlations, known as the **correlation matrix (5 in Figure 7)**. If a technical requirement has a correlation they can be identified with the following symbols: + for positive and a - for negative.

All of the customer needs are then cross evaluated with the technical requirements to examine which pairs will have a relationship, known as the **interrelationship matrix (4 in Figure 7)**. If a relationship is formed, it can be marked as either having a strong (O – 9 points), medium (■ – 6 points), or weak (▲ – 3 points) relationship. This is used to make sure that each of the customer's needs are being properly addressed and also if any technical requirements may have other interactions with other needs.

Lastly is the technical priorities/benchmarks and targets section. Each technical requirement is also given a **target/limit value** and a difficulty score **(6 in Figure 7)**. The target/limit value is used to determine the unit for which the technical requirements can be measured by. The difficulty score is used to determine which tasks might take longer or require more resources to accomplish.

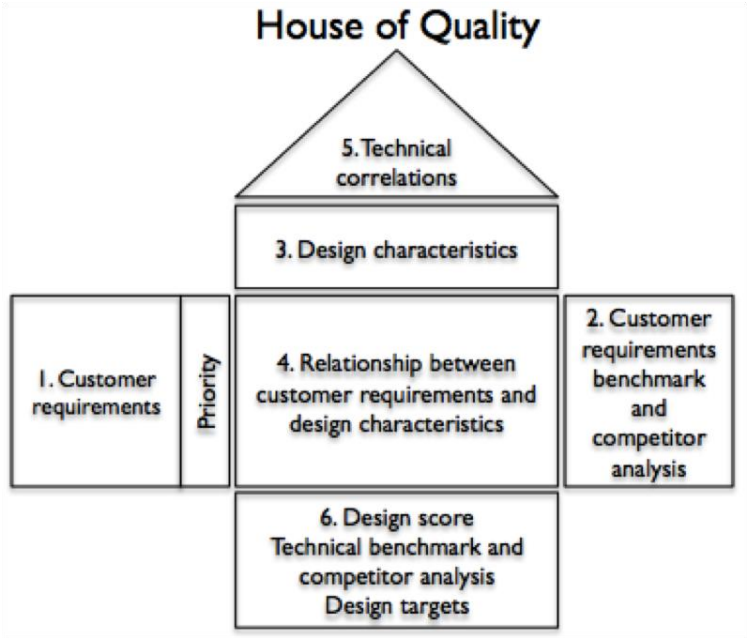


Figure 7: *House of Quality. Digital Image. LinkedIn. August 16, 2015. Web.*

3. Planning

The first phase of the project was dedicated towards planning future recurring meetings and times for the team. The MQP was divided over three terms as is common for MQPs. The overall plan was to create and pitch a project proposal to the sponsors by the end of B term based on initial findings. From there the team was to further develop the app and create a second iteration of the prototype.

Early on the issue of IRB (Institutional Review Board) approval for our data collection was a factor in planning the project. For details on the team's IRB approval process, see **Section 4.1**.

The team used When2Meet each term to find meeting times for recurring weekly group meetings, weekly meeting with our advisor Professor Loiacono, as well as non-recurring meetings, such as the meeting with the sponsors. The advisor meeting was generally planned during the weekly group meetings. For meeting agendas for sponsor meetings, see Appendix A. For meeting minutes of the weekly meetings with Professor Loiacono, see Appendix B. Our first meeting with one of our sponsors, Dr. Carl Fulwiler at University of Massachusetts Center for Mindfulness, was on September 21st, 2016, where the future of the project and its direction were discussed. The meeting minutes for this meeting can be found in Appendix C. The presentation planned for the end of B term occurred on December 14th; a copy of the presentation is included in Appendix H. The functional prototype based on the previous team's mockups was demoed, and the plans for the next iteration of the prototype based on early findings was discussed. The final presentation was held on March 13th, see Appendix J for slides from the final presentation. See Appendix K for sponsor signoff on final presentation. The updated functional prototype the team developed was demoed, and the future of the project discussed.

4. Procedure / Methodology

This section explains the team's methodology in gathering feedback on the design created by the prior project team. The team explains how it converted the prior design into a live mockup, which is used to gather feedback from interviewees. In addition, this section explains why interviews were chosen over other forms of data collection. The process for qualitatively analyzing the interview data is explained, as well as the team's implementation of a "house of quality," a tool used to map the features of the proposed application into technical terms.

4.1 Institutional Review Board (IRB)

Before we started our project, the team needed to seek approval from the Institutional Review Board (IRB) at WPI. To do this, we had to take an online training course to inform us upon the correct and ethical way of interviewing and interacting with our interviewees. After completion, each member was presented with a certificate, which certified that they completed the course. Each member sent their certificate to their advisor, Eleanor Loiacono, which was then sent to the IRB for their approval of the project on October 18, 2016. The team received approval from WPI's IRB on October 25, 2016 until April 25, 2017, which gave the team permission to collect information from interviewees as long as they give oral or written consent. The full IRB approval document (IRB #00007374) can be found in Appendix D.

Upon approval, the team went forward with creating a list of questions that they would use to present to their interviewees. Many of the questions were taken from the list that the previous team had created (which was originally approved by the IRB as well). However, the team wanted to ask a few additional questions to get a better understanding of the interviewees opinions of the mobile application. These questions were sent to the advisor who verified with the IRB that the questions were appropriate to be asked.

4.2 Mockups

In order to develop a new application design and better understand the needs that the it will fulfill, the team created functional mockups of the proposed MBSR mobile application. These functional mockups assisted in demonstrating the potential uses of the application, and allowed the team to gather feedback on the proposed functionality and design. Web-based tools such as InvisionApp were utilized to create mockups that can actually be clicked through on a simulated mobile phone. InvisionApp is a free prototyping tool that can simulate web, Apple iOS, and Android applications. This tool can make static mockups come to life, by allowing its users to define how each screen relates to one another; this allows for defining what happens when users tap, swipe, or scroll on various regions of the mockup image. **Figure 8** shows the main page of the mockup. This method of presenting the MBSR app's design and functionality was more engaging, and less overwhelming, than a flat storyboard which lays out all possible screens. Utilizing tools such as InvisionApp, the team was able to gather stronger and more specific feedback on the proposed application design.

Figure 8: *The InvisionApp workspace, displaying a mock-up built from the prior team's design.*

4.3 Identifying User's Needs

During our interviewing process the team used a mixture of both interviews and surveys to capture a wide range of needs from our users. Our idea was to use interviews to gain specific ideas from our users to see if they wanted similar features to be included in the application. After completing our interviews, the team used focus groups to capture any notable ideas that the team may have missed from our interviews. Additionally, the team decided that the team would offer $10 Amazon gift cards as incentives to any participant of our study to increase the number of potential interviewees.

Before trying to identify the users' needs, the team knew the team would be limited in the number of participants the team would be able to reach with our questions about the mobile application. However, what the team did not know was to what severity that issue would be. For example, the team aimed to gather at least 80% of total user needs from its focus group sessions. To do this, the team would need to have four focus groups of about fourteen to sixteen participants, according to our previous research. However, identifying a group of that many students who were actively practicing mindfulness and were available to meet at the same time proved to be difficult for the group. Instead, the team decided to have a balanced mixture of interviews, focus groups, and surveys to identify our customer's needs. This would allow the team to explore the thoughts and ideas of our users from all perspectives to ensure the team were able to identify as many needs as possible.

For the interviews, the team worked with a mindfulness group practicing on WPI's campus. The team explained to the group about our project and explained that the team would need input from students in order to create an application that would best suit their needs. From that group, the team were able to interview six members. A list of questions was prepared ahead

of time that were IRB approved to be asked to the interviewees. To see details on the interview protocol, see Appendix G. Two members of our team were present at each interview, one to ask the questions and one to transcribe notes. Interviews were conducted in rooms in WPI's library to provide the interviewees with a neutral and non-threatening environment. The team plans on contacting the teacher who runs the group to identify any new potential interviewees that may have joined the group after our initial contact with them.

After the team's initial round of interviews, the team decided that it would hold a focus group with their next grouping of students, which would take place at Quinsigamond Community College (QCC). This decision was made because the team's research indicated that a focus group of twelve participants or more would identify a majority of user's needs, which the team had heard that the class was around that size. The team had gotten in contact with the teacher of the mindfulness group operating out of QCC and planned on holding a focus group with at least five of her students. The team still thought a focus group would be efficient here because a grouping that size would allow us to identify at least 50% of our user's needs. Unfortunately, due to heavy snow the proceeding night, only one student showed up to the session. The team opted to hold a focus group with the student and the teacher to get an understanding of how the mobile application might be used in a classroom setting.

Lastly, the team used surveys through Qualtrics to follow up with interviewees after the interviews and focus groups were complete. The survey was brief and included questions to gain the interviewees consent as well as ask them which mental illnesses they experience on a day to day basis. Each interviewee was given a code to input into the website so that the team could link the interviewee to what illness they may be suffering from while still maintaining confidentiality. The full transcript of each interview can be found in Appendix F.

4.4 Interview Analysis

Having concluded the data collection process, the team proceeded to prepare the data for analysis. Using the audio recordings and the notes taken during the interviews, the team transcribed the interviews into text files. Each of the transcribed interviews was identified through the code given to each participant through the Qualtrics survey, to guarantee their anonymity. Having transcribed the interviews, the team was ready to import the dataset into NVivo and begin the coding process.

4.4.1 NVivo

As mentioned before, the QDA software the team decided to use was NVivo. The main purpose of utilizing software like this was to assist in how the team organized, managed and analyzed the data gathered from users. The first step of the analysis was to import our data into the program. After the interview process, the team carefully transcribed each interview so that they could be thoroughly examined later on. Once the data was uploaded, the analysis was divided in three main steps: Developing a coding frame, coding the data and running queries and drawing conclusion. Each of them will be explained in the following sections.

4.4.2 Developing a coding frame

Prior to the start of the analysis, the team developed an “a priori” coding frame derived from the interview protocol used to gather data. By understanding the questions and the context in which they were to be asked, the team estimated to some extent the nature of the answers (Stuckey, 2015). The preliminary coding frame was built upon the themes expected to be found. Later on, the initial coding frame was modified as necessary.

4.4.3 Coding the data

With the preliminary coding frame defined, the team started to systematically process each interview, assigning the data as it fits the existing codes. The team was issued two NVivo licenses through WPI, which were activated in the computers of two members. The team agreed that each license holder would code the data independently of each other, and then the team would compare and contrast the final coding frame and preliminary findings. As a result of the comparison, the team came up with a reliability percentage to quantify the variation in the initial approach of each of the analysis. Finally, the team integrated each of the analysis to create a single, final analysis from which reports and results were gathered.

During the analysis process, the coding frame of any project is likely to change as the analyst finds patterns or ideas initially unthought of. It is recommended that the researcher takes notes of the changes made; doing so can help remember the reasons supporting certain decisions and understand the changes in the thought process throughout the course of the analysis. (Stuckey, 2015). Following these good practices, the team members that performed the coding documented the process by recording any relevant changes or thoughts that arose. These records proved themselves helpful towards the end of the process, especially during the comparison stage since each member was able to easily explain the idea that each node was meant to contain and the context under which it was conceived. During this step, NVivo's built-in note taking tool facilitated process and kept all the project's resources in a single location.

Once both independent analyses were completed the team proceeded to compare them, determine how similar the final coding structure was, and merge both analysis into a single file. The comparison started by listing all the nodes in a table, grouped by different concepts they represented; as seen in **Figure 9**. For explanation purposes, we will name the analyses made by

the team as A and B. Analysis B had a more complex node structure that included node hierarchies, and therefore had a significantly higher number of nodes than A. For counting purposes, however, only the parent nodes were counted since the children nodes served to better organize the information rather than to expand the theme represented by its parent node. The number of nodes A had was 16, whereas B had 15, adding up to a total of 31 nodes. Next, the team identified and counted which nodes described the same idea, despite of any naming difference. The count of matching nodes between A and B was 13. The reliability percentage was calculated by dividing the count of matching nodes by the total number of nodes. With 26 matching nodes (13 from each analysis) and 31 total nodes, the analysis reliability percentage is 84%.

Concept	Coding Frame A	Coding Frame B
Appearance	App Appearance	User Interface PN
	Appearance Suggestions	Button layout CN
		Color Scheme CN
		Font CN
Features	Feature Suggestions	Calendar
	Notable Features	Excercises
	Calendar Feature	Inspirational Corner
	Least Favorite Feature	Suggested Features PN
	Local Events Feature	Mood Tracking CN
	Push Notifications	Activity Tracking CN
	Timer Features	Social Features PN
		Chat Room CN
		Local Events CN
		User Count CN
		Usage Reminder
		Timer
Mindfulness	Mindfulness Format (Options 1,2,3)	Class Structure
	Mindfulness Meaning	Meaning of Mindfulness
	Mindfulness Unclear	Barriers to practice
	App and Class Integration	Use of Mindfulness
App (General)	App Format	Usefulness PN
	App Name	Positivive feedback CN
	Uses for App	Negative feedback CN
		Improvement Suggestions
		Benefits of Using App
		Mental Health Condition
		Other

Figure 9: Coding frame comparison table

After finding the similarities and differences between analysis A and B, the team proceeded to merge both files into a single analysis that reached a 100% agreement. Given that analysis A had a greater number of coding references overall, it was chosen as the final file since that would reduce the total number of reference migration. The process was divided into three major steps. First, the node hierarchy of the matching nodes from file B was added to the main file. The main reason for implementing the hierarchy was to capture in further detail all the data acquired. It also allowed us to create better, more significant reports and graphs. The second step was to review every coded reference for each one of the matching nodes, coding any missing reference on the corresponding place. At last, the independent nodes from file B were imported to the main file. Some of those imported nodes were merged with already existing ones in the main file given that they referred to themes that, although not completely similar, were related enough to be represented by a single node. At this point, the main file was finally completed with a compilation of data from two independent analysis. A table displaying the final coding frame can be found in **Figure 10** and a more detailed table including children nodes can be found in Appendix L**.**

4.4.4 Running queries and drawing conclusions

Once completing the coding process, the next step was to utilize the tools provided by NVivo to understand the relations within the data set that are relevant to our study. Through the use of queries, word clouds, word trees and other hierarchy charts, the team was able to examine the data and draw significant conclusions about the user needs and their feedback from the different application features' they were asked about during the interviews. The conclusions and results are discussed later on in this document.

While creating the hierarchy charts, NVivo gives the researcher two different ways of ranking or counting the data. The first ranking method, is based on the total amount of references that a node has. In other words, it just counts how many pieces of data have been coded at a given node, regardless of the source of the data. Alternatively, the second method ranks nodes based on the number of sources associated with the material coded at a particular node. The distribution of the elements on the hierarchy chart can change significantly depending on which method is chosen. In order to obtain accurate results that represent the data correctly, it is important to understand the nature of the question trying to be answered and the difference between these two ranking methods.

4.5 Creating the House of Quality

After the data collected from the interviews was analyzed, the team decided to build a House of Quality to highlight the interaction between what features the application already has and what the users want. The HOQ will provide the next group who develops this project with a better understanding of which features weigh the most comparative to overall application design and user expectations. The full House of Quality can be viewed as Appendix I.

The team used the NVivo nodes to help determine the list of technical requirements that they would use to define the features of the current application. Those features being app appearance, calendar features, local events feature, push notifications, timer features, exercises, inspirational corner, and the chat room. Once these features were noted, the team decided which features needed a change of direction (either positive or negative) or no change at all. From the results of the data analysis, it was determined that app appearance, calendar features, push notifications, exercises, and the chat room all needed to see an increase in improvement. Conversely, it was determined that both local events and the inspirational corner needed to be

toned down due to a lack of interest in both features. The only feature that would be left mostly untouched was the timer features. In addition to the direction of improvement, each feature was rated against one another in the correlation matrix. In total, there were three negative correlations and five positive correlations between the features. These results were ascertained through observation of the data analysis results. Then, based on the team's research and results of the data analysis, the team decided upon the target value of each technical requirement. The information in this section is the team's interpretation of how each technical requirement should be created moving forward. Additionally, each target value item was given a score of zero to ten (zero being easy to accomplish, ten being extremely difficult) on each level of difficulty to accomplish.

After the completion of the technical requirements sections, the team filled out the customer requirements section. Here is where we listed the results from our data analysis of features that our users would like to see added or changed about the original application. The consensus from our interviews concluded the following demanded features: an anonymous chat feature, up to date local events, adjustable push notifications, a calendar to track mindfulness milestones, non-redundant inspirational material, different color scheme, and different font type. Each of these features were given a weighting on a scale of one to ten (one being not very important, ten being very important) to determine how important the team felt each change was to the usefulness of the application.

The customer requirements were then compared against all of the technical requirements and given a symbol to denote relationship: strong (O – 9 points), medium (■ – 6 points), or weak (▲ – 3 points). After each combination of customer requirements and quality characteristics were evaluated, the relative weight of each customer requirement and technical requirement

could be calculated. These scores help developers understand which features have the most amount of impact on the application, and should be features that are focused on developing first.

5. Results and Analysis

In this section, we discuss the findings of the team's analysis. As mentioned before, the team utilized multiple reporting tools, including queries, frequency counters and hierarchy charts to obtain conclusive data regarding user's needs. First, we will discuss the overall findings from the analysis. Continuing, each one of the main nodes is analyzed in greater detail to undercover more specific requirements. A more detailed table with counts for inner nodes and representation percentages can be found in Appendix L. The NVivo file containing the study was submitted to the team's project advisor for future reference. To conclude the project, the team prepared a final presentation for the sponsors of the project and presented the results of the analysis.

5.1 Overall Analysis

The final code structure contained ten parent nodes, extending to a total of 25 nodes when the inner nodes are counted. There were 11 sources of data (11 interviews), and a total of 209 references coded. The distribution of the references among the general coding frame nodes can be seen in **Table 3**, and a graphical representation is found in **Figure 10**.

Final Coding Structure

Node	References	Sources
Notable features	98	10
App Appearance	31	10
Mindfulness Meaning	16	10
Feature Suggestions	15	5
Mindfulness Format	14	10
Appearance Suggestions	13	5
Mindfulness Unclear - Barriers to practice	10	6
Uses of App	6	6
Least Favorite Feature	5	4
App name	1	1

Table 3: Final Coding Structure with aggregate reference and source counts

The node that gathered the most references was called “Notable features”, and it contains any comments on the existing features of the app. This node had the highest number of children nodes as well. Following was “App appearance”, a node representing any comments about the characteristics of the UI such as color scheme, font and navigation. The next five nodes contained similar number of references, but the number of sources from which those references came had higher variation. Finally, the last three nodes were not populated with as many references as the previous nodes. Nevertheless, they contain important comments that represent a valuable contribution to understanding the user requirements. In the following sections, each of the nodes, and the requirements obtained, will be discussed in further detail.

