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FinHealth Application Design: Designing Fintech for Bipolar Disorder

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ABSTRACT

Research on the relationship between management of finances and mental health has revealed the many ways in which financial stress can negatively impact those with mental illness. People with bipolar disorder specifically have a unique strained relationship to finances, as manic episodes can lead to impulsive financial behaviors, which can then cause cycles of spending, anxiety, depression, and guilt. Thus, to address the gap in resources for this stakeholder group, a financial technology application prototype called FinHealth was developed for this thesis, which sought to provide users with bipolar disorder a tool to manage their finances. In this thesis, FinHealth was designed following a review of literature, a stakeholder survey, and research on user experience design standards. Then, the application was tested during an unmoderated usability evaluation to quantify the success of the application's design. The usability evaluation resulted in positive feedback from the participants regarding navigability, ease of use, and comprehension, as well as some areas for improvement within the design. Additionally, limitations regarding the usability testing were identified and suggestions for future work were proposed. Ultimately, the research and prototype presented in this thesis demonstrated competency in user experience design principles.

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Chapter 1

Introduction

In 2020, 14.2 million adults in the United States were estimated to have a serious mental illness (SMI), a more severe subset of any mental illness (AMI). SMI is defined as a mental, behavioral, or emotional disorder which involves serious functional impairment (The National Institute of Mental Health, 2022). Bipolar disorder, one type of SMI, is described as substantial shifts in mood, energy, and activity levels which interfere with the ability to complete daily tasks (U.S. Department of Health and Human Services). These mood episodes can be classified as manic/hypomanic, an abnormally happy mood, or depressive. Bipolar disorder can manifest as bipolar I disorder, bipolar II disorder, or cyclothymic disorder, each of which consist of varying experiences of manic, hypomanic, and depressive episodes (Mayo Clinic).

In the Money and Mental Health Policy Institute's 2016 study of over 5,000 adults with AMI, 72 percent of the participants responded that their mental health problems worsened their financial situation. Additionally, 86 percent of participants stated that their financial situation exacerbated their mental health problems (The Money and Mental Health Policy Institute, 2016). Thus, for the millions of adults with mental illnesses that are struggling with managing their finances, a solution which provides support is necessary. One potential field which could provide a valuable solution is financial technology, also known as fintech. This discipline focuses on utilizing technology to deliver various forms of financial services. A 2019 study proved that the use of fintech applications could translate into better financially capable behaviors (French et al.,

2019, p. 3). Therefore, the use of a fintech application tailored to the needs of those with SMIs could assist in minimizing the detrimental relationship between finances and mental health.

To further examine this problem space, I will be building a prototype of a fintech application that supports individuals specifically living with bipolar disorder. This prototype will undergo a usability evaluation to ensure that it demonstrates high levels of competency in user experience design. Through the completion of this application prototype and a subsequent usability testing, the following research question will be answered: how can user experience design principles be effectively applied for the creation of an application to alleviate financial stress for those with bipolar disorder? Ultimately, the goal of this research is for the data to show success in the application's support of the stakeholders through its functionality and user experience.

This thesis is broken down into several chapters to examine the different aspects of the research, prototyping, testing, and results from this project. The first chapter synthesizes existing literature relating to the relationship between mental illness, the value of fintech, design considerations, and the types of possible interventions to employ. The next chapter explores the methods used to design the app, gather user data, and complete the usability evaluation. Then, the following chapter will disclose the usability testing results, succeeded by a chapter discussing the meaning of the results. Lastly, the final chapter will conclude the thesis and present recommendations for future research in this field.

Chapter 2

Literature Review

Relationship Between Mental Illness and Financial Matters

Mental illness has a major impact on the global economy, as well as an extensive relationship with personal finances. Mental illnesses have both direct and indirect costs; direct costs refer to visible costs such as medication, therapy sessions, or hospitalization, while indirect costs relate to less observable losses, such as lost contributions due to work absence or early retirement. According to research from Trautmann et al., the direct and indirect economic costs of mental illness globally can be estimated at 2.5 trillion US dollars (2016, p. 1245). Additionally, it is projected that between 2011 and 2030, there will be a cumulative economic loss of about 16.3 trillion US dollars associated with mental illness (Trautmann et al., 2016, p. 1246). This data highlights the objective economic influence of mental illness and the current gap in resources addressing this impact.

The Money and Mental Health Policy Institute also completed an extensive survey of over five thousand adults with mental health problems to highlight the strong correlation between mental illness and personal financial difficulties. This study, conducted over a 42-day period, utilized a voluntary response sample (*Money on Your Mind*, 2016, p. 29). After collecting the data, the researchers analyzed the responses to the open-ended questions to reveal prevalent themes. One common theme was the impact of a negative financial situation on mental health. 86 percent of the respondents reported that their financial situation made their mental health decline,

specifically in the form of guilt, anxiety, fear, suicidal ideation, and panic attacks. Anxiety, a dominant symptom, translates to a cognitive load, meaning that it lowers the capacity to attend to financial affairs (*Money on Your Mind*, 2016, p. 11).

Additionally, mental health problems directly affect finances, with respondents commonly reporting the presence of debt, loss of savings, bankruptcy, or legal issues (*Money on Your Mind*, 2016, p. 15). Over nine hundred of the participants specified that mental health problems hindered their cognitive functioning, which made it harder to manage finances in multiple ways. One common theme was budgeting, as impaired cognitive functioning increased the difficulty in creating and adhering to a budget, as well as comprehending numbers. Researchers also identified the theme of memory and timekeeping, as participants often noted struggles with remembering appointments, bill deadlines, or purchases; this worsens financial situations as it can result in fees and penalties (*Money on Your Mind*, 2016, p. 17). The majority of respondents also disclosed that they spend more money in symptomatic periods. This overspending can take many forms: manic spending, nihilistic spending, comfort spending, impulsive spending, or addictive spending (*Money on Your Mind*, 2016, pp. 18-19). Overall, the research completed by the Money and Mental Health Policy Institute for *Money on Your Mind* further confirms the necessity of a tool to assist those with mental illness in reducing financial difficulties.

Another Money and Mental Health Policy Institute report, *Bipolar Disorder and Financial Difficulties: Some Preliminary Findings*, described findings on the specific relationship between bipolar disorder and financial struggles. The report states that when experiencing an episode of mania, people with bipolar disorder may be more impulsive, which may include engaging in behaviors such as buying sprees or compulsive spending (Richardson,

2017). The report also includes the results of a study conducted with participants who had bipolar disorder. The study asked 44 participants how they viewed their finances in relation to their mental health. Seven themes were elicited from the study: overspending, anxiety and depression, regret and guilt, avoidant coping, cyclical behaviors, poor employment, and comfort spending. Specifically, the study identified a potential harmful cycle where experiencing financial difficulties leads to anxiety and depression, which can then trigger comfort spending, avoidance of finances, or higher spending. This impulsive behavior may then cause regret and guilt, which reignites the feelings that fuel depression and anxiety (Richardson, 2017). This report ultimately highlighted that the finances and mental health are fundamentally connected in those with bipolar disorder.

The Value of Fintech Applications

Although fintech often refers to digitalization of financial services, such as online banking, it can also refer to personalized services, such as budgeting or debt reduction. French et al. aimed to discover whether such fintech applications could improve financially capable behaviors of the users. To do so, the researchers conducted a randomized control trial of working-age members of the Derry Credit Union, with the treatment group receiving four fintech smartphone applications. The application package consisted of an expenditure comparison app, a debt management app, a loan interest comparison app, and a cash calendar app (French et al., 2019, p. 2). The effectiveness of the four applications was then evaluated in three ways. First the research team inspected whether the applications improved financial knowledge and literacy; the study participants did demonstrate improvements in these areas.

Next, the researchers examined whether the use of the applications translated into changed attitudes and motivations towards finances. Again, the team found improvements in this area, as the treatment group demonstrated an increased likelihood to plan financially, as well as a greater confidence in financial decision-making. Lastly, French et al. investigated whether improvements in financial knowledge and motivations led to more financially capable behaviors, such as management of bills or regular saving. The treatment group exhibited more resilience to financial shocks and a higher likelihood of budgeting (French et al., 2019, p. 3). Thus, French et al. highlighted the usefulness of fintech applications in improving the mindsets and behaviors of its users regarding financial management.

In 2017 the Money and Mental Health Policy Institute released a report on the relationship between mental health and fintech. The report states that fintech can support financial management during symptomatic periods through the reduction of stress, worry, and financial difficulty. Specifically, the report claims that fintech can assist with money management and improve financial literacy. Additionally, fintech can engage with support systems through the sharing of data, which further provides aid to the user. The report also describes how data analytics can be utilized to enable early identification of problematic behavior, allowing for individualized solutions (Evans & Acton, 2017, pp. 12-19). Ultimately, fintech applications with users with SMIs can be tailored for improved efficacy.

Design Considerations for Mental Illness

While fintech applications have proven to be effective, Wahab et al. clarify in their usability evaluation that certain user experience characteristics must be addressed to create a

successful fintech application. Specifically, the team encourages employing elements of learnability, efficiency, ease of use, effectiveness, navigability (Wahab et al., 2021, p. 5). Although these features are crucial, designers must also consider the more specific design needs of those with mental illness. One consideration noted by Blair is that previous technology designed for SMI relied heavily on self-reporting measures, which created a user burden and limited accuracy. In ten interviews of patients with bipolar disorder, Blair found that participants were open to using technology that utilizes data analysis of online behavior trends instead of self-reported data (Blair, 2021, p. 2).

A 2019 pilot study of Toucan, a mobile application designed to help those with conditions like mental illness or dementia manage their finances, studied 14 participants, three of which disclosed that they had bipolar disorder (Kursar, p. 22). In this study, participants used Toucan set up with third-party notifications, which were notifications sent to a trusted family member or friend about their spending data. The study demonstrated that setting up alerts helped the participants build improved financial habits. For example, participants reported being more likely to check their balance and transactions, even if doing so had been a source of anxiety in the past (p. 10). Additionally, participants had an improved awareness of their spending patterns, which enabled some participants to plan ahead or choose not to engage in impulsive purchases (pp. 32-33). In addition to the pilot study, the researchers also conducted a survey with over 200 respondents. In respondents who were already receiving support with money management, 96 percent supported third party alerts when they are unwell and 89 percent supported third party alerts day-to-day (Kursar, p. 19). The enhanced financial habits, in addition to the survey respondents' support for third party alerts, shows that an alert system can be a beneficial design feature within money management tools built for those with mental illness.

Blair also stated that previous technologies for those with SMIs have had high drop-off rates for users, which in turn decreases the efficacy of the application (Blair, 2021, p. 2). To address this concern Mesibov suggests designing apps that add intrinsic motivation, rather than extrinsic motivation. For instance, instead of excessive gamification and rewards, an application can retain users for longer periods through providing a framework for goal achievement and personal control (Mesibov, 2018). To further support the needs of users with mental illness, Gibson highlights minimizing complexity to avoid cognitive overload. This can be in the form of organizing the application so it is intuitive and employing color thoughtfully. Gibson also advocates for neutral imagery, since images with an overly sad or happy connotation can be jarring to the users (Gibson, 2019). Thus, in addition to standard user experience principles, additional design considerations must be assessed when designing for users with mental illness. Furthermore, the presence of research on the relationship between mental illness and financial difficulty, but the lack of sufficient and accessible technological support, emphasizes the gap between knowledge on the issue and available solutions.

Acceptance and Commitment Therapy Techniques as Intervention

One form of therapy that can be used as intervention to increase financially capable behaviors is Acceptance and Commitment Therapy (ACT). The goal of ACT is to fully experience and accept unpleasant emotions rather than trying to dismiss negative feelings, enabling progress towards goals (Wada & Klontz, 2015, p. 270). Furthermore, it is hypothesized that employing ACT in financial interventions can assist individuals in moving toward their goals since they will accept their financial behavior faults and remove any negative emotions

associated, allowing for openness to growth (p. 270). ACT specifically uses the techniques of acceptance, cognitive defusion, being present, and expression of values to decrease avoidance behavior and increase flexibility (p. 272). Acceptance involves embracing unwanted thoughts about money, rather than avoiding them. The cognitive defusion technique aims at showing individuals that trying to change unwanted thoughts is not part of the solution, but part of the problem. Being present encourages nonjudgement and expression of values refers to exploring financial decisions in connection to personal values and goals (pp. 272-273). One key component of being present in ACT techniques is use of mindfulness exercises, as they encourage acceptance and open-mindedness towards one's thoughts (Wada & Klontz, 2015, p. 272).

In their 2018 article, Levin et al. suggested that there are advantages to delivering ACT intervention through smartphones, as mobile applications can deliver intervention in a way that is low-intensity and high frequency; this format supports the strengthening of useful psychological skills (Levin et al., 2018, p. 689). The researchers also proposed that intervention could be further improved by administering the ACT skills tailored to in-the-moment check-ins. To test this theory, Levin et al. conducted a study with 69 adult participants, assigning them to one of three conditions for a four-week intervention: use an application with tailored ACT skills, use an application with random ACT skills, or use an application with only check-ins (pp. 690-691). The check-ins were administered in the form of ecological momentary assessments (EMAs), which is a data collection tool which studies an individual's thoughts and behavior by collecting responses in real time (p. 690).

The results showed that when using an application that provides ACT skills tailored to real-time check-ins, participants improved more on distress, positive mental health, and social functioning compared to the random skill and EMA-only conditions (p. 696). The research also

showed that when assigned to the EMA-only condition, participants completed significantly more check-ins than the tailored and random skill conditions (Levin et al., 2018, p. 695). The findings from Levin et al., integrated with the information from Wada and Klontz on applying ACT to financial behavior, indicate that using EMAs and tailored ACT skill suggestions in a fintech application could engage users and increase financially capable behaviors.

Chapter 3

Methodology

Once the review of literature was completed, the next step was to design the application prototype, named FinHealth. In order to design a comprehensive application two forms of research methods were utilized: a survey and usability testing.

