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„A Smartphone App for Goal Pursuit: Effects of a Ten-Week
Smartphone-Based Intervention on the Pursuit of Personal
Goals“

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Paula Czichos (BSc)

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Univ.-Prof. Dr. Veronika Job

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Introduction

It is common practice that just before the new year, people set New Year's resolutions they want to implement in the coming year. At first, they are extremely motivated, but motivation usually decreases after several days or weeks. Often, they cannot even remember the goals they have themselves set once they have arrived in the daily grind of the new year. But why? One prominent theory in goal striving literature is Locke and Latham's Goal Setting Theory (1990; 2013). The theory states that motivation and performance are significantly influenced by goals and feedback on their achievement. The basic proposition of this theory is that goals motivate people and are direct regulators of human action. Specifically, it is assumed in goal-setting literature that individuals monitor their progress towards personal goals and change their behaviour and strategies if the previous efforts have proven unsuccessful (Brunstein & Maier, 2002; DeShon & Gillespie, 2005).

Goals are described as desired end-states that individuals strive to attain through action (Carver & Scheier, 1982). They are organised hierarchically with abstract, superordinate goals (e.g., complete studies) at the top, followed by concrete subgoals (e.g., pass exam) and even more concrete, behavioural subgoals (e.g., discuss the subject matter in a study group) (Kruglanski et al., 2002). The goal concept integrates cognitive, affective, and behavioural processes. Accordingly, our goals, i.e., what we want to achieve or prevent in the future, structure our lives, occupy our thoughts, control our behaviour, open or close opportunities and, thus, ultimately determine our well-being or discomfort (Brandstätter et al., 2018).

Locke and Latham (1990; 2013) suggested several goal-setting principles that can improve goal progress. Two of these include the need for individuals to be committed to their goal, and the need for individuals to receive feedback on their goal progress. If these principles are not sufficiently fulfilled in the goal striving process, individuals can detach from their goal and fail to achieve it.

The present study is the first to evaluate a newly developed smartphone application (app), called EverGoal, in promoting effective goal pursuit. EverGoal was developed in 2020 by a team of young entrepreneurs from Austria. Its intended purpose is to address the issue that people tend to forget their goals or lose motivation to pursue them over time, resulting in not achieving them. The app aims to hold users accountable and to help them with successful goal striving. By setting their goals and reading them daily in the app, users' goals are at the forefront of their mind,

according to the developers (EverGoal KG, 2021). If users neglect to read their goals, EverGoal sends them goal reminders via push notification. Thus, users not only get feedback regarding their current goal progress, but it is also assumed that the reminders will encourage app users to act on their goals, increasing their future goal progress. Furthermore, the app allows to break down each goal into subgoals by developing an action plan which helps manage the goal's task complexity. Ticking-off the subgoals already achieved during the goal striving process, helps to visualise progression toward a given goal, and efforts already made, designed to better commit app users to their goal.

Today, in the age of digitalization, it seems impossible to imagine life without smartphones. From the workplace to our private lives, smartphones are comprehensively integrated into all areas of life. On average, Americans check their smartphones every 4 minutes, and with most engagement being spent on mobile apps (Wheelwright, 2022). Therefore, the idea of an app as a tool for pursuing personal goals does not seem far-fetched. As calls for greater use of mobile devices in psychological research are growing louder (Howells et al., 2014; Miller, 2012), my study contributes to this research gap.

My thesis focuses on personal and short-term goals. Since I conducted an evaluation study during the Summer 2022 semester, I decided to focus on short-term goals because they are acute, instant, and usually achievable within a few months (Boersma et al., 2006). Personal goals are considered as subjectively meaningful endeavours that individuals actively strive for in their daily lives (Little, 1983). Klinger (1977) defines them as a mix of idiographic and nomothetic aspects. They are idiographic constructs because different individuals describe unique constellations of personal goals. In addition, they can be rated and compared based on a set of nomothetic variables like goal commitment and perceived goal progress. In my thesis, I specifically look at these nomothetic variables and what kind of effect the app use has on them.