Final Coding Frame Reference Distribution

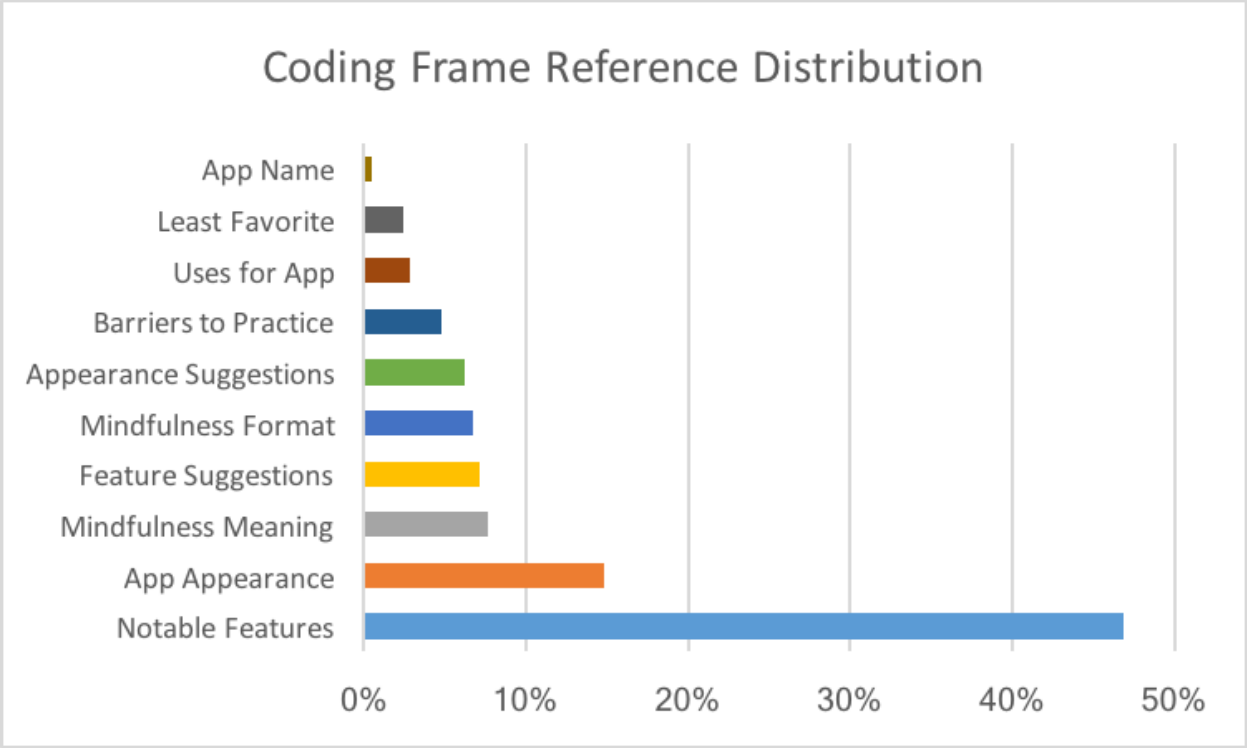


Figure 10: Reference distribution on final coding structure

5.2 Notable Features

The notable features node contains all the references related to the existing features of the app. As part of our interview protocol we asked the participants if they would like the application to send push notifications as a reminder to use the app; the comments about that feature were also coded under this node. With 98 references, this node contains 47% of all the coded material of the entire analysis. This node has several child nodes, one for each of the features displayed in the old application mockup.

5.2.1 Social Features

As shown in **Figure 11**, the "Social Features" node is itself a parent node with three child nodes: "Chatroom", "Local Events" and "User Counter". This parent node, as its name suggests,

was used to contain all the features that suggested or required some type of social interaction with other users. With 33 out of the total 98 references coded at the "Notable Features" node, social features seem to be a subject that caught user's interest. The most discussed feature was the chat room, which received more than half of all the references coded at the parent node. Local events and a user counter received some comments as well, in lesser amounts. A detailed explanation on the finding on each follows in the preceding sections.

5.2.1.1 Chat Room

The chat room feature received 21 comments from seven different participants. After running a word frequency query in this node, two topics we found to be consistent. As seen in **Figure 11**, the first one was that it caught users interest. The other topic that came up consistently was anonymity, which all users desired. Only one user indicated he would never use the feature. Most users responded neutrally or positively, with the general sentiment being interest, if not excitement. This ratio is common to most online forums, with the vast majority of users existing as read-only users.

Figure 11: Word frequency query for Chatroom feature comments

5.2.1.2 Local Events

Local Events is a feature which lists mindfulness related events near colleges using the app. Four users responded positively to this feature, with one indicating that this was the feature they were the least interested in, and the rest being neutral. Among those who did comment on the feature, many expressed concerns that the feature would be hard to maintain post launch. The team decided to keep the feature, with the note to future teams to design a system to maintain current local events.

5.2.1.3 User Count

The user count is a feature which shows how many users are currently using the app. Three users responded positively, and one indifferently. The users that responded positively thought of it as a feature that would increase their accountability as well as a feeling of

community. The team decided to keep the feature, as well as a total record of the number of hours the app has been used.

5.2.2 Push Notifications

Push notifications are a feature present in most modern operating system that provide alerts to the user. Nine of the ten users responded positively to the feature, and none indicated that it would be annoying. Users indicated that notifications would be best employed when the user had not opened the app in some time, perhaps after a day of inactivity. Two users suggested this feature should be adjustable to the like of the user.

5.2.3 Calendar

The Calendar would be a calendar used to track user meditation history as well as allowing users to plan future mindfulness exercises. Five users mentioned the calendar specifically as something they are interested in. Users gravitated towards the calendar as one of the more core features of the app, something that felt more fundamental than the other features. Some users indicated that this feature was something that was expected, but not enough of a reason to use the app over other apps.

5.2.4 Exercises

The exercises feature would contain a repository of yoga and breathing exercises in audio or video format. It would also include a link to a YouTube page where user would be able to access similar content. This features received comments from seven participants. They all suggested that it would be a feature they would utilize and that would help incorporate the practice of mindfulness into their lives better.

5.2.5 Timer Feature

The timer feature provides a countdown clock used to time self-guided mediation. Users

were familiar with such a timer. The users interviewed had previously used timers such as these in their mindfulness practice, and the general sentiment was that a timer feature was expected.

5.2.6 Inspirational Corner

The inspirational corner is a social media feed linked to mindfulness related social media accounts. Four users indicated interest in this feature, and one indicated it was the feature they were least likely to use. One user suggested that this feature should be something that would show a single post, a quote or image, upon opening the app but not be present as something to select from within the app. User sentiment indicated that it might be hard to maintain such a feature and there was concern it would end up being abandoned after the app launched.

5.3 App Appearance

5.3.1 Color Scheme

Out of the total number of references regarding the app appearance, color scheme had the most references. From eight participants who commented on it four indicated they disliked the color scheme, two indicated mixed feelings, and two indicated positive feelings. There was very little comment about what users would like to see instead. The team decided to dramatically overhaul the aesthetics of the app due to generally negative sentiment towards the apps aesthetics.

5.3.2 Navigation

Part of the appearance of the app involves how users access the different features of the app. Four users indicated that the navigation was intuitive, and one indicated it was not intuitive. The flow of the app has remained mostly the same in the new iteration, with the change in color scheme hopefully helping the readability of navigation elements.

5.3.3 Font

Only two users commented on the font, both indicated dislike. The font has been changed from a serif font to a more legible sans serif web font.

5.4 Feature Suggestions

Any suggestion about an existing feature or a feature unthought of before was captured in this node. A total of five users contributed with suggestions. One of the important findings from this node was an unthought group of functions that some users suggested would be beneficial to include. This suggested component is described in the following subsection.

5.4.1 Activity Tracking

Three users indicated interest in additional features to help motivate users by tracking mindfulness achievements. Specific suggestions included tracking more detailed metrics about mindfulness, giving an acknowledgement on the calendar for each day the app was opened and used, and having milestones to work towards.

5.4.2 Other features

One user indicated interest in more text-based mindfulness exercises, since some users might have noise sensitivity, and they might dislike audio or video components. Two users expressed interest in having the push notifications be quotes, one suggested passages from the Tao.

5.5 Mindfulness Format

Users were asked to select a preferred mindfulness class format from three distinct structure, each utilizing the mobile app in different ways. The first option was a more traditional

classroom based approach, with the use of a mobile app to compliment the class material limited to the students' personal preference. The second was a mixed approach, where half of the course load was given through physical class attendance, and the other half was available through the mobile application. The third option was an app intensive approach, where students were required to meet only one time in the entire course and the rest was delivered through the mobile application. The distribution of preferences is shown in **Figure 12**.

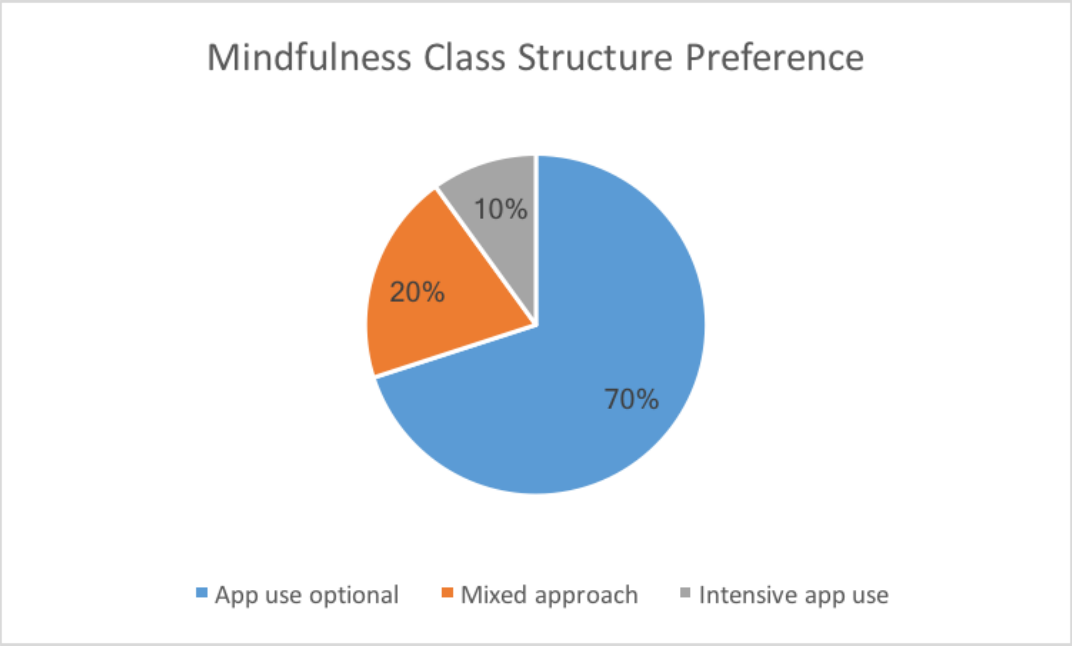


Figure 12: Mindfulness class structure preference distribution

Seven users indicated the classroom based class format would be their preference, two selected the mixed approach, and one preferred the entirely app based course option. The users that chose the traditional class based approach did not commented much on the reasons why they preferred such format. One user said the repetitive nature and constant practice was the decision factor. One of the users that selected the mixed based approach mentioned that learning how to communicate with other was a big part of mindfulness, thus making the app intensive approach

not viable to teach mindfulness. The advocate of the app-only approach justified his choice by arguing that schedule flexibility is very important to reach college students who are under stress and most likely would not have time to fit in-person classes in their schedule. An app-based approach would allow the student to make progress at his own pace.

5.6 Mindfulness Unclear - Barriers to Practice

As part of the interview protocol followed during the interviews, the team asked the participants if they were unclear about anything related to their practice of mindfulness and what were the barriers to practice, if there were any. Understanding the reasons why users are discouraged to practice mindfulness is in the interest of our study since it allows the team to identify or confirm requirements that the users might not recognize or show enough interest in. Out of six users who commented on the barriers they experience, four mentioned that finding time to do it was a problem. This sentiment was confirmed after running a word frequency query, shown in **Figure 13**, on the ten references coded at this node. One user mentioned that he was unsure on how to practice or get better at it, and similarly another user commented that the feeling of failing when his is not able to concentrate discourage him to practice.

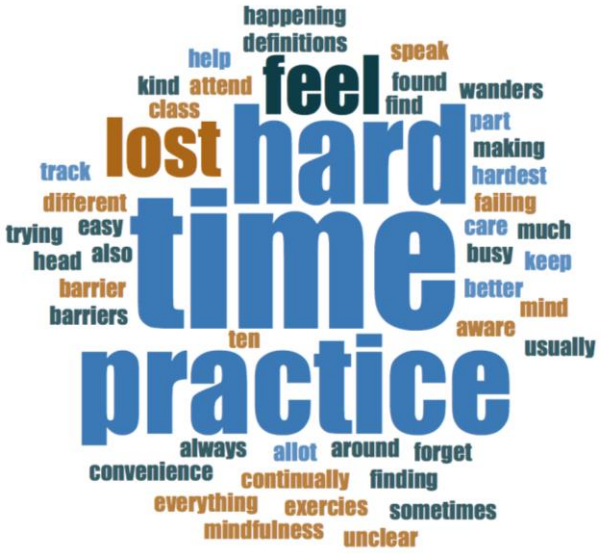


Figure 13: Word cloud from Barriers to Practice comments

5.7 Uses of App

During the interviewing process, some users explicitly mentioned how the use of the app would facilitate their practice of mindfulness. To be precise, six users contributed to this topic. One user said that the main purpose of utilizing the app would be to learn more about the capabilities of mindfulness. Four users mentioned the app would help to practice regularly through the calendar's scheduling capabilities. This sentiment has especial importance and validity since it could be potentially correlated with the findings from the previous section.

5.8 Remaining Nodes

The remaining nodes contain information related to explicit negative comments that users mentioned during the interviews about different features. While there are only six references from four different users, the team considered that these comments should be included to show every opinion from the pool of participants.

5.9 Final Presentation Recommendations

The team prepared a final presentation for the sponsors of the project. During the presentation, some additional functionality of the application was discussed. One of the sponsors' suggestion was related to the UI color scheme. While there were positive comments about the UI colors, allowing users to select the color palette of the UI when opening the application for the first time (a setting that they could later change) was strongly suggested. The team decided to include this suggestion as a result of the analysis since it aligns with the variation of comments made by the participants of our study regarding the color scheme, as mentioned in section 5.2.4.

6. Conclusions

This section details the conclusions and decisions the team came to from our data analysis. This section focuses on the updated version of the prototype, showing new and updated mockup screens.

6.1 New App Mockup

A new app mockup was created from the qualitative analysis of the team's interviews. The new mockup was designed using a combination of Adobe Photoshop and the Moqups platform. Some of the key screens of the new mockup are shown below. A comprehensive gallery of the new app mockup is displayed in Appendix E.

6.1.1 Splash Screen

The prior app did not contain a splash screen, or an image displayed to the user while the mobile platform's operating system is loading the app. To make the app feel more responsive, a splash screen, shown below in **Figure 14**, was created:

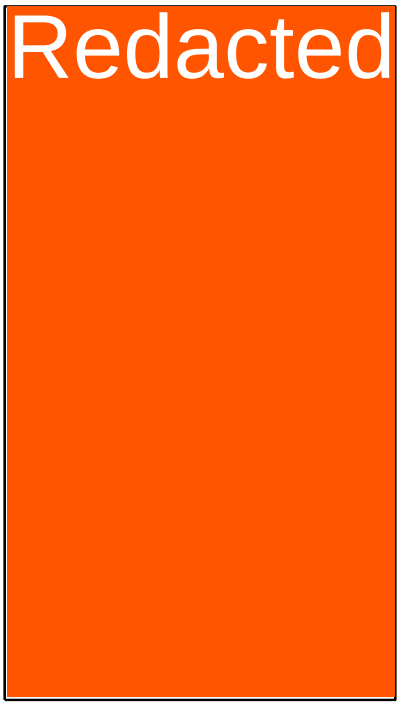


Figure 14: ‘Do You Mindful’ Splash Screen

6.1.2 Main Screen

The app’s main screen is the first screen the user is presented with once the app has loaded. Shown below in **Figure 15**, it contains the major tasks the user can complete (such as mindfulness exercises, calendar/timer, and inspirational corner).

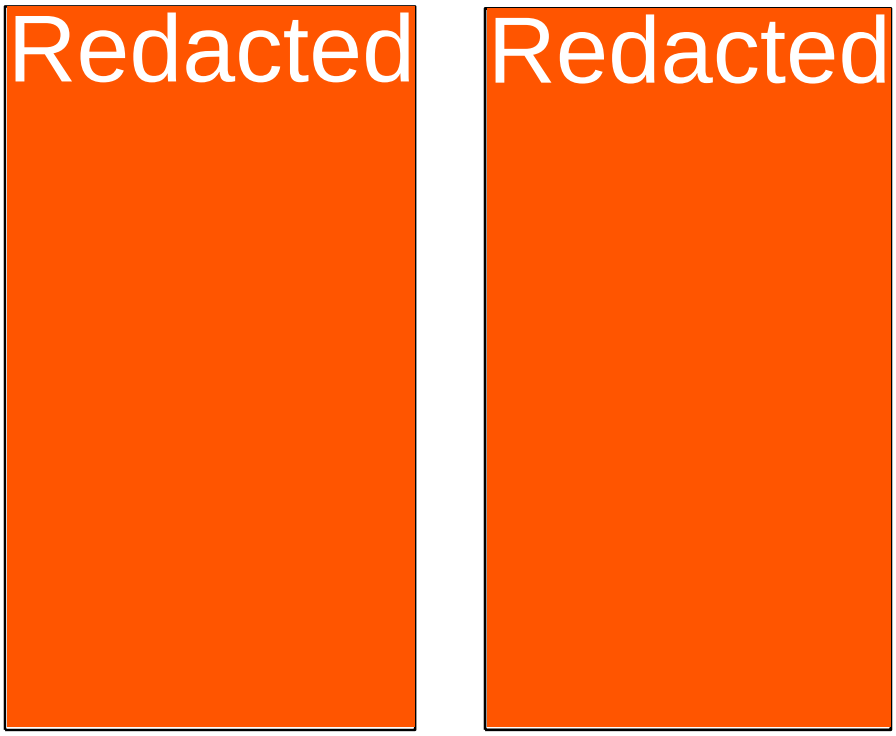


Figure 15: 'Do You Mindful' Home Screen, before (left) and after (right)

Changes to Home Screen: Comments about the home screen included comments about appearance, such as the fonts appearing blurry. One interviewer commented that the 'About Do You Mindful?' button was confusing to understand, and that at first, they did not think it was a button. In the revised version of this screen, buttons are separated and colored consistently. Icons were also added which give the user a visual cue about their functionality, without necessarily reading the button label.

6.1.3 About Mindfulness

The 'About Mindfulness' section of the app contains information on MBSR and mindfulness. As shown in **Figure 16**, it contains both general information, such as links to YouTube videos from Jon Kabat-Zinn, as well as dynamic content, such as 'Mindfulness Around the World' which has news on mindfulness from around the globe.

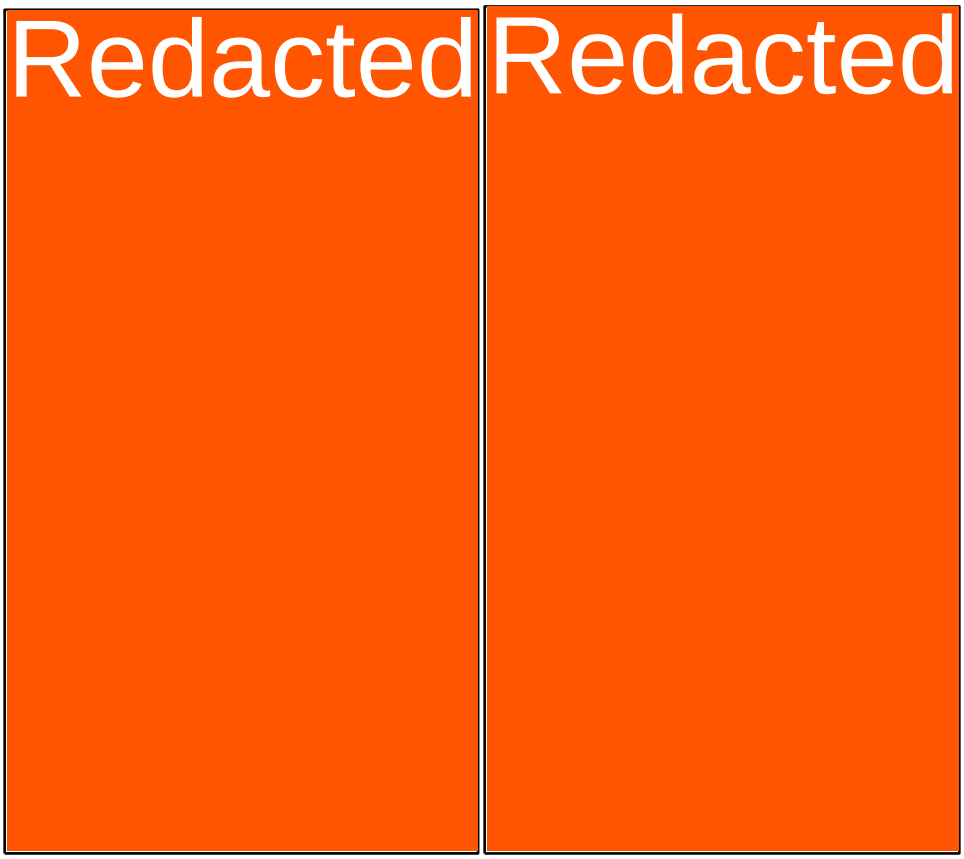


Figure 16: ‘About Mindfulness’ and ‘What is Mindfulness?’