Stakeholder Survey

Prior to the completion of the prototype, first a survey was conducted with participants in the identified stakeholder group of adults with bipolar disorder. This voluntary response survey, conducted by the Wellbeing & Health Innovation (WHI) lab in the College of Information Sciences and Technology, was used to inform design decisions and to highlight stakeholder needs, behaviors, and desires. The survey was conducted with a total of 460 participants with ages ranging from 25 and 74 years old, located in the United States, United Kingdom, and Ireland. 36 percent of the participants had a diagnosis of type I bipolar disorder and 38 percent were diagnosed with type II bipolar disorder; the remaining 32 percent either did not know, had an unspecified diagnosis, had a cyclothymia diagnosis, or did not answer. The goal of this survey was to understand the participants' relationship to their finances, the strategies used to minimize impulsive spending, and participant comfort with sharing financial data in relation to various factors.

Following the completion of the survey, results were coded to identify common themes. Regarding participants' relationship to their finances, results showed that many respondents tend to have a negative relationship with their finances, as the participants most often reported avoiding their finances sometimes, often, or most of the time. The majority of participants, however, expressed that they do employ strategies to reduce or prevent impulsive spending. One of the common themes found in reported strategies to lessen impulsive spending was giving control of finances to family members. Specifically, respondents reported giving their cards to family members, having someone monitor their bank transaction, or having family members remove access to money or their online shopping accounts when they are manic. Another common impulse management technique was delaying their purchase and instead talking to an accountability partner, someone who they have a supportive discussion about the impulse. Some participants utilize a cooling period, where they will add items to their cart but wait a predetermined amount of time before returning to the cart, or add the items to their cart but do not purchase at all. Lastly, some participants deliberately budget for future impulses by setting aside an allowance that is acceptable to spend when impulsive. In terms of participant comfort with sharing financial data, the preliminary analysis showed that participants were more willing to share if the data is only shared to themselves.

Design Rationale

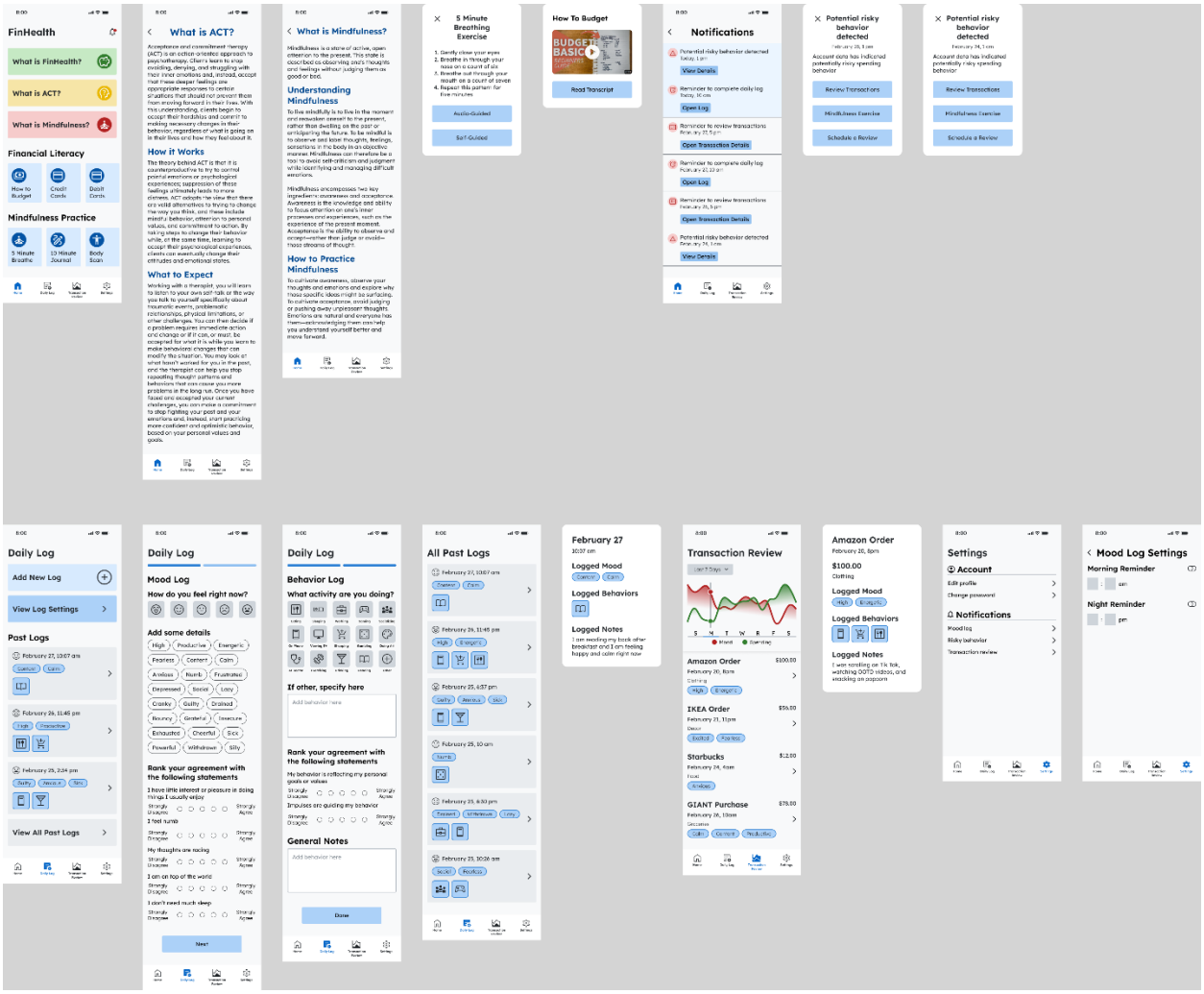
The themes revealed from the survey, in addition to the researched intervention styles, informed the decision making for selecting the functionality to implement in the application that would address stakeholder wants, needs, and attitudes. The first functionality supported by the

application design is the daily log, which collects data on the user's mood and behavior at a set time in the form of EMAs. The demand for this feature is supported by the research on using EMAs in combination with ACT intervention techniques. The ability to review recent transactions is a second feature of the application, allowing users to view relevant information about their purchasing behavior over a period of interest. The data collected on mood fluctuations through the EMAs is contrasted to variation in transaction behavior, allowing users to visualize how impulsive spending behavior might manifest during manic episodes. Additionally, the application reminds users to review their transactions if they have not recently looked at the data. This addresses the problem space identified in the survey of participants having the tendency to avoid their finances.

The application also notifies the users of potentially risky behavior, identified by sudden changes to their spending patterns. These sudden changes in spending patterns would be identified by the Plaid API, thus eliminating the need for further self-reporting measures. This notification directs the user to choose between completing a mindfulness intervention, reviewing their transaction history, or completing an EMA. This notification redirects users from the potentially risky behavior into completing a strategy that may help them reduce or prevent impulsive spending. Users also have the ability to complete an unprompted ACT-inspired mindfulness session to help manage any impulses they may experience. Lastly, the application has a home page with instructional information and the ability to review their notification history, as well as a settings page to adjust their preferences. These pages are displayed in the high-fidelity prototype shown in Figure 1.

Figure 1

High-Fidelity FinHealth Frames

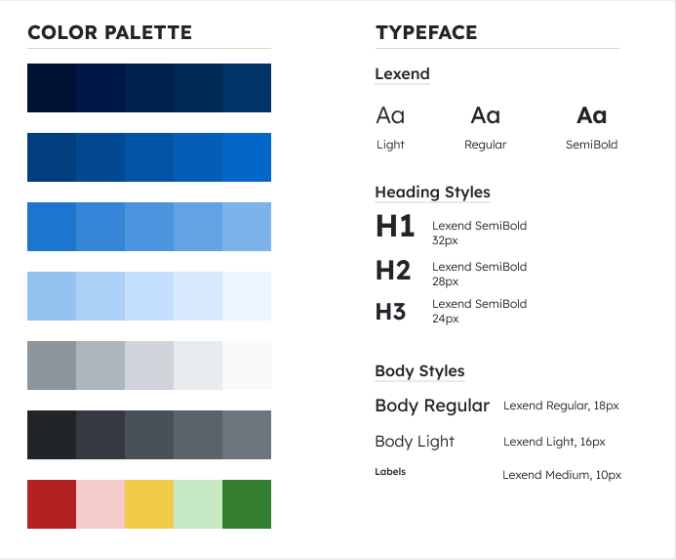


When selecting the visual features of the prototype, each design choice was made intentionally. First, in order to formulate a style guide for the application, color choice was considered. Color psychology states that the use of blue elicits feelings of security, trust, and reliability in an application. Additionally, black evokes beliefs that the application is high quality (Kachan, 2019). Thus, the color palette was established as varying shades of blue and black, establishing a sense of reliability and quality, as well as ensuring minimal visual complexity.

Additionally, the Figma plugin named Stark was used to verify that color contrast on every page meets the standards of the Web Content Accessibility Guidelines (WCAG). The font Lexend was selected to be the only font used within the app, with different font sizes and weights being implemented to differentiate between header and body texts. Lexend was chosen due to its variable nature and the empirical evidence showing it to significantly improve comprehension and reading-proficiency (Lexend). Furthermore, the body font size was set at an 18-point font in order to follow the WCAG guidelines for font size (W3). Lastly, when designing each page within the application, each feature was designed using autolayout as a component or variant. Autolayout was employed to ensure that each element was properly positioned and stayed aligned as the designs were altered. The elements were created as components and variants in order to establish consistency throughout all pages of the application.

Figure 2

FinHealth Style Guide



Usability Testing

After completing the high-fidelity design of the application, the prototype was tested with unmoderated usability testing. The test, conducted unmoderated and remotely through Loop11, led the users through various use cases in the prototype, enabling interaction between the users and the primary application functionality. Completing the usability testing unmoderated avoided observation and interviewer bias, as well as allowed for the comfort of the participants. As the participants navigated through the prototype, they voluntarily answered questions embedded into the test; the questions were a mix of qualitative and quantitative, allowing both objective and subjective measures to be assessed. The test was distributed to a convenience sample of participants located in State College, Pennsylvania. While the participants of the usability test were not exclusively in the identified stakeholder group, the design of the test still allowed for the evaluation of the prototype as a whole, in regard to functionality and visual design.

The test began with a general description of the project and what the test would be evaluating, followed by a check for consent. Then, the participants are prompted to answer a series of demographic questions, in the form of open-ended and fixed-choice questions. Next, the participants were provided a scenario to interact with the first use case: interacting with a notification of risky behavior. After completing the tasks associated with this use case, the participant then answered a series of Likert scale and open-ended follow up questions related to the experience. The same procedure of completing a task for the use case and answering follow-up questions was followed for the second scenario, reviewing a recent transaction, and the third scenario, completing a daily log. After finishing the tasks associated with the three use cases, the participants were then asked to answer a series of open-ended and fixed-choice follow up questions. To view the usability testing script, see Appendix A. The usability test was closed

after one week to allow for analysis of the quantitative data regarding response time and percent task completion, as well as the qualitative responses on opinions and obstacles faced.

Chapter 4

Results

In total, nine participants completed the unmoderated usability test on Loop11, all of which provided their consent. In terms of demographics, all participants were in the 18-24 age range, described their gender as ‘woman’, and had some level of college education. Additionally, four of the participants are employed part time, while the remaining five participants are not currently employed. Three of the participants claimed to have used a phone application to assist with management of money, including to pay others, to budget, to review accounts, or hold themselves accountable for spending goals. Of the nine participants, five had been professionally diagnosed with a mental illness; all five had been diagnosed with anxiety and two of the five had been diagnosed with depression as well.

For the first task, the completion percentage was 100%. The average duration of the task was one minute and 54 seconds (01:54), with the maximum time at 04:19 and the minimum time at 00:50. Additionally, the first task received a lostness score of 0.94. When asked their agreement with the statement, “The notifications are easy to find,” 66.7% of participants agreed and 33.3% strongly agreed. For the statement, “It was difficult to find the specific notification of interest,” 33.3% strongly disagreed, 44.4% disagreed, 11.1% neither disagreed or agreed, and 11.1% agreed. 55.6% strongly agreed and 44.4% agreed with the statement, “The contents of the notification were easy to comprehend.” Regarding comprehension of the intervention options, 55.6% agreed and 33.3% strongly agreed that they “understood what the intervention options

meant," while 11.1% disagreed. In response to the statement, "It was easy to navigate to the mindfulness exercise," 55.6% agreed and 22.2% strongly agreed, while 11.1% neither disagreed or agreed and 11.1% strongly disagreed. When prompted with the open-ended question, "Is there anything you would add or change," one participant said, "I really struggled without the close button. I eventually assumed you just had to click off of the pop up." Lastly, 77.8% of participants rated the task as easy and 22.2% rated the task as average.

Table 1

Task One Likert Scale Results

	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree	No Response
The notifications are easy to find	0%	0%	0%	66.7%	33.3%	0%
It was difficult to find the specific notification of interest	33.3%	44.4%	11.1%	11.1%	0%	0%
The contents of the notification were easy to comprehend	0%	0%	0%	44.4%	55.6%	0%
I understood what the intervention options meant	0%	11.1%	0%	55.6%	33.3%	0%
It was easy to navigate to the mindfulness exercise	11.1%	0%	11.1%	55.6%	22.2%	0%

For the second task, there was a completion percentage of 88% and a lostness score of 0.05. The average task duration was 00:45, the maximum was 01:07, and the minimum was 00:28. In response to the statement, "It was easy to navigate out of the mindfulness exercise," 75% of participants strongly agreed, 12.5% agreed, and 12.5% selected neither agree nor disagree. 50% strongly agreed and 50% agreed with the statement, "It was easy to find the

transaction review page." The response to the statement, "It was easy to change the time period to the past week," was more mixed, as 50% of participants agreed, 25% selected neither agree or disagree, 12.5% disagreed, and 12.5% did not answer. For the following statement, "I understood the information provided in the graphs," 75% of participants agreed, 12.5% selected neither agree or disagree, and 12.5% did not answer. In response to "It was difficult to find the specific Amazon purchase," 12.5% strongly disagreed, 62.5% disagreed, 12.5% agreed, and 12.5% did not answer.

Table 2

Task Two Likert Scale Results

	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree	No Response
It was easy to navigate out of the mindfulness exercise	0%	0%	12.5%	12.5%	75%	0%
It was easy to find the transaction review page	0%	0%	0%	50%	50%	0%
It was easy to change the time period to the past week	0%	12.5%	25%	50%	0%	12.5%
I understood the information provided in the graphs	0%	0%	12.5%	75%	0%	12.5%
It was difficult to find the specific Amazon purchase	12.5%	62.5%	0%	12.5%	0%	12.5%

100% of participants responded that they clicked on the Amazon purchase to see more information. To answer the open-ended question, "Is there anything you would add or change?", one participant expressed interest in being able to access explanations in the application about the relationship between mood and spending. Another participant suggested changing the name

"Review" to "Transaction History." A third participant responded positively, saying, “I liked that it has mood and what you were doing then.” 75% of participants stated that overall, the task was easy while 25% stated that it was of average difficulty.

