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Improving Student Mental Health Through Health Objectives in a Mobile App

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Abstract. This research sets out to validate a mobile app intervention that aimed to improve the participant's mental health by asking them to engage in small daily challenges. The challenges encouraged the participant to create a better sleep, diet, and exercise routine, which in turn create better mental health. The challenges were gamified with points, badges, and leaderboards. The participants were split into two groups with the gamification features only shown to half of the participants to help measure the effect of gamification on the engagement. The study gathered 73 participants, of which 67 completed at least one challenge, 30 participated in multiple mental health surveys allowing us to calculate a change in mental health over time, and 8 completed the entire 8-week trial. Throughout the trial participants were asked to fill out a 4-item questionnaire to evaluate their mental health, while analytics were gathered about their engagement with the app as measured by the number of days they opened the app and number of points they collected. Correlation analyses were performed to measure the relationship between engagement and mental health and split by group. We observed a negative correlation between points gained and mental health score, as well as a difference in means between the control and experiment groups suggesting that engagement could be influenced by gamification and has a positive effect on mental health.

Keywords: Sleep · Diet · Exercise · Physical Activity · Intention · Intrinsic Motivation · Patient Health Questionnaire (PHQ) · System Usability Scale (SUS) · Measurement of the Intention to be Physically Active (MIFA)

1 Mental Health Concerns

1.1 State of Affairs

Student mental health has been a concern for a long time [1–3]. Post-secondary education is a transitioning period for a lot of individuals and comes with a new set of responsibilities and challenges. Half of post-secondary students report struggling with anxiety, depression, or even suicide [4]. Due to the overwhelming demand on the counseling system [2] students may have to wait for weeks before receiving any help, which can make the difference between prevailing, or dropping out. Occasionally if the issues are severe, it can mean the difference between life and death.

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Even though institutions have been increasing their support programs, many students are still not using these services. A survey discovered that about half (54%) of respondents with mental health difficulties did not seek help [5]. Other studies confirmed that students are either unaware of the access they possess, or have stigma-related inhibitions about using such services [6, 7].

In many cases, preventative measures can help students cope with stress. Studies have shown that healthy sleep, diet, and exercise can contribute to healthier mental function [8–11]. The Government of Canada published a guide to better mental health where it stated the top three ways to improve one's mental health are through eating a healthy diet, being physically active, and getting enough sleep [12].

1.2 Motivation

Recent studies have shown that there is a need for students to improve their sleep, diet, and exercise [13–15]. Other studies suggest habits relating to sleep, diet, and exercise can be changed through interventions that can result in better quality of life, performance, and output [10, 16–18]. By helping students improve these three habits, it is possible to positively affect their mental health [12, 19].

The recent COVID-19 pandemic events also had a negative impact on mental health and mobility. As lockdown and self-isolation mandates rolled out throughout the world more individuals turned to indoors and their mobility greatly decreased along with good eating habits and mental health [20]. This decline in mental health is also reflected in the Canadian labour force which showed an increase in mental health related disability [21].

Research has shown that using mobile apps as interventions for a variety of mental health issues can be successful [22–26]. Research has also shown that mobile app interventions can be used to improve sleep, diet, and exercise, and observe that digital technologies and mobile apps are an effective and sought-after means of intervention for improving physical or mental health, and that mobile apps can be used to influence and change behaviour [27–29, 47].

The availability of mobile devices, the reach and low cost to the user of mobile apps, and the ease of engagement make apps an appealing means of intervention, as evidenced by a multitude of studies [23, 24].

However, several papers note that there is a lack of standardized testing and validation of these interventions [23, 24, 30, 46]. The aim of this research was to conduct a randomized controlled trial (RCT) that validates the effectiveness of the different aspects of the intervention. By designing the application in a way that allows for monitoring and logging of activity, progress, and engagement, a quantitative analysis can be carried out and an evaluation can be made about each aspect of the intervention.

Batra et al. reviewed studies over the last 10 years dealing with digital health technologies and noted that mobile apps were the most common, were primarily used for monitoring, and demonstrated feasibility for mental health care [22]. Grist et al. reviewed publications over the last 10 years to look for evidence supporting mobile app effectiveness [30]. They note that despite the large number of mental health apps available on the market, only a few have been mentioned in any clinical studies, and fewer still have quality results. The commercial app market is developing much faster than academic

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research, so the data that is available is limited due to apps being removed from the market or lack of clinical testing of those apps in the first place [30–32].