Changes to ‘About Mindfulness’ and ‘What is Mindfulness?’: The About Mindfulness menu screen and associated features were updated to be consistent with the overall visual adjustments. Core functionality was not changed.

6.1.4 Calendar and Timer

The calendar and timer functionality allows users to set scheduled reminders, and also to time their practice of mindfulness on the go. Both the calendar and timer features are shown below in **Figure 17**.

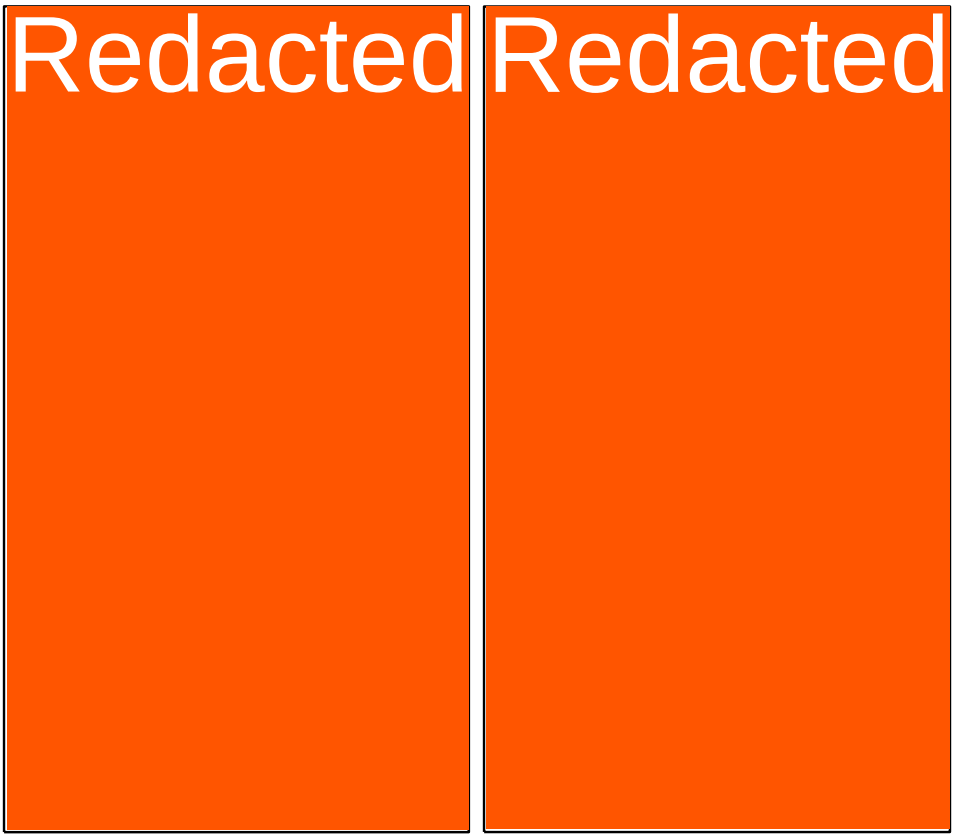


Figure 17: Timer and Calendar Features

Changes to Timer and Calendar: Interviewees reported that a timer and calendar feature would be helpful in setting reminders for mindfulness activities. However, some people felt that the analog-only clock style could be hard to read for some users. We remedied this by displaying both an analog clock and a digital readout. In addition, we moved the 'Set Random Alerts' functionality to the settings page of the app, because its meaning was not consistently understood in the context of this feature.

6.1.5 Inspirational Corner

The Inspirational Corner is an area of the app for users to view inspirational photographs and quotes. Photographs and quotes are mindfulness or MBSR-related; photos would be curated

by the Instagram account envisioned by the prior MQP team. An example of Inspirational Corner content is displayed below in **Figure 18**.

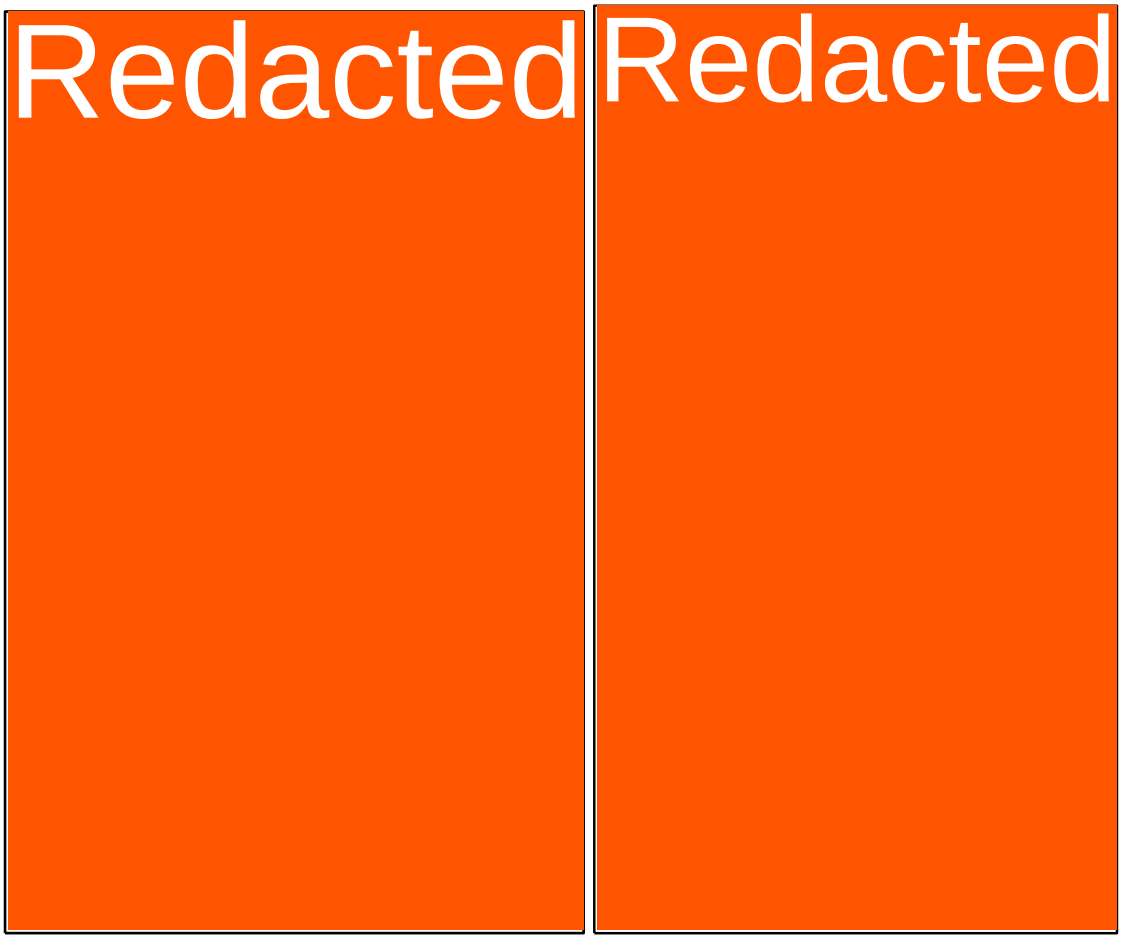


Figure 18: Inspirational Corner

Changes to Inspirational Corner: The Inspirational Corner has been updated to reflect the new visual look and feel. Icons are used in a similar manner to the app's home screen, which provide a visual cue to the various sections of the screen. Comments regarding the Inspirational Corner were mostly positive, but some users expressed some concerns. One interviewer said that "lack of maintenance" could be an issue for this feature; this would have to be mitigated by ensuring that the associated Instagram account or other feeds are regularly updated.

6.1.6 College Room

The College Room functionality allows users to engage in conversations with fellow students practicing mindfulness. Users can post questions or thoughts in a forum-style manner; responses are ranked by a user voting system. Highly-rated replies are displayed toward the top of the thread, as displayed in **Figure 17**. This feature was one that generated some of the most discussion during interviews. Most users said they had interest in the feature, with only one saying they would never use it, but many had reservations if they would be active posters or not. The format decided on was one that would give content to read, as well as basic participation, voting, for those that did not want to post.

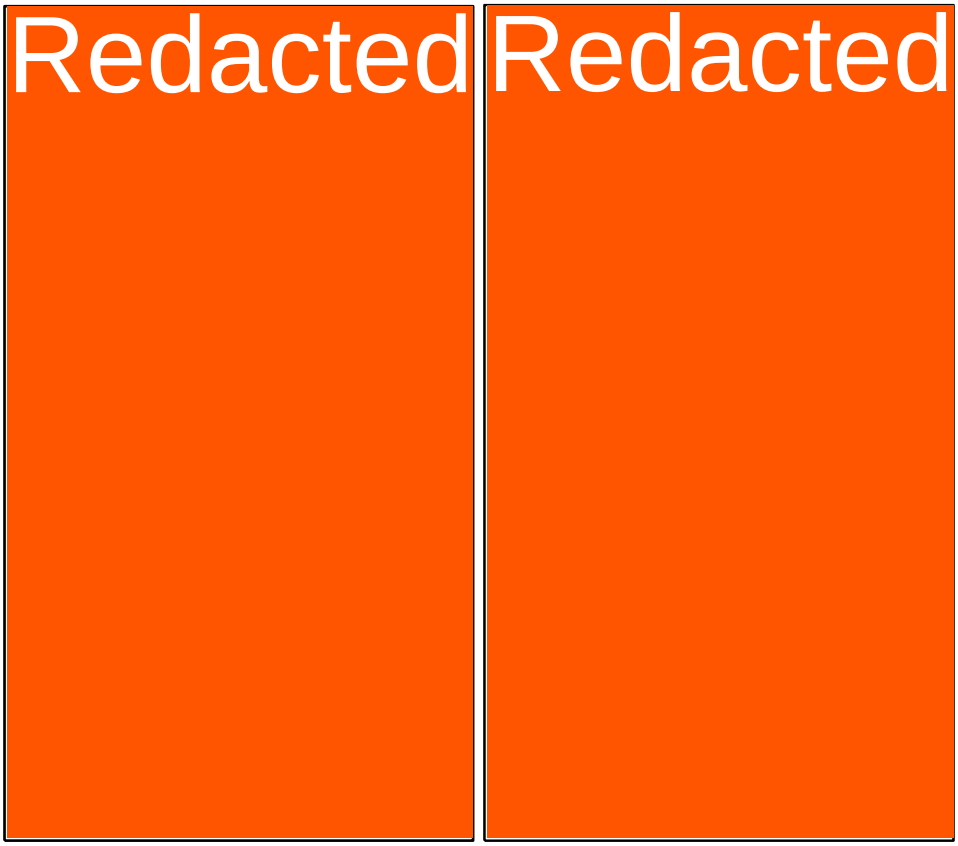


Figure 19: College Room Feature

Changes to College Room: The College Room social feature has been updated to be consistent with comments from interviewees. The user voting and ranking system is one addition made to the feature based on the comments provided. In addition, interviewees largely wanted this feature to be anonymous, at least to an extent. The new College Room design has support for user-creatable pseudonyms, rather than displaying a real first and last name.

6.1.7 Local Events

The Local Events feature displays mindfulness events that are geographically-close to the user. The user also has the option of specifying a location to search for events near, as shown in **Figure 20**.

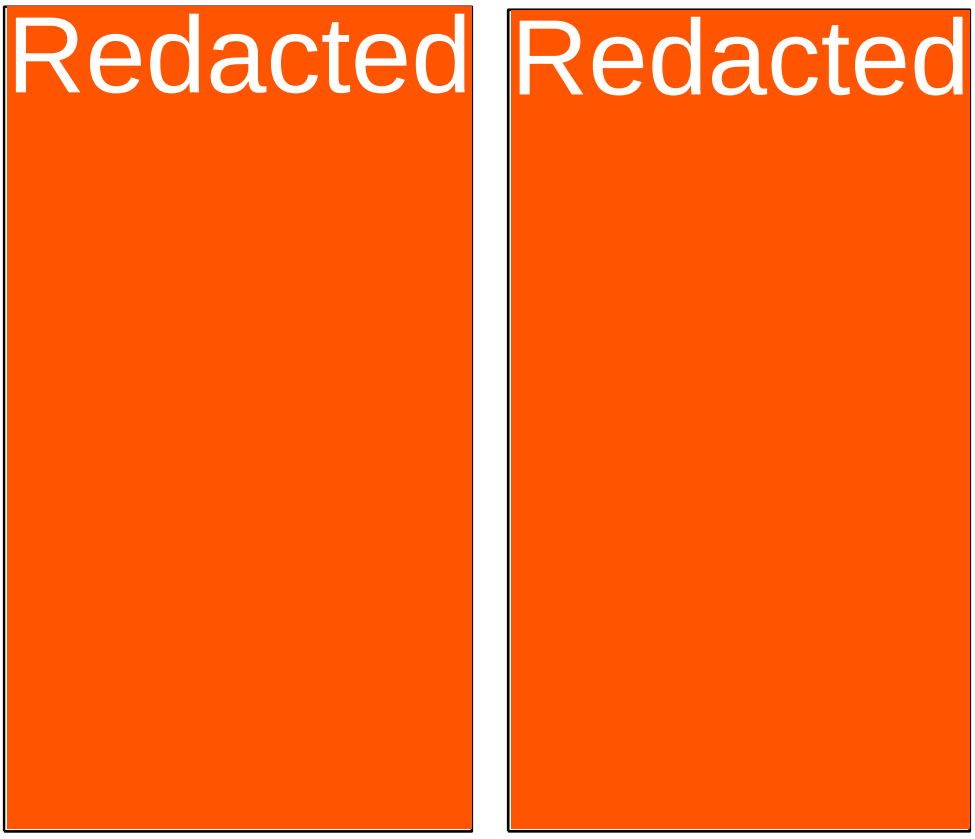


Figure 20: Local Events Feature, before (left) and after (right)

Changes to Local Events: Users commented mostly positively on the Local Events feature; some comments included “I like the local events” and “I think local events is interesting but hard to manage,” referring to the upkeep of the list of events. From the perspective of the app, this feature has been updated to match the new visual style. A button to change the location to one chosen by the user has also been added. Lastly, events can optionally be shown with an image now. In the above example, one event with an image, and one event without an image are shown.

7. Reflections and Lessons Learned

Each group member gained from this project in many ways. Below they reflect upon their findings.

Richard: Seeing fellow student's takes on mindfulness was interesting to me, as it gave insight to what others focus on; what is important to other people's worldviews. The information about mindfulness has been interesting to me as well, much of the practice seems useful to improving my personal life. I have been making an active effort to notice small, otherwise mundane, things in my day to day life, and make more effort to focus on the present moment rather than ruminating on the future. Trying to focus on each moment as it comes gives a feeling to each day of importance and meaning that can be easily lost in a day-to-day grind.

Andrew: I found it interesting that many people we interviewed had conceptually-similar ideas of what they believe mindfulness is, but practiced it in their own unique way. I think the proposed mobile application is accommodating of this with a wide variety of features; while any one user may not take advantage of all features, each feature may be useful to a particular kind of user.

Nick: I was very interested to see how varying people's opinions on how something should be created. While there was a popular opinion on how our mobile application should be structured that was identified through our data analysis, we found that not everyone agreed on the same things. Many people had some great ideas on how a particular portion of the application should be changed because it would benefit their own personal taste. We tried to incorporate all of these features into the application, however not all suggestions were practical. I personally would've thought that you would hear the same suggestions from people over and over again, but as we began conducting interviews, we found that wasn't the case. Additionally, I was happy

to learn about mindfulness and all of its positive benefits that it can have on mental health. Everyone can benefit from practicing mindfulness, as it allows you to clear your head and focus on the here and now. I will definitely be using some of the techniques we learned about from researching mindfulness and apply them to my own life when I need to destress.

Juan: One of the main takeaways I have after completing this project is that mindfulness serves a tool for many people to remain present and concentrate in what is happening at the moment. It was interesting to see that despite their goal was the same, each person had their own methods of practicing mindfulness according to their situation and preferences. As I learned more about mindfulness and how some college students practice it I became aware of the impact of stress-related problems in students of higher education institutions. Mindfulness provides a viable solution to this problem, and I believe that a well-developed app can assist to incorporate this practice in the lives of people who need it.

7.1 Global Impact

The team's final deliverable of the mobile application was achieved through both a combination of research and skills we learned though our classes and learning through WPI.

The team was not familiar with MBSR before coming into this project, and so our first task was to learn all about it. MBSR falls into the realm of the psychology discipline as it helps those dealing with stress, anxiety, and other mental ailments cope in their day-to-day lives. Due to this, when creating the mobile application, the team had to be cognizant of the intricacies that pertained to its users. Some of this information was ascertained through research while some was identified in the data gathering stage of the project. By identifying as many of these intricacies as

possible, the team was able to take that information and translate that to an effective mobile application.

The design of the mobile application came from our previous knowledge in the information technology discipline. We used what we had learned as Management Information Systems (MIS) majors to build a mobile application that would be easy and intuitive to use. Published information on best practices for user interface and experience were used to design the layout of the mobile application. Additionally, we used what we learned about data analysis to synthesize the information we received from our interviews and focus groups into data that could be used to influence the application's design. Without our background in this discipline, this project would have been difficult to accomplish.

Glossary of Terms

House of Quality (HOQ) - A diagram that compares technical requirements of a product against the customer requirements of the same product.

InvisionApp: A web and mobile prototyping application.

Institutional Review Board (IRB) - A group of administrative faculty who review research to ensure it follows strict guidelines to protect the rights of interviewees.

Mindfulness-Based Stress Reduction (MBSR) - The application and practice of mindfulness to address symptoms of stress, anxiety, and other mental ailments.

Moqups: A platform for designing application mockups, wireframes, and diagrams.

Quinsigamond Community College (QCC) - A school where one of the focus groups were held.

Qualitative Data Analysis (QDA) - A process in which the collected data from interviewees is processed to find trends.

User Interface (UI) - The visual representation of an application on a screen in which a person interacts with.

User Experience (UX) - The experience a person receives when using an application.

University of Massachusetts (UMass) - The school which sponsored the project.

Worcester Polytechnic Institute (WPI) - The school where the team conducted the project out of.

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Appendix A: Meeting Agendas

Meeting Agenda for 9/20/16

Previous Week:

- Completed NIH human subjects training.
- Discovered and tried several existing Apple and Android apps for mindfulness; this type of app is becoming increasingly popular.
- Defined an objective statement:

Our project's objective is to build and expand upon the framework of the MBSR app that was conceptualized by the previous MQP group in collaboration with UMass Medical. Our plan is to investigate how young people use mindfulness apps, and to test the proposed design of app to ensure ease of use, and identify key features that users would need on a daily basis.

We plan on accomplishing our goal by analyzing other mindfulness apps currently available today. In addition, we plan on conducting surveys with users to get feedback on the proposed design and features, and working closely with our sponsors at UMass and WPI.

Plans for Next Week:

- Continue identifying what the crucial features of a mindfulness app should be, and where other mindfulness apps fall behind.
- Further refine project objective.
- Start working on the report.

Issues / Questions:

- Meeting with project sponsor
- What deliverables do we need by the end of A term
- Should we look into why Apple included a mindfulness app in their new iOS? How did they analyzed the users and who are they targeting?
- Should we focus on increasing the functionality by supporting wearable tech to interact with the application? (This is an issue to decide later on, but it is an important factor to consider)

Meeting Agenda for 9/28/16

Previous Week:

- Met with Dr. Carl Fulwiler at UMass Center for Mindfulness in Shrewsbury, MA:
    - MBSR and mindfulness are not synonymous
    - App would support students enrolled, or would like to enroll, in a MBSR course
    - MBSR classes are three parts (practice, group discussion, and class topic)
- Revised our objective statement:

Our project's objective is to build and expand upon the framework of the MBSR app that was conceptualized by the previous MQP group in collaboration with UMass Medical. Our plan is to investigate how young people use mindfulness apps, and to test the proposed design of app to ensure ease of use, and identify key features that users would need on a daily basis. Such an app would reinforce the teachings of MBSR by reminding and aiding in applying mindfulness to everyday activities outside of lesson times.

