The Importance of Motivation and Goals in Behavioral Change and Their Usage in Mindfulness Apps

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ABSTRACT

With the pace of the world becoming faster and faster, the levels of stress have been increasing, putting more people at a higher risk of developing mental health issues as a consequence of it. Practicing mindfulness through well-being apps is one of the ways to deal with daily stress and take care of our health. The goal of this study is to gain an understanding of the role a person's motivation and goals serve in mindfulness apps from a behavioral change point of view. To accomplish this, firstly, we have looked at the significance that motivation and goals play in the process of willingness to behavioral change. This part included performing a literature review, aiming to gain more understanding from a psychological perspective. Our findings suggest that a person's preexisting goals and motivation have a positive influence on behavioral change. Subsequently, we have looked at the usage of motivation and goals from a user modeling perspective, analyzing their employment in existing apps. This part of the study was focused on collecting and analyzing data from the "onboarding" and "exploration" phases of existing well-being apps focusing on mindfulness. The analysis showed that all the examined apps took into consideration the users' goals and motivations. Furthermore, we have looked at and concluded that all of the examined mindfulness apps have a positive the influence on the users' preexisting motivation and goals.

Additional Key Words and Phrases: Mindfulness, Behavioral Change, Influence, Persuasion, User Modeling, Motivation, Goal, Self-Determination Theory

1 INTRODUCTION

Mental health has been an ongoing issue in the past decades, currently being one of the leading causes of illness and disability among adolescents [37]. With the pace of the world we live in getting faster and faster [4], stress has become an inseparable part of most people's daily lives [27]. With stress being one of the causes of mental diseases [27], this makes the mass of the population exposed to developing mental health problems. Past research shows that mindfulness has a positive effect on both preventing the development of mental health disorders and helping with already existing ones [38]. One of the most accessible ways for people to practice mindfulness on their own is by using technologies such as health apps promoting mindfulness. Researchers in the past have found that such technologies, targeting behavioral changes, have successfully assisted users dealing with mental health issues [21]. To successfully influence the users, they have to convince them to change their behavior. In mindfulness apps, this behavioral change is expressed in ways of persuading the users to practice mindfulness exercises regularly. Researchers propose that the success of supporting the users relies on the amount of self-initiative they have to change [21], which brings us to what these behavioral change technologies emphasize. They emphasize approaches focusing on self-initiative, where the users use such technologies to change their behavior by building upon their motivation or goals [21].

This gave rise to the **Goals** of this project. We aim to focus on three aspects.

Goal 1: Gain a better understanding of how a person's goals and motivation influence their behavioral change process.
Goal 2: Acquire knowledge regarding the employment of a person's preexisting motivation and goals in mindfulness apps.
Goal 3: Obtain knowledge about the influence that mindfulness apps have on people's preexisting motivation and goals.

In order to achieve the above-mentioned goals, this research will focus on the following **Research Questions**:

RQ1: How do a person's preexisting goals and motivations influence their willingness to behavioral change?
RQ2: To what extent do well-being apps focusing on mindfulness consider the user's goals and motivations?
RQ3: How do well-being apps focusing on mindfulness influence a person's preexisting goals and motivations?

To answer these questions, firstly, by working on RQ1, we will focus on the role that a person's preexisting motivation and goals play in the behavioral change process according to existing literature. Subsequently, we will look at motivation and goals from a user modeling point of view. To answer RQ2, we are going to analyze existing apps focusing on mindfulness to try to understand to what extent they incorporate the user's motivation and goals into their design. Additionally, we will go in more depth regarding the influence that these features might have on the users' motivation and goals. This evaluation will address RQ3 and will be conducted based on our findings from existing literature, regarding RQ1.

This paper consists of 6 main sections. *Section 1* gives an introduction of the chosen topic, followed by *Section 2* where it is discussed past work related to this paper. Subsequently, *Section 3* regards the methodologies used to conduct this research. The main findings from the research are presented in *Section 4*, which focuses on existing literature, and *Section 5*, which is related to the app analysis. Furthermore, in *Section 6* we present our conclusions and discuss related future work.

2 RELATED WORK

This section will go into more detail about past work related to the researched topic.

A systematic review, conducted in 2018, has identified that mobile health applications have successfully influenced behavioral change [13]. In fact, many of the studies found that the participants were more satisfied with the use of health-related apps compared to the use of conventional care [13]. Furthermore, another study has identified that young adults who are interested in technologies supporting health-related behavior change have a particular interest in the ability to track their behavior and goals [9]. However, a past study, conducted in 2018, has noted that the design of mobile health apps is lacking in terms of supporting behavior change and needs to be improved [20]. To reanalyze this finding and study the current state of health-related apps, this research aims to examine the roles of goals and motivation in behavioral change and their presence in mindfulness apps, among all health-related apps.

A lot of research, focusing on different aspects, has been performed regarding the evaluation of mindfulness apps. One of the ways mindfulness apps have been evaluated is by measuring the alignment of their features and functionalities to existing literature from a health and clinical perspective [22]. Other research has focused on examining what barriers exist to the usage of such apps [17]. Researchers have also conducted studies on evaluating mindfulness apps based on the Mobile Application Rating Scale (MARS) [19] and have measured the engagement levels of mindfulness apps [2]. In addition, no research was found to be evaluating the utilization of motivation and goals in mindfulness apps.