Of the apps that have been developed and available on the market for managing mental or physical health, most were commercially developed rather than with considerations for clinical trials [32], or input from healthcare professionals during the design stages [30] as recommended by a publication on the design of mobile health interventions [33]. Similarly two recent systematic reviews of mobile mental health interventions note the need for more accurate evaluation and reporting on the efficacy of these interventions [45, 46]. A recent review of mobile mental health app interventions draws from literature as well as analysis of available mental health apps and provides a list of sixteen recommendations that should be considered in future development to address issues and shortcomings of existing interventions [23]. Using these recent studies as an example and guide, it is possible to put together an app designed for a clinical trial that will validate the effectiveness of different features.

1.3 Literature Review

This generation finds themselves much more comfortable communicating through their mobile devices, which makes mobile apps an appealing, low-cost intervention [32, 34]. Current mobile health apps range from activity trackers, to building physical/mental resilience, to goal-setting and coaching for building self-confidence and self-efficacy, to health literacy as a means of prevention and coping [44].

A recent review of 17 studies evaluating app-based health interventions found apps to be an effective mechanism for changing behaviour but concluded that more randomized controlled trials (RCTs) are still needed [32]. The review also summarized suggested feature improvements and highlighted "self-monitoring, goal setting, feedback, and social networking features… amount of participant time required… user-friendly design, usefulness of the information, usability of the app… tailored advice, supplemented by additional background information" as useful features for mobile interventions. These recommendations were considered during the design phase of our project and many of them were implemented into the final mobile app.

Duncan et al. summarize the implementation of behaviour change techniques in different activity trackers and discuss the use of challenges, leaderboards, and social networks [35]. They note that leaderboards for sleep may be ineffective, due to the anxiety that may be caused by a competitive component; rather sleep is best encouraged by personalized goal-setting and prompting the user of the approaching time. They note instead that challenges and leaderboards can be an engaging way to encourage regular activity breaks. They also note that there is only modest evidence to support the effectiveness of social networks.

Bakker et al. conducted a review of literature and mobile health apps to create a list of sixteen recommendations that should be used by developers and researchers to direct mobile mental health research [23]. In short they suggest that Cognitive Behavioural Therapy (CBT) be used; that apps should be designed for use by regular individuals, not only those diagnosed with a disorder; that individuals are interested in prevention, rather than diagnoses and treatment; that the experience should be tailored; that recording thoughts, feelings, and behaviours elicits self-reflection, which is helpful for changing

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behaviour; that setting goals and schedules is an effective way to minimize avoidance; that education and literacy about mental health is a way to increase treatment credibility, and decrease stigmatization; that non-technology based engagements and interactions should be used; that gamification can be used to motivate the user, and should be done with user-set goals; that logs of past activity can be used as a way to review progress and draw narrative, which can help engagement; that reminders have been shown to reduce dropout rate and should be used to engage the user; that an intuitive interface and simple verbiage with non-action defaults that still allow participation are a good way to increase retention; and finally that randomized controlled trials need to be carried out to determine efficacy.

A recent study sums up behaviour change research with a three-dimensional model – predisposing, enabling, and reinforcing. Apps which increase the user's knowledge and self-efficacy influence predisposing, while apps that allow the user to gather data and self-monitor are enabling, and apps that enable social interaction and feedback are reinforcing [24]. To tap into some of these dimensions the app is designed in a way to predispose the user through education, information dissemination, and self-assessment; enable the user with suggested challenges, self-monitoring, and gamification; and reinforce the behaviour through in-game rewards and leaderboards.

1.4 Research Model and Hypotheses

Based on recommendations from prior research this study sets out to answer the questions of whether a mobile app can be used to improve mental health, and whether prolonged exposure can build motivation. To do this we build an open-source mobile app to encourage students to engage in self-care behaviour with the ultimate goal to improve mental health and inspire better habits. The app was made available to students world-wide and promoted through social media. This study attempted to measure and prove the effectiveness of this kind of intervention, as well as collect data to help refine and improve it in the future.

To make this observation we first needed to take baseline measurements of mental health and sport motivation. Then engage the user in self-care behaviour over a period of time while measuring their mental health status. At the end, we needed to measure any change in sport motivation and evaluate the usability of the mobile app.