The we plan on accomplishing our goal by analyzing other mindfulness apps currently available today. In addition, we plan on conducting surveys with users to get feedback on the proposed design and features, and working closely with our sponsors at UMass and WPI. Insights gained from surveying users will be used to further refine the app's proposed design and feature set.

→ What are we going to be able to deliver?

NEW:

Our project's objective is to expand the framework of the MBSR app conceptualized by the previous MQP project team. Our plan is to investigate how young people, and those diagnosed with mental health issues use mindfulness apps; we will test the proposed design of the app to further refine its design. The revision process will ensure ease of use, and identify key features that users desire to have on a daily basis. In addition, we will refocus the app's layout and content structure to create a format that is conducive toward course applications. Overall, the app will reinforce the teachings of MBSR by reminding and aiding in applying mindfulness to everyday activities

The we will accomplish our above goals through analyzing similar apps that are already available today. In addition, we will conduct surveys with potential users of the app to obtain feedback on the proposed design and features. The we will work closely with our sponsors at UMass Medical and at WPI. The insights gained from surveying potential users will be used to then further refine the app's proposed design and feature set.

Plans for Next Week:

- Continue working on the MQP project proposal.
- Determine how to leverage what the prior MQP team has completed.
- Begin to rework UI and create mockups for new app.
- Research effective UI strategies.

- Identify additional areas of improvement for the app.

Issues / Questions:

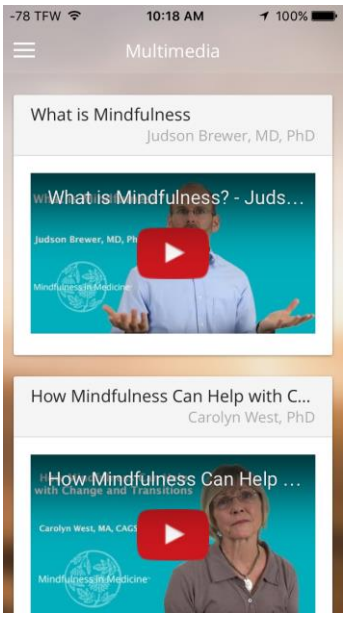
- Can we get in touch with the instructors of the UMass/WPI MBSR classes?
- How do we write a report as a continuation? For example, the background of the prior project is largely not changing in our project.
- The prior team had a large emphasis on social media; is this something we should be focusing on, and if so, with what objective?

Meeting Agenda for 10/5/16

Previous Week:

- Researched UI literature
    - Apple's Human Interface Guidelines may serve as a helpful resource
    - UI Basics from Usability.gov
    - *The Essential Guide to User Interface Design: An Introduction to GUI Design Principles and Techniques, 3rd Edition* and similar texts

- Looked at the UMass CFM app:



- Refined objective statement using the feedback from prior meeting:

Our project's objective is to expand the framework of the MBSR app conceptualized by the previous MQP project team. Our plan is to investigate how young people, and those diagnosed with mental health issues use mindfulness apps; we will test the proposed design of the app to further refine its layout and features. The revision process will ensure ease of use, and identify key features that users desire to have on a daily basis. In addition, we will refocus the app's layout and content structure to create a format that is conducive toward MBSR course application . Overall, the app will reinforce the teachings of MBSR by reminding and aiding in applying mindfulness to everyday activities.

We will accomplish our above goals through analyzing similar apps that are already available today. In addition, we will conduct surveys with potential users of the app to obtain feedback on the proposed design and features. We will work closely with our sponsors at UMass Medical and at WPI. The insights gained from surveying potential users will be used to then further refine the app's proposed design and feature set.

Plans for Next Week:

- Literature review and background

Issues / Questions:

- What is the line drawn between Background and Literature Review?
- How deep into UI design should we include in background?
- Where does the MindfulnessNOW iOS app (http://www.umassmed.edu/cfm/ummhc-mindfulness-in-medicine/ummhc-mindfulness-now-app/) fit into the scheme of our project?
- Response rates for email blast surveys; other channels for questionnaire distribution.

Meeting Agenda for 10/12/16

Previous Week:

- Literature review and background

Plans for Next Week:

- We will continue to work on the project proposal over the term break, and plans on wrapping it up shortly thereafter.
- Andrew - Continue to learn how to leverage InVision app prototyping, and continue to write background information on user design and related topics.
- Richard - Protocol and Survey Questions
- Juan - Refine the documentation and good practices for mobile UI design.
- Nick - When to use 1 on 1 or Focus Group/ Handouts
- Have Prof. Loiacono email sponsors after break (est. 1 week contact)

Issues / Questions:

- Feedback
- Additional things to focus on that we haven't mentioned above

Meeting Agenda for 10/26/16

Previous Week:

- Created written list of tasks with deadlines
- Assembled deadlines into shared Google Calendar
- Outlining of project proposal
- Some sections of proposal drafted

Plans for Next Week:

- Each team member will continue to work on writing the project proposal
- Forming of questions for interviews and/or focus groups
- Complete focus group documents
    - Interview protocol, handouts, questions for focus groups, etc.
- Finish background section

Issues / Questions:

- Feedback on proposed deadlines

Meeting Agenda for 11/2/16

Previous Week:

- Project proposal writing
- Interview protocol and questions
- Pre-Interview Handout/Email
- Adjusted schedule and added items based on feedback from last meeting

Plans for Next Week:

- Complete House of Quality
- Complete first draft of proposal
- Bring the prior app design into InvisionApp

Issues / Questions:

- 2 sponsor presentations? One before we begin development and one at the end when we finish?
- If each section is going to be reviewed as it gets done, do we need to present a draft of the final paper in advance of its due date?
- Who exactly are we interviewing? Students?

Meeting Agenda for 11/9/16

Previous Week:

- Project proposal writing
- Completed House of Quality
- Prior design images imported into InvisionApp. Mockup functional on a PC or mobile device.
- Sent questions in for approval

Plans for Next Week:

- Data analysis software learning
- Revisions to Proposal
- Email to Sponsors/Interviewees
- Interview Procedures

Issues / Questions:

- Contact with WPI and Quinsigamond MBSR leader
- Nvivo or IBM Watson?

Meeting Agenda for 11/30/16

Previous Week:

- Thanksgiving break
- Revisions to project proposal document
- NVivo trial and self-training
- Set up a Trello to keep track of tasks and due dates

Plans for Next Week:

- Today: introduce ourselves to Susie Fairchild's class and explain our MQP
- Schedule and complete interviews
- Continue project proposal revisions

Issues / Questions:

- Gift cards and other incentives for interviews
- Interviewing MBSR-specific people
    - WPI people are mindfulness in general (not MBSR)

Meeting Agenda for 12/7/16

Previous Week:

- Revisions to project proposal document
- Interviewed WPI students
- E-mailed UMass to arrange project proposal presentation

Plans for Next Week:

- Continue interviewing students
- Create and practice presentation
- Continue Proposal

Issues / Questions:

- Make sure gift cards get sent out to students who have completed interviews with the team
- Quinsigamond possible Focus group

Meeting Agenda for 1/23/17

Previous Week:

- Transcribed all interviews
- Imported interviews into NVivo and started coding process
- Finished gathering consent forms

Plans for Next Week:

- Project report document
    - Complete overhaul of House of Quality
        - Translating what people say into technical design needs
    - Document NVivo (**section 3.2**) with info on NVivo and technicial parameters used
    - Document housekeeping
        - Appendices
        - Glossary
        - Bibliography checkup
- Start creating new mockup images based on preliminary feedback
- Create second revision of InvisionApp using new mockups

Issues / Questions:

- Objectives for additional interviews and focus groups this term (example: a focus group at QCC)
- MBSR journal article forwarded by Dr. Fulwiler

Meeting Agenda for 1/30/17

Previous Week:

- Further analysis in NVivo
    - Developed coding
    - Started coding process
- Created milestone list with deadlines
- Proposal work completed

Plans for Next Week:

- Finalize data analysis
- Begin creating new mockups based on analysis
- Meeting with Susie Fairchild's C-term group of students on Wednesday. We will solicit more students for interviews.

Issues / Questions:

- Coding frame structure

Meeting Agenda for 2/6/17

Previous Week:

- Met with Susie Fairchild's new class
- Scheduled 5 interviews
    - 3 interviews already completed, 2 to go
    - Consent forms obtained prior to interviews on Qualtrics
    - Team will provide info to Prof. Loiacono for gift cards
- Transcribed new interviews

Plans for Next Week:

- Coding and analyzing new interviews
- New mockups based on findings from interview data
- Continue writeup of analysis process in project document

Issues / Questions:

None, as of this agenda.

Meeting Agenda for 2/15/17

Previous Week:

- Scheduled final interview
- Coding, analysis in NVivo
- Starting process of new mockups based on NVivo feedback

Plans for Next Week:

- Continue writing about NVivo methodology, findings
- Continue work with new mockups/InvisionApp

Issues / Questions:

- Poster content and format. Is there a template? Past team's poster for reference?

Meeting Agenda for 2/20/17

Previous Week:

- Editing of paper based on feedback
- Designing new mockup based off of interview data
- Juan and Andrew compared their NVivo findings

Plans for Next Week:

- Have new app mockup completed
- Have House of Quality complete
- Incorporate new app mockup into project report
- Schedule presentation time with Dr. Fulwiler and Dr. Davis

Issues / Questions:

- Any preferences on presentation date at UMass?
- Timing of next round of revisions

Meeting Agenda for 2/27/17

Previous Week:

- Extensive editing based on prior suggestions
- Addition of data, findings, analysis material into document
- New mockup finished (built in Moqups and brought into InvisionApp)
- Presentation scheduled
    - Monday, March 13, starting at 1 PM at the Center for Mindfulness in Shrewsbury
    - Dr. Fulwiler and Dr. Davis will be in attendance.
    - Robyn Leonard and Sandra Manning assisted in scheduling it.
    - Waiting to hear back to confirm that the conference room with projector is being reserved for us.

Plans for Next Week:

- Finish project document
- Create project poster
- Work on final presentation PowerPoint

Issues / Questions:

- Anything missing from our plans for the next several days?

Appendix B: Meeting Minutes

MQP Meeting Minutes 8/30/16

- MQP Process
    - 3 Terms
        - A term proposal
            - Requirements gathering
        - B term
            - Development
        - C term
            - Company approval and handoff
- Working with UMass
    - MBSR
        - Look at NSF grant for more funding to develop app for people with mental health issues for mental health
        - Benefits
            - Facilitate MBSR, not replace it
- Last Year
    - Team came up with mockups
- Over the summer
    - Wanted to interview students who have done MBSR classes
- Now
    - Figure out scoping
    - Get it to a point where we can get people looking at these mockups to finalize the mockups for a grant
    - More functioning mockup, not a full blown app
- Follow an SDLC model for developing this project

For next time

- Sign up for MQP
- Review last MQP
- Research MBSR

MQP Meeting Minutes 9/6/16

What we want to discuss:

- Un-redacted MQP
    - We can get it, setup google drive and she will upload it
- Any necessary/important files
    - Make a checklist and she will give those to us
- Training
    - https://phrp.nihtraining.com/users/login.php
- Contact info for sponsors. What kind of contact should we be having with them?
    - Meeting with sponsors, in person
    - Not much contact
    - Debrief with them
    - Send availability to her for next 2 Wednesdays
        - 8:30 am earliest
- Discuss next few weeks
    - Do the training
    - Review Material
    - Format documents
    - Paragraph of what we believe the project is
        - Discuss that with sponsors

Email Prof. Loiacono with the following:

- Protocol and confidentiality
- Times we are available

MQP Meeting Minutes 9/13/16

- Interview Protocol
    - Would you use this
        - Face to face training
        - On your own training
    - Where would you rank the following questions
    - Used this to get a general feeling of how users would feel about the app
- Get the app to a "second round" to check if that's what people want
    - What's the next phase of this app?
- Already diagrammed
    - Now we figure out if the way it's laid out is helpful/useful to the user
- Does MBSR help college students
    - What are the target demographic of MBSR users?
    - Use skills we have learned in class to identify points to expand on in the project

For next time:

- Setup the project objective
    - Information and direction of the project matches the objective
- Figure out how people use current MBSR apps
- Send Professor Loiacono our certificates

MQP Meeting Minutes 9/20/16

- Part of the goal: figure out what type of technology can bridge people in a class (students who have mental health issues and doing MBSR) and bridge the gap from face to face to online.
- Creating a protocol for structuring the technology in such a way that provides the best functionality
- UMass – can we get MBSR to the app. Proven studies to see if this helps young adults with mental health issues
    - What we would do is set that up (protocol), what are the tools to do that testing
- Survey people to see what features they like about other apps to get a general feeling of what people like the most
    - Try and normalize the app so that it blurs the line between people who have health issues vs not
    - Cross reference past MQP data with what other apps offer to see what works best
- Figure out the best way to order our survey to explain features and what the user prefers (do we show screenshots, do we just describe it idea, or both)

Issues / Questions:

- Meeting with project sponsor
    - Email sent
- What deliverables do we need by the end of A term
    - Write up what we did and how we did it. Planning and setting up methodology to do the testing
- Should we look into why Apple included a mindfulness app in their new iOS? How did they analyzed the users and who are they targeting?
    - Look at online news sources (Wired, Time, etc.), look at app store ratings, etc.
- Should we focus on increasing the functionality by supporting wearable tech to interact with the application? (This is an issue to decide later on, but it is an important factor to consider)

MQP Meeting Minutes 9/28/16

- UMass is also developing additional apps for mindfulness
    - But not specifically MBSR
- Develop a process for the following:
    - Interviews with MBSR people
    - Gathering requirements for the app
- Setup and design the UI for the new app
    - HIC and UX to help move that along. **Literature review here**
- App is targeted at those who have mental health issues who are using MBSR.
    - Interview people on how they would use the app
        - Would they like to use this 100% instead of classes, a supplement, or not at all?
- Setup the app as a general open to the public, and then associate groups/instructors with specific modules in the app.
- OR Setup the app so that it's specific to MBSR courses and then expand to general public
- Backend to support the app
    - I.e. database, cloud storage, security, etc costs.
    - **Literature review**
- Things to deliver
    - Solid mockup that's being tested
        - Better UI and backend costs
        - Costs analysis
    - Interview protocol
- Turn qualitative data into quantitative data by color-coding words said in interviews to give basis for assumptions
    - Worlde/NVivo?

For Next Time

- Bullet out what deliverables we want to accomplish
    - List of objectives and date of completion
- rework the project objective
- Start writing up the things we've found out for the literature review

MQP Meeting Minutes 10/5/16

- Objective Statement
    - Looks good
- CFM app
    - Keep app design similar to it maybe
    - Separate from MBSR projects
- Literature Review/Background
    - Background is a setup of the project
        - Talk about the center and the other MQP that was done (Spark).
        - What's the goal?
        - Project objective
        - How to enable them to get funds to go further
        - Lays out a roadmap for the rest of t paper
    - Literature Review
        - Things we researched (Protocol, app design, protocol, etc.)
        - Make sure there's a transition from Background to Lit Review. Connect them
            - Also transition to other topics as well.
                - Ex UI design to interview protocol. How are they related
    - Project Proposal
        - Place holder for all sections
        - Layout things that will need IRB for her
        - NVivo
    - Interviews
        - Ask interviewees permission to reach out to them again
        - Emails can be sent to WPI aliases, WPI mindfulness group, Quinsigamond
        - Use previous qualtrics interview as a starting point
            - Use qualtrics to link ID of the interviewee to mental health issue

MQP Meeting Minutes 10/12/16

Team is still investigating interview apps and processes

Specific deadlines for deliverables

- Gantt chart may not be as helpful, but monthly calendars are good, to see when the deadlines are. Google Calendar, or Outlook, etc.
- Put down key dates to visualize timeframes. Written dates may not convey the time as well.
- Next time the team meets, have deadlines defined in a calendar or some other format.

Team sent out a When2Meet for the next term.

- Wednesdays are still good for the professor and the team. May not work toward the end of the term.

Team would like to talk with the people they will be interviewing, but first needs to finalize the protocol. Will also have to come up with a schedule. Professor will contact IRB to make sure requirements are in place.

For next time:

- Deadlines in a calendar or other visual format.
- Deliverables as a part of the agenda, going forward.
- Outlines, in terms of the sections, for the project proposal.

MQP Meeting Minutes 10/26/16

- IRB has been successfully modified
- Calendar suggestions
    - Add deadline for first draft to be reviewed
    - Add deadline for a final draft and revision of the project report so it can be reviewed before the sponsor presentation
    - Add sufficient time for Prof. Loiacono to review presentation
- Contact e-mail
- Project outline
    - Talk about MBSR efficacy
    - Technology and MBSR
    - App development -> user interface design
    - What's been done so far? (prior MQP initial design)
        - Getting feedback
        - Making adjustments to what it would look like
- How many people do we have to interview?
    - 10 to 20
- Can refer back to previous group's survey methods
- Visuals are good for the project report (text only is boring)

For next time:

- Writeups of material so feedback can be provided
- Examine interview protocol, and write interview section
    - What does the team agree/disagree with
    - What changes should be made
    - Team should start doing interviews soon
    - E-mails to send people next week

MQP Meeting Minutes 11/2/2016

- Nick discussed the House of Quality he is currently working on.
    - Compares the previous app with the new app
    - App does not have competition in the sense that it is focused on MBSR specifically (not mindfulness as a whole)
    - Prof. Loiacono believes some of the elements will change once we get feedback from interview participants
- MBSR app UMass may be able to be brought into the picture
- Richard made an interview protocol based on the change he would like to make. He thinks some of the features based on connecting with other users may be distracting; app should focus on the users as an individual.
- Richard will send Prof. Loiacono the interview question pool for review
- Practice the interview script with some friends to get a feel for it, paying attention to timing and responses.
- Proposal presentation: team should schedule a date for this soon.
- Interview population: students who have taken something similar to MBSR (not necessarily a course from the Mindfulness Center)
    - Prof. Loiacono will send a list

MQP Meeting Minutes 11/9/2016

- Previous week
    - Project proposal writing
    - InvisionApp mockups
    - Completed initial house of quality; further renditions will be coming after insight from interviews
    - Sent questions in for approval
- InvisionApp
    - Investigate feedback and commenting features
- Survey Questions
    - Avoid priming the question
        - Instead: "What do you like most?", "What do you like least?", etc.
        - Later on: "Would something like the app reminding you be a helpful feature?"
    - To start off, "what does mindfulness mean to you?" (Rather than "what is mindfulness to you"); don't spend a lot of time on this part. Input on the app is more important.
- Team is comfortable with interview procedure; interviews will hopefully be in person. Make sure to include the rating system shown in prior PowerPoint.
- Getting in contact with interviewees: Prof. Loiacono will introduce the team to the representatives at Quinsigamond.
- Data analytics: Nvivo, IBM Watson
    - Questions are qualitative data
    - Nvivo is good at translating qualitative data into grouping (positive, negative, etc.)
    - Prof. Loiacono has requested 2 licenses for Nvivo
- Prof. Loiacono will send the Quinsigamond contact and the person at WPI doing mindfulness work
- Plans for next week:
    - Revisions and additions to proposal
    - Emails to sponsors/interviewees
    - Learning how to use Nvivo, etc.
- Pre-interview survey
- Team should start learning how to use Nvivo
- When contacting people, team needs to not disclose who else they are contacting
- Specify that we are an MQP team, working on getting feedback on MBSR training through apps, etc. in the protocol
- Team will send the documents to Prof. Loiacono before sending anything out.