Hence, this study aims to address the missing gap in the academic literature related to the employment of motivation and goals in mindfulness apps.

3   METHODS OF RESEARCH

To perform the research at hand, the following steps have been taken into consideration. Firstly, regarding RQ1, we have performed a literature review about the roles that motivation and goals play in behavioral change. To accomplish that, we have conducted a comprehensive search aiming to gain more knowledge about their roles from psychological and behavioral change points of view. The literature that we are considering is mainly from a psychological background, as we are trying to understand and reason how motivation and goals can influence behavioral change from a psychological perspective.

Answering RQ2 and RQ3 required collecting data from existing well-being apps focusing on mindfulness. In terms of the apps which were considered, this study has focused on apps that offer guidance towards achieving mindfulness. This guidance can be expressed in suggestions for meditation practices, guided meditations, or activities that aim to support the user's well-being and mindfulness. According to that, apps were chosen that support one or more of the features mentioned above. What is more, apps focusing on spiritual content such as religious and horoscope-based practices were excluded, as their content did not match the rest of the selected apps. Furthermore, we have only focused on features which have been displayed in the "free" version of the apps, meaning that this research has not accounted for app aspects which appear after joining a membership. Additionally, apps that function only as timers, reminders, trackers, and journals have not been accounted for as they do not provide useful information for this research. We have also discarded the malfunctioning apps as they could not be analyzed.

As the research is centered around user modeling of mindfulness apps, we focused on apps that offer personalization. To determine that, we examined the apps by downloading them and checking if they provided any means of getting to know the users better. The features that we have been searching for include questionnaires asking for user input that would be used to personalize the functionality of the app to the users' needs. As a result, mindfulness apps featuring questionnaires that did not go in-depth and asked only for the users' names, for example, have been disregarded.

The selection process for suitable apps for this research was conducted under the search term "mindfulness apps" in Google Play. On 29.05. 2024, we downloaded the top 30 apps that were found to be the most relevant, engaging, and high in quality according to Google Play. To achieve as unbiased results as possible, apps were chosen only under the category "More apps" because apps selected from other categories such as "Sponsored", "Limited-time events" or "Recommended for you" could create potential bias. After examination, we discovered that 19 out of those 30 apps meet our criteria. As a result, our analysis and conclusions are based on the content that these 19 apps provide.

4   LITERATURE REVIEW

In this section, we are going to reflect on RQ1 by covering some of the literature regarding the roles of motivation and goals toward behavioral change. Firstly, we will briefly cover ideologies from Goal Setting Theory, Social Cognitive Theory, and Expected-Value Theory. Subsequently, we will go into more depth regarding Self-Determination Theory, as it forms the foundation of this study. We will first explain our reason for selecting it, which will be followed by a comprehensive discussion about the different kinds of motivation and goals that can be derived from it.

4.1   Goal Setting Theory

The purpose of motivation and goals towards behavioral change has been researched in depth in the past 50 years. Throughout the years, one of the first theories that has emerged and has been widely adopted since then is the Goal Setting Theory. Initially, the theory focused mainly on the findings that people setting *specific, challenging,* and *attainable* goals, tend to outperform the others who set a "do your best" type of goals [18]. Specificity needs to be accompanied by the difficulty of the goal itself to increase performance as otherwise it does not have a noticeable effect. Throughout more recent research four moderators have been identified to influence the goal-performance effects. These are: *receiving feedback, having commitment,* especially to difficult goals, *having the knowledge and skills to* achieve them, and *having favorable situation factors* in the environment. These moderators have been identified as crucial to achieving better goal performance [18].

4.2   Social Cognitive Theory

Another theory that has been incorporating motivation and goals as a determinant of behavioral change is the Social Cognitive Theory. In Social Cognitive Theory, according to Zimmerman, motivation is associated with self-regulation [35]. Furthermore, past research has shown that students who are *self-regulated,* tend to actively pursue their own goals. Self-regulation is also associated with self-observation, self-judgment, and self-reactions [36]. It has been further noted that when people *react positively to failure in monitoring their own activities and evaluating themselves,* this leads to a higher chance of them continuing with the given task/goal at hand. Another concept that Social Cognitive Theory is concerned with is self-efficiency. What Bandura means by self-efficiency is an individual's confidence in their ability to successfully accomplish a task [1]. Self-efficacy differs from person to person, as some people believe more in themselves than others. Bandura claims that those *efficiency expectations* that people have of themselves are a major factor in goal setting, willingness to put more effort in a certain task and persistence.

4.3   Expectancy-Value Theory

Expectancy-Value Theory is also one of the initial psychological frameworks associated with motivation, goals, and behavioral change. In the model developed by Eccles and her colleagues [10] the choices that people make are thought to be influenced by both positive and negative task characteristics, and all choices are believed to have a cost. In the ideologies of this theory, expectancy refers to the belief that putting effort into a certain task will lead to success. The value people place on a task refers to the significance they put on the outcome of it,

which can be separated into four categories - personal importance of doing well on a task (*attainment value*), enjoyment from performing the task (*intrinsic value*), the task's relatedness to a person's goals (*utility value*) and the drawbacks of participating in the task (*cost*). As a consequence, the expectancies people have towards a certain task and the value they put on it directly affect their choice of task, the performance of the task and the persistence that they have towards it.