Observing the participants' change in mental health as well as engagement with the app would allow us to measure correlation that might suggest that engagement could in part be responsible for the change in mental health. Additionally, if the System Usability Survey (SUS) came back with positive results we could also infer that the app was usable as desired and that technology was not a barrier to participation.

1.5 Experiment Design

The main purpose of the app was to allow the users to participate in daily challenges and anonymously submit responses to surveys. A clean, simple, yet detailed interface would allow the users to have brief interactions, while at the same time helping the study evaluate only the bare elements of the gamification without letting an attractive interface or engaging gameplay influence participation. The interaction with the app was meant

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to be minimal to avoid burdening the user with having to spend time on data entry and instead encourage engaging with the challenge to be the key element.

An interface presented the user with a few cards each morning stating the challenge, for example “Drink a glass of water” or “Do 5 push ups”. Each card allowed the user to check off the task when complete and for challenges with many repetitions a plus button allowed the user to track how many times they’ve repeated the exercise. The next day a new set of challenges was assigned to the user.

Since the app wanted the participant to focus on multiple areas of their routine (sleep, diet, and exercise) it was decided to slowly build the interaction and only ask the user to complete a few small challenges to start, then slowly build the engagement by offering new challenges every day and as the user engages more with the app.

As the user successfully completed a challenge for three days the user’s level for that particular challenge increased, and the next time they were assigned this challenge it required more from the user. For example the basic task of drinking a glass of water in a day, when completed three times then began asking the user to drink two glasses of water in a day, and so on until the user drank 8 or more glasses of water per day. Similarly with physical challenges to perform 5 pushups or squats eventually asked the user to do 10, then 15, and so on until 100.

2 Mobile Mental Health

2.1 Project Implementation

To carry out this study we created a mobile app that would challenge the user to engage in better sleep, diet, and exercise habits and measure their participation against their mental health scores at a regular cadence. We needed an app that would ask the user to engage daily but at the same time not demand too much time or commitment, and while encouraging consistent participation also being accommodating to occasional use. We needed a way to start the user at a low challenge level and gradually build up as they gain mastery in each of the different areas. We needed a mechanism for gathering survey responses, and splitting participants into control/experiment groups, while at the same time keeping everything anonymous. Finally we needed a way to measure and record everything like the participant’s engagement, their mental health, and their responses to occasional surveys.

We decided to give the user a lot of self-control and autonomy with completing the challenges. They should be able to participate by completing challenges of their choice, and not be hindered by not being able to complete or participate in a certain challenge. They should be slightly challenged by the activity goal, but not so much that it seems impossible, and build up more challenging goals as they complete existing ones. They should be able to complete the challenges throughout different times of day and easily record their metrics. The user should be able to receive reminders at key times of the day to encourage them to build better routines.

The primary technical requirement was to deliver a mobile app to the user’s device. We chose to develop an Android app due to cost limitations with developing for Apple devices. Android devices contributed to ~70% [36] of worldwide mobile devices at the time of planning and development, which allowed for the majority of market coverage.

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The secondary technical requirement was to deliver surveys and receive back responses from app participants anonymously. Some surveys needed to be delivered when the user first registered, then another survey throughout the trial, and then final exit surveys at the end of the trial. The survey responses needed to be able to relate to app usage, but without compromising anonymity.

With the above requirements in mind we built an Android app that connected with two microservice APIs. The front-end UI acted as the intermediary between the user and the APIs. While the back-end services handled database connectivity, keeping track of challenges and activities, tallying points and leaderboards, and delivering and receiving surveys.

2.2 Administration

To administer the infrastructure of the project, accounts were created with Google Cloud Platform (GCP) (for the database and servers), the Google Play Store (for hosting the mobile app), and Firebase (for error logging, analytics, and push notifications). The researcher created and managed a profile on the Google Play Store for the app, which also connected with the Firebase account to gain insights into app crashes, usage analytics, and facilitated push notifications.

During the trial the researcher would perform occasional database backups by logging into the GCP console and issuing a command to dump the database contents into an SQL file on a cloud storage bucket. These backups were kept in case of database failure and to be able to instantiate a copy of the live database locally for development and debugging.

At the end of the trial custom queries were executed against the Research and Application databases to export CSV files including UUIDs, daily activity summaries, and survey responses. Since the UUID generated by the Research server was later used to register with the Application server, this value was then cross-referenced to link user activity to their survey responses and observe if there is a relationship between the two.

