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Informative Journaling Application (Unwind) for Ambient Awareness on Mood in Young Adults to Reduce Anxiety and Depression: A randomized, placebo-controlled trial

Jalen Wang

Abstract

The mental health of young adults in America is worsening. Technology-based interventions may offer an accessible way to help with this problem. The objective of the study was to determine the feasibility and preliminary efficacy of an informative journaling application to reduce symptoms of anxiety and depression for young adults. In an unblinded trial, 20 individuals age 18-22 were recruited from Dartmouth College and were randomized to either participate in using the informative journaling application (Unwind) (n=10) or were directed to a National Institute of Mental Health pamphlet as part of the control group (n=10). All participants completed the 9-item Patient Health Questionnaire (PHQ-9) and the 7-item Generalized Anxiety Disorder scale (GAD-7) at the beginning and end of the one-week study period. The results from the pre-test of PHQ-9 and GAD-7 and post-test of PHQ-9 and GAD-7 indicate that the use of the Unwind application resulted in a reduction of anxiety and depression symptoms. Thus, we conclude that an informative journaling application can be a feasible and effective way to reduce symptoms of anxiety and depression for young adults.

1. Introduction

The mental health of youths within the United States is worsening [1]. Multiple studies have found that mental health problems are prevalent and persistent, especially within the student population [2]. Identifying and resolving these problems is paramount as severe mental disorders typically stem and are preceded by less severe problems (such as anxiety) that are unlikely to

reach professional attention. In a National College Health Assessment study, they found that one in three undergraduates reported feeling anxious, depressed, or had difficulty functioning at least once in the previous year [3]. There is an unmet need for mental health treatment among young adults with over 40% of youths not receiving the mental health services they need, even in states with the best access [1]. In recent years, there has been an increasing number of studies that tackle this problem with the assistance of technology, especially in an age where most young adults have access to a smart device.

Studies have shown the efficacy of technology-based interventions for treating symptoms of anxiety and depression [4]. These studies not only show the use of technology as a feasible approach to reducing anxiety and depression in the student population [5], but also, a cost-effective, safe approach for dealing with such disorders [6]. Generalized anxiety disorder (GAD) is defined as a state of excessive worry for an extended period of time [7]. GAD can be triggered from a number of things that include personal health, social interactions, work, and even every day, common-play tasks; however, the effects of untreated anxiety can result in real problems. Depression is characterized as a more serious mental disorder that negatively impacts how the person feels [7]. Research has also shown that awareness of anxiety and one's mood is an important steppingstone for resolving and treating such feelings [8]. We aimed to tackle this problem with the use of a smartphone application that not only reduces anxiety, but also creates ambient awareness of one's mood.

Within our research, we wanted to test if an informative journaling app that provided ambient awareness of one's mood could reduce anxiety and depression symptoms within young adults. We hoped to provide an accessible method to increase awareness of one's mental health so college students could more easily understand their mood and seek professional help if they

needed it. We choose to create a journaling application because of previous studies that have shown journaling as an effective method for dealing with mental health disorders; in fact, writing and organizing one's thoughts have been shown to reduce stress and anxiety caused by these thoughts through finding reasonable solutions [9]. Although this study did not focus on digital journaling, we believed, especially with the help of guided questions within journaling, the process of putting thought to digital text could still allow for the release of emotional expression and lead to a positive health benefit [9].

Our research was especially motivated by the recent COVID-19 pandemic that has overtaken and changed many people's lives. Beyond the mass home-confinement and added stress associated with catching the virus, a recent study has shown the adverse effect of the pandemic on the health of Americans [10]. In particular, added stress and anxiety have come from job insecurity, inadequate supplies, medical concerns, and a dramatic change in work and life routines [10]. We hoped that our solution could help young adults both during and after this pandemic to create a healthier society.

We built Unwind, a multi-platformed journaling application designed to create ambient awareness of the user's mood and promote reflective journaling. This application allows the user to easily journal their days with the help of guided questions. Additionally, users are informed on their past moods in order to better understand how they have been feeling. Our research found that the Unwind application could reduce symptoms of anxiety and depression within young adults.