4.4 Self-Determination Theory

Self-Determination Theory (SDT), initially developed by Richard M. Ryan and Edward L. Deci, is one of the empirically based theories which have looked into human motivation and goals from a behavioral change perspective. Throughout the years, numerous papers have been published, providing empirical evidence that Self-Determination Theory-based interventions have successfully influenced people's behavior in different spheres of life such as health [33], sports [11], and education [12] among all. Furthermore, Self-Determination Theory offers a comprehensive base for understanding the different types of motivation and goals and their role as indicators of performance and persistence. It looks deeper at how environmental factors can either enhance or diminish these various forms of motivation and goals. Because of its broad reach, comprehensibility, and depth, we have determined that it would be a suitable framework for addressing our research question on how motivation and goals influence behavioral change.

According to its ideologies, goal pursuit is divided into two parts - the "why" part, being responsible for the underlying motives, and the "what" part, focusing on the content of the goals that people are pursuing [29]. We are first going to focus on the "why" aspect, it being the motivation that drives people striving towards their goals.

Self-Determination Theory categorizes people's motivation into two components - people who are motivated because they value an activity (*intrinsically motivated*) and people who are motivated because of external influences (*extrinsically motivated*). In the following lines, we will go into more detail regarding the development, sustenance, and diminishment of those types of motivations.

4.4.1 Intrinsic Motivation

Intrinsic motivation is believed to be the natural motivation to want to explore, learn, and seek out challenges [25]. It is believed to be the type of motivation that children possess in their healthiest states when they are active and playful. Despite it being naturally developed in people, its maintenance and enhancement require specific conditions. A sub-theory of Self-Determination Theory, called Cognitive evaluation theory (CET) [7] presents its findings on different social and environmental factors and their influence on intrinsic motivation. Their findings articulate around the psychological needs for *competence* and *autonomy*. According to CET, events associated with a certain action, which lead to a sense of competence, such as *receiving positive feedback* [6], *receiving a reward* that makes you feel competent, or *social communications* about the topic, can enhance intrinsic motivation for that action. Furthermore, according to CET, competence on its own does not necessarily increase intrinsic motivation, unless it is accompanied by a feeling of autonomy. Meaning that people have to experience their motivation from self-determination. Throughout the years of theory development in SDT, *relatedness* (the need to feel connected and feel belongingness)

has been claimed to influence positively intrinsically motivated behavior in people as well [25].

On the contrary, studies have shown that *receiving negative feedback* diminishes intrinsic motivation in people [6]. Furthermore, *control*, opposingly to how autonomy affects intrinsic motivation, can rather undermine it. Past research has identified that *tangible extrinsic rewards*, expected after finishing a task successfully, diminish autonomy and can influence badly on this type of motivation [5]. Similarly, *threats*, *deadlines*, and *pressured evaluation* yield to the same results of diminishing intrinsic motivation.

4.4.2 Extrinsic Motivation

As defined in Self-Determination Theory, not all of the activities are intrinsically motivated. Activities which are performed in order to attain a specific outcome are driven by extrinsic motivation [25]. According to Ryan and Deci, this type of motivation is developed whenever someone (e.g. parent, teacher, boss) encourages certain behaviors in others. The type of motivation can vary between complete unwillingness, passive compliance, or personal commitment. Furthermore, it is believed that the type of motivation that is formed depends on the degree to which the fostered behavior's values and regulations have been adopted and perceived as one's own. The place of *extrinsic motivation* lies between *amotivation* (the complete unwillingness to engage in an activity) and *intrinsic motivation* (doing an activity for its pure satisfaction). As a consequence of that, there are 4 types of extrinsic motivation, that can be developed, each varying in the amount of autonomy they support.

The least autonomous one, defined as *externally regulated*, is the type of motivation that individuals experience when behaviors are performed to fulfill an external demand or a reward condition. In SDT, such behaviors are perceived as controlled or alienated [25]. Next on the scale of autonomy is placed *introjected regulation*, that is a type of motivation in which an individual adopts a certain regulation but does not fully accept it as their own. For this type of motivation, behaviors are believed to be performed in order to avoid guilt and anxiety or enhance one's pride [25]. The following two types of extrinsic motivation tend to be more autonomous, compared to the ones mentioned above. *Regulation through identification* is a type of motivation in which an individual reflects the values upon a certain behavior in a way the action, associated with it, is perceived to be personally important. *Integrated regulation*, on the other hand, occurs when the values and regulations of a certain behavior are fully adopted by an individual in a way they match with the individual's values and needs.