2.3 Academic and Systematic Solution

To observe engagement, app analytics were used to measure the number of times the user opened the app over the duration of the trial, the number of challenges in which they engaged, and the number of points they gained by completing those challenges. Mental health level was measured with the Patient Health Questionnaire (PHQ-4) [37], which is a four-question survey measuring two factors - Depression and Anxiety. Scored from 0 to 12 where scores of 0–2 indicate “normal”, scores from 3–5 indicate “mild”, scores 6–8 indicate “moderate”, and scores 9–12 indicate “severe” mental health distress. The survey was offered every 7 days to better observe change over time. Of the 58 participants in the PHQ survey the average participation was every 12 days with 30 participants having more than one entry. The initial mental health state (PHQ^1) was recorded when the user first downloaded the app and filled out the first PHQ questionnaire.

To evaluate intrinsic motivation for physical activity a Measurement of the Intention to be Physically Active (MIFA) [38] survey was chosen. Based on the work by Pelletier et al. the original Sports Motivation Scale [39] was used to measure three factors for

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intrinsic motivation - to experience stimulation (ES), to know (KN), and to accomplish (AC). The modified scale has an additional factor for intention (IN) that is evaluated for changes after the completion of the trial.

The System Usability Scale (SUS) [40] helps evaluate if the intervention was successfully implemented. If the user interface (UI) or experience (UX) were hindering the desired engagement or flow for the user, then we could explain lack of user engagement by the usability of the system. The average score given was 73.125. Recent research consider the SUS score 68's correspondent adjective rating is OK, the score value between 68 to 80.3 means Good, and a score higher than 80.3 indicates Excellent for the perceived usability [41].

Nielsen suggests to test five users in a usability study and finds that with five users researchers can get close to the maximum benefit-cost ratio [42]. He also suggests to have 20 users for a study that aims for quantitative studies. Hwang and Salvendy [43] find that there are many discussions on optimal sample size for usability studies and the "magic number five" rule (which is also called "4 ± 1" rule) could detect 80% of usability problems. With meta-analysis results, they conclude "10 ± 2" rule is a general rule for optimal sample size for major usability evaluation methods [43]. Therefore, the usability of the proposed mobile health app is Good as classified by 8 users (~10%) who filled out the SUS survey.

3 Results and Discussion

The experiment was carried out by advertising the study through the Athabasca University bulletin board and social media. 74 participants were recruited and received at least one challenge and 67 participants completed at least one. While the average participant received 143 challenges and completed 59 (~40%), the top 10% was 8 participants with over 470 attempted challenges and between 200 and 600 completed challenges. Of the 74 participants only 56 filled out the demographics survey, and only 8 filled out the post-trial System Usability Survey. The mental health questionnaire was filled out by 58 participants in total, however 29 participants only filled it out once, 13 filled it out twice, 11 between 3 and 7 times, and only 7 participants filled it out 8 or more times. The participation data was analyzed using SPSS v28.0.1.1 [48] by performing t-tests, regression, and correlation analyses and looking for correlation between specific data points that would help support the proposed hypotheses. The data reliability and validity was tested by looking at the Cronbach's alpha and values to be greater than .7 which was observed for PHQ, and SUS questionnaires.

3.1 Analysis

The data gathered was used to measure engagement with the platform - how often the users were logging into the system and what kind of activities they were completing, as well as observe how a user's mental health changed over time and how it correlated with the user's participation and interaction with the app. At trial completion the SUS questionnaire was used to evaluate the usability of the system, by those who engaged

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for the entire 8 weeks, to determine if technology was a barrier to using the app and if the interaction was successful.

To evaluate mental health a Patient Health Questionnaire-4 (PHQ-4) was used. It was chosen for its terseness to encourage regular participation. The test reduced the number of questions from 20 in the original PHQ-20 down to 4 and was still found to explain 80% of the variance of the two primary factors - depression and anxiety.

The System Usability Scale (SUS) was used to evaluate the app overall from a usability perspective. This helps determine if the implementation lacked anything that may have acted as a barrier to participation.