The completion percentage was 100% for the final task, with a lostness score of 0.22. For this task, the average duration was 01:34, with a maximum duration of 03:04 and a minimum duration of 00:33. Of the seven Likert scale questions relating to the third task, nine participants answered the first two questions and eight answered the remaining five questions. For the statement, “It was easy to navigate to the daily log page,” 55.6% of participants strongly agreed and 44.4% agreed. 88.9% of participants strongly agreed and 11.1% agreed with the statement “It was easy to start a new log.” In terms of the icons used to convey mood states, 55.6% strongly agreed and 33.3% agreed that they “understood what the mood pictures meant.” In response to the statement, “I understood the mood agreement questions,” 44.4% strongly agreed and 44.4% agreed. 22.2% of participants strongly agreed, 44.4% agreed, and 22.2% neither agreed nor disagreed with the statement “I understood the behavior options.” The behavior agreement questions in the mood log received mixed feedback, with 22.2% strongly agreeing, 44.4% agreeing, 11.1% neither agreeing or disagreeing, and 11.1% disagreeing with the statement, “I understood the behavior agreement questions.” Lastly, 33.3% strongly disagreed and 55.6% disagreed with the statement, “It took too long to finish the daily log.”

Table 3

Task Three Likert Scale Results

	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree	No Response
It was easy to navigate to the daily log page	0%	0%	0%	44.4%	55.6%	0%
It was easy to start a new log	0%	0%	0%	11.1%	88.9%	0%
I understood what the mood pictures meant	0%	0%	0%	33.3%	55.6%	11.1%
I understood the mood agreement questions	0%	0%	0%	44.4%	44.4%	11.1%
I understood the behavior options	0%	0%	22.2%	44.4%	22.2%	11.1%
I understood the behavior agreement questions	0%	11.1%	11.1%	44.4%	22.2%	11.1%
It took too long to finish the daily log	33.3%	55.6%	0%	0%	0%	11.1%

In response to the open-ended question, "Is there anything you would add or change," one participant suggested flipping the Likert scales so that the "strongly agree" label is on the right instead of the left. Additionally, one participant stated that the touchpoints for the Likert scale were too small. Two participants also noted that the behavior questions were asking about activities rather than behaviors. When asked about the difficulty of the task, 77.8% of participants said that the task was easy overall and 22.2% said the task was of average difficulty.

After completing the three tasks and their associated questions, the participants were prompted to answer a series of open-ended opinion questions. The first of these five questions asked about the first thing the participant noticed about the prototype. Four of the participants reported first noticing the colors on the homepage, two noticed the different options in the navigation bar, and two participants stated that they noticed that the design was clean. Additionally, two participants reported finding the design simple which made it easy for them to

navigate. The next question asked about the participants' opinion on the design and layout of the prototype. All of the responses were positive, with praise for the color scheme and navigation. Five participants commented on the ease of navigation, with two specifying that the layout made it easy for them to find everything. The third open-ended opinion question asked, "Was the prototype easy for you to navigate and understand?" Eight participants responded with only "yes" and one participant responded with "yes, very easy to understand and navigate."

Next, participants were asked, "Did you find anything difficult to grasp when going through the prototype." Four participants responded with "no" and three participants provided positive feedback saying, "Nothing was too difficult. I would classify it as a normal learning curve for the first time using an app"; "No, everything seemed very straightforward to me"; and "Nope! Nothing was too difficult." The last participant said, "I think I was just confused as to how a mindfulness exercise after a risky behavior purchase helps rather than before." The fifth question asked participants, "Did you feel as though the application was lacking any functionality?" and eight participants answered this question, with seven responding "No". One participant responded by saying "maybe a more concise home page."

The participants were then prompted to answer a series of modified system usability scale questions. The first statement was answered by all nine participants, while the remaining five were answered by eight participants. The first statement, "I think I would like to use this app frequently," had 11.1% of participants strongly agree, 44.4% agree, 11.1 neither agree or disagree, and 33.3% disagree. Next, 22.2% strongly disagreed and 66.7% disagreed with the statement, "I found this app complex." In response to the statement, "I think the app is easy to use," 55.6% agreed and 33.3% strongly agreed. 44.4% strongly agreed and 44.4% agreed with the statement, "I think that most people could learn to use this app quickly." For the statement,

"The organization of information provided in the app is clear," 33.3% strongly agreed and 55.6% agreed. To the final Likert question, "I like using the interface of this app," 11.1% strongly agreed and 77.8% agreed.

Table 4

Modified System Usability Scale Results

	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree	No Response
I think I would like to use this app frequently.	0%	33.3%	11.1%	44.4%	11.1%	0%
I found this app complex.	22.2%	66.7%	0%	0%	0%	11.1%
I think the app is easy to use.	0%	0%	0%	55.6%	33.3%	11.1%
I think that most people could learn to use this app quickly.	0%	0%	0%	44.4%	44.4%	11.1%
The organization of information provided in the app is clear.	0%	0%	0%	55.6%	33.3%	11.1%
I like using the interface of this app.	0%	0%	0%	77.8%	11.1%	11.1%

Following the system usability scale questions, participants were given four open-ended wrap-up questions. First, participants were asked, "Please explain any difficulties you encountered when completing the tasks." Two participants mentioned struggling to use the Loop11 platform itself but having no issues with the FinHealth prototype. Another two participants reported experiencing no difficulty. One participant stated that the "close button was hard to find and the touch points were small sometimes so I would click and nothing would happen." Two participants described experiencing some confusion regarding navigation when first interacting with the prototype, with one of the participants saying their struggle to locate

components “was a normal amount of time for using a new app.” The final two participants communicated that they would have preferred more context on certain features within the application, specifying “mindfulness exercises and the mood/spend chart” and “the question with behaviors.”

Next, participants were asked to rate their experience with the FinHealth system on a scale of 1 to 10, with 10 being the best. The average rating was 8.78, with a maximum score of 10, a minimum score of 8, a median score of 9, and a mode score of 8. When asked for their “overall impression of the FinHealth app”, five of the participants gave general positive feedback, saying “good,” “it’s a great idea,” or “it seems very practical and a good finance tracking app.” One participant was more specific, saying, “It would be very useful for those who have a connection with reckless behavior and spending or are emotional spenders. I enjoyed the concept of notifications for possible risky spending.” Another participant responded with “the logs were easy to understand.” One participant reported being interested in the FinHealth application for personal use, responding, “I would benefit from using it and am interested in how it could help me.” The remaining participant responded with some suggestions, saying “very well laid out, the brand/color scheme could use some more thought.” The final question in the test asked participants if there were “Any last comments, questions, or concerns,” to which all participants responded with “nope” or “no”.

Chapter 5

Discussion

Overall, the results proved that user experience design principles were effectively applied in establishing functionality and design that supports stakeholders. This claim is supported by the usability evaluation data, as the majority of the results indicated high levels of navigability, ease of use, and comprehension. Specifically, for the task one Likert scale results, the answers for all five statements had at least 78% agreement in the expected direction. The results for the task two Likert scale responses followed a similar pattern, with all but one statement receiving at least 75% agreement in the desired direction. Again, task three results demonstrated success, as five of the seven statements received all responses in the anticipated agreement direction. Additionally, for all three tasks, the majority of participants rated the task as easy. Furthermore, in the modified system usability scale questions, for all statements relating to navigability, ease of use, or comprehension, all participants responded in the expected agreement direction. Participants also reported few comments of dissatisfaction in the open-ended questions, with most responses being positive in nature. Multiple responses described the design as clean, easy to navigate, straightforward, easy to understand, and useful. Additionally, the average rating of 8.78 for participant experience demonstrates an overall positive interaction with the prototype for all participants. Thus, the direct user feedback on the prototype exhibits high levels of competency in user experience design.

The quantitative data collected by the Loop11 platform, regarding completion percentage, task duration, and lostness scores, also exemplify competence in user experience design. Tasks

one and three both had 100% completion rates, with task two having an 88% completion rate. For the second task, however, the participant who abandoned the task did show comprehension of the task and the appropriate interactions, as they provided relevant and specific feedback in the follow-up questions. Thus, it may be possible that rather than being unable to navigate through the task, this participant ended the task on the Loop11 platform in the incorrect way. The first task resulted in the highest task duration and lostness score. This may be explained by the fact that participants were largely unfamiliar with interacting both with Figma and with Loop11. For instance, the lostness score, which indicates navigation efficiency, was a 0.94 for the first task, which suggests that participants were struggling to navigate through the prototype. This score dropped down to 0.05 for the following task, which aligns with the explanation that participants were struggling to navigate due to their unfamiliarity with the platform, rather than the prototype design. Furthermore, the task duration decreased by over a minute from the first task to the second, again supporting this notion.

The task duration increased from the second to the third task, to 1:34, which is expected due to the number of steps required for the third task compared to the second task. Additionally, the lostness score increased slightly for the third task but remained at a low number overall, therefore still indicating navigability for the third task. Thus, the qualitative data further suggests success in achieving high navigability, ease of use, and comprehension. While the design demonstrates strong user experience overall, user feedback did indicate some minor design aspects that should be iterated on for future use.

First, a close button was added to the pop-up overlays, as previously users had to click outside of the overlay to close it. This was simple to add into the prototype, as the overlays were created as components, so adding a close button to the main component applied this change to all

overlays. Additionally, the main component for the bottom navigation bar was updated to change "Review" to "Transaction Review". This aligned the navigation bar label on all pages to the header on the transaction review page, creating more consistency within the prototype text. The Likert scales in the daily log were also adjusted by increasing the size of the touchpoints, as well as swapping the locations of the "Strongly Agree" and "Strongly Disagree" labels. This improves accessibility, as well as aligns the prototype to the users' existing mental patterns of Likert scales. To view these changes, see Appendix E.

Additionally, in future iterations of the design, improved accessibility to explanations would be implemented. For instance, one participant in the usability evaluation expressed interest in learning more about the relationship between mood and spending while on the transaction review page. Participants also requested to have the ability to obtain more context for the mindfulness exercises, as well as the behavior questions in the daily log. By embedding more information into the application, users would be able to further their understanding of both ACT therapy and financial literacy at any time they desire. Lastly, two participants expressed confusion about the behavior questions in the daily log, stating that the questions asked about activities rather than behaviors. This distinction is one that could be clarified in future iterations by discussing with the members of the Wellbeing & Health Innovation (WHI) lab, as well as their psychologist contact. With these feasible improvements, the design will further improve in its user experience.

In addition to the need for slight design changes, some limitations within the research design were revealed in the usability evaluation. First, the Loop11 platform received multiple complaints from participants, both in the evaluation comments and in direct communication. Participants cited "difficulty with the user testing software" and described the platform as

"glitchy". Thus, for future usability evaluations, it could be beneficial to the participant experience to transfer the evaluation to a different user testing platform. A future usability evaluation could also be improved through the addition of the standardized system usability scale (SUS). The use of a modified SUS could have limited the quality of data elicited. Additionally, future user testing could benefit from a wider range of participants from a more varied demographic; specifically, the results of this test lacked external validity, since none of the participants were in the stakeholder group of adults with bipolar disorder. Overall, while the design and usability test have potential for growth, the FinHealth prototype ultimately exhibited high levels of competency in user experience design and success in its ability to support stakeholders.

Chapter 6

Conclusion

Ultimately, this thesis sought to examine how user experience design principles could be most successfully employed in the creation of FinHealth, an application created to alleviate financial stress for those with bipolar disorder. Through a review of existing literature, analysis of a stakeholder survey, and research on best practices for design rationale, the usability evaluation demonstrated results of accomplishment in user experience design competency. The usability evaluation elicited extensive positive feedback, highlighting how the functionality and user experience of the FinHealth application was successfully designed to support its stakeholders.

To ensure the creation of this holistic design, first past literature was reviewed. This review included four main themes: the relationship between mental illness and financial matters, the utility of financial technology, considerations when for stakeholders with mental illness, and acceptance and commitment therapy techniques. The investigation of these topics extracted crucial information regarding necessary features to be implemented in the FinHealth application, including many of the specific intervention methods. Then, the survey conducted by the Wellbeing & Health Innovation lab was analyzed to conduct further research on the specific stakeholder group. The survey results emphasized the gap in the problem space and highlighted potential ways to address the gap. Following the examination of the survey results, user experience standards regarding color, accessibility, and consistency were established. The results

from the literature review, survey, and best practices were then combined to design the FinHealth application.

Once the application was designed, a usability evaluation was conducted. The usability evaluation generated qualitative and quantitative feedback regarding the navigability, ease of use, and user comprehension of the FinHealth application. Overall, positive feedback was provided with some small suggestions for improvement, which were then implemented. The requests for more context and changes in the behavior section of the mood log, however, would be executed in future design iterations. In addition to implementing these changes, as well as rectifying the discussed limitations, there are still gaps in the problem space that could be addressed with future research. For instance, features could be added to the application design that enable collaboration and communication with a trusted third party, such as a family member, partner, or therapist, as this would align with the results from the stakeholder survey. Additionally, features could be implemented to strengthen intrinsic motivation, such as streaks for completing daily logs.

This work demonstrated one of the potential ways in which financial technology can be utilized to aid those with bipolar disorder. Through further development, the FinHealth application showed potential in being able to address resource gaps for users with bipolar disorder who may be struggling with impulsive overspending, as well as the related anxiety, depression, guilt, and other cyclical behaviors. Thus, this work exemplified that thorough research and thoughtful design choices, financial technology can be successful in assisting users with bipolar disorder. Furthermore, this thesis highlighted ways in which work in this field could be improved in future research and applications to better serve the stakeholders. Overall, this

thesis proved user experience design competency, as well as produced a promising path for future growth, in regard to both the design and the research structure.