What can be seen in the above-mentioned types is that when people embrace values and regulations associated with a certain behavior, they experience greater autonomy in that behavior. It has been identified that more autonomous motivation correlates with higher behavioral effectiveness and more volitional persistence [23]. As a consequence of that, we will further look at the social conditions that can promote the integration of extrinsic motivation. It has been claimed that the main reason for people to perform behaviors which they do not find intrinsically satisfying is because the behaviors are promoted or valued by someone whom they feel related to [25]. These findings suggest that providing a sense of *belongingness* and *connectedness* is an important aspect of facilitating internalization [26]. Furthermore, for a person to adopt a certain behavior, they have to feel competent in it [25]. Meaning, to promote internalization, a person has to receive

support for competence, which can be expressed in ways of *receiving optimal challenges* and *relevant feedback* [25, 26]. Additionally, another core aspect that plays a role in the process of internalization is *autonomy*. Autonomy is essential for individuals to feel self-determination towards a certain activity or behavior rather than feeling controlled and forced into it. As a consequence of that, *autonomy support* plays a crucial role in the process of internalization [26].

4.4.3 Discussion related to Motivation in SDT

The performed literature review focused on the motivation aspects of Self-Determination Theory, has yielded that support for *relatedness, autonomy,* and *competence* play a crucial role both in intrinsically motivated behaviors and extrinsically motivated ones. Comparisons between the two types of motivation have yielded that intrinsic motivation in people leads to better performance and persistence compared to extrinsic motivation even if the evaluated people have the same levels of self-efficiency for a certain activity [25]. Alongside these findings, the more autonomous extrinsic motivation types have also yielded positive outcomes through interventions in many fields such as healthcare [34], education [24], and physical activity [3] among all.

4.4.4 Goals

Self-Determination Theory also examines the content of goals, also known as the "what" part in goal pursuit. Just like the ideologies for motivation, goals can be divided into two categories - *intrinsic goals* and *extrinsic goals* [14, 15]. Intrinsic goals are the ones that bring satisfaction on their own and those that can be associated with psychological well-being and positive adjustments [8]. This would include goals such as community contribution, health, personal growth, and affiliation [29]. On the other hand, extrinsic goals are the ones that have an "outward" orientation [32] and are associated with gaining external signs of self-worth [16]. Typical extrinsic goals can be defined such as fame, financial success, and physical appearance [29].

4.4.5 Discussion related to Goals in SDT

Comparing the two types of goals, research has shown that extrinsic goals lead to poorer performance compared to intrinsic ones [30]. Furthermore, it has been identified that intrinsic goals promote a deeper processing of the activity at hand and a higher level of persistence. Similar effects were observed when the goals were developed in an autonomy-supporting environment, compared to a controlling one. Speaking from a well-being perspective, intrinsic goals have been also associated with greater health and well-being compared to extrinsic ones. Further research has identified that those effects can be experienced both short-term and long-term.

4.4.6 Integration of SDT in mindfulness apps

Above we have looked at the ideologies of Self Determination Theory regarding people's behavior. More specifically, we regarded the content (the "what" part) and the motive (the "why" part) of one's goals. According to SDT, goals towards a person's well-being such as health and personal growth have been defined as intrinsic ones, meaning that they are fueled by intrinsic motivation. As a consequence of that, we can say that people who use mindfulness apps have a preexisting intrinsic motivation. The findings from our literature review regarding the views of Self-Determination Theory on behavioral change provide useful insights about the ways of enhancing or diminishing a person's motivation. With motivation being

defined as a crucial part in reaching a goal, this makes its analyses in mindfulness apps an important part of this research.

5 ANALYSIS OF MINDFULNESS APPS

In this section, we are going to regard RQ2 and RQ3. We will first focus on determining to what extent mindfulness apps consider a person's preexisting goals and motivation. Subsequently, we will go more in-depth regarding the influence that mindfulness apps have on a person's motivation and goals according to our findings from the literature review.

5.1 Consideration of motivation and goals in mindfulness apps

To determine the extent to which mindfulness apps consider a person's preexisting motivation and goals, we have collected data from 19 apps, listed in *Appendix B*, that fit the selection criteria of this research. The data that was collected comes from the "onboarding" stages of the apps and the content that they provide to the users. Based on the results from the collection process, we have categorized our findings and analyzed their frequency counts (*shown in Appendix B*), which you can see in Figures 1, 2, and 3. In the following sub-sections, we are going to look over those categories and the yielded results. We are first going to focus on the findings from the onboarding process of using the apps. Subsequently, we are going to discuss features and details that have resulted from the analysis of the app contents.

5.1.1 Onboarding Stage

The "onboarding" process of app exploration represents the initial stage that apps provide in order to help the users set up the apps and give an introduction to the apps' features [2]. One of the focus points of this research was extracting data from elements of the "onboarding" process that aimed to get to know the users better. In the examined apps these elements were represented in the form of questions, aiming to understand more about the users' demographics, interests, and goals. Furthermore, with this research being centered around goals and motivation, our analysis has focused on the goal-related aspects of the "onboarding" stage.

The main aspect which was considered throughout the "onboarding" stages of mindfulness apps, was the identification of the users' goals, also defined in this research as "User Input". This was an important criterion for understanding if certain apps are interested in the users' specific preexisting goals and motivations. According to our findings (see Figure 1), all of the apps that this study covered (19 out of 19) wanted to collect, to some extent, the user's preexisting goals and motivations. Furthermore, the goals and motivations in which the apps were interested can be classified into four categories (see Figure 2) - *Topic-based goals* (related to specific aspects of the users' daily lives that the users want to improve on), *Activity-based goals* (related to a certain activity that the users are interested in such as guided meditation sessions or breathing exercises), *Time-based goals* (related to a suitable time of the day for practicing or the placement of reminders), and *Experience-based goals* (related to previous experience of the users with certain activities such as meditation).