Numerous studies indicate that personal goals play a central role in directing human behaviour and promoting well-being (Brandstätter et al., 2018; Brunstein, 1993; Brunstein et al., 1998; Emmons, 1986; Wallenius, 2000). Therefore, the assessment of goal dimensions promoting effective goal pursuit seems important. Following this notion, Brunstein (1993) provided early evidence that goal commitment and goal progress account for interindividual differences in measures of well-being. Especially goal progress seems important, as a meta-analysis by Klug

and Maier (2015) summarizes several studies showing that progress toward personally meaningful goals promotes subjective well-being across diverse population groups.

There is already empirical evidence (see Howells et al., 2014) that smartphone-based interventions (e.g., engaging with an empirically supported mindfulness intervention for ten days) can significantly enhance elements of well-being. The current study aims to contribute to goal striving research by investigating the effects of a smartphone-based intervention targeting personal goal pursuit. Regarding the above-mentioned state of research, which emphasizes the importance of personal goals in our daily lives, and their major role in directing human behaviour and promoting well-being (Brandstätter et al., 2018; Emmons, 1986; Wallenius, 2000), I developed the following research question:

How can a smartphone application for personal goal pursuit help to increase people's progress toward their self-set goals?

Theoretical Background

Motivated Action Theory

My research was based on DeShon and Gillespie's (2005) model of goal-oriented behaviour, the motivated action theory (MAT). According to this theory, action is directed toward the attainment of goals. To accomplish a goal, one needs to develop an action plan, which consists of several action steps or highly flexible strategies for achieving the desired target (DeShon & Gillespie, 2005). Once this action plan is evolved, it draws attention to situational opportunities and means that support goal accomplishment (Gollwitzer, 1996). The theory is based on Carver and Scheier's (1998) idea that each goal is monitored by a discrepancy detecting system, comparing the current state of a person to the desired end state. They stress the primacy of personal goals in determining actions. They go on to claim that individual self-regulation is a process of comparing one's present actions with personally meaningful goals and adjusting one's actions to minimise discrepancies between present behaviour and desired states. Specifically, the discrepancy resulting from the comparison triggers an output function that searches for a relevant behaviour to reduce this gap. Earlier research suggested that human information processing is highly sensitive to discrepancy detection. Consistent with this, Hilton et al. (1991) showed that discrepancy information occurs automatically even when humans focus on other environmental aspects.

The MAT assumes that a goal gets increased activation through the detection of discrepancies and claims that action levels decide which target directs human behaviour. Accordingly, the highest activated goal catches attention and actions are implemented to reduce the detected discrepancies. Response tendencies that are in line with the activated target receive increased activation (e.g., using a hand to open the door versus using a hand to cut vegetables). The pursuit of the activated target continues until the activation of other goals becomes higher either through the successful reduction of the discrepancy or changes of the environment that increase the activation levels of other targets (DeShon & Gillespie, 2005).

The theory claims that excellent outcomes for the individual appear when one either perceives a little gap between the desired and the actual goal state or at least perceives that they are making sufficient progress toward reducing the perceived gap (DeShon & Gillespie, 2005). This assumption is based on Carver and Scheier's (1998) suspected existence of a feedback loop that monitors the effectiveness of movement toward goals. If the progress is too slow, one

experiences negative affect (e.g., sad, depressed). In contrast, if the progress is satisfactorily quick, one experiences positive affect (e.g., satisfied, happy). Accordingly, perceived goal progress, rather than goal attainment or failure, influences and determines positive and negative affect (Carver & Scheier, 1998). Empirical evidence supports this suggestion in showing that perceived progress toward highly valued goals results in positive emotional states (e.g., joy, happiness, satisfaction) and significantly affects subjective well-being (Brunstein, 1993; Emmons, 1986; Hortop et al., 2013; Klug & Maier, 2015).