Appendix A

Moderated Usability Testing Script

Introduction-

Hi, thank you for your participation in this usability study. I am Jennifer Hodsdon, and I am a fourth-year student studying Human-Centered Design and Development in the College of IST. Today you are going to go through an application called FinHealth, which I designed as part of my honors thesis. FinHealth was made with the objective of helping users with bipolar disorder manage their finances. This session will start with a few questions about your demographic information and then move into a usability test. The usability test shows me how users interact with our system by having you perform activities intended to test the function and usability of the application. Specifically, your participation in this study will involve you navigating through the app and following various scenarios. In order to best measure the usability of the app, I encourage all participants to talk aloud and voice their honest thoughts and actions as they go through each process. Make comments, mention eye-catching features, state areas of interest, and add small informative statements on anything you see or do—any feedback is good feedback. Your contributions to the usability testing are very valuable, and you aren't alone—many other participants will be completing this usability testing as well. Together, you and other participants form a team that produces usability data that will be used to improve the FinHealth prototype. As part of this study, your walkthrough will be recorded, in order for me to analyze the data and learn from what you do. You will remain anonymous, and all collected recordings will be used for feedback purposes only. Do you consent to the recording of the session?

- Yes
- No

Warm-Up/Demographic Questions-

1. What is your name? [Open-Ended]
2. What is your age? [Fixed-Choice]
    a. 18-24
    b. 25-34
    c. 35-44
    d. 45-54
    e. 55-64
    f. 65 and over
3. How do you describe your gender? [Fixed-Choice]
    a. Man
    b. Woman
    c. Non-Binary
    d. Prefer not to answer
    e. Other
4. Are you currently employed? [Fixed-Choice]
    a. Yes, full-time
    b. Yes, part-time
    c. No
5. What is your level of education? [Fixed-Choice]
    a. Some high school, no diploma
    b. High school graduate, diploma or the equivalent (for example: GED)

   c. Some college credit, no degree
   d. Trade/technical/vocational training
   e. Associate degree
   f. Bachelor's degree
   g. Master's degree or higher

6. Have you ever used a phone application to assist with management of money? [Fixed-Choice]
   a. Yes
   b. No
   c. Unsure
   d. Other
7. If yes, what did you use the app for? Select all that are applicable. [Fixed-Choice]
   a. Paying others
   b. Budgeting
   c. Reviewing your accounts
   d. Improving financial literacy
   e. Holding yourself accountable for spending goals
   f. Other
8. Have you ever been professionally diagnosed with a mental illness? [Fixed-Choice]
   a. Yes
   b. No
   c. Unsure
   d. Other

9. If yes, what was your diagnosis? [Fixed-Choice]
    a. Bipolar disorder I
    b. Bipolar disorder II
    c. Depression
    d. Anxiety
    e. ADHD/ADD
    f. Other

Scenarios and Tasks-

Scenario 1: In this first scenario, imagine that you just received a notification that you might be exhibiting potentially risky spending behavior. Navigate to that risky behavior notification from February 24th and choose to complete the mindfulness intervention.

Scenario 1 Follow-Up Questions: View most recent notification and click on the mindfulness option

1. Rate your agreement with the following statements [Fixed-Choice, Likert Scale]:
    a. The notifications are easy to find
    b. It was difficult to find the specific notification of interest
    c. The contents of the notification were easy to comprehend
    d. I understood what the intervention options meant
    e. It was easy to navigate to the mindfulness exercise
2. Is there anything you would add or change? [Open-Ended]
3. Overall, was this task [Fixed-Choice]:
    a. Easy

   b. Average
   c. Hard

Scenario 2: After you complete your mindfulness exercise you remember you bought something on Amazon this past Monday, so you decide you want to review your transaction history within the last week. Navigate to the transaction review and review your recent Amazon transaction.

Scenario 2 Follow-Up Questions: View most recent transaction

1. Rate your agreement with the following statements [Fixed-Choice, Likert Scale]:
   a. It was easy to navigate out of the mindfulness exercise
   b. It was easy to find the transaction review page
   c. It was easy to change the time period to the past week
   d. I understood the information provided in the graphs
   e. It was difficult to find the specific Amazon purchase
2. Did you click on the Amazon purchase to see more information? [Fixed-Choice]
   a. Yes
   b. No
   c. Other
3. Is there anything you would add or change? [Open-Ended]
4. Overall, was this task [Fixed-Choice]:
   a. Easy
   b. Average
   c. Hard

Scenario 3: After reviewing your transaction history, you remember that you have not yet completed your daily log. Navigate to the daily log and start a new log to note your current mood and behavior.

Scenario 3 Follow-Up Questions: Fill out your daily log

1. Rate your agreement with the following statements [Fixed-Choice, Likert Scale]:
    a. It was easy to navigate to the daily log page
    b. It was easy to start a new log
    c. I understood what the mood pictures meant
    d. I understood the mood agreement questions
    e. I understood the behavior options
    f. I understood the behavior agreement questions
    g. It took too long to finish the daily log
2. Is there anything you would add or change? [Open-Ended]
3. Overall, was this task [Fixed-Choice]:
    a. Easy
    b. Average
    c. Hard

Final Questions-

1. Opinion Questions [Open-Ended]:
    a. What was the first thing you noticed about the prototype?
    b. Did you like the design of the prototype? The layout?
    c. Was the prototype easy for you to navigate and understand?

   d. Did you find anything difficult to grasp when going through the prototype?

   e. Did you feel as though the application was lacking any functionality?

2. Rate your agreement with the following statements [Fixed-Choice, Likert Scale]:

   a. I think I would like to use this app frequently.

   b. I found this app complex.

   c. I think the app is easy to use.

   d. I think that most people could learn to use this app quickly.

   e. The organization of information provided in the app is clear.

   f. I like using the interface of this app.

3. Wrap-Up Questions [Open-Ended]:

   a. Please explain any difficulties you encountered when completing the tasks.

   b. On a scale of 1-10, 10 being best, rate your experience with the FinHealth system.

   c. What is your overall impression of the FinHealth app?

   d. Any last comments, questions, or concerns?