2. Related Work

We believe Unwind is currently the only study that utilized a journaling-based approach to reduce anxiety and depression in young adults. However, other methods have been tested with

differing efficacy in tackling the same problem. For example, Fitzpatrick et. all built a conversational agent (Woebot) that was fully automated to deliver a self-help program for college students [13]. They found that those that utilized Woebot significantly reduced their symptoms of depression and anxiety over the period of study. Thus, they concluded that conversational agents could be a feasible and effective manner to deliver cognitive-behavioral therapeutics (CBT).

Other applications have been developed to be used in conjunction with a general practitioner. Reid et. all created a mobile type program that helps keep track of mental health assessment by monitoring mood, stress, activities, sleep, exercise pattern, and alcohol consumption [14]. They found that this allowed for a more effective diagnosis and treatment when coupled with licensed professionals in dealing with the individuals mental health disorder.

Fulmer et. all utilized integrated psychological artificial intelligence to offer college students with CBT [15]. They used their AI, Tess, to help reduce self-identified symptoms of depression and anxiety within their 75 participants randomized controlled trial. They found that Tess was a feasible and cost-effective method to deliver CBT with a reduction in both anxiety and depression; however, it could not replace the role of a trained therapist.

Dear et. all focused their research more on elderly patients over the age of 60 years [16]. They created a self-guided internet delivered CBT program for treating anxiety and depression. In their 47-participant trial, they found significant improvement in both anxiety and depression. Their participants noted that they found the program worthwhile and useful such that they would continue using such a program.

3. Methods

Recruitment and Procedure

Potential participants were recruited via email through Dartmouth College’s Listserv system. Important criteria and requirements were laid out such as a minimum age of 18 years, a daily commitment to potentially use our journaling application, and accessibility to a smart device. Users did not receive any monetary incentive to participate within our study. Once potential candidates were selected, they were sent another email confirming their willingness to commit the time necessary to finish one journal entry daily for the duration of one week. Race and gender were not considered when selecting candidates. A total of 22 participants were selected with 2 being beta-testers, 10 being participants who utilized our application, and 10 being participants who were part of our control group. All participants were randomized using a generator for either 0, 1, or 2 corresponding with control group, application utilizers, and beta-testers respectively.

Intervention

Figure 1-3. Visuals of the Unwind Journaling Application

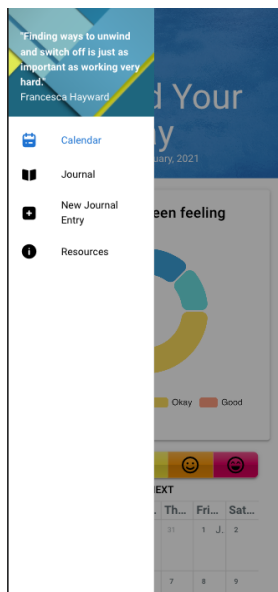


Fig 1. Navigation View

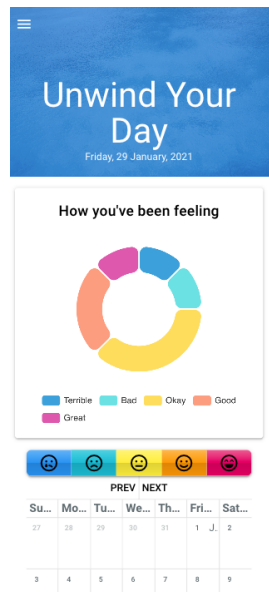


Fig 2. Homepage View



Fig 3. Journal View

Unwind

Unwind is a multi-platformed journaling application designed to create ambient awareness of the user's mood and promote reflective journaling. Users of Unwind were given instructions to download the application and then allowed to use it whenever and wherever they wanted to during the study period. The journaling application is platform agnostic and can be used on both desktop and mobile devices. Upon entering the application, there is a daily greeting with a selection of five different emojis ranging from angry to extremely happy that the participant must select (depending on the participants mood for the day) (see Figure 2). The journal itself is a guided journal that includes specific questions to track your current mood and reflective questions that provoke thoughts. These questions include ones such as "What are you most grateful for at the moment" and "What worries you the most currently." These questions were designed to both understand stressors in the user's life and remind users of the positive. Along with these questions was also the option to reflect purely on that day and whatever the user wants to write. An option of attaching a photo was also available to make that day more memorable and associate that photo with their mood for that day.