MQP Meeting Minutes 11/14/2016

- Previous week
    - Start sending emails to interviewees after Thanksgiving
    - Download the Nvivo trial to start to use the software
        - Have everyone code the first node separately and then compare the codes to discover discrepancies
        - How might we analyze the qualitative data? Something to think about
    - Project proposal presentation the week after Thanksgiving
- Feedback on Proposal
    - Front Page
        - Spell out MBSR
    - Page 2
        - Table of contents shouldn't have a number
    - Abstract, Authorships, etc.
        - Have holding pages
    - Introduction
        - Describe what an MQP is. Someone who knows nothing about MQP should be able to pick this up and read it
        - Reference the actual MQP in the paragraph. Title should be sufficient
        - Say college aged over young people
        - University of Massachusetts Medical Center (UMass Medical)
            - Spell out the acronym first, put the abbreviated version in parenthesis and then we can refer to it
            - Create a glossary
    - Background
        - Talk about SPARK and why there's a collaboration between the parties involved
        - Better flow of the introduction of SPARK
            - Who they are and how do they relate to the project
        - Add citations where you make statements
            - (Author, Year)
        - Don't lead paragraphs with acronyms
        - Add some images and visuals to where you talk about apps
    - Procedure/Methodology
        - Better transition from one section to the other
        - Talk about the procedure that we're follow. No framing of how we plan to complete what we set out to do
            - Add before mockups
            - Add meetings, how we're going to analyze data, etc.
    - Other

        - Change title to not procedure
        - Last MQP didn't end in December
        - Explain why we're changing the old design
        - Spell out UI
        - Explain the 3 ways of getting data and how they're important
            - Survey, Focus Group, Interviews
            - Chart to show pros and cons of the 3 too
        - Replace book title with actual author
- Questions
    - Nvivo
        - No licenses yet, they're coming though
    - WPI MBSR Meeting
        - Email Susan back to set something up a time to make the group familiar and comfortable with who we are before we set up interviews.
        - Email Quinsigamond, Terry was out the day the email was sent initially. Follow up the email that Prof. Loiacono sent out

MQP Meeting Minutes 11/30/2016

- Team worked on revising the project proposal document
- Some of the team downloaded NVivo and started trying it out
    - The professor now has the license keys for the team
- The team set up a Trello to manage deadlines and tasks (in addition to the existing Google Calendar)
- Team hopes to meet with Ms. Fairchild after this meeting to explain the project to her students
- Schedule and complete interviews with Ms. Fairchild's class, as well as the interviewees at Quinsigamond CC.
    - Team should definitely interview both groups for diversity.
    - Group at QCC is probably not MBSR-specific, but was recommended by Dr. Fulwiler.
    - Goal for now should be getting in touch with people who have done mindfulness.
- Prof. Loiacono will forward the license key to Andrew and Juan; license is for 2 users right now.
- Prof. will be in Dublin but we can Skype her in for the presentation.
    - Focus on the presentation for this aspect (rather than the proposal, which will all be delivered at the end.)
- Next week: team can give materials for review early.
- General structure of presentation
    - Title page, WPI logo, etc.
    - The Process (that the team used - plan, analyze, create, deliver, or modified SDLC, or something from *theory*)
        - Include timeframe for each
        - This is where the team is
        - This is when the final deliverable will be
    - Stepping Back
        - Survey Data/Preliminary was in the prior one
            - We will talk about how we will collect/collected interviews
    - Analysis and analysis tools
        - It will present the data in x format
        - Allow us to present it as x
    - Show mockup and tool used to create it
    - Deliverables (what we expect them to be)
        - Report
        - Revised design
    - Open time for discussion and questions
        - Take notes for this
    - TIME: ~15 minutes

    - Make sure it is understood the work that has gone into the project (explain literature review and research done)
    - Send to professor for review
- Form to go along with presentation that explains the content for sponsor to sign off on
- Talk about NVivo in the paper
    - What it allows you to do
    - How the team will do it
    - What the results will be
- Team should get on the schedule to present
- Amazon cards can be purchased for interviewees as incentives
    - Collect e-mail address and have it delivered directly

MQP Meeting Minutes 01/23/2017

Prior weeks:

- Transcribed interviews
- NVivo coding

Project proposal

- Revisions and corrections necessary to make it accurate
- Needs to be frozen into a proposal first, before it goes to the final project document
- Final project document will mention change of scope, comments from proposal, etc.

What UMass may want:

- Additional interviews

Interviews

- Mixed themes regarding the app
- Additional interviews can help with saturation
- Boston University
    - MQP team will have to contact Dr. Fulwiler to possibly arrange this
- Respondents need to be anonymized, but team needs to create a document for Professor Loiacono that links them
- Follow up with WPI group to see if we can get more interviews from them

For next meeting:

- Timeline and milestones
- Have project proposal done; include comments from presentation and collecting additional data at BU and WPI.

MQP Meeting Minutes 1/30/17

- NVivo coding
    - Creating nodes individually
    - Can do coding nodes individually and see what differences are between Juan and Andrew. Discuss the ones at issue and come to 100% agreement.
    - Coder reliability - in terms of what you identified - 70, 80, 90 percent
- Due date / milestone list
    - When do you want to have final presentation done (work backwards)
    - Have proposal a week before that for Prof. Loiacono to review
- Team is meeting with Susie Fairchilds' class Weds. to gather more interviews
    - Consent forms sent out prior to interview
    - Get e-mail addresses for Amazon gift card incentive
- Coding structure
- Document NVivo process as it is done for project report

MQP Meeting Minutes 2/6/17

- Team met with Susie Fairchild's new class. Team scheduled 5 interviews, and had 6 from the prior term at WPI/QCC.
- Completed 4 interviews already, 1 to go.
- Consent forms completed prior to interview.
- Gift cards will need to be sent out.
- New interviews being transcribed as we go.

Throughout the next week, the team will be…

- Getting the new interviews into NVivo
- New mockups based on analysis from NVivo
- Using data to start building new house of quality graphic (Nick)
- Look at age, gender, anxiety vs depression to see if there is a correlation with some of the mixed feedback (e.g. colors good, colors bad). Who is on the positive side vs. negative side? Look at the demographics.
- Import Qualtrics answers as nodes.
- After coding, can make report for men vs. women to compare, etc.

Deadlines: Draft of final document next Friday. Team will discuss other deadlines and goals at their next meeting this week.

Be methodical with writeup. Explain the process as well.

Transfer of data needs to be considered. Both raw and analyzed data will be transferred at the end.

To-do:
Set up final presentation date with Dr. Fulwiler.

MQP Meeting Minutes 2/15/17

- Feedback on document
    - Cover page needs to meet MQP standard
    - Transitioning between sections
    - Background: explanation at the beginning (we have done some research, etc.)
    - Citations are author, year.
    - Make sure figures are referenced before they appear
    - Data analysis, data gathering. Show what you are going to be talking about in this section before you start talking about it.
    - Introduce and describe NVivo, screenshot, etc. (This is the tool.)
    - Procedure/Methodology needs to show that we followed a method to ensure things done appropriately. We followed similar design to systems analysis and design, waterfall, etc. (even though it's not being developed).
    - Minutes from client are appendices, etc. Describe them in the planning phase, we met with advisor x many times, with agendas, and minutes. See appendix X for …
    - Explain IRB process (possibly as appendix)
    - Incentives
    - Interview protocol can be included when talking about interview
- Poster
    - Do document first
    - Diagrams you put into document will be helpful for poster
- Nominating project
    - Process is that team will submit it, and then professor will support it.

MQP Meeting Minutes 2/20/17

- Juan and Andrew compared their NVivo findings
    - When they first sat down, record percent reliability between the two
    - Include the theme
    - End result should be a percentage
- Mockup started
- Nick is continuing House of Quality document. Started from scratch in a new, less confusing format. Will demonstrate what users want with corresponding numbers to technical needs. It is more of a roadmap for people that might come in and code the app.
- Team could get feedback on revision over the weekend, but probably not enough time to act on it it by Monday. Team should add the new sections as well.
- Date's for final presentation: 7th, 8th, 10th - starting between 9:30 to 1 PM.
- Poster.
- Think about what will be included in presentation. How team got data, house of quality, visuals of the process.

MQP Meeting Minutes 2/27/17

- This will probably be one of the team's last meetings.
- Team spent a lot of time doing edits of the document, and adding new material, and appendices.
    - NVivo data being added in
    - Hierarchy charts
    - Word trees
        - More useful if you have NVivo open.
    - Word clouds
        - Maybe not as useful. Juan still analyzing them.
    - Screenshots are generated, being added into the report.
- Deliverables
    - Spreadsheet linking names to data turned into Prof. Loiacono, and then deleted.
- Final presentation scheduled for Mar. 13 at 1 PM.
- Nomination? Team will discuss.

Appendix C: Minutes with Project Sponsor

Meeting with Dr. Carl Fulwiler on 9/21/16

- MBSR and mindfulness are not the same
    - The developed app would need to follow the structure of MBSR
    - "Mindfulness" can cover a wide range of different types of meditation
        - i.e. Focus on a lake is considered relaxation not mindfulness
    - Yoga is a part of MBSR that isn't always utilized by other mindfulness apps
- The app would be used to support students who are currently enrolled in an MBSR or for those who would like to be
    - An idea would be to have instructors lead "group" on the app to extend classes to individuals on their own time
    - Have 2 separate views: 1 for instructors and 1 for students
    - Have a calendar that can show the formal classes but also allow for informal "classes" to be scheduled.
        - Ex Be able to set reminders to be mindful when walking to their car (assuming that's a stress trigger for them)
    - The app will be more focused on Classroom -> App -> Home Application
- MBSR classes can be divided in 3 portions: Practice, Group Discussion, Class Topic
    - Practice
        - Body Scan – Ask the students to do a task and think about how their body is feeling
    - Group Discussion
        - Focused on in class or from the Homework
        - Ask pointed questions about what was going through their head at that moment from the practice session. Share with the group
    - Class Topic
        - Discussion and learning
            - Sometimes sprinkled through some exercises
        - Ex. Stress Reactivity (what stress factors do individuals react negatively to)
    - Homework
        - Is assigned at the end of each class
        - 45 minute assignments which include meditation
        - Not encouraged to do additional homework, encouraged to be in the now
        - Encouraged to apply learnings in day to day life

Appendix D: IRB Approval

WORCESTER POLYTECHNIC INSTITUTE

Worcester Polytechnic Institute IRB# 1
HHS IRB # 00007374

25 October 2016
File:16-128M

RE: Modification to IRB File 16-128M, "MBSR College Students App Mock-Up Interviews"

Dear Prof. Loiacono,

The WPI Institutional Review Committee (IRB) approves the modification submitted to application #15-174M "MBSR College Students App Mock-Up Interviews", dated 18 October 2016, and approves the modifications to add study personnel Andrew Mahn, Juan Rodriguez, Nicholas Pataky.

We continue to waive your use of written consent and approve the use on line consent process and use of oral consent for phone interview.

The period covered by this approval is from 25 October 2016 until 25 April 2017 unless terminated sooner (in writing) by yourself or the WPI IRB. Amendments or changes to the research that might alter this specific approval must be submitted to the WPI IRB for review and may require a full IRB application in order for the research to continue.

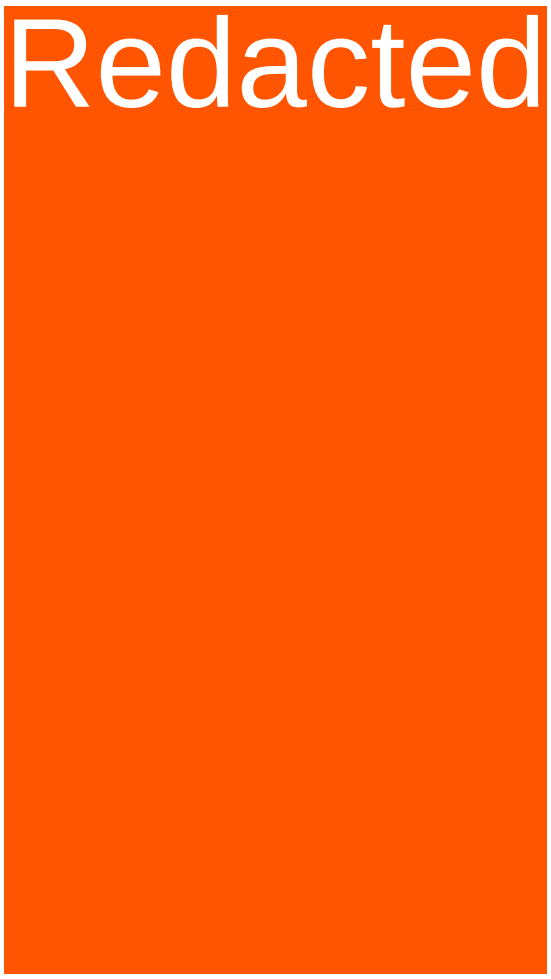
If the research is to continue past 25 April 2017, a renewal application must be filed with the IRB in sufficient time for approval before 25 April.

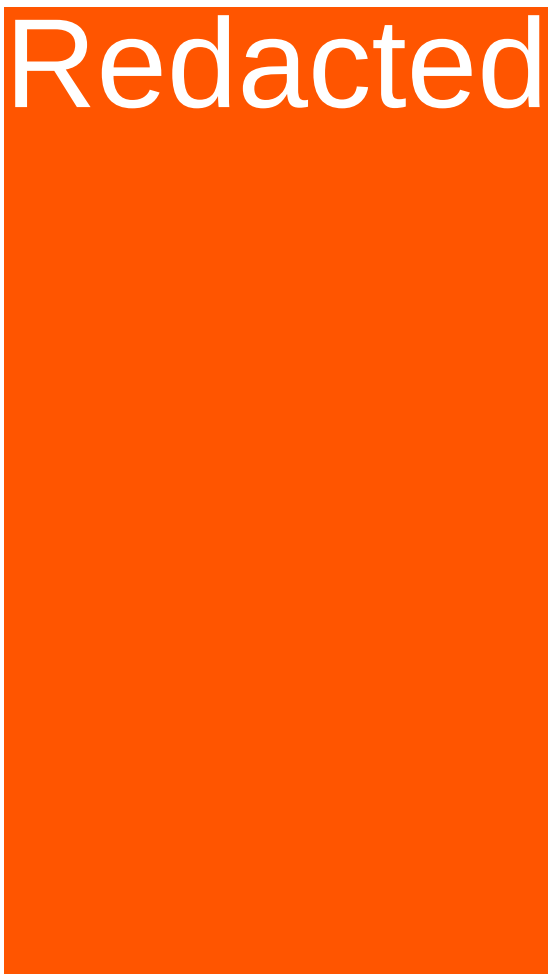
Please contact the undersigned if you have any questions about the terms of this approval.