Appendix B

FinHealth Hand-Sketches

Figure 3

Frames One Through Three of the Hand-Sketches

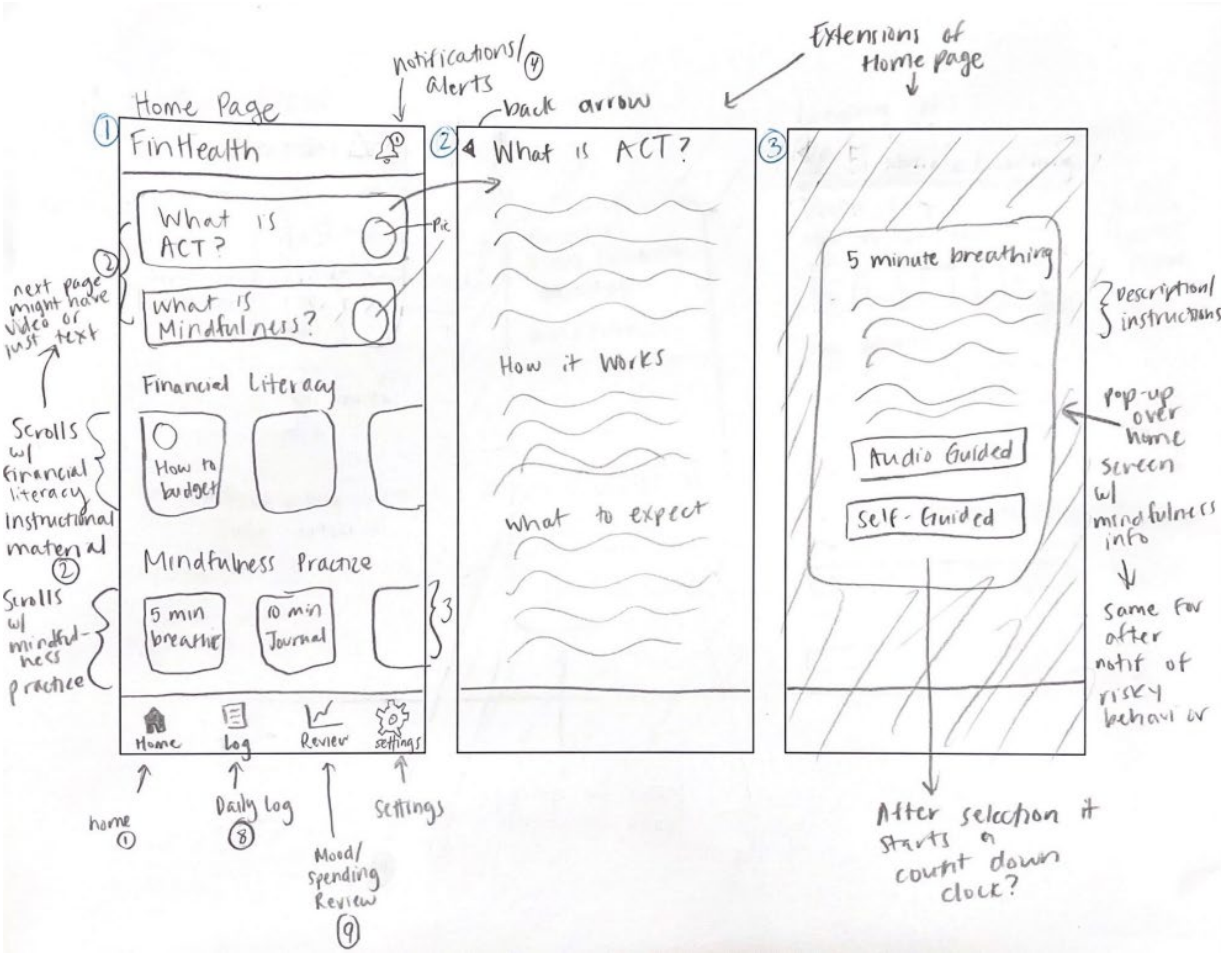


Figure 4

Frames Four Through Six of the Hand-Sketches

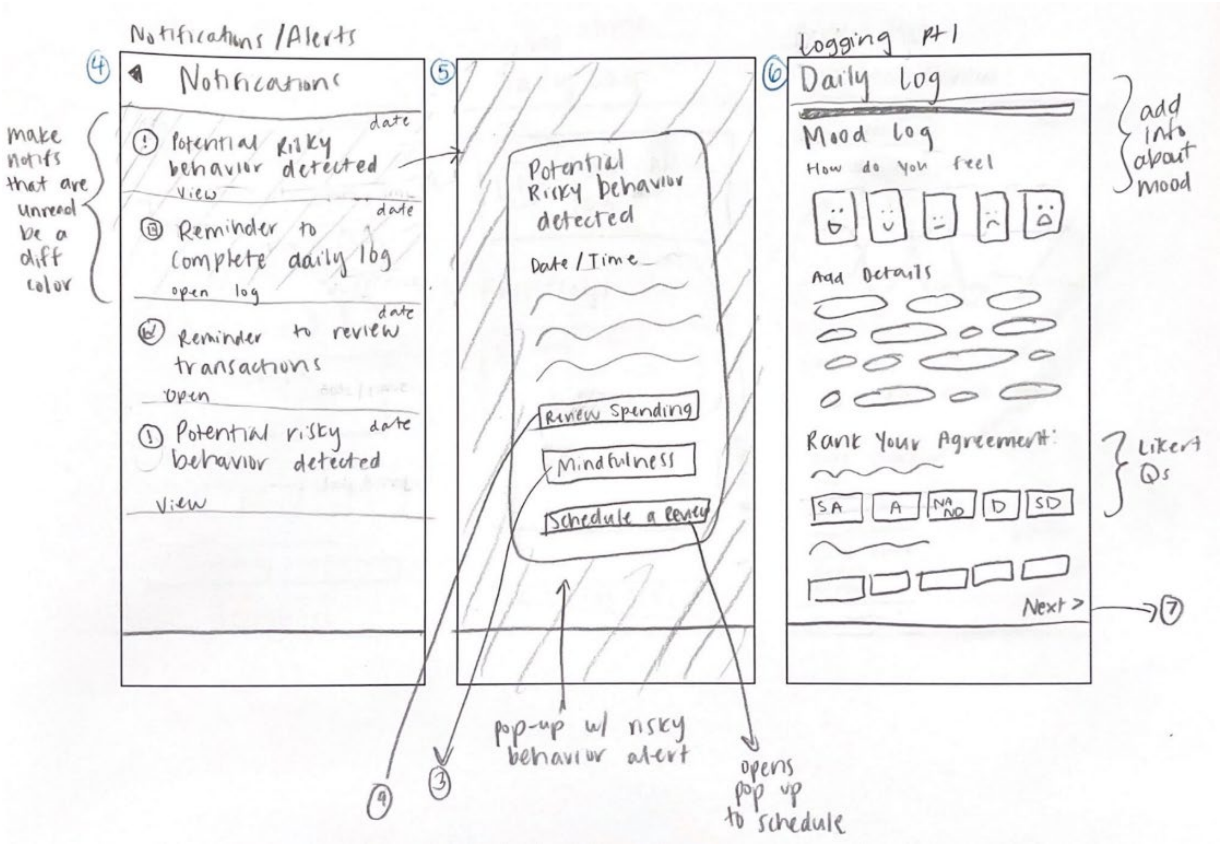


Figure 5

Frames Seven Through Nine of the Hand-Sketches

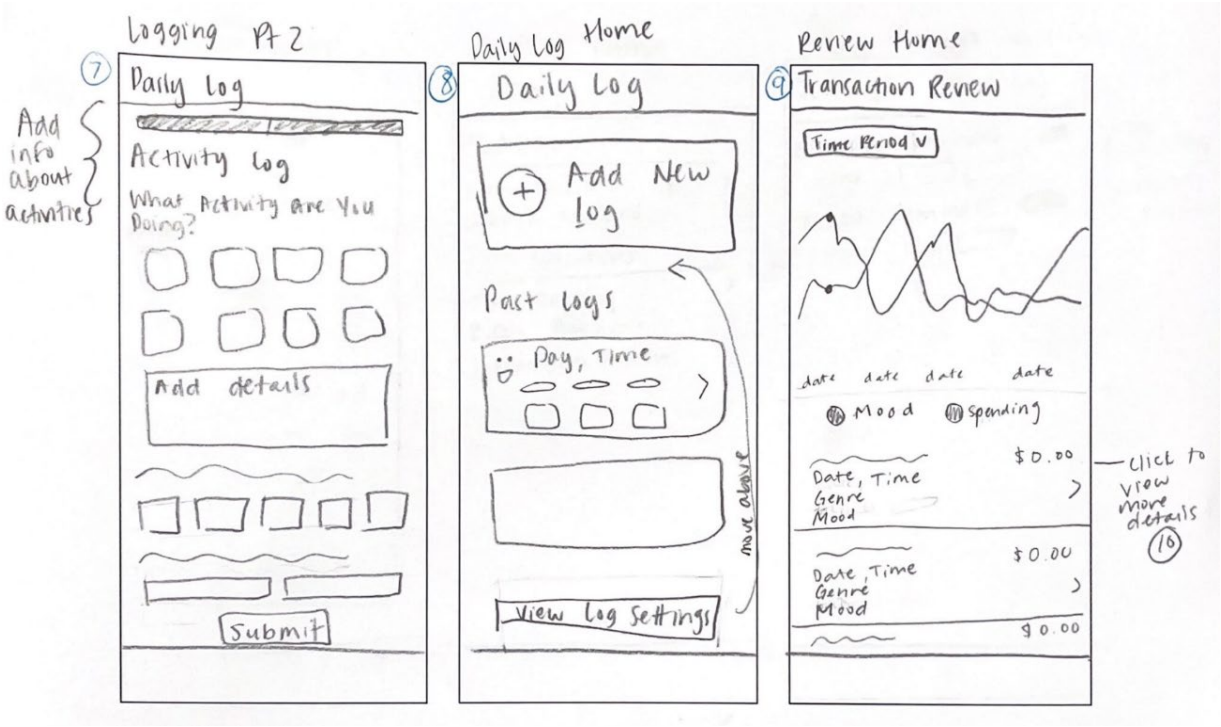
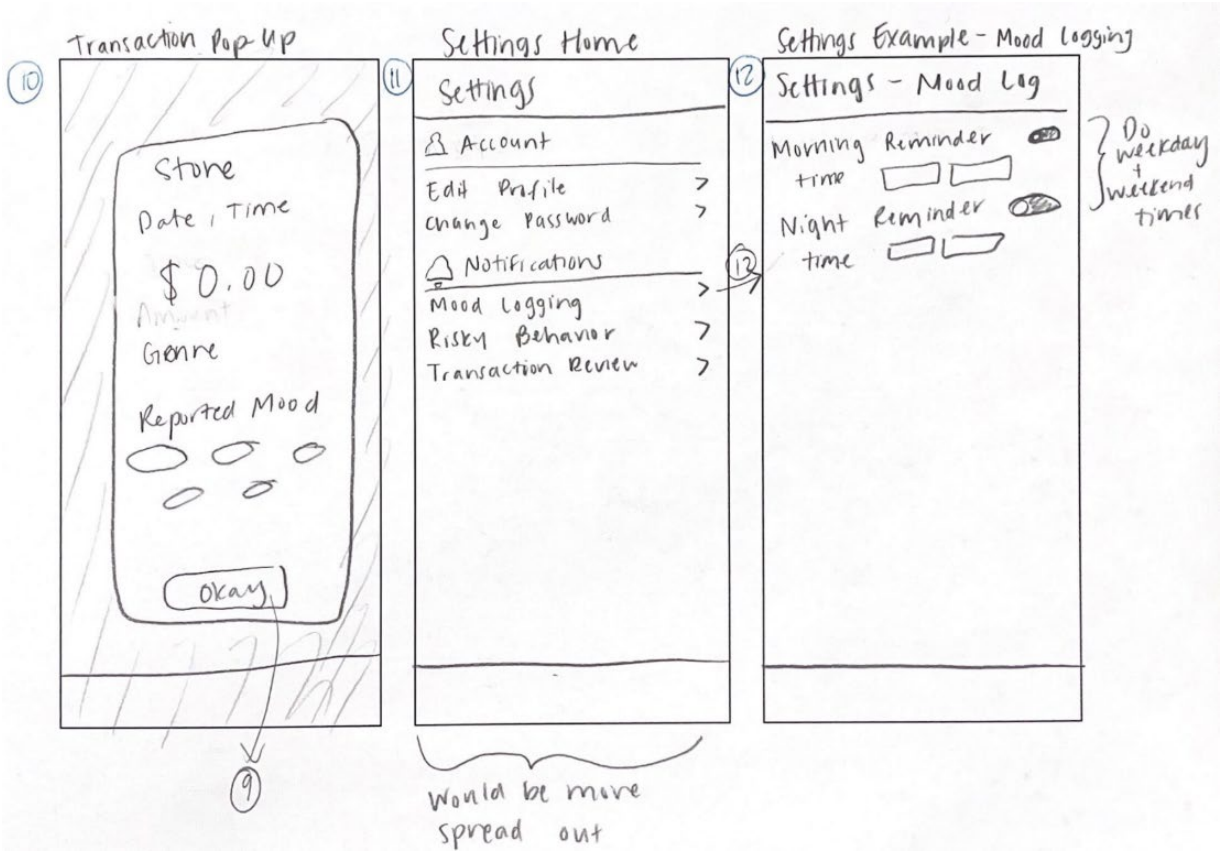