The journal interface was modeled after popular social media applications such as Facebook and Instagram that allows the user to scroll and see their journals as "feed," sorting the journal in chronological order in an easy, scrollable fashion (see Figure 3). The user can filter their feed by week, month, and year; the user also has the option to delete a journal entry if they choose too. Journals are stored cross-platform in a secure database that only the user can access.

The application features a side navigation bar that easily allows the user to navigate from new journal entries, to their journal feed, and the application homepage (see Figure 1). On the

homepage of the application, the user is shown infographics of how they've been feeling based on the initial greeting emoji the user selected and information gathered from their past journal entries (see Figure 2). In addition to the infographics featured on the homepage, there is also a calendar that the user can more easily discern how they felt on each day. Each day within the calendar is colored in reflecting the mood the user felt that day, with no fill as the default if the user did not use the application that day. The use of infographics in conjunction with the calendar were presented on the homepage to create ambient awareness of how the user has been feeling immediately upon entering the application.

To increase user engagement with the application, users can set a predetermined time that launches a push notification on the user's device, reminding them to "unwind" for the day and use the journaling application. This predetermined time can be easily modified and toggled on and off depending on the user's preference.

Information Control Group

Within the information control group, participants were directed to continue their normal activities without the use of the Unwind application. Instead, they were directed to the National Institute of Mental Health (NIMH) resources entitled "Coping with Stress" and "Depression" [7]. These NIMH pamphlets detailed what stress and depression are, how they might affect one's overall mental health, how to identify whether you are currently dealing with these disorders, and how you can manage your symptoms. They also include a list of resources such as a helpline number, frequently asked questions, and other resources to aid the participants should they need it. We asked participants to read the pamphlets in their entirety during the week, though we could not track if users truly did.

Pilot Study

Pilot study testers were selected to try the application before testing was done with the Unwind test group. They utilized the application for the duration of the week, being asked to take note of any and all problems they encountered. Feedback from these testers would be incorporated within the application re-design in order to reduce the number of problems the Unwind group might face such as an unintuitive design or bug within the application.

Measures

Generalized Anxiety Disorder-7

The Generalized Anxiety Disorder 7-item scale (GAD-7) is a measure to assess whether a person is experiencing anxious thoughts or behaviors. Each question within GAD-7 is measured on a scale of 0 to 3 with 0 being “none at all” and 3 being “nearly every day.” A total score of 21 is possible with a score greater than 10 indicating moderate anxiety and a score greater than 15 denoting severe anxiety. The GAD-7 has shown good reliability in past studies of constructing a valid diagnostic of a person’s anxiety level. Questions within GAD-7 include those such as “Feeling nervous, anxious, or on edge” and “Worrying too much about different things” [11]

The Patient Health Questionnaire-9

The Patient Health Questionnaire (PHQ) is a version of the PRIME-MD diagnostic instrument for common mental disorders. PHQ-9 is a subset of PHQ to identify depressive thoughts, which scores each of the 9 DSM-IV criteria as either “0” (not at all) to “3” (nearly every day) [12]. A total score of 27 is possible. Scores ranging from 0-5 indicate no symptoms of depression, 5-9 as mild symptoms, 10-14 as moderate symptoms, 15-20 as moderately severe, and 20-29 as severe symptoms of depression. PHQ-9 is a widely accepted measure to help diagnose depressive disorder and is widely used as a clinical and research tool. Questions that the

PHQ-9 include are those such as “Little interest or pleasure in doing things” and “Trouble falling or staying asleep or sleeping too much.”

Statistical Analysis

To determine whether there is a statistically significant correlation for users that utilized the Unwind application, independent paired t-Tests were conducted on the GAD-7 and PHQ-9 results. We conducted a two tailed t-Test to gauge if there was a statistical significance. For our significant level, we used a standardized 0.05 alpha. Our two tailed t-Tests would test the statistical significance in both directions with each tail having a distribution of 0.025.