Regarding *Topic-based goals*, the data analysis yielded that most of the apps (18 out of 19) were interested in the different aspects of daily life that the users want to focus on improving (see Figure 2). The way that the examined apps showed interest in this type of goal was by providing questions that were related to figuring out the users' goals, interests, or purpose of using the certain app. Here are some examples of questions that the

apps would ask: "What brings you to this app?", "How can we help you?", "What topics would you like to focus on in your life?", etc. Furthermore, this category was mostly seen in apps that offer support for audiences with different needs, such as support for stress-related issues, anxiety-related issues, mood improvement, etc.
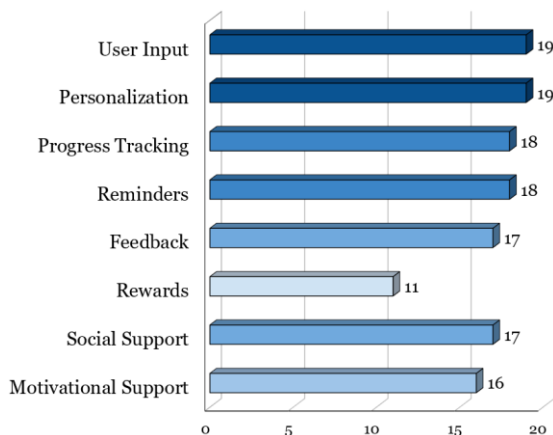

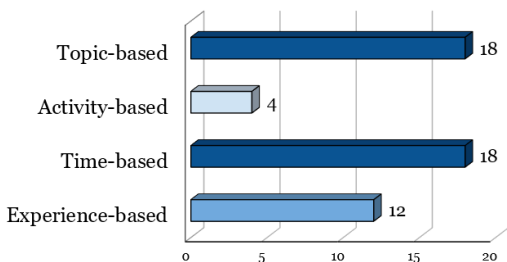**Figure 1. Frequency count analysis on app features (see Table B.1)**

Figure 2. Frequency count analysis on goal types (see Table B.2)

Concerning *Activity-based goals*, only 4 out of the 19 examined apps were interested in the different types of activities the users wanted to focus on (see Figure 2). To learn more about the users' preferred activity, the apps would ask closed questions, by providing a certain amount of answers, which would be the different activities the apps would support. These are some example questions taken from the apps we have analyzed: "Lastly, what sort of content interests you?" and "What type of content would you like to see?". Attention to activity-based goals was only seen in apps that offered a range of activities, such as breathing exercises, different types of meditations, movement exercises, etc. None of the apps that provided only one type of activity, such as featuring only unguided meditation sessions, took the users' preferred type of activity, into consideration.

On the topic of *Time-based goals*, almost all apps (18 out of 19) considered it important to take into account what time is suitable for the users to practice mindfulness (see Figure 2). In this category, we considered results both from the "onboarding" process and from the apps' content analysis, due to the fact that similar features, in different apps, were presented in different stages of the app exploration. In the "onboarding" stages, interest in time-based user goals was shown by the usage of questions (see Figure 3) related to the availability of the users to practice mindfulness and by asking the users if they would like to set reminders, for a specific time and day. Similarly, the option to set reminders was also found in the content analysis stages of the apps' exploration, mainly seen on the "Settings" page as a feature that can be turned on. In some of the apps, the reminder settings were placed under the settings for

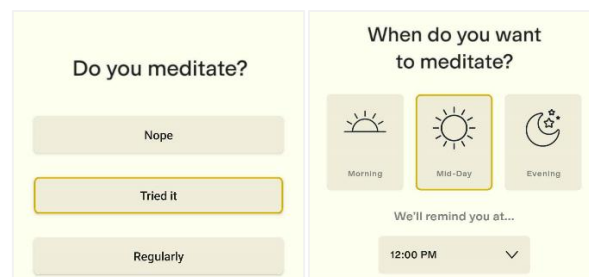"Notifications" while in others they were displayed straight away.

Figure 3. Visually enhanced images from the "onboarding" process (Ten Percent Happier app)

The last goal type, *Experience-based goals*, related to the users' experience with practicing mindfulness was noted in more than half of the apps' onboarding stages (12 out of 19, see Figure 2). The way these apps expressed interest was by asking the users a closed question (see Figure 3), regarding their experience in a certain activity, which was offered by the apps. Due to the fact that all of the studied apps, that were interested in the users' experience, offered meditation practices as a main type of activity, in all 12 cases, the apps were interested in the user's previous experience with meditation.