Figure 6

Frames Ten Through Twelve of the Hand-Sketches

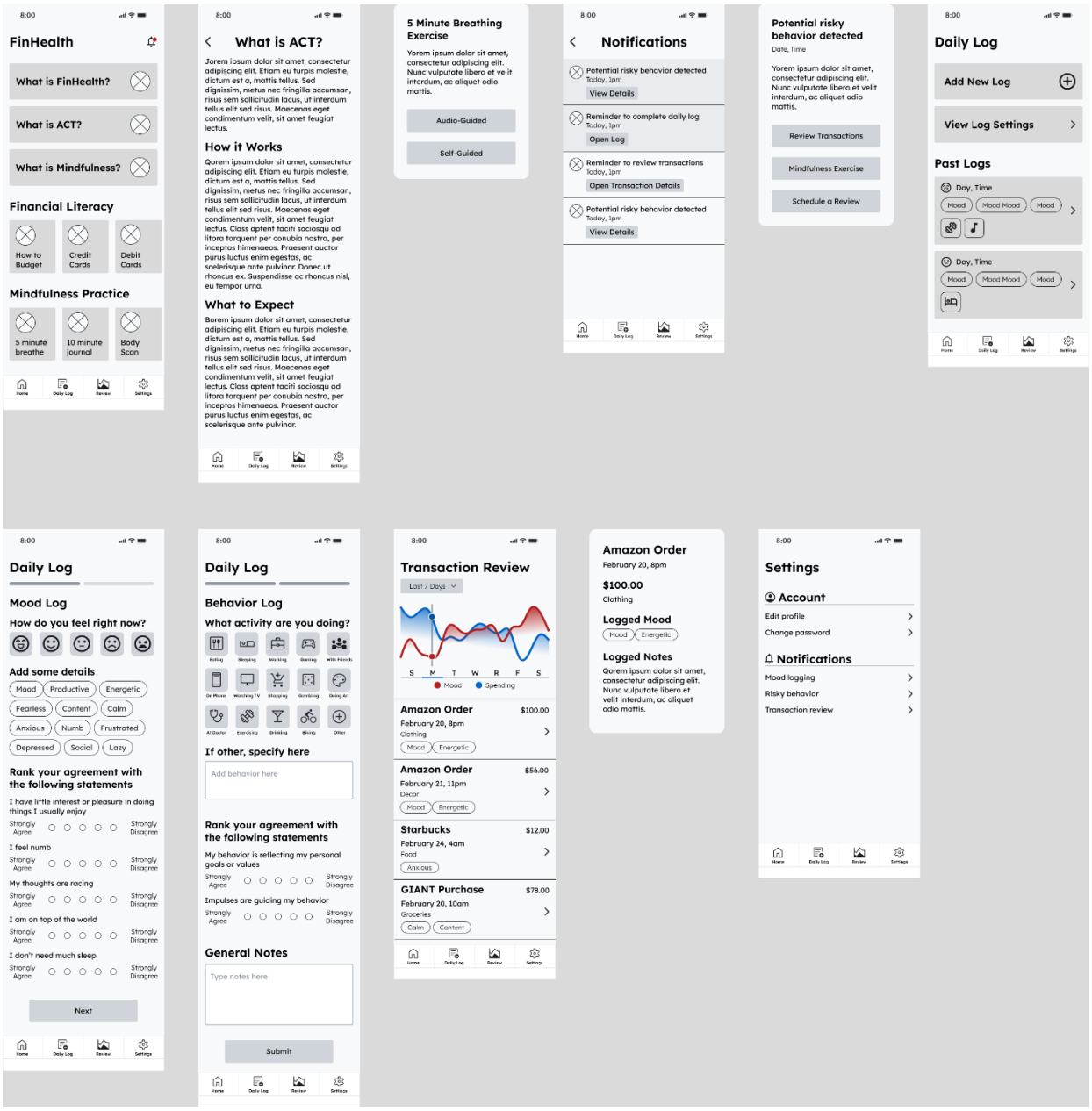


Appendix C

FinHealth Low-Fidelity Wireframe

Figure 7

FinHealth Low-Fidelity Wireframe



Appendix D

High-Fidelity Wireframe

Figure 8

Components Used to Create the High-Fidelity Prototype

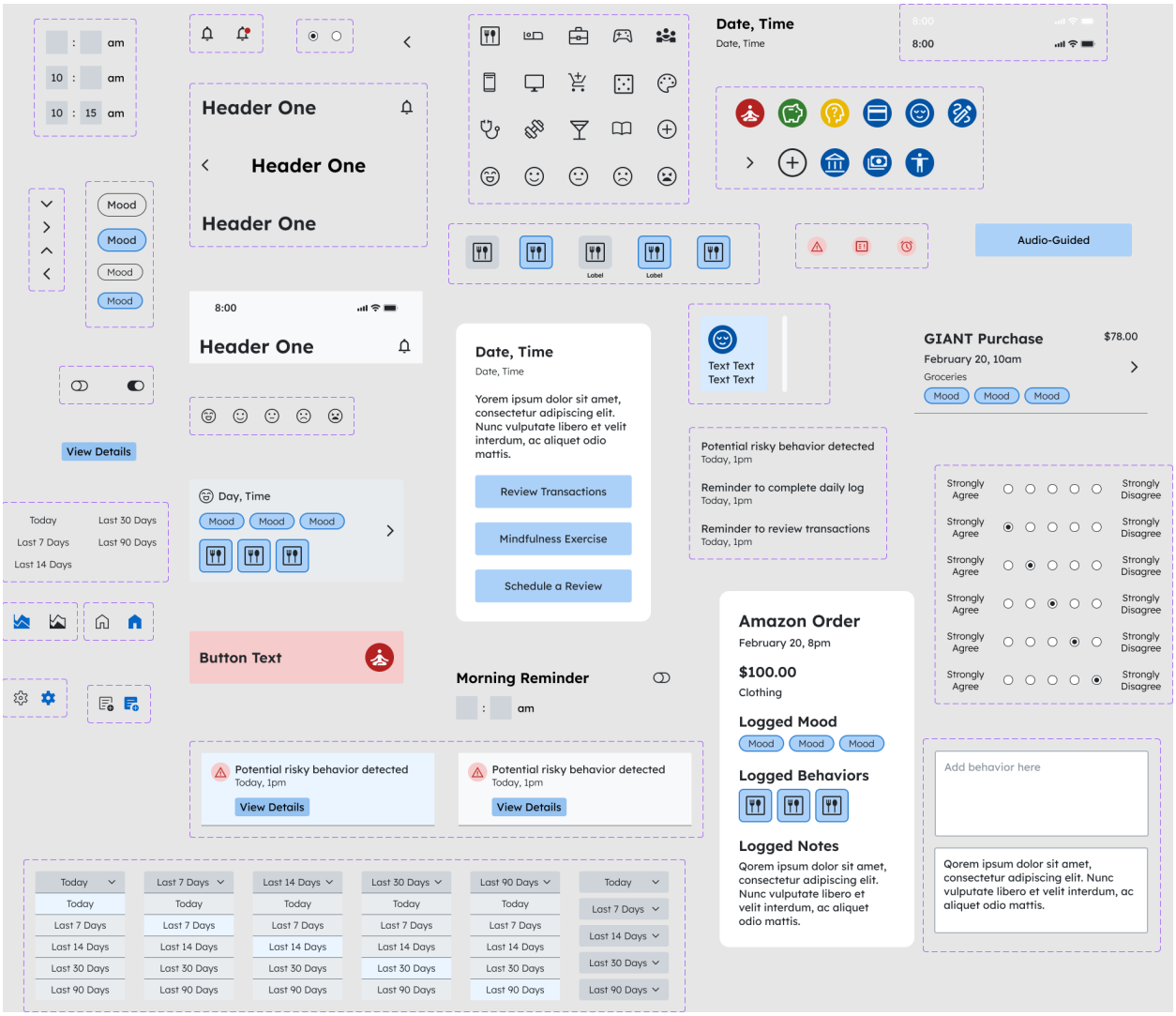


Figure 9

FinHealth Home Page

Figure 10

ACT Information Page

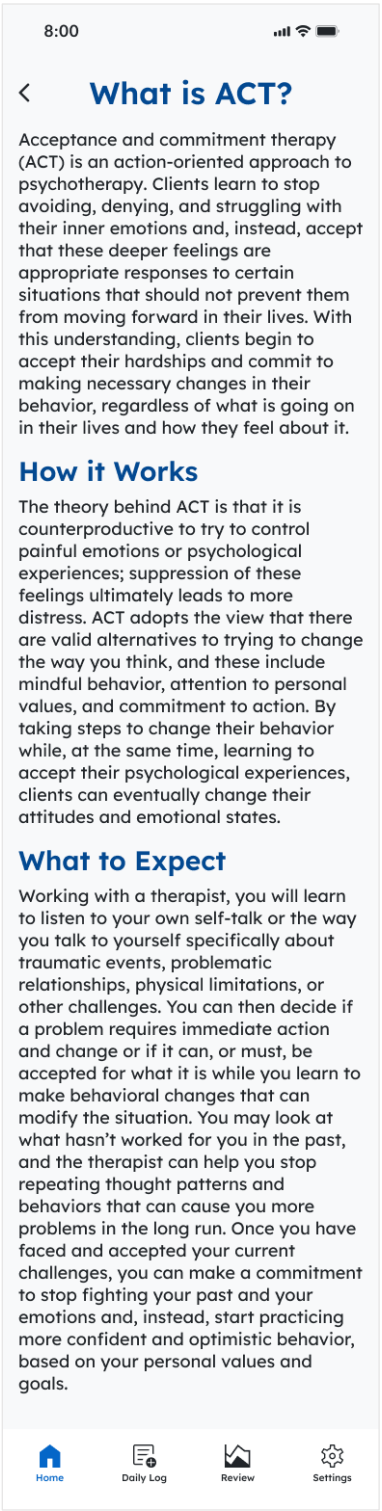


Figure 11

Mindfulness Information Page

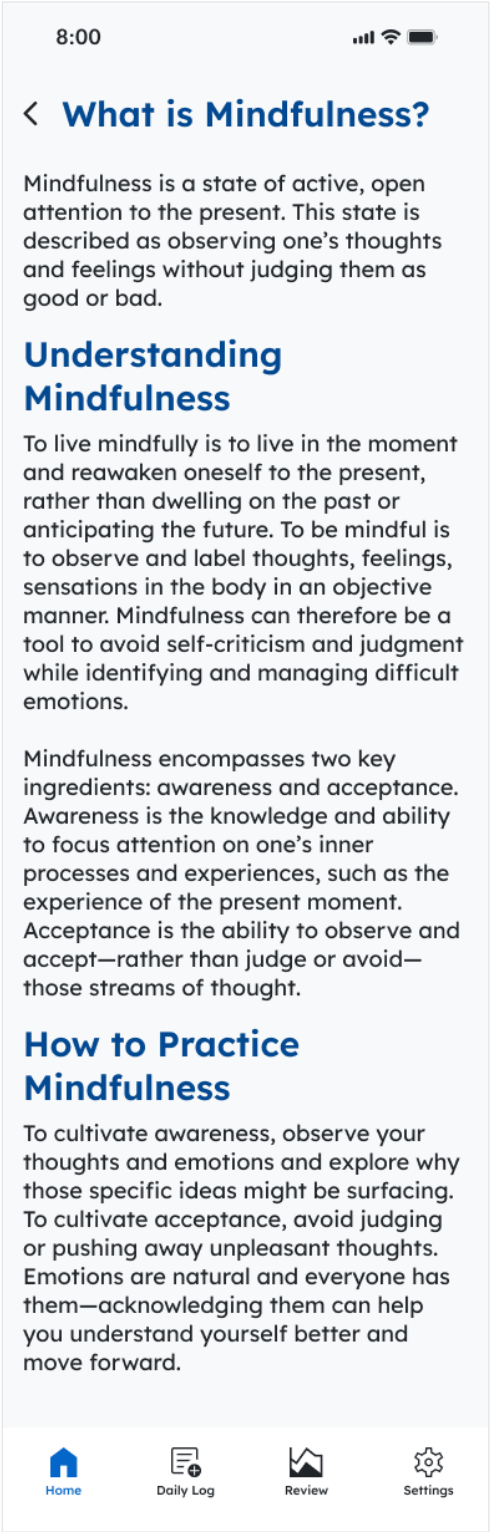


Figure 12

Mindfulness Overlay

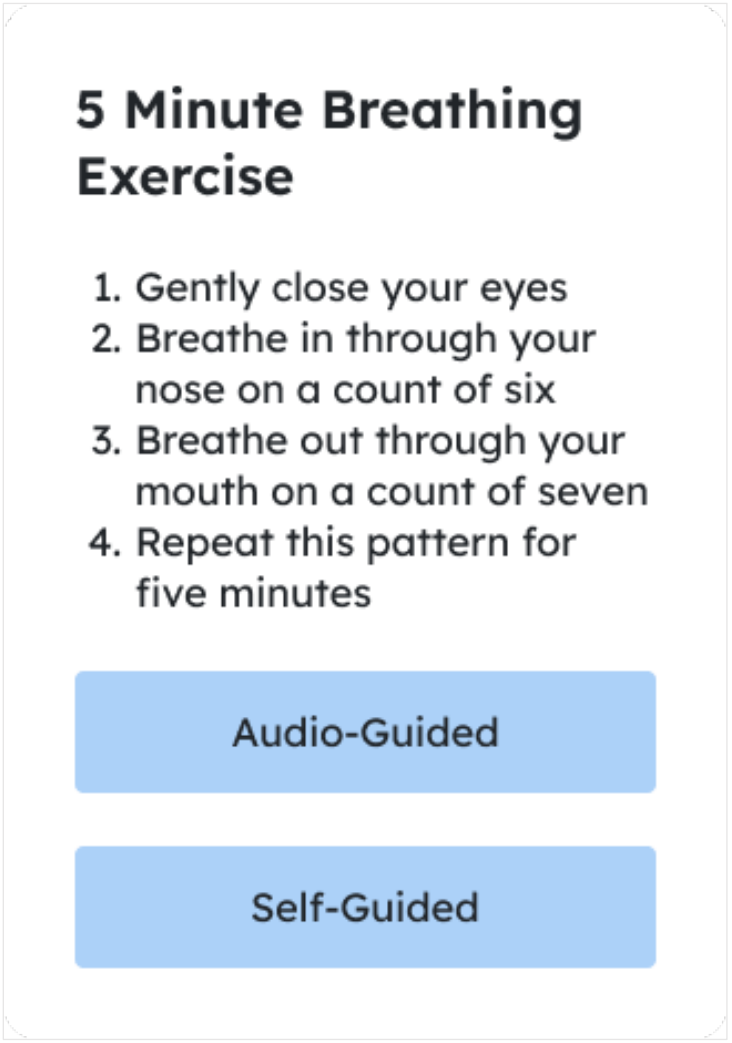


Figure 13

Budgeting Information Overlay

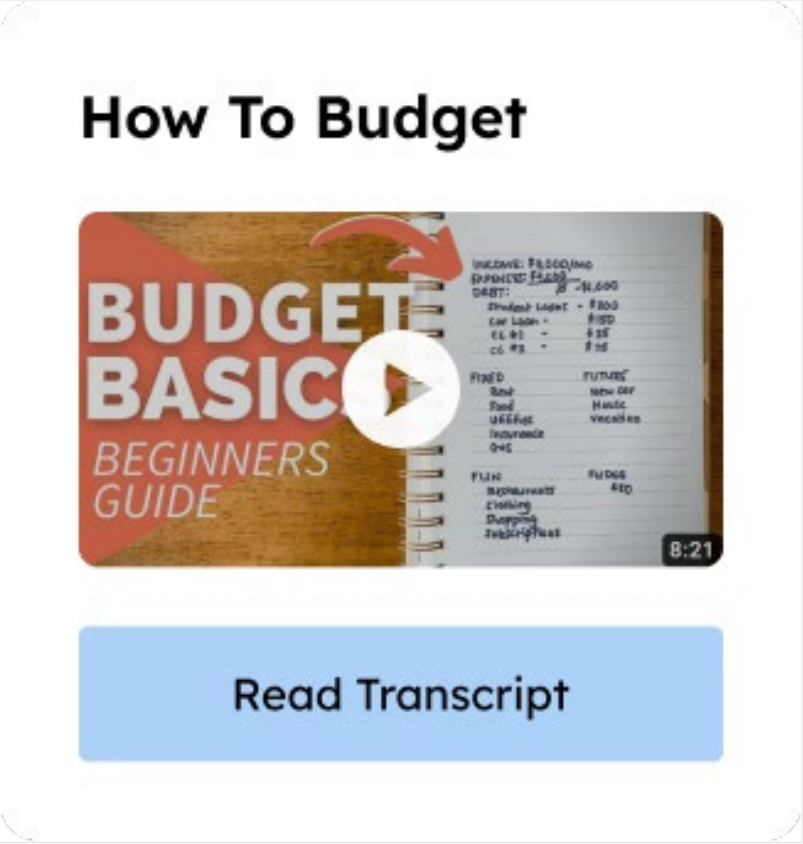


Figure 14

Notifications Page

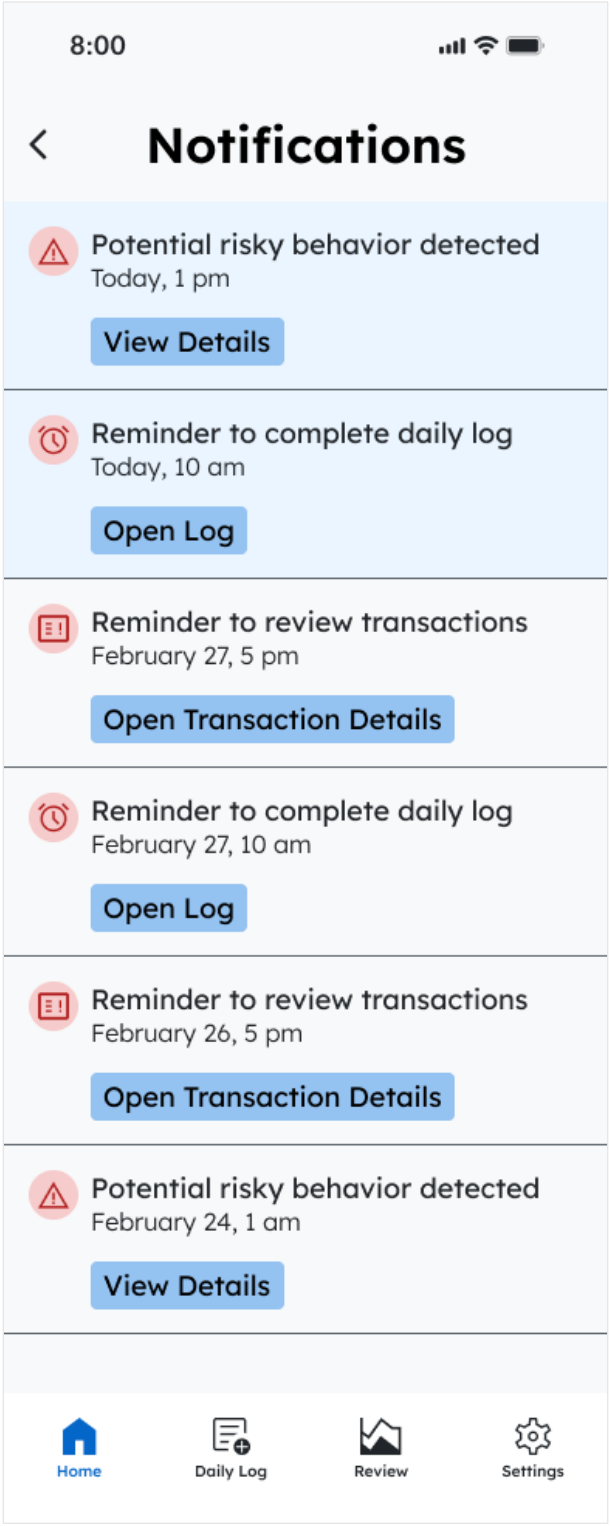


Figure 15

Risky Behavior Overlay

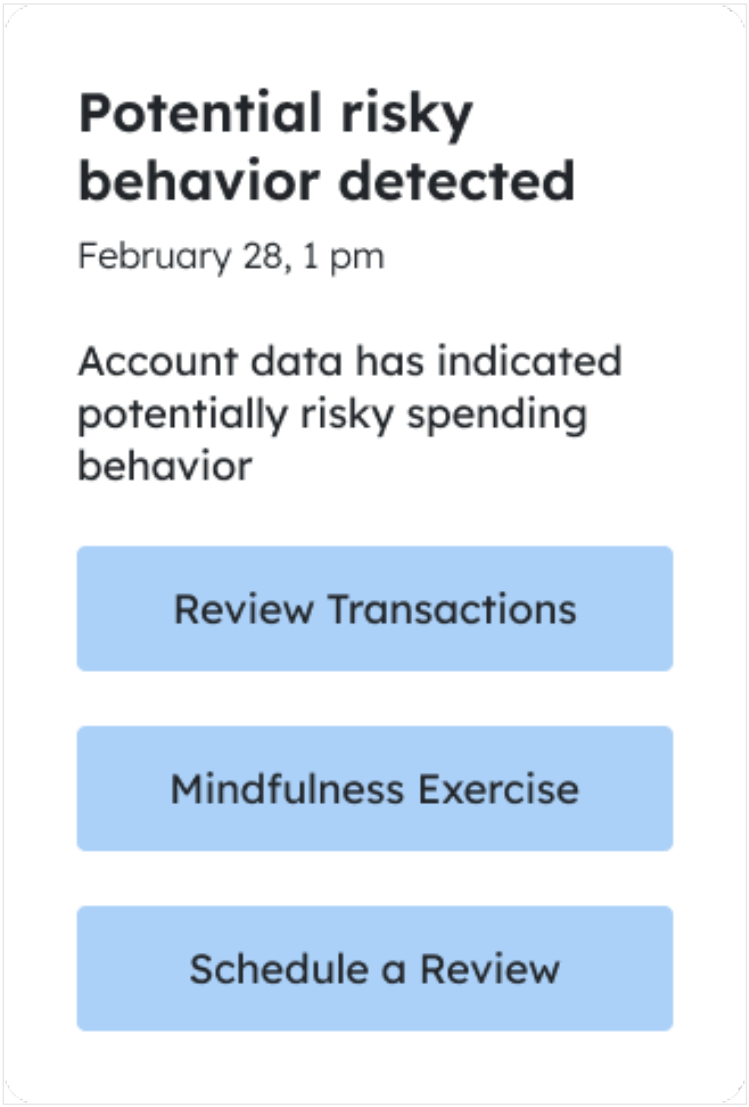


Figure 16

Daily Log Page

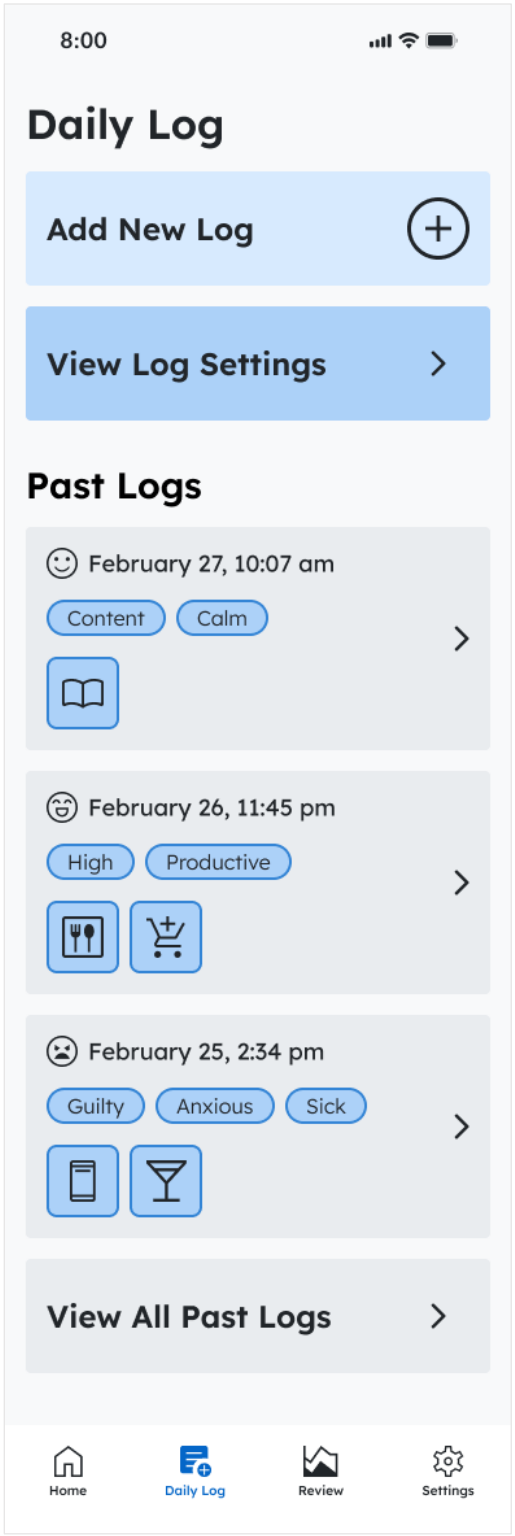


Figure 17

Past Logs Page

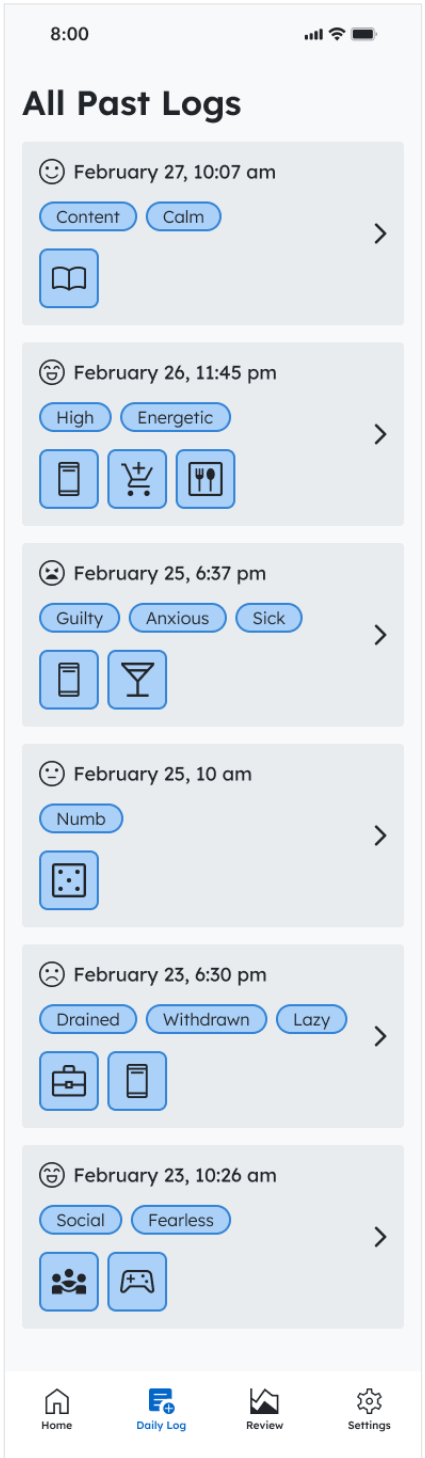


Figure 18

Past Log Overlay

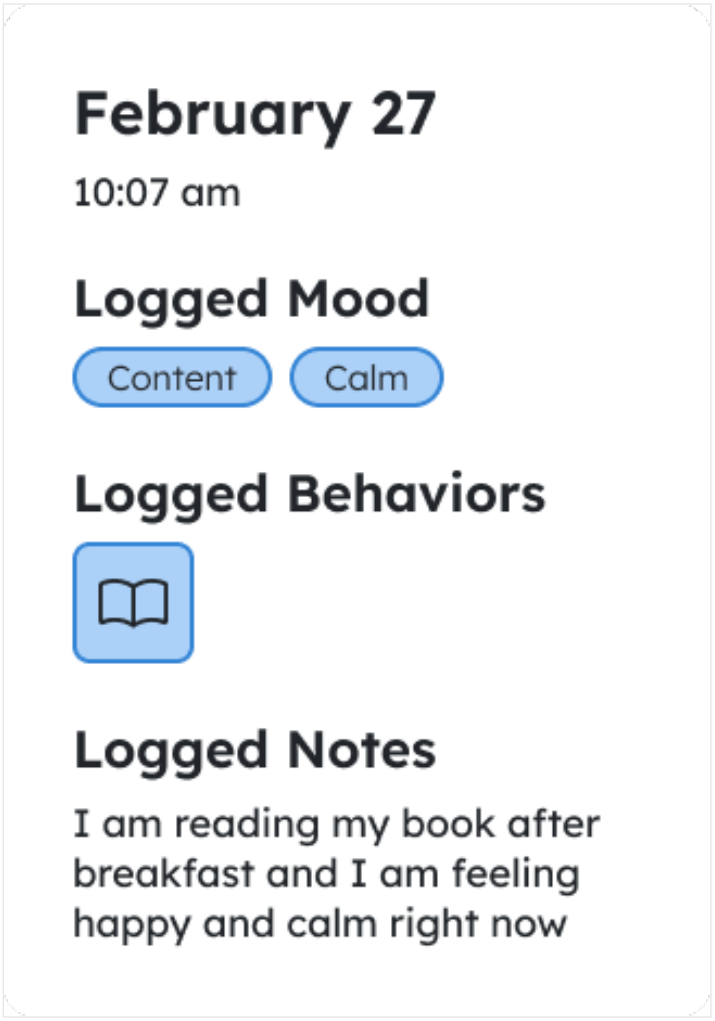


Figure 19

New Log Page One

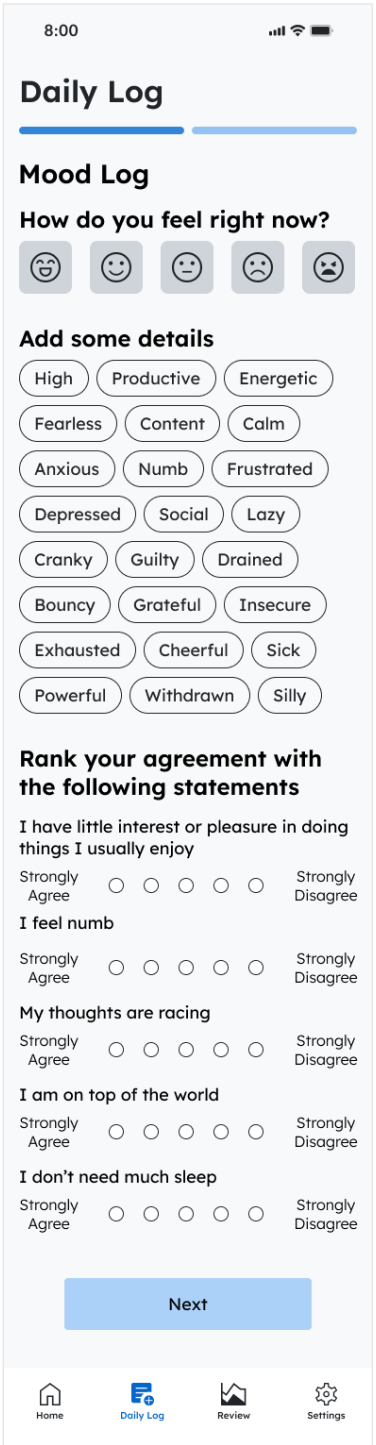


Figure 20

New Log Page Two

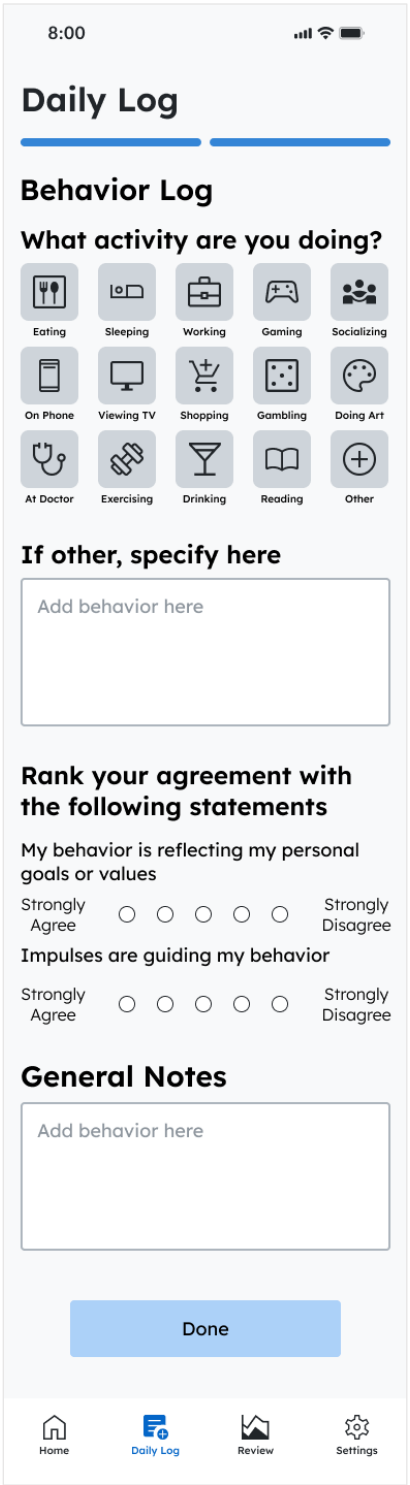


Figure 21

Transaction Review Page

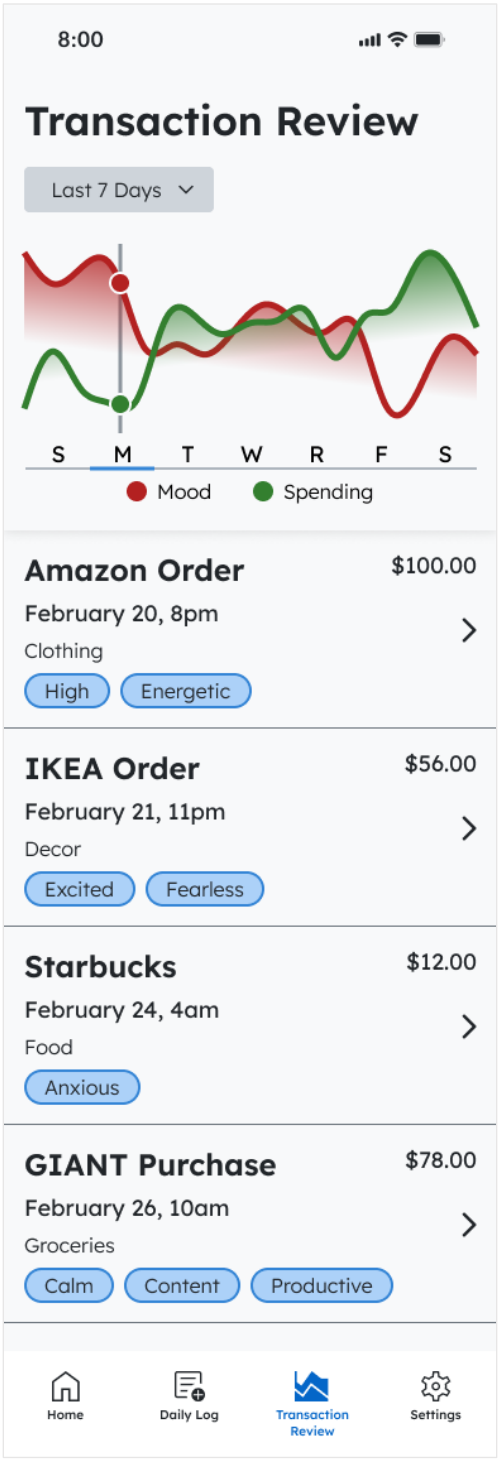


Figure 22

Past Transaction Overlay

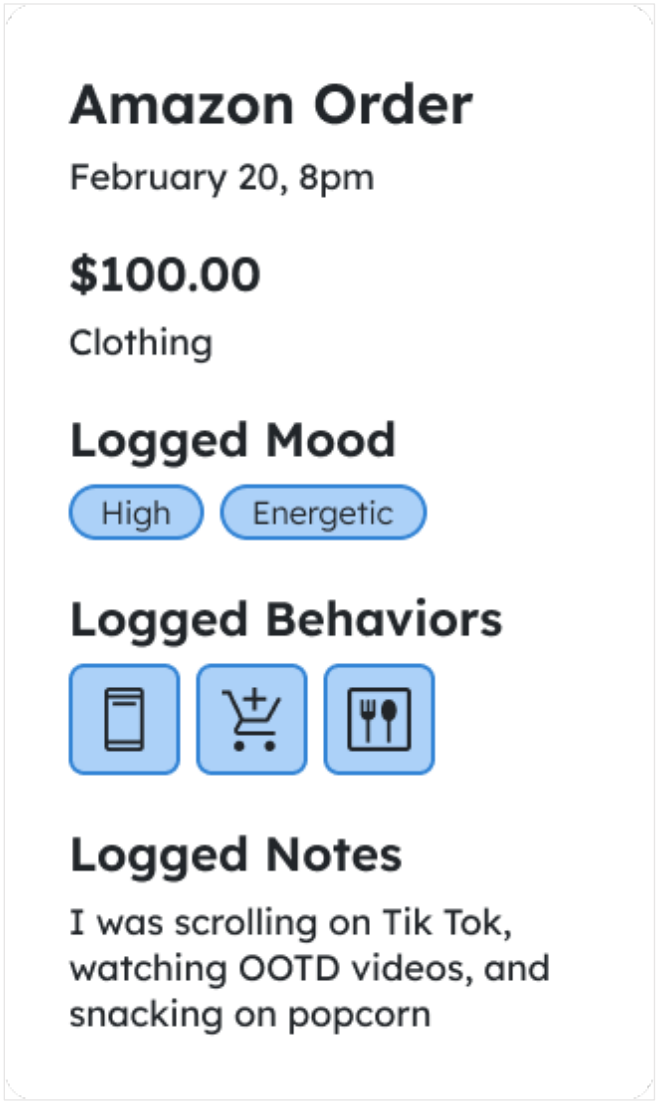


Figure 23

Settings Page

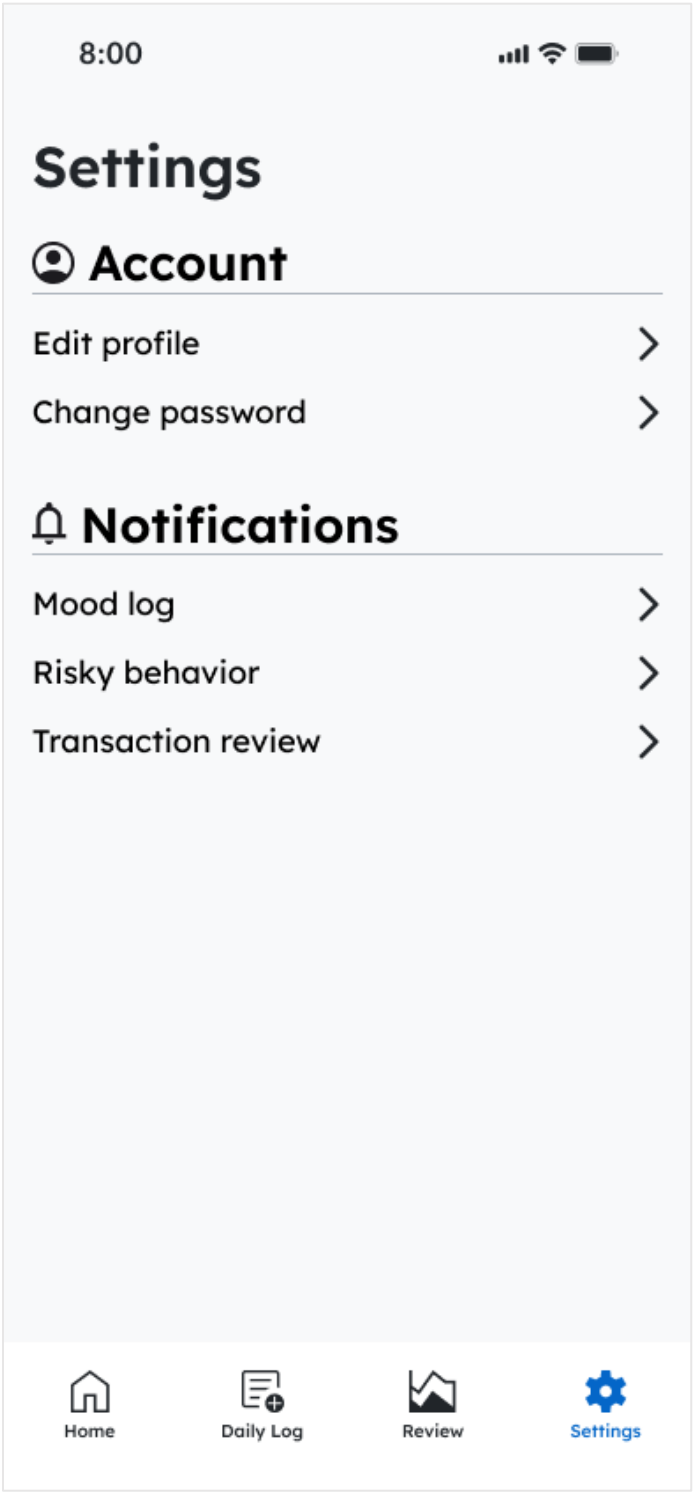
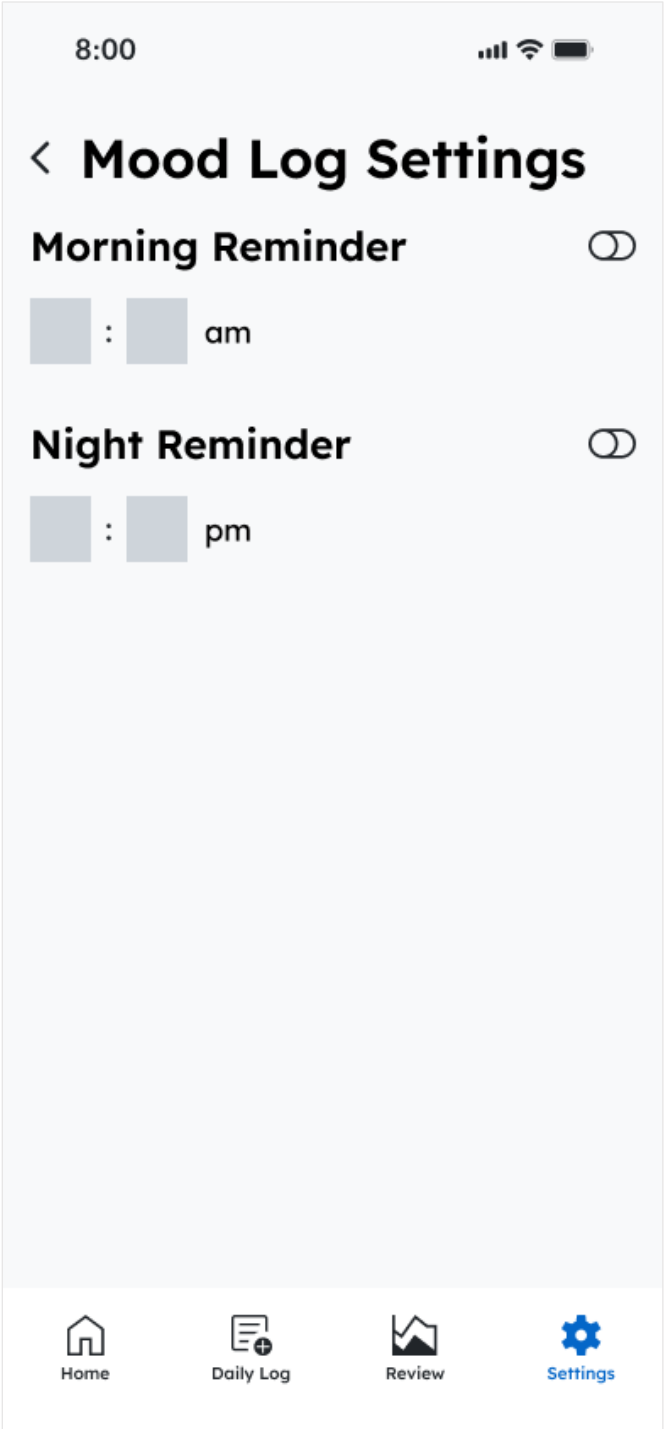


Figure 24

Mood Log Settings Page



Appendix E

Post-Evaluation Changes

Figure 25

Overlay with Updated Exit Button

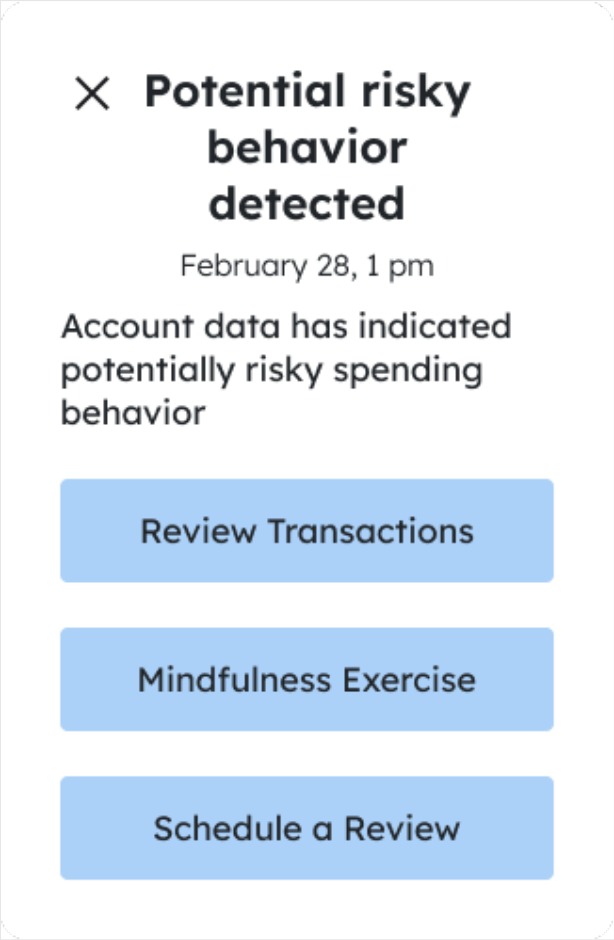


Figure 26

Updated Navigation Bar Components

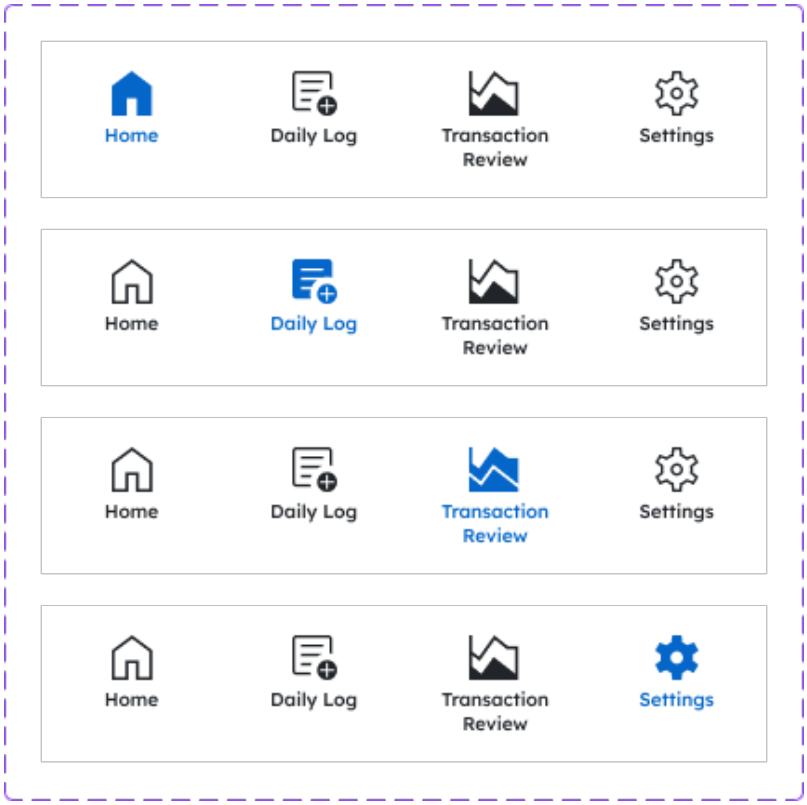


Figure 27

Home Page with Updated Navigation Bar

Figure 28

Updated Likert Scales

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ACADEMIC VITA