The challenges assigned by the system had point values. As the user completed the challenge they were awarded an amount of points. The more points a user gained in a particular challenge the higher was the user's level in that activity. Next time the user requested a challenge for that activity, they received one in line with their skill level in that category. So the more pushups a user did, the more difficult the challenges became to eventually even out with the user's ability. The points can be shown to the user on a timeline as a self-monitoring tool in an effort to encourage and motivate more active participation. The points can also be summarized on a leaderboard in a similar effort to encourage friendly competition with the community.

These gamification features in particular were tested in our study by comparing participation and mental health between a control and an experiment group. The experiment group received the entire app experience with surveys, challenges, and the ability to see their points on a timeline and leaderboards. The control group received a reduced experience with no visibility into their points either via timeline or via leaderboards, meanwhile still receiving daily challenges, and surveys. The challenges interface for both groups was also the same. The only difference was a "Stats" menu item was not shown to the control group. In the end we were able to evaluate whether the gamification features had any influence on application usage and desired outcomes.

3.2 Reliability and Validity

All analyses were carried out using SPSS version 28.0.1.1 [48]. PHQ responses were grouped by participant and by date and analyzed for reliability. The 4 items testing 2 factors for Anxiety and Depression together had a Cronbach's Alpha value of .932. The responses were also analyzed using principal component analysis and a single component was extracted based on eigenvalues greater than 1.

3.3 Analysis Results and Findings

The primary focus of the study was to evaluate whether mental health could be improved through app use and based on the evaluated data this hypothesis was confirmed. We observed a negative correlation between engagement (ENG) measured by the number of points (PTS) a participant gained and their score on the mental health questionnaire (PHQ). In all the cases analyzed together we observed a slight but significant Spearman's rho correlation between PHQ and ENG.PTS. When we separated the results into control and experiment groups we observed the correlation as well, and slightly stronger in the experiment group. The results are summarized in Table 1. It makes more sense in our

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case to rely on Spearman's rho as opposed to Pearson r since the PHQ is affected with the duration of engagement (ENG) over time, and Spearman's rho can more accurately evaluate ranked data, which in our case was ranked by the date of the survey.

Table 1. Correlation PHQ with ENG.PTS

	Spearman's ρ	N
All Cases	-.315***	127
Control	-.315***	66
Experiment	-.359***	61

*: $p < 0.05$, **: $p < 0.01$, ***: $p < 0.001$

When looking at the PHQ scores of each participant we also looked at the average of those scores for each participant, and then the average of all those scores. When separated by group we observed that the mean PHQ score was higher in the control group than in the experiment group. Similarly we observed the average of the points gained by the experiment group to be higher than the control group. These two observations suggest that the gamification features could have influenced more participation to gain points, which in turn caused PHQ scores on average to be lower. The PHQ and points means are shown in Table 2.

Table 2. PHQ and ENG.PTS means by group.

	PHQ			ENG.PTS		
	Mean	Std. Dev.	N	Mean	Std. Dev.	N
All Cases	3.56	3.82	127	859.02	1447.81	127
Control	3.86	3.17	66	841.02	1483.57	76
Experiment	3.23	4.42	61	877.76	1419.65	73

Additionally we also observed a negative correlation between the mean of all the PHQ scores for a given user and the number of days that user engaged with the app as measured by the number of days the user queried the system for new challenges, and the number of days the user logged in. These correlations are shown in Table 3 and Table 4. This correlation was not observed with other forms of engagement such as challenges completed or points earned. This suggests that the more a participant engaged with challenges (not necessarily completed them), but actively queried for challenges daily, the more likely their average PHQ score over the trial was lower suggesting better mental health.

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Table 3. Correlation PHQ.MEAN with ENG.NUM (number of days queried for challenges).

	Pearson *r*	N
All Cases	-.273*	58
Control	-.201	31
Experiment	-.345	27

*: $p < 0.05$, **: $p < 0.01$, ***: $p < 0.001$

Table 4. Correlation PHQ.MEAN with ENG.LOG (number of days logged in).

	Pearson *r*	N
All Cases	-.303*	58
Control	-.237	31
Experiment	-.395*	27

*: $p < 0.05$, **: $p < 0.01$, ***: $p < 0.001$

We did not observe any correlation between SUS scores and app usage as may be reflected by duration of engagement, frequency of engagement, points collected, days participated, or challenges completed. Similarly we did not observe correlation between SUS and initial PHQ, average PHQ, or slope of PHQ over the trial. The caveat being that only 8 participants completed the exit survey and filled out the SUS questionnaire, which is not enough data to make broadly conclusive statements.