5.1.2 Content analysis stage

Mindfulness apps have been found to consider the user's preexisting goals and motivation not only in the "onboarding" stages while getting to know the users better, but also in the features that they provide. In this section, we are going to go into more detail about the following categories which have been derived from analyzing the apps' contents. These are *Personalization*, according to the users' goals, *Progress Tracking* of the users' goals, features for setting *Reminders*, features for receiving *Feedback*, obtaining *Rewards* after the completion of a task, aspects of *Social Support* in terms of sustaining motivation, and attributes for *Motivational Support* to enhance the users' motivation (see Figure 1).

The first category that we will analyze is *Personalization*. The *Personalization* aspect is related to the extent to which apps personalize their content according to the user's preexisting goals. According to the collected data, all of the examined apps yielded positive results in this category (19 out of 19, see Figure 1). These findings were also related to the fact that all of the apps were interested in the users' preexisting goals throughout the "onboarding" stage, making it possible to offer personalized user experience according to these aspects. As a result, the apps could personalize their content according to the users' topic of interest, preferable activity, a suitable time for practicing mindfulness, or experience in a certain activity. Furthermore, the types of personalization the apps provided were suggestions for meditation sessions, exercises, or informational articles, tailored specifically to the users' goals. For example, if the users' goal would be to improve their stress and anxiety by learning how to meditate, they would receive a suggestion for a meditation session, for beginners, focusing on stress relief.

The next category, related strongly to the users' goals and motivation is *Progress Tracking*. *Progress Tracking* is a useful way to keep track of your progression toward a certain goal while staying on schedule and receiving visual feedback after performing activities daily. The results yielded that mostly all of the apps (18 out of 19) provided features that let the users track their progress (see Figure 1). These features were represented through statistics, regarding the amount of time

users have spent practicing mindfulness, daily, weekly, and monthly charts, streak counters, or mood-tracking calendars. Examples of progress-tracking features can be seen in Figure 4.
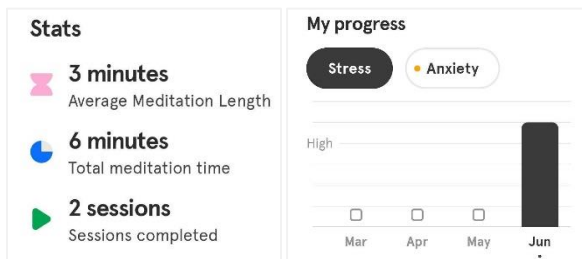

Figure 4. Progress-tracking features - statistics about meditation time and mood-tracking chart related to stress (Headspace: Calming Meditations app)

Regarding the aspect of providing the option to set a *Reminder*, the analysis showed that most of the apps (18 out of 19) supported this feature (see Figure 1). The different types of reminders that the apps offered can be summarized in three different categories - mindfulness practices-related reminders, sleep-related reminders, and motivational messages-related reminders. The reminders feature was found mainly in the "Settings" page of the apps, letting the users enable, disable, or control the timing of a certain reminder.

Receiving *Feedback* was also found to be a very common feature as 17 out of 19 apps supported it (see Figure 1). The way these apps would give feedback was by either providing supporting and encouraging messages, such as "Good job for completing this session! Keep up with the good pace!" after the users completed a task or by progress-related messages such as "Your sessions this month are longer than last month.", meant to let the user know about their current state of performance.

Another feature, related to the user's motivation towards following and achieving their goals was found to be the aspect of receiving *Rewards*. More than half of the apps (11 out of 19) supported that feature (see Figure 1). In these apps, the feature would be related to receiving some sort of reward for completing a task or a certain amount of tasks. We identified two distinct categories of rewards - one related to receiving a type of achievement such as a milestone, a badge, or a level-up, after conducting certain activities and one related to obtaining points, in the shape of coins, after each approached task, which later on could be used in the app.

The last two features, analyzed in this section, are solely related to the motivational aspect of the apps. *Social Support*, as one of those features, is the ability for users to communicate with the world around them and to feel as a part of a community. The results yielded that 17 out of the 19 examined apps were found to support that (see Figure 1). Some of the apps offered community-building features, which the users could be part of by joining groups with other members, making friends, or attending events. Other apps would offer the feature of displaying the current amount of people using the examined app to practice mindfulness, reminding the users that they are not alone. Furthermore, a very common feature was the possibility for the users to share their sessions and exercises with the world, outside of the app, which also contributes to the community-building process.

Motivational Support was the other feature, strongly related to the users' motivation. This category was created by taking into consideration the motivational messages and quotes that the apps provide. The analysis revealed that 16 out of the 19 apps at hand had a feature related to providing *Motivational*

Support (see Figure 1). The motivational messages and quotes could be received in three ways - as an app notification, as a part of an app's page, and after the completion of a task in the form of a daily quote being unlocked. Below, you can see a motivational message captured from one of the examined apps (see Figure 5).
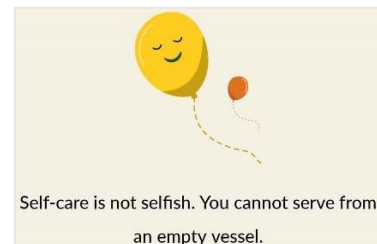

Figure 5. A daily motivational message (Evolve: Self-Care & Meditation app)

5.1.3 Discussion

The results from the data collection and analysis revealed that all of the studied apps take into consideration the user's preexisting goals and motivation. In fact, each of the apps aimed to offer personalized features based on different criteria such as the user's focus area, time availability, activity preference, or previous experience. Additionally, it was found that many of the features in the examined mindfulness apps were designed to sustain the users' goals and motivation.