Jennifer Hodsdon

EDUCATION

The Pennsylvania State University, University Park *Graduation: May 2023*

- Bachelor of Science Human Centered Design and Development
  - Minor in Psychology
  - Focus Area in Digital Arts
- Schreyer Honors College

WORK EXPERIENCE

Lowe's Companies, Inc. *May 2022 - August 2022*

User Experience Design Intern

- Converted design elements, patterns, and templates into full Figma components for the Post-Purchase Design Library using variants, Booleans, swap instances, and text properties
- Participated in moderated design testing sessions and synthesis
- Executed audits on content and design with the goal of enhancing consistency

Erie Insurance *May 2021 - August 2021*

Business Analyst IT Intern

- Collaborated with software engineering team to design capacity management tool which provides estimates of project delivery dates to business partners
- Wrote user stories, requirements, and acceptance criteria; conducted elicitation sessions and requirements reviews; and analyzed months of historical data
- Presented final capacity management tool and analysis documentation to IT Managers and HR Team

PROJECT EXPERIENCE

Human-Centered Design for Mobile Computing Project *January 2022 - May 2022*

- Built functioning unit converter application in Android Studio with team members

Digital Portfolio Elements Project *August 2021 - December 2021*

- Designed an application to be utilized by undecided students that will enable exploration of majors and careers to find a major of interest
- Surveyed stakeholders and analyzed results in an affinity diagram to elicit common behaviors, goals, and needs
- Transformed hand-drawn sketches and low-fidelity Adobe XD wireframe into high-fidelity Figma prototype

Methods for Studying Users Project *August 2021 - December 2021*