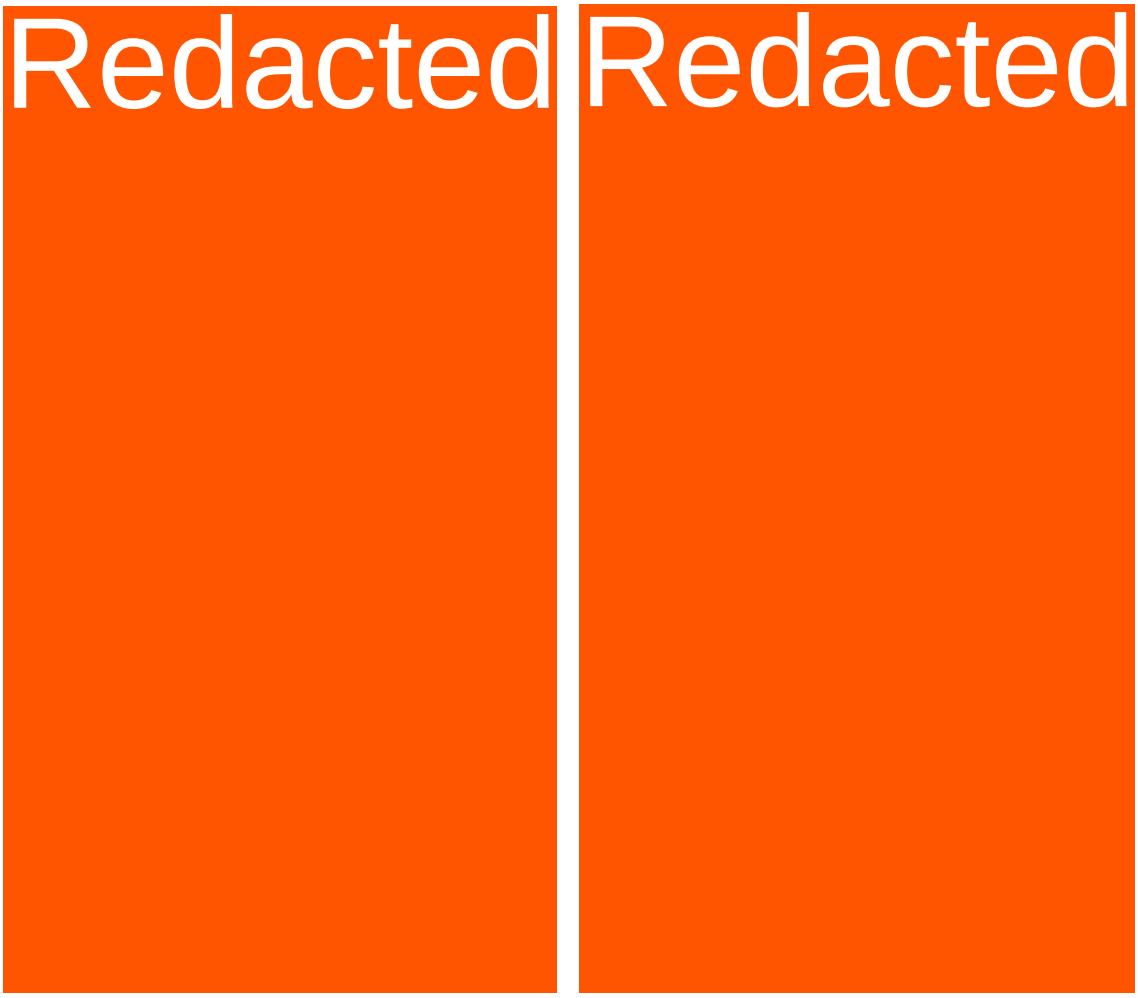
Sincerely,

Kent Rissmiller
WPI IRB Chair

Appendix E: ‘Do You Mindful’ New Mockup Images



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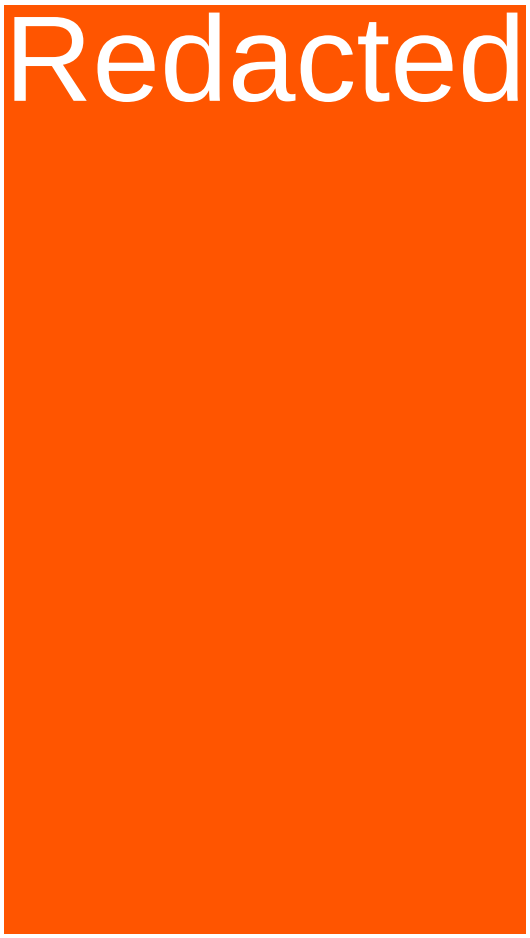
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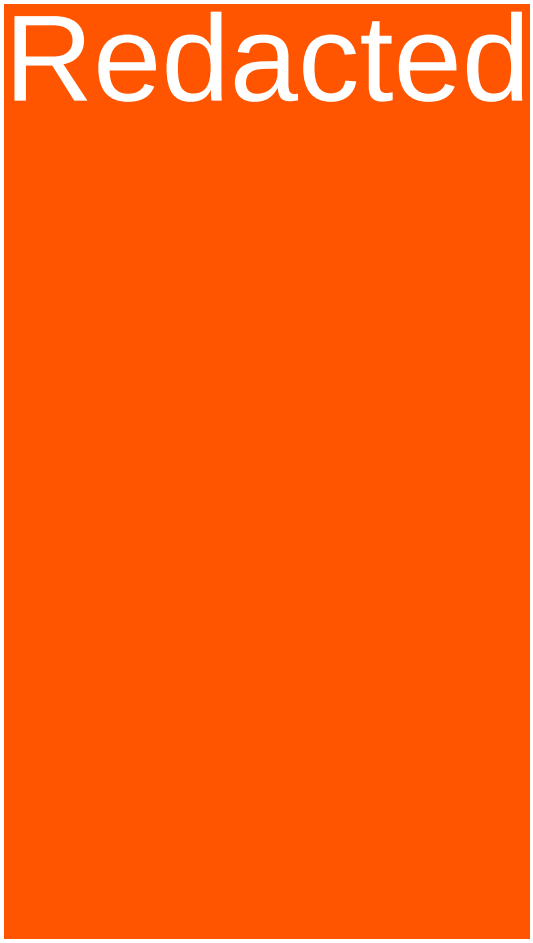
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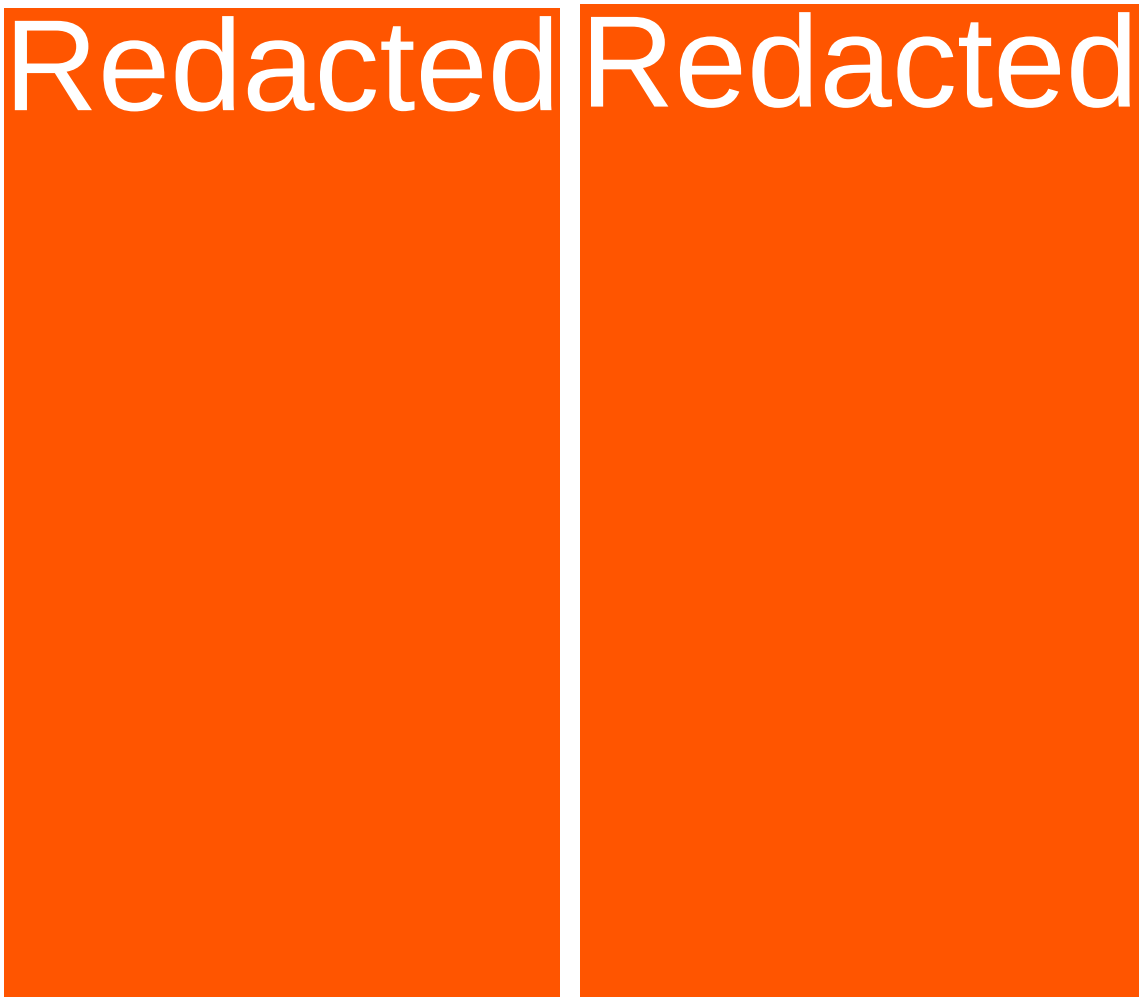
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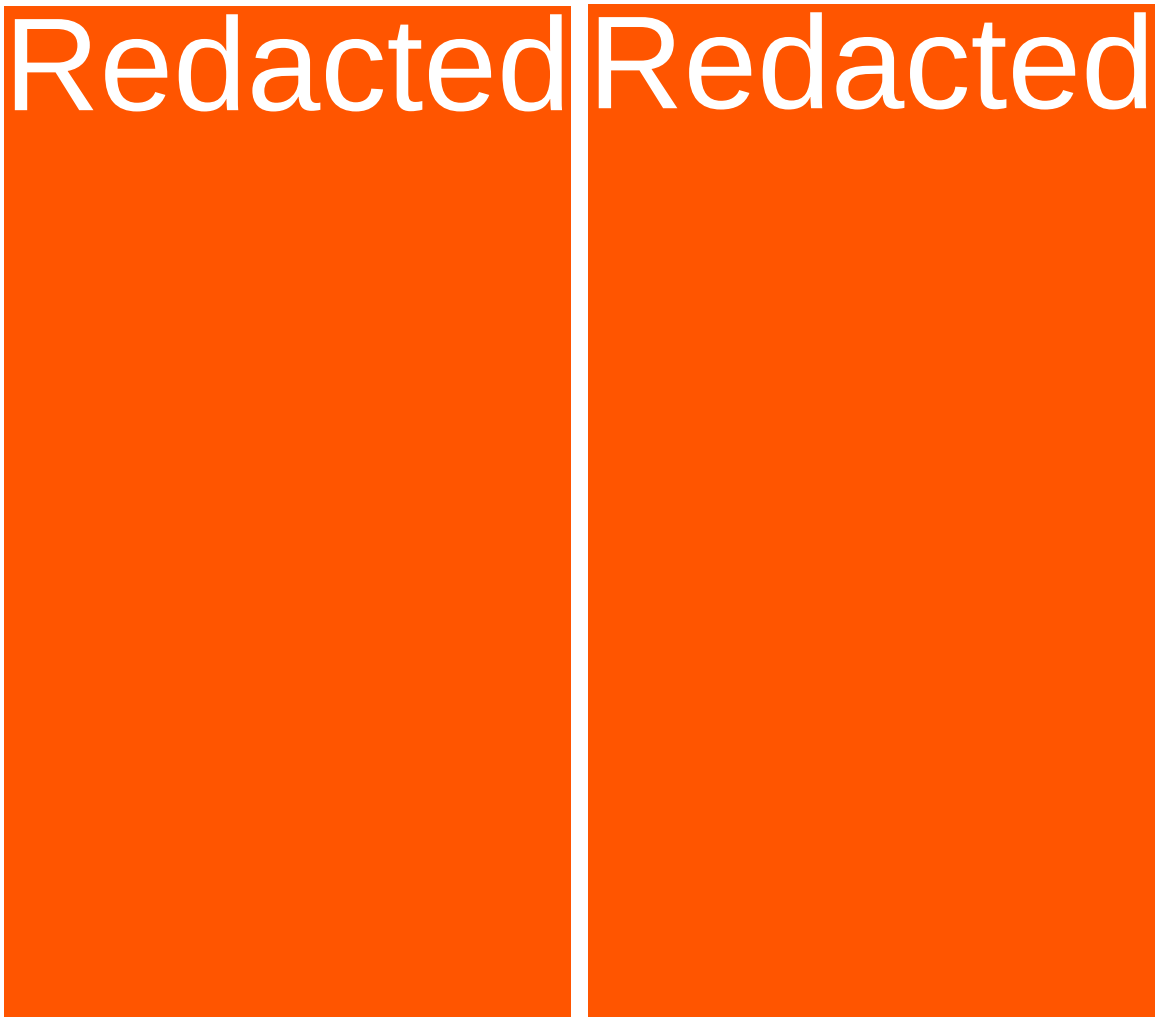
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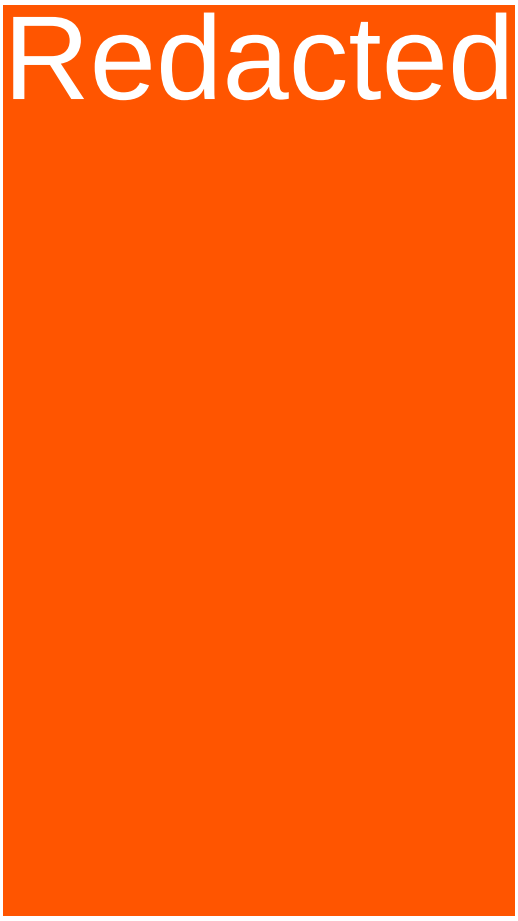
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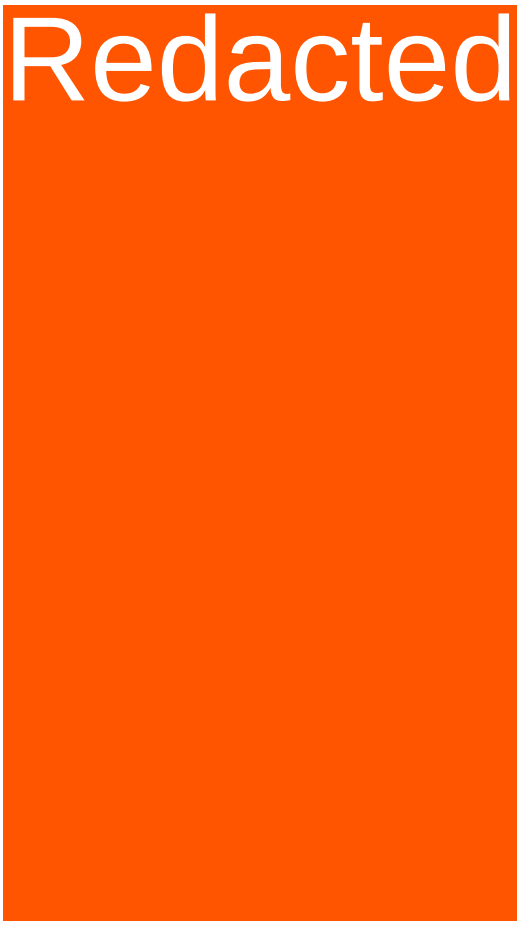
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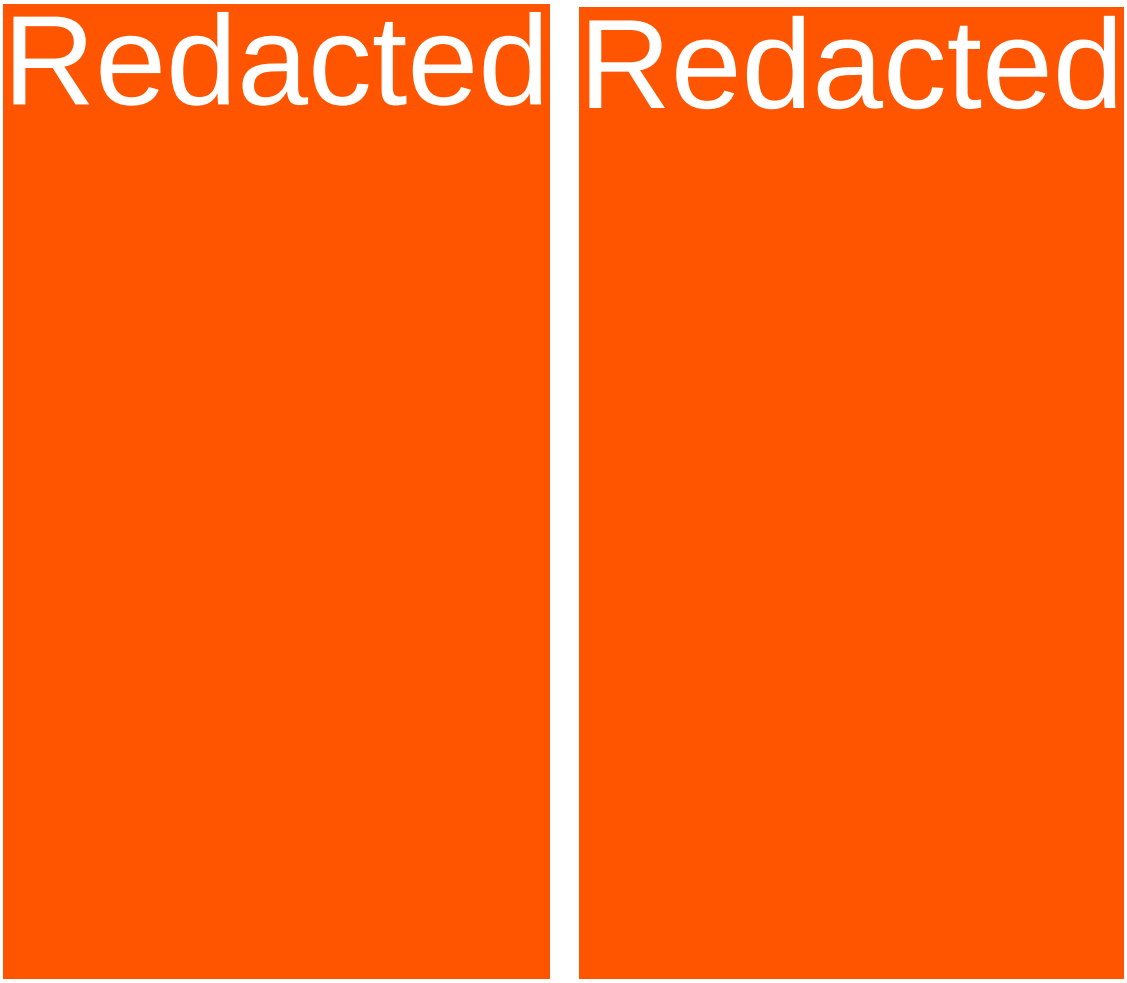
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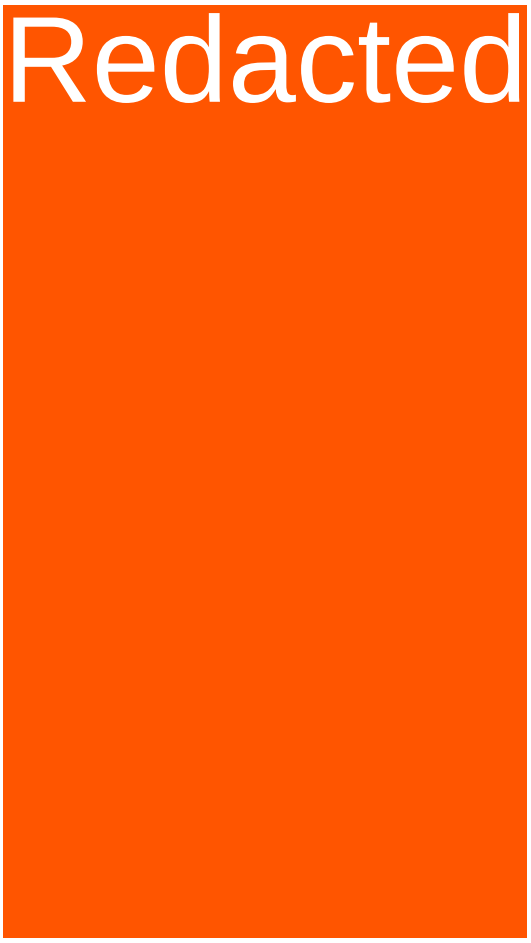
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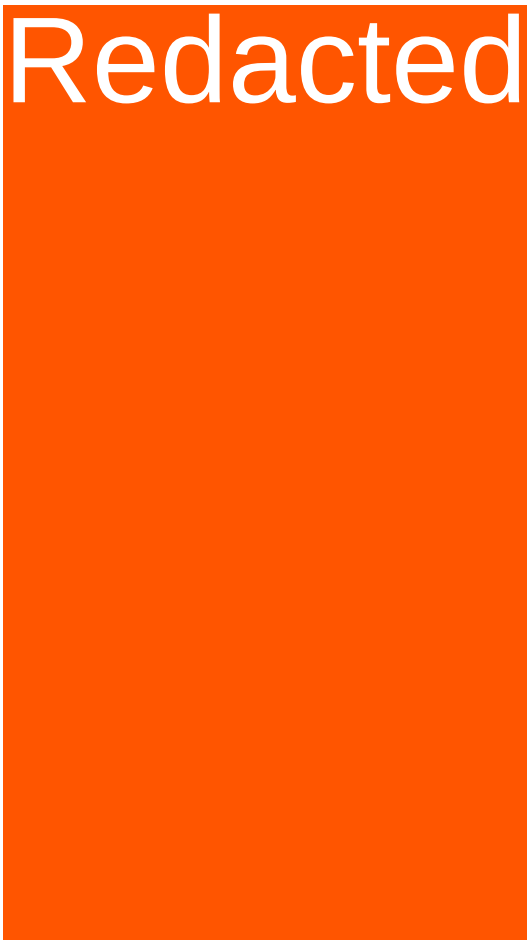
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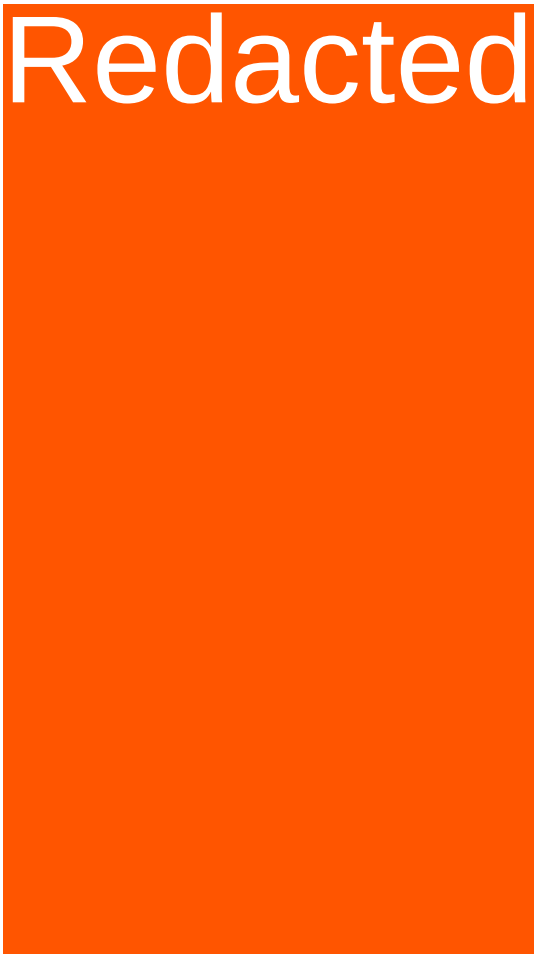
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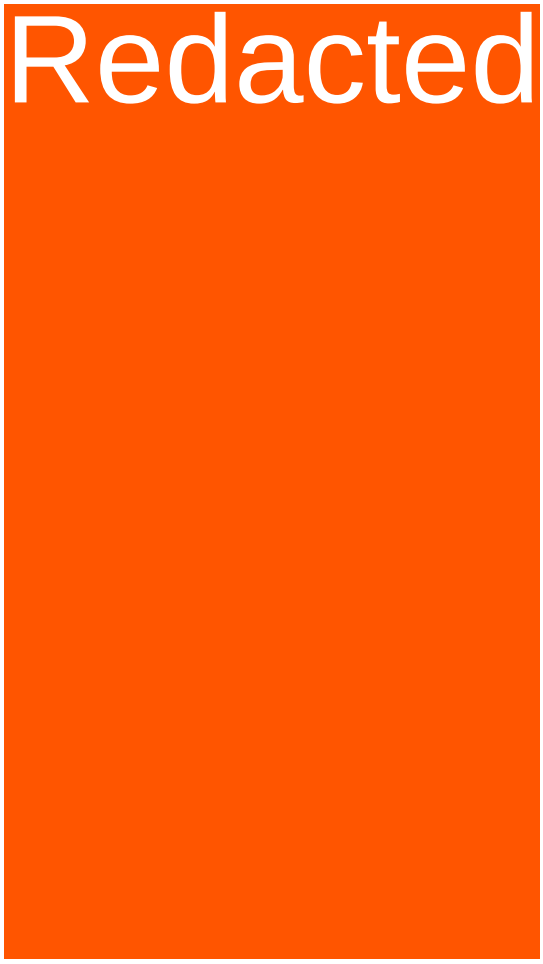
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Appendix F: Interviews

This appendix contains the interviews the team performed.