5.2 Influence of mindfulness apps

According to the literature review and Self Determination Theory, there are three psychological needs which have to be fulfilled in order to sustain and enhance a person's intrinsic motivation. These are the needs for *competence*, *relatedness*, and *autonomy*. In this section, we are going to analyze the effects that certain app features might have on these needs. More specifically, we will focus on the aspects of *Feedback*, *Rewards*, *Social Support*, and *Motivational Support* (see Figure 1, Figure 6).

Figure 6. Frequency count analysis on app features (see Table B.3)

5.2.1 Feedback

Beginning with the feature of receiving *Feedback*, according to Self-Determination Theory, feedback can have an influence on the need for *competence*. Positive feedback affects competence in a good way, also having a positive effect on a person's intrinsic motivation. Opposingly, negative feedback has a rather negative and undermining effect. To be able to identify what influence mindfulness apps have on a person's intrinsic motivation, from a *competence* point of view, we have analyzed the apps based on the two types of feedback that can be received.

The results yielded that 17 out of the 19 examined apps had a feature to give the users positive feedback (see Figure 6). This was seen in ways of congratulating the users for completing a

task successfully, responding to the users in a friendly manner when the users would identify a struggle, thanking the users for participating in an activity, or giving the users positive feedback regarding their progress.

Additionally, only 2 out of the 19 studied apps contained features for receiving negative feedback (see Figure 6). One of the features was related to sending alerts such as "You are about to ruin your streak." when the users' progress was about to be compromised. Such types of alerts can have a negative influence on the users by making them feel like they are not putting enough practice towards achieving their goals. The other feature was related to displaying negative feedback such as "The last two weeks you were less active than before." about the users' progress. Similar to the effect of the alerts, mentioned above, such negative messages can make the users feel bad about their progress journey.

5.2.2 Rewards

On the topic of *Rewards*, receiving different types of rewards is strongly connected to the psychological needs for *competence* and *autonomy*. On one hand, rewards which aim to give the users positive feedback about their task accomplishment, can be beneficial to sustaining intrinsic motivation by affecting *competence* in a positive way. On the other hand, rewards which are expected by the users and, hence, drive the users' behavior, can be damaging to a person's intrinsic motivation because they undermine the psychological need for *autonomy*. Such rewards are experienced as a rather controlling aspect, in a way that the rewards start driving the users' behavior rather than the users' own intrinsic motivation. The way rewards are perceived is also related to the way that the users react to them, meaning that a reward cannot be strictly good or bad.

Based on the data that we collected, we separated the rewards into two categories - *Simulating Rewards* which can be seen as positive feedback, beneficial for *competence*, and *Undermining Rewards* which can be seen as expected tangible rewards, harmful to *autonomy*. The app analysis revealed that out of the 11 apps in which we found features for receiving rewards, 10 apps offered *Simulating Rewards*, and only 1 app supported features that can be classified as *Undermining Rewards* (see Figure 6).

The *Simulating Rewards* were expressed in ways of receiving badges, milestones, achievements, or leveling up after the completion of a task or a certain amount of tasks.

The one app that supported *Undermining Rewards* featured a Gamified experience where it offered tangible rewards, such as points, in the form of coins, after the execution of each activity in the app. With those coins, the users of the app could purchase new trees that they could plant and grow while practicing mindfulness. Even though such types of apps, offering tangible rewards, had a big success on the market in persuading people into certain activities [28, 31], they are not suitable for actions, supported by intrinsic motivation, as they might take away from the user experience of practicing mindfulness for one's own good rather than for an expected reward.

5.2.3 Social and Motivational Support

Lastly, the psychological need for *relatedness* also plays a big role in the sustenance of a person's intrinsic motivation. In the apps that we examined, we have found two aspects which can contribute to users feeling related to and understood. These are the aspects of *Social Support* and *Motivational Support*, which have been analyzed in detail in the previous section. With 17 out of the 19 examined apps offering *Social Support* and 16

offering *Motivational Support* (see Figure 1), it is clear that the mindfulness apps we have examined offer support for the psychological need for *relatedness*.

5.2.4 Discussion

The analysis revealed that positive features, enhancing the psychological needs for *competence*, *relatedness*, and *autonomy*, were prevalent. This leads to the conclusion that the examined mindfulness apps have an overall positive effect on the users' intrinsic motivation, according to the ideologies of Self-Determination Theory. With intrinsic motivation being the fuel behind intrinsic goals, associated with the improvement of a person's well-being and strongly related to mindfulness, this means that most of the studied apps also have a positive influence on the users' goals.

6 CONCLUSION

This research has aimed to assess the roles that a person's preexisting motivation and goals play from a psychological behavioral change standpoint in mindfulness apps. To understand what influences a person's goals and motivation, we have conducted a literature review which was focused on the ideologies suggested by Self-Determination Theory. Our findings indicate that the psychological needs for competence, autonomy, and relatedness play a huge role in the process of achieving behavior change. Meaning, to enhance a person's behavioral change process, these needs have to be addressed and fulfilled.