- Conducted contextual inquiry to view participants interacting with their current course scheduling system
- Constructed high-fidelity Figma prototype of a modernized scheduling system from hand-sketched wireframes
- Performed both moderated and unmoderated usability testing

Programming for the Web Project *January 2021 - May 2021*

- Designed and coded travel website with team members using HTML, CSS, and JavaScript

Design Practice in Human-Centered Design and Development Project *August 2020 - December 2020*

- Completed stakeholder interviews, user stories, use case diagram, product backlog, style guide, and various prototype iterations to produce interactive remote learning application in Figma

TECHNICAL SKILLS

- **Design** - Figma, Adobe XD, Adobe Photoshop, Adobe Illustrator, Adobe Premiere
- **Coding** - Java, HTML, CSS, JavaScript

LEADERSHIP AND ACTIVITIES

Days for Girls at Penn State *November 2019 - Present*

Administrator - Elected April 2021

- Organize meeting logistics and manage official Days for Girls PSU email and Instagram accounts
- Execute and promote Days for Girls fundraising initiatives and campaigns

Omega Phi Alpha Service Sorority *November 2020 - Present*

Technology Chair - Elected November 2020

- Orchestrate all aspects of technology during recruitment, including operating Zoom for 75+ people and creating social media graphics to recruit new members

Merch and PR Chair - Elected April 2021

- Designed merchandise, communicated with apparel supplier, and coordinated payments from members

Division of Undergraduate Studies (DUS) Leadership Council *April 2020 - May 2021*

- Crafted and facilitated hour long leadership development meeting with partner
- Launched DUS Instagram and worked with team of 10 to create weekly Instagram posts that capture the DUS experience