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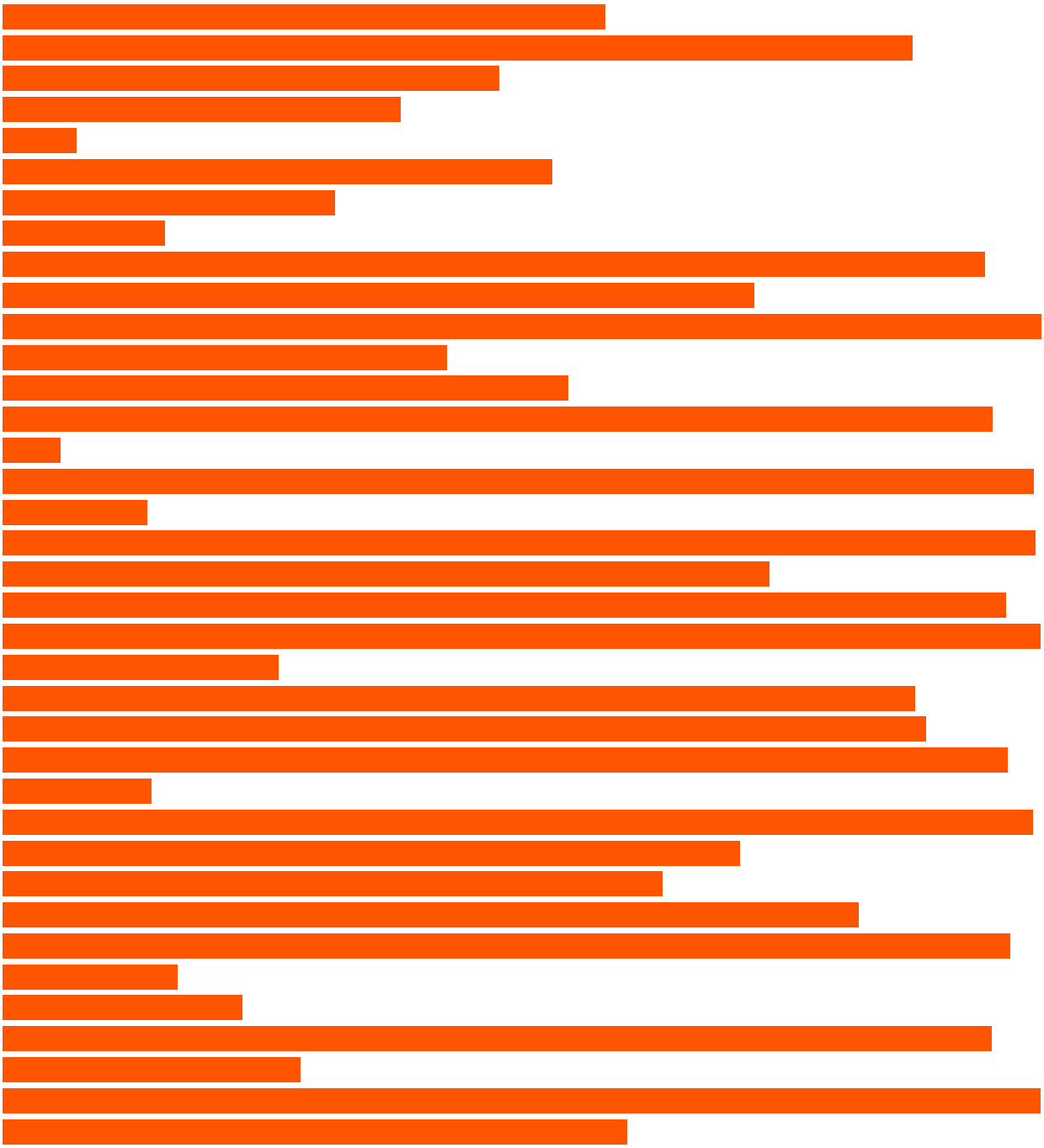


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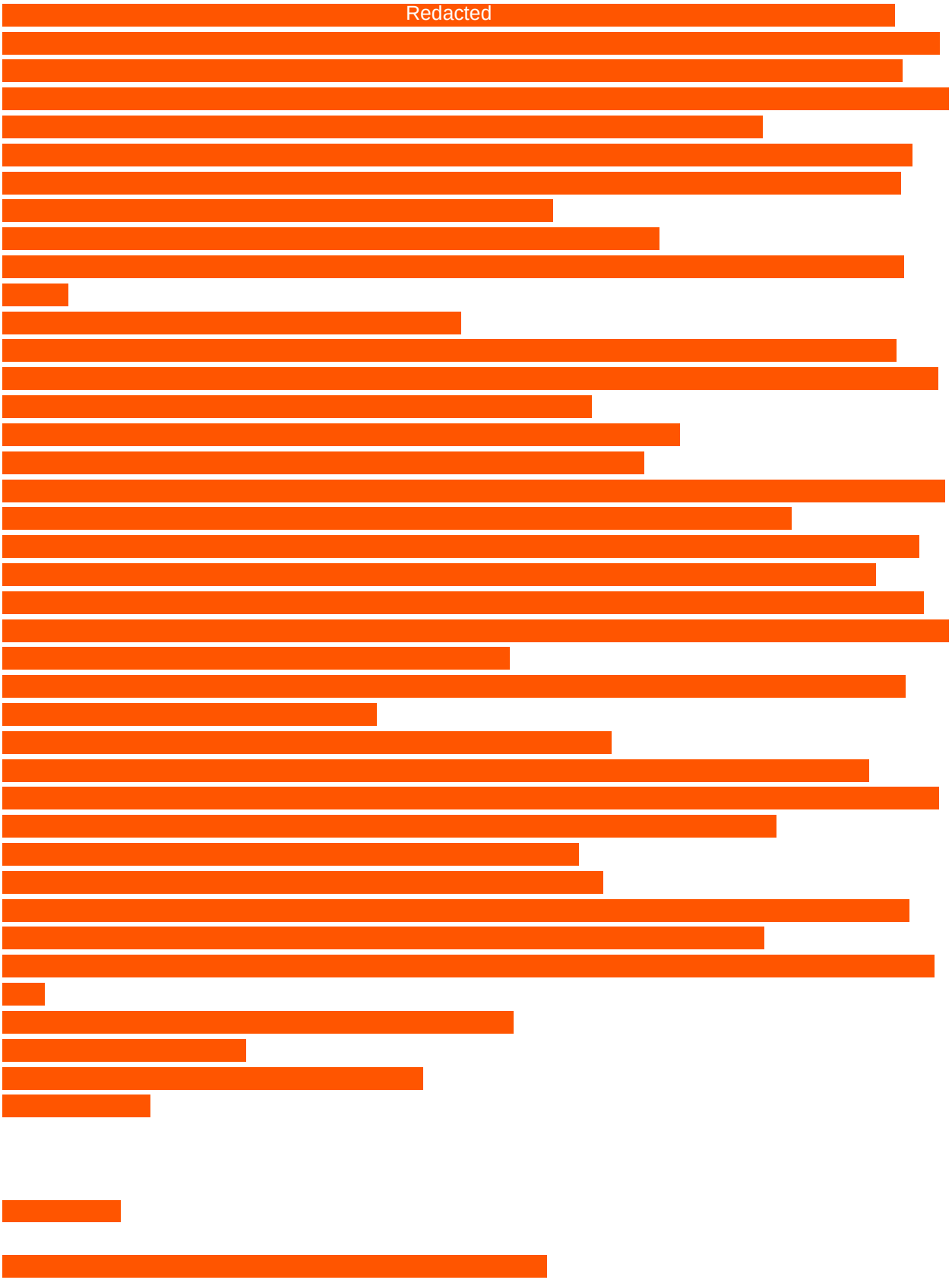
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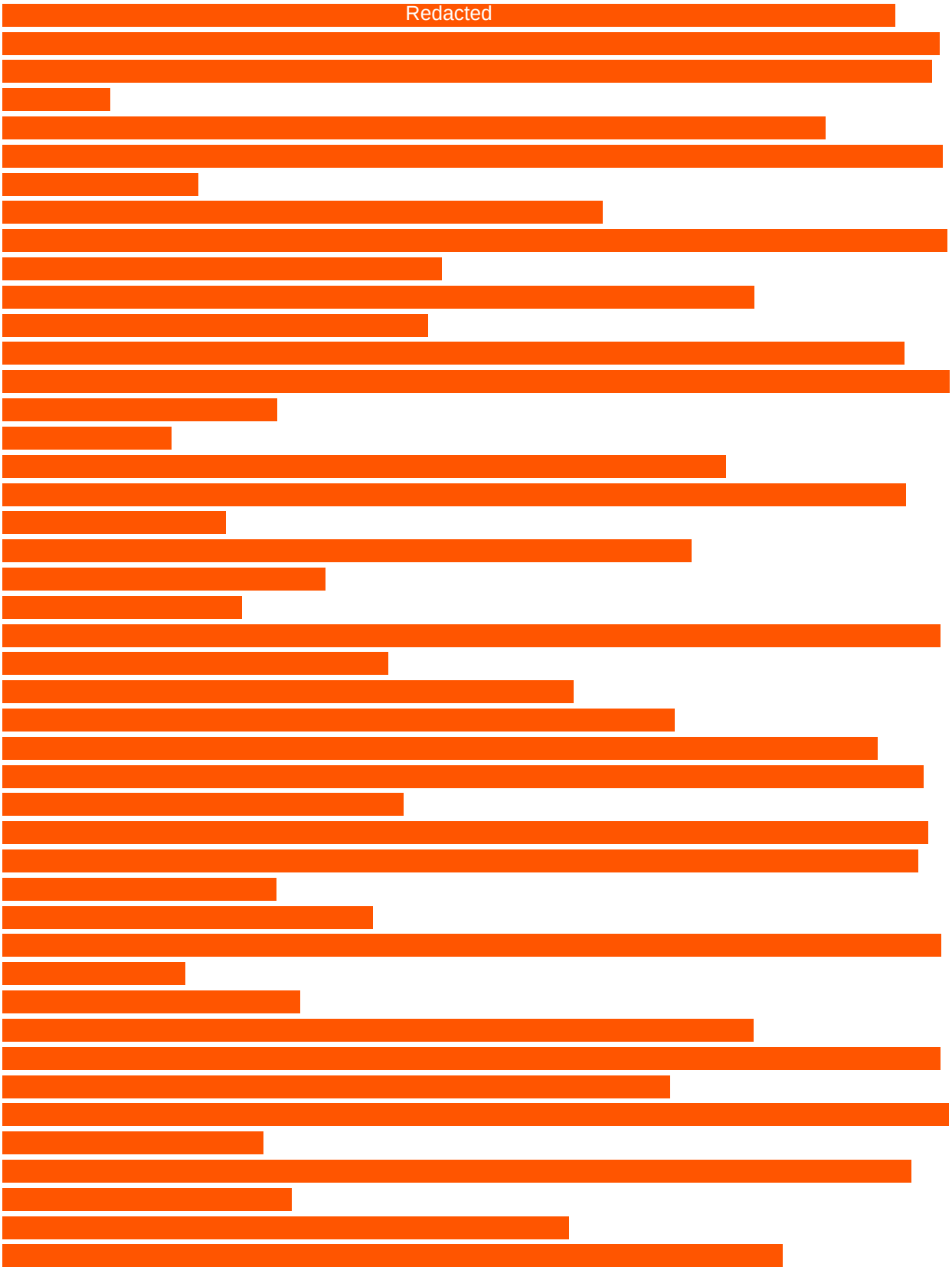
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Appendix G: Interview Protocol

Thank you for agreeing to be interviewed. We are a group of students developing the spec for an app designed to assist college students, particularly ones with mental health issues, by assisting with Mindfulness Based Stress Reduction, or MBSR. Mindfulness is the practice of being aware of one's state of mind and being as a means to help focus. Mindfulness as part of MBSR has been clinically proven to decrease symptoms of stress, anxiety, and depression. We have mockups of two prototypes and would like your input on which of these builds you prefer. We will be audio-recording our discussion if that is okay with you. Is that okay with you.\ Your name will not be identified with specific comments or suggestions you make.

1. To start off, tell us what mindfulness is to you. This isn't a test about the facts of mindfulness, but about your personal experience with it. What can you tell us about mindfulness? What are your impressions or thoughts?
2. And following up on that, do you feel unclear about anything about mindfulness?

[Show app mockup]

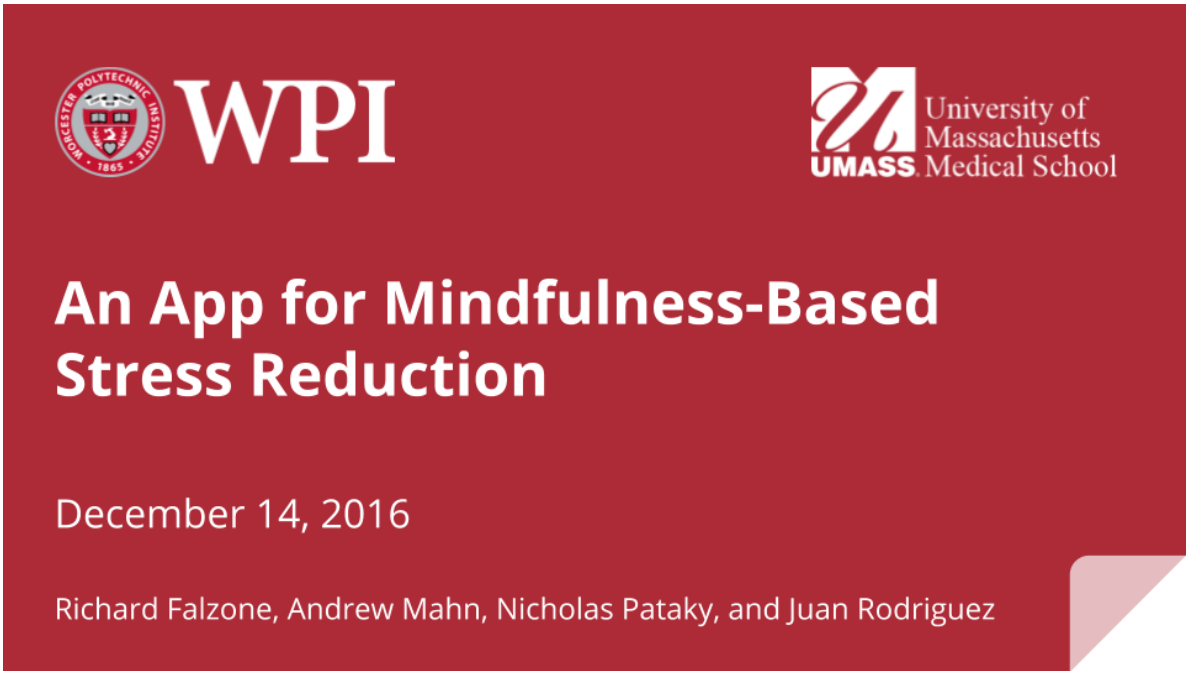
3. Would you use such an app in your MBSR practice?
4. How would you use it? What features would be most useful to you?
5. Do you feel it would help you better incorporate MBSR into your life?
6. Would you want the app to remind you to use it after days that you didn't open it?
7. Would such a feature be annoying or decrease your likelihood of using the app?
8. Do you think it would help reduce barriers to your practice of MBSR?
9. What do you like most about it?
10. What do you like least about it?
11. How would you improve it?
12. If the app was incorporated into MBSR training, which of the following formats do you feel it would best fit with?

8 weekly 2-hour classes and 1 all-day class on a Saturday or Sunday with presentations, teaching and practice of mindfulness and yoga practices, and discussion. App to be used in between classes on your own.
The first and last classes are 4 hours on a Saturday morning separated by 6 weekly 90 min. live, interactive video classes via the app and 1 all-day class with presentations, teaching and practice of mindfulness and yoga practices, and discussion.
Teaching of mindfulness and yoga practices is provided completely on the smartphone app and the "class" is a weekly 1 hour live, interactive video class to discuss the material and practices with the teacher and other participants.

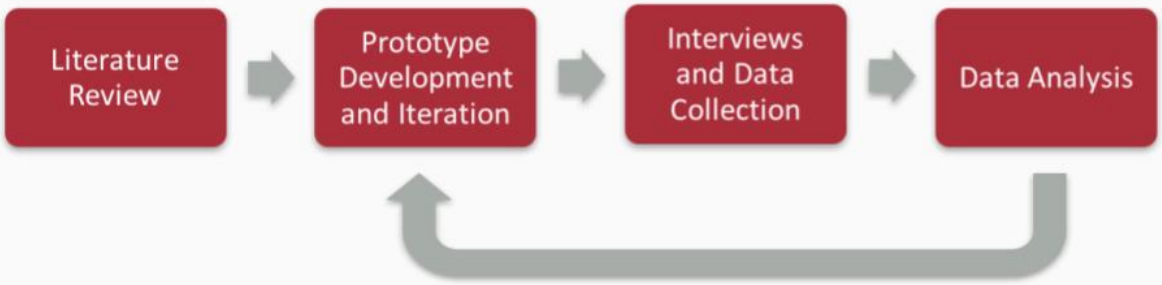
13. Based on your experience (the class you took), what would have helped you in retrospect with learning and practicing MBSR.
14. Anything else you would like to add about the app or the practice of MBSR that you would like to share?