4. Results

Between January 12th to January 26th, a total of 23 participants responded to our initial outreach to participate in our study. Of which, 22 were selected, one being excluded because they were already receiving professional help in dealing with their mental health disorder. The total sample size for our study was N=22 of which participants were either selected to be a beta-tester (N=2), Unwind participant (N=10), or control group participant (N=10) through a randomized algorithm.

Attrition

Of the 22 originally selected candidates, all 22 participants went on to provide complete data, giving a total attrition rate of 0%. We believe there was no attrition (loss of participants or incomplete data) for this study as the trial was only a week in duration. Additionally, participants had to want to participate due to the nature of how we found users

Figure 4-7. Change in mean depression (PHQ-9) and anxiety level over the study period for both the control and Unwind user groups.

Figure 4. PHQ-9 Scores for Unwind group

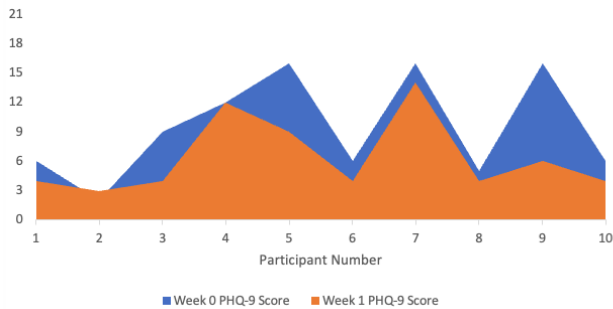


Figure 5. PHQ-9 Scores for control group

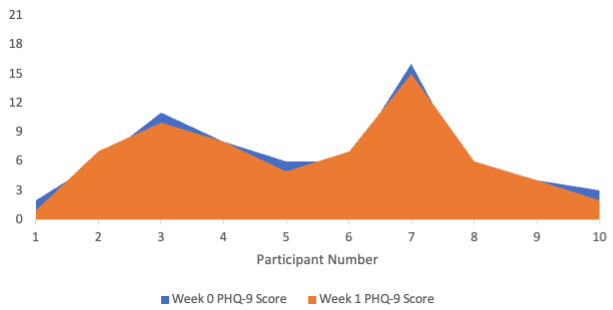


Figure 6. GAD-7 Scores for Unwind group

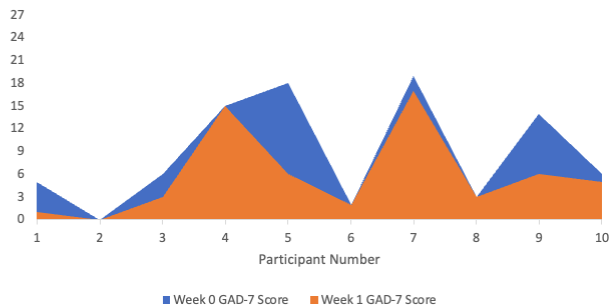
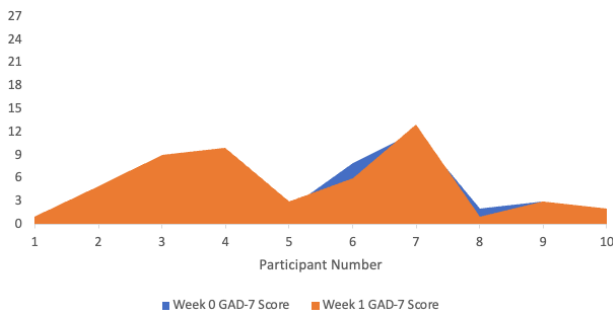


Figure 7. GAD-7 Scores for control group



Preliminary Efficacy

As shown in Figures 4-7, primarily results indicate a clear mean reduction in the severity of depression and anxiety symptoms. Both PHQ-9 (Pre-test, $M=9.4$, $SD=5.2$, Post-test, $M=6.4$, $SD=3.9$) and GAD-7 (Pre-test, $M=8.8$, $SD=7$, Post-test, $M=5.8$, $SD=5.8$) showed a mean change of 3 points within the duration of the study period. The control group for PHQ-9 (Pre-test, $M=6.6$, $SD=4.2$, Post-test, $M=6.5$, $SD=4.0$) and GAD-7 (Pre-test, $M=5.2$, $SD=4.0$, Post-test,