To understand the role that a person's preexisting goals and motivation serve in mindfulness apps, we examined 19 apps. Our research was focused on determining to what extent mindfulness apps consider these aspects and the influence that the apps might have on them. The conducted analysis suggests that all of the studied apps provide features, regarding the users' goals and motivation. Moreover, it was found that the majority of the features that the examined apps provide have a positive influence on the users' preexisting motivation and goals.

The findings of this research fill the missing gap in the academic literature related to the usage and role of goals and motivation in mindfulness apps. Furthermore, this study offers evidence of the use of psychological practices, related to Self-Determination Theory, in the creation of existing mindfulness apps. It also raises concerns regarding current practices that might have a bad influence on people's preexisting goals and motivation. These findings can serve as a foundation for the further development of user models in the healthcare environment.

One of the limitations of this study was the fact that we collected data only about features which were displayed without joining any memberships. As a result, it would be valuable to also analyze these apps, by examining their features after subscribing to their platforms and identifying, if there are any, differences in the experience.

Furthermore, since we have focused mainly on the ideologies of Self-Determination Theory, it would be beneficial to explore what influence mindfulness apps might have on the users' preexisting goals and motivation according to other theories as well. We believe that by exploring a broader specter, this could lead to a more accurate analysis.

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Appendix A

During the preparation of this work, the author used Word in order to write and format the paper. Furthermore, the author used Grammarly for grammar correction. To add citations and format the references, the author used Zotero. After using these tools, the author has reviewed and edited the content as needed and takes full responsibility for the content of the work.

Appendix B

1. Calm, Sleep, Meditation, Relax
2. Headspace: Calming Meditations
3. The Mindfulness App
4. Insight Timer – Meditation App
5. Smiling Mind: Meditation App
6. Balance: Meditation & Sleep
7. Meditopia: Sleep & Meditation
8. Meditation Moments
9. Simple Habit: Meditation App
10. Ten Percent Happier Meditation
11. Aura: Meditation & Sleep
12. Breethe – Meditation & Sleep
13. Waking Up: Beyond Meditation
14. Evolve: Self-Care & Meditation
15. Atom: Meditation for Beginners
16. Guided Meditation: Lojong
17. Mindfulness.com Meditation App
18. Brightmind Meditation
19. Sattva – Meditation App

Table B.1 Examination of app features that consider the users' preexisting goals and motivation

Apps	Category							
	User Input	Personalization	Progress	Reminders	Feedback	Rewards	Social Support	Motivational Support
1	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes
2	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes
3	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
4	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
5	Yes	Yes	Yes	Yes	Yes	No	Yes	No
6	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes
7	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
8	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes
9	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
10	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
11	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
12	Yes	Yes	Yes	Yes	Yes	No	Yes	No
13	No	Yes	Yes	Yes	No	No	Yes	Yes
14	Yes	Yes	Yes	No	Yes	No	Yes	Yes
15	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
16	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
17	Yes	Yes	No	Yes	No	No	Yes	Yes
18	Yes	Yes	Yes	Yes	Yes	Yes	No	No
19	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Table B.2 Examination of goal types seen as User Input

Apps	Goal Types in User Input			
	Topic-based	Activity-based	Time-based	Experience-based
1	Yes	No	Yes	Yes
2	Yes	No	Yes	No
3	Yes	No	Yes	Yes
4	Yes	Yes	Yes	Yes
5	Yes	No	Yes	No
6	Yes	No	Yes	Yes
7	Yes	Yes	Yes	Yes
8	Yes	No	Yes	Yes
9	Yes	No	Yes	No
10	Yes	No	Yes	Yes
11	Yes	Yes	Yes	No
12	Yes	No	Yes	No
13	No	No	Yes	Yes
14	Yes	No	No	No
15	Yes	No	Yes	Yes
16	Yes	No	Yes	No
17	Yes	Yes	Yes	Yes
18	Yes	No	Yes	Yes
19	Yes	No	Yes	Yes

Table B.3 Examination of app features which influence the users' preexisting goals and motivations

Apps	Category					
	Rewards	Simulating rewards	Undermining rewards	Feedback	Positive Feedback	Negative Feedback
1	No	-	-	Yes	Yes	No
2	No	-	-	Yes	Yes	No
3	Yes	Yes	No	Yes	Yes	No
4	Yes	Yes	No	Yes	Yes	No
5	No	-	-	Yes	Yes	No
6	Yes	Yes	No	Yes	Yes	No
7	Yes	Yes	No	Yes	Yes	No
8	No	-	-	Yes	Yes	Yes
9	Yes	Yes	No	Yes	Yes	No
10	Yes	Yes	No	Yes	Yes	Yes
11	Yes	Yes	No	Yes	Yes	No
12	No	-	-	Yes	Yes	No
13	No	-	-	No	-	-
14	No	-	-	Yes	Yes	No
15	Yes	No	Yes	Yes	Yes	No
16	Yes	Yes	No	Yes	Yes	No
17	No	-	-	No	-	-
18	Yes	Yes	No	Yes	Yes	No
19	Yes	Yes	No	Yes	Yes	No