Appendix H. Presentation to Sponsor

Delivered on December 14, 2016 at the Center for Mindfulness, Shrewsbury, MA



The Process



Literature Review

Mindfulness-Based Stress Reduction (MBSR)	• What is it? • Effectiveness • Technology	• Kabat-Zinn, 2007 • Bohlmeijera, 2010 • Cohen, 1988
User Interface Design (UI)	• Incorporating User • Design Principles • Design Trade Offs	• Garret, 2010 • Galitz, 2007
Identifying Customer Needs	• One-on-One Inteviews • Focus Groups	• Griffin, 1993 • Tapke, n.d.
Qualitative Data Analysis	• Turning Data into Design	• Casterle, 2012

Identifying Customer Needs - Research

- Interviews
  - Easier to Gain Insight On a Particular Idea/Comment
  - More Time Consuming
- Focus Groups
  - Produce Most Results per People
  - Interviewees May Not All be Heard
- Survey
  - Quick Way to Obtain Quantitative Data
  - Harder to Convey Ideas (Interviewee and Interviewer)

Identifying Customer Needs - The Results

- **Worcester Polytechnic Institute (WPI)**
  - 6 Individual Interviews
- **Quinsigamond Community College (QCC)**
  - 1 Focus Group
- **Surveys through Qualtrics**
  - Follow-up Questions

Data Analysis and Analysis Tools

Organizing and sorting data

- Develop coding frame
- Systematically code material

Quantitative Data Analysis (QDA) Software: **NVivo**

Produce textual and visual reports

Redacted

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Deliverables

- **Project report**
  - Data and findings
  - Recommendations
- **Revised design in an interactive format**
  - New concept artwork
  - Redesigned mockup
  - Mockup of recommended features

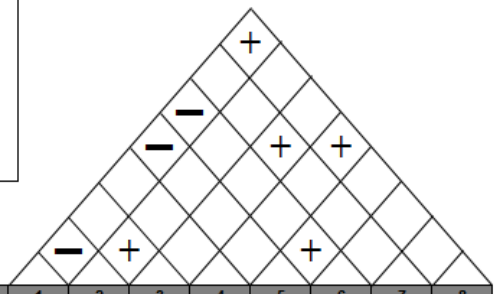
Observations

- Everyone Uses Mindfulness Differently
  - The app must be customizable to fit a wide range of people
    - Button Layout
    - Content
- Students Want to Practice Mindfulness but Forget
  - Gentle reminders to get them to practice
- User interest in secondary features; chat room

Questions and Discussion

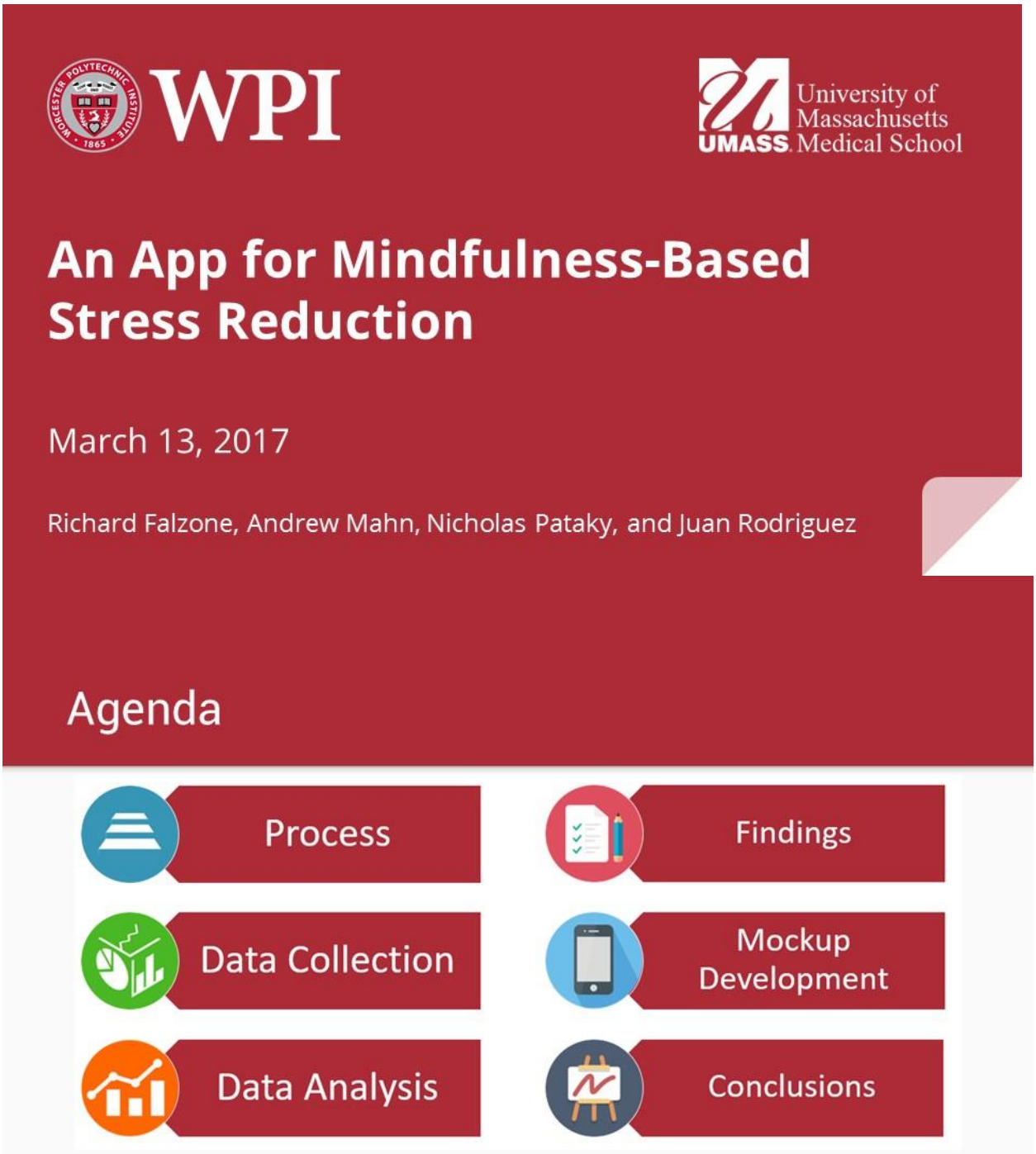
Appendix I: House of Quality

Legend	
O	Strong Relationship
■	Moderate Relationship
▲	Weak Relationship
+	Positive Correlation
−	Negative Correlation
▼	Objective Is To Minimize
▲	Objective Is To Maximize
x	Objective Is To Hit Target

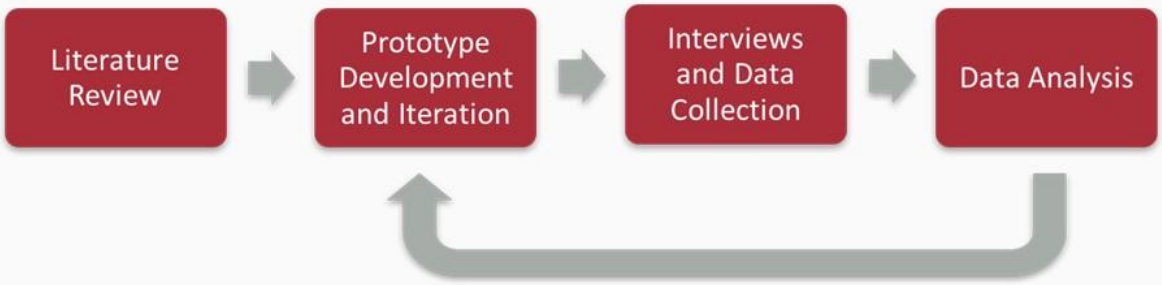


Row Number	Max Relationship Value in Row	Relative Weight	Weight / Importance	Customer Requirements \ Technical Requirements	1 App Appearance	2 Calendar Feature	3 Local Events Feature	4 Push Notifications	5 Timer Features	6 Excercises	7 Inspirational Corner	8 Chat Room
				Direction of Improvement	▲	▲	▼	▲	x	▲	▼	▲
1	9	24.3	9.0	An anonymous chat feature								O
2	3	10.8	4.0	Up to date local events		■						
3	9	8.1	3.0	Adjustable push notifications	■	■		O		■		
4	9	24.3	9.0	A calendar to track mindfulness milestones		O		■	■	■		
5	9	10.8	4.0	Non-redundant inspirational material				■			O	
6	9	16.2	6.0	Different color scheme	O							
7	9	5.4	2.0	Different font type	O	■	■				■	■
				Target Value	New Look, Same Feel	Helps Keep Track of Practice	Automated Content	Controllable Notifications	Keep The Same	Add Features To Track Completed Excersies	Make Content More Automated	Different Layout Than Original
				Difficulty (0=Easy to Accomplish, 10=Extremely Difficult)	9	9	3	7	0	4	2	9
				Max Relationship Value in Column	9	9	3	9	3	3	9	9
				Weight / Importance	218.9	291.9	16.2	178.4	73.0	97.3	113.5	235.1
				Relative Weight	17.9	23.8	1.3	14.6	6.0	7.9	9.3	19.2

Appendix J: Final Sponsor Presentation



The Process



Identifying Customer Needs

Initially

6 Individual Interviews

1 Focus Group

Since then

5 Individual Interviews

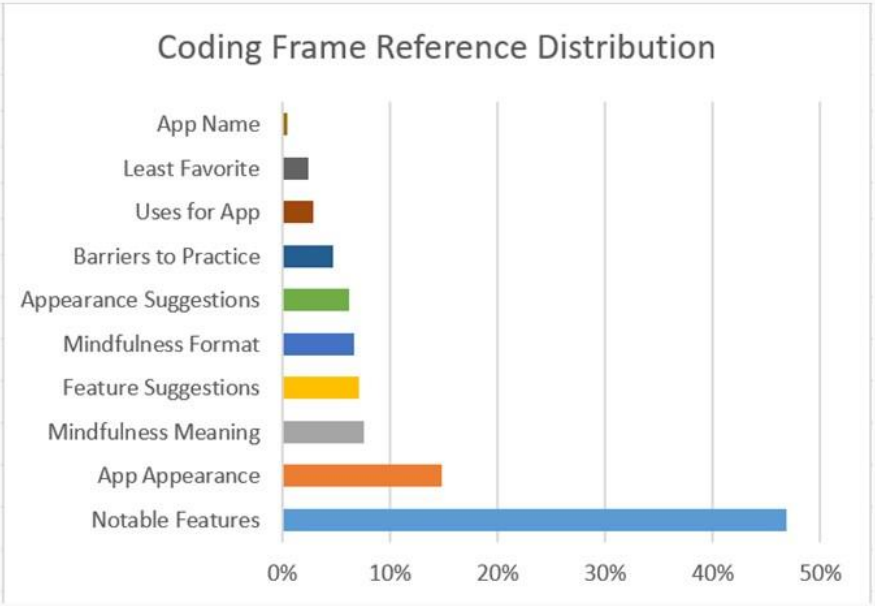
Data Analysis and Analysis Tools

NVivo Qualitative Data Analysis Software

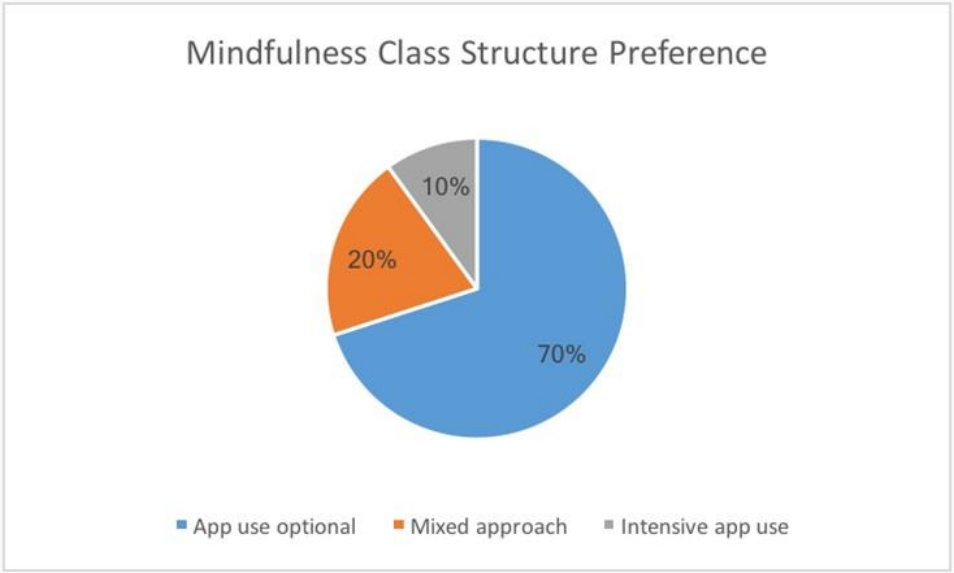
- Import and code interview transcripts
- Produce textual and visual reports
  - Charts
  - Word Clouds
  - Word Frequency

Coding Frame Structure

Nodes	References	Sources	Percentage
Notable Features	98	10	47%
Social Features	33	8	34%
Chatroom	21	8	64%
Local Events	6	4	18%
User Counter	4	4	12%
Push Notifications	31	9	32%
Calendar	9	6	9%
Excercises	9	7	9%
Timer Feature	6	3	6%
Inspirational Corner	5	5	5%
App Appearance	31		15%
Color Scheme	12	8	39%
Navigation	5	5	16%
Font	3	3	10%
Mindfulness Meaning	16	10	8%
Feature Suggestions	15	5	7%
New Features	9	5	60%
Existing Features	6	2	40%
Mindfulness Format	14	10	7%
App use optional	9	7	64%
Mixed approach	3	2	21%
Intensive app use	2	1	14%
Appearance Suggestions	13	5	6%
Mindfulness Meaning	10	6	5%
Uses for App	6	6	3%
Least Favorite	5	4	2%
App Name	1	1	0%
Total	209		



NVivo Coding Frame



Mindfulness Format

Barriers to Practice

Chatroom Feature

Word Clouds

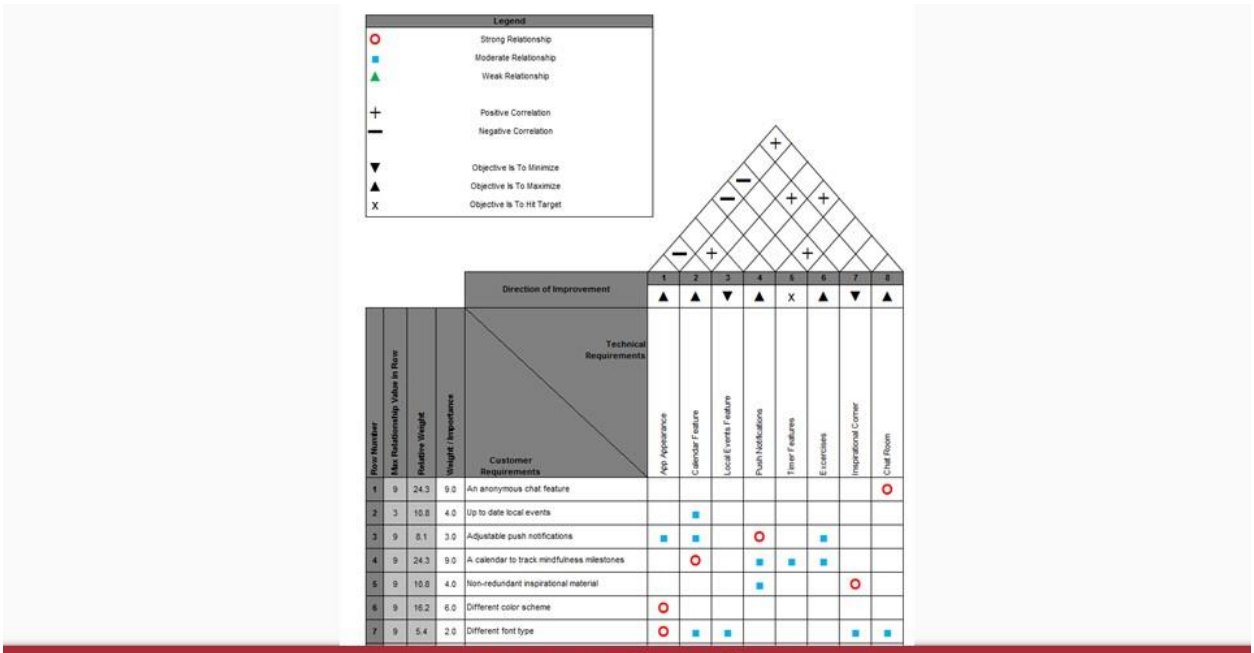
House of Quality

Used to compare technical requirements and user requirements

Scores and weighs each requirement

Highlights which features need more development than others

Will aid the development team who takes over this project



House of Quality

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Conclusions

The next step is development of the application

A future MQP team could conceivably start the development process

Students prefer less app-intensive class format

Questions and Discussion

Coding frame detailed distribution

Nodes	References	Sources	Percentage
Notable Features	98	10	47%
Social Features	33	8	34%
Chatroom	21	8	64%
Local Events	6	4	18%
User Counter	4	4	12%
Push Notifications	31	9	32%
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App Appearance	31		15%
Color Scheme	12	8	39%
Navigation	5	5	16%
Font	3	3	10%
Mindfulness Meaning	16	10	8%
Feature Suggestions	15	5	7%
New Features	9	5	60%
Activity Tracking	6	3	67%
Existing Features	6	2	40%
Push Notification	3	2	50%
Inspirational Corne	2	2	33%
Exercises	1	1	17%
Mindfulness Format	14	10	7%
App use optional	9	7	64%
Mixed approach	3	2	21%
Intensive app use	2	1	14%
Appearance Suggestions	13	5	6%
Mindfulness Meaning	10	6	5%
Uses for App	6	6	3%
Least Favorite	5	4	2%
App Name	1	1	0%
Total	209		

Redacted

User Interface

"color scheme isn't my favorite" - ID 01

"turquoise to me is not a calming color" - ID 06

"I like that you're using a black background, but your blocks are big, so a lot of brightness." - ID 08

"White on black is loud." - ID 11

"About Do you Mindful. Weirdly grammatical mess of a sentence." ID - 08

"text seems blurry" ID - 01

"I don't like that font on the top." ID - 08


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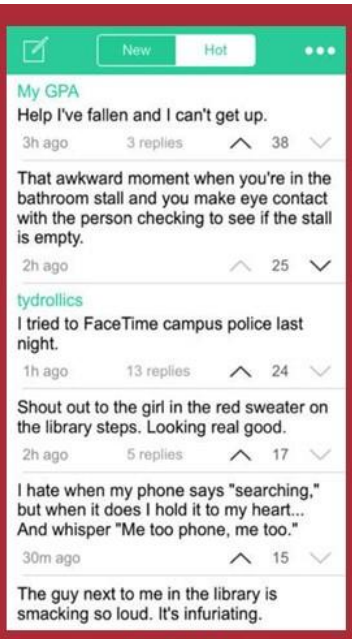
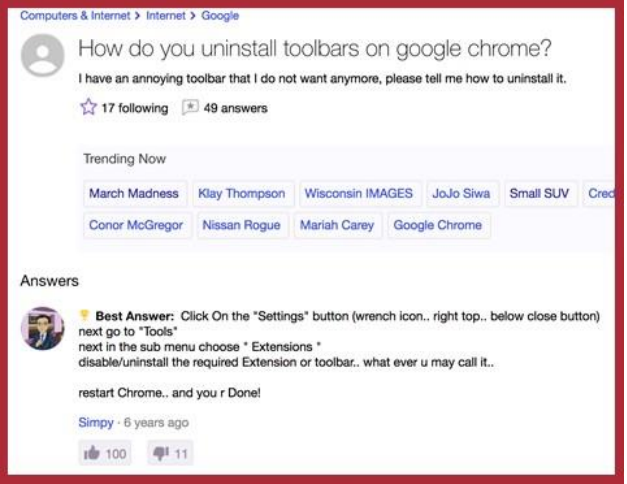
Redacted



Yik Yak

Reddit

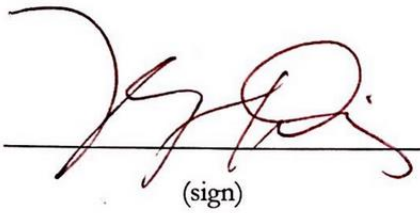


Yahoo Answers

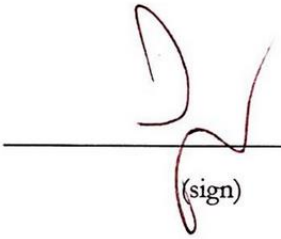
Appendix K: Final Presentation Signoff

MQP Final Presentation Signoff

We, the sponsors of the Major Qualifying Project (MQP), accept what the MQP team has completed to date on the Mindfulness-Based Stress Reduction App project. We formally sign off below to acknowledge that you delivered a final presentation on March 13, 2017 at the UMass Medical campus in Shrewsbury, MA.

Dr. Maryann Davis:  3/13/17

(sign) (date)

Dr. Carl Fulwiler:  3/13/17

(sign) (date)

Appendix L: Final Coding Frame

Nodes	References	Sources	Percentage
Notable Features	98	10	47%
Social Features	33	8	34%
Chatroom	21	8	64%
Local Events	6	4	18%
User Counter	4	4	12%
Push Notifications	31	9	32%
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