M=5.3, SD=4.1) on the other hand showed a 0.1 average decrease and 0.1 average increase respectively. Only one Unwind participant within our trial showed an increase in stress or depression symptoms after using our application; however, it should be noted that this participant exhibited almost no depressive or anxious thoughts with scores of 2 and 0 in their pre-test for PHQ-9 and GAC-7 respectively. Thus, we do not believe our application caused an increase in their anxiety or depressive symptoms.

Statistical Analysis

The results from the pre-test of PHQ-9 (M=9.4, SD=5.2) and GAC-7 (M=8.8, SD=7) and post-test of PHQ-9 (M=6.4, SD=3.9) and GAC-7 (M=5.8, SD=5.8) indicate that the use of the Unwind application resulted in a reduction of anxiety and depression symptoms, $t(10) = 2.8, p = 0.02$ and $t(10) = 2.3, p=0.04$ for PHQ-9 and GAC-7 respectively.

Use and Acceptability

Participants using the Unwind application created a journal entry within the application at least once per day for the duration of the study. Although we did not track how often a user entered the application, we confirmed both via the application's backend that 10/10 participants checked-in daily. There was no way to confirm whether the control group utilized the NIMH website provided to them and read through the pamphlets on stress and depression; however, each of the participants attested that they spent some time reading the information on the website at an end of study interview. We acknowledge this could be a potential issue in our study and cause a bias if a parti4

Qualitative Analysis

In understanding whether or not the application helped the participants utilizing the application, a post-week interview was conducted with each person. Although the sample size of

participants who utilized the application (n=10) was not large enough to create a meaningful thematic map of the responses, three general themes arose when asked about the usefulness of the application. The first of which was the visibility of the infographics upon entering the application. One user mentioned “it was nice to see how I felt yesterday so I could try to improve how I am today.” Secondly, users mentioned how they liked the reflective prompts within the journal entry. One participant commented on how this was “not something she usually thinks about” and thought that it was helpful to understand why she felt a certain way to help change her attitude in approaching that subject. Lastly, users liked how there was a reminder feature within the application to remind the user to “unwind” for the day. They found it was easy to incorporate into their routine and got into the habit of journaling at the same time each day. One major concern that was raised about the application, however, was that a few users wanted the option to edit a previous journal entry. Often, participants thought of something else that they wanted to add to their journal that they had previously forgotten to write and there was only the option to delete rather than to edit.

5. Discussion

Principal Results

To our knowledge, this is the first randomized trial of a journaling-based application designed to increase ambient awareness of one’s mood. The objective of the study was to determine whether journaling and increased awareness of one’s mood could be used to decrease symptoms of anxiety and depression in young adults. We hypothesized from pre-established research on the benefits of journaling that by guiding our users to answer reflective questions and having users more aware of their mood, we could greatly reduce anxiety and depression levels relative to our information control group over the 1-week study period. We found that users who

utilized Unwind experienced a statistically significant reduction in their depression and anxiety level, supporting our hypothesis.

Limitations

There are several methodological limitations within our findings for this study. The first of which is the small number of participants (N=10) for each of our test groups. Our study was a proof-of-concept idea to test our previously stated hypothesis. However, it should be noted that just the difference of two participants' responses could have greatly impacted the results of our study. Additionally, the community we tested was limited to just Dartmouth College and we did not factor in criteria such as socioeconomic status, race, or gender. Thus, our results may be an overgeneralization.

Conclusion

Because of the limitation previously stated, our results should be met with some caution and the findings need to be replicated. Nevertheless, our study concluded that an informative journaling application with ambient awareness for one's mood has the potential to be used to reduce anxiety and depression among young adults.

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Appendix

Link to participant responses and raw data:

https://docs.google.com/spreadsheets/d/1Woq_p1E3ziYa_haHCxni_qpLFD07WIk/edit#gid=2133618853