The hypotheses that initial mental health (PHQ^1) will influence sports motivation ($MIFA^1$) or engagement (ENG) or that engagement (ENG) will be influenced by sports motivation ($MIFA^1$) were not supported. We did not see any correlation of initial Intention ($MIFA.IN^1$) with any form of engagement (ENG) as measured by duration of engagement, frequency of engagement, points collected, days participated, or challenges completed. Similarly we did not observe a correlation between initial Intention ($MIFA.IN^1$) and the participants first mental health survey (PHQ^1). There were also no significant correlations between initial mental health (PHQ^1) and any form of engagement (ENG) such as days participated, days engaged, or achievements completed, so the hypothesis that initial mental health level will influence app engagement is also unsupported.

3.4 Discussion

The study aimed to answer two primary questions - whether mental health could be improved through app use, and whether app use could help motivate and create intention towards physical activity. The negative correlation between PHQ scores and the number of points a participant gained suggests that engaging with the app and completing the challenges has a chance at reducing the participant's depression and anxiety. Additionally the negative correlation between PHQ mean and the number of days the user engaged

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with the app suggests that continued engagement increases the likelihood of the desired outcome.

Our hypothesis that initial mental health would influence intention to be physically active was also not supported as we did not find a correlation between the first mental health questionnaire (PHQ[1]) and MIFA[1]. Out of the 73 participants in the trial, where 67 users completed at least one challenge, 53 individuals completed the MIFA[1] and a PHQ questionnaire. This observation could signal that mental health was not an influencing factor for sports motivation. With intention (IN) values ranging from the lowest possible value of 5 and to the almost maximum value of 24, with the average 17.7, and standard deviation of 4.1 – there was a broad range of respondents. Those respondents' PHQ scores were also well represented with values ranging from the extremes at 0 and 12, average at 5.4, and standard deviation of 4.1. The lack of correlation suggests that mood does not influence one's intention to be physically active. We also did not observe any correlation between the MIFA scores and any form of engagement, suggesting that users engaged whether they were motivated towards sports or not. Of course there was a percentage of users who disengaged or did not use the app at all, however, the observation suggests that it was not related to initial mental health or sports motivation. This could be an important finding in the context of a self-help mobile app suggesting that an intervention like this could be used by individuals of varying mental health and high or low sport motivation. If the app is there and is being used then it is possible that it could be the self-help routine that can nudge the participant towards action and a better mental health.

Our hypothesis that initial mental health would also influence engagement with the app was also not supported as we did not observe any statistical correlation between PHQ[1] and engagement (ENG). This suggests that depression or anxiety did not influence the participants ability to engage with the app. However, due to the low participation numbers it is difficult to say this with certainty.

The lack of correlation between SUS scores and engagement, initial PHQ, average PHQ, or slope of PHQ over the trial suggests that system usability was not influenced by mood, or amount of time engaging with the app. This observation would suggest that this minimal implementation was sufficient for being usable and even eliciting change in certain individuals. The caveat being that although 8 participants is enough of a sample to rely on the results of the SUS survey, the correlations that those 8 participants had or didn't have with engagement or PHQ may not be representative of the entire population.

4 Conclusion

In the end the study did not gather enough participants to make broad and general conclusions. We did observe that indeed the more a participant engaged with the activities, the more likely they were to score lower on the mental health questionnaire. This suggests that such an app could be used as a self-directed mental health hygiene tool and potentially help improve mental health and resilience in certain individuals.

The rejected hypotheses could suggest that the intervention can be used by individuals with no existing sports motivation, since MIFA had no influence on engagement, and by individuals with varying mental health states, since initial PHQ score did not seem to influence MIFA or engagement. Overall the study did find evidence supporting the

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idea that using an app such as the one built for this project to engage users with positive sleep, diet, and exercise habits can have a positive effects on their mental health.

One of the participants of the study took the time to contact the primary investigator and provide heartfelt positive feedback. The participant stated that prior to using the app they have struggled with mental health and had no physical activity routine. After having used the app they now feel much better, have a daily workout routine, and actively seek out large walks. They stated that small prompts were enough to motivate them to get into it at the start, and the points encouraged them to come back every day and check in. Their constructive feedback was to include more customization to replace built-in exercise challenges and allow the user more control over what exercises to perform and how many reps. This feedback supports our hypotheses and observations.

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