Goal Commitment

The effectiveness of goal pursuit has been generally operationalised as perceived progress, humans' subjective evaluation of the rate of advancement toward their goals (Monzani et al., 2015). Among other goal-related variables, goal commitment (e.g., identifying with the goal and being determined to continue to pursue it even in the face of possible difficulties) is one of the most important requirements of satisfactory goal progress (Brandstätter et al., 2018). Locke and Latham (1990) define goal commitment as people's determination to reach a pursued target, which influences behaviour in various situations. Motivation is one of the main consequences of commitment to any objective (e.g., Klein et al., 2012) and goal commitment has been shown to correlate with motivation operationalised in terms of effort (e.g., Erez & Judge, 2001) and persistence (e.g., Chang et al., 2010). In line with the MAT's assumption, research shows that highly committed individuals are motivated to invest effort to reduce the gap between their current situation and the desired goal state (Fishbach et al., 2009; Koo & Fishbach, 2008). Additionally, goal commitment moderated effects on subsequent goal choice. Fishbach and Dhar (2005) found that highly committed people were less likely to change their targets by showing that individuals, who focused on goal commitment, were more likely to engage in further goal pursuit rather than pursue other goals when progress was sufficiently.

One line of research deals with the cognitive representation of goals (Förster et al., 2005; Goschke, 2008; Kruglanski et al., 2002) and emphasizes that to determine our actions, goals must remain cognitively activated even if there is no opportunity to act, or action must be interrupted (Goschke & Kuhl, 1993). Kruglanski and colleagues (2002) stress that goals are cognitively associated with their corresponding means. Specifically, a mean (e.g., studying) strongly associated with a goal (e.g., passing an exam) may promptly bring the goal to mind, eliciting feelings and cognitions linked with the attainment of that goal. In one study, they found that

participants indicated higher levels of commitment to an activity when it was the only means listed (therefore the association with the goal was strong) compared to one of several activities listed, which reduces the strength of association. Since the goal reminders in EverGoal also list just one means at a time, namely a subgoal, I assume this will increase app users' commitment to the associated focal goal. Moreover, Kruglanski's study showed that participants were significantly more likely to be committed to a goal when first primed with the specific construct with which it was associated. Conversely, a different study revealed that priming participants with an alternative goal undercut their commitment to the main goal and hindered progress towards it (Shah & Kruglanski, 2002). Thus, I presume that the reminders used in my study may act similarly to a priming stimulus. By containing a means that is strongly associated with the focal goal, the reminders direct users' attention towards that goal and away from alternative goals. Thus, the main goal remains cognitively activated and goal commitment increases.

Following on from Kruglanski's research, Sonnentag and Kühnel (2016) investigated goal activation in the context of work. Specifically, they looked at the effect of reattachment to work in the morning on work engagement. Reattachment to work means mentally reconnecting to work before starting to work (e.g., thinking about the upcoming tasks). The study showed that morning reattachment to work positively predicted work engagement throughout the day. Moreover, the relationship between reattachment and work engagement was strongest in the morning. According to the MAT, they assumed that reattachment activates work-related goals. In a further study, they confirmed their assumption by showing that reattachment predicted work engagement indeed through goal activation (Sonnentag et al., 2020). They concluded that the activation of goals will induce response tendencies that help pursuing the goals by being in an optimal cognitive and affective state. These results support Rothbard and Wilk's (2011) idea that mornings are especially important for setting the tone for the day and they highlight the general importance of reattaching to one's goals to activate them. I assume that personal goal striving is also subject to cycles of detachment and reattachment to one's goals. Hence, a smartphone app that sends out goal reminders might help people to reattach to their goals. Through this, goals will remain cognitively activated, drawing attention to goal-related response tendencies, like the MAT's assumption. Subsequently, people may likely be more committed to act on their goals. Based on the above presented state of research, the following hypothesis is proposed:

H1a: Participants using a smartphone application with goal reminders report greater goal commitment over time than participants in the control condition (no app).

Goal Progress

Sonnentag et al. (2020) further assumed that thinking about the workday and its upcoming tasks might feel like a first step towards achieving the goal, resulting in perceived goal progress. A longitudinal study showed that goal progress was positively influenced by goal commitment with individuals being highly committed to their goals reporting subsequently more goal progress than individuals being less committed (Monzani et al., 2015).

A recent study by Stieger et al. (2020a) investigated the effects of a 2-week smartphone-based intervention to change one facet of a personality trait. Several micro-interventions were delivered twice daily via text message. One intervention aimed to actuate discrepancy awareness such as the MAT's feedback loop. This was done using Martin et al.'s (2014) suggestion that one way to target discrepancy awareness is to repeatedly remind people of their self-set change goals and to provide information on the gap between their actual and desired behaviour. The study results revealed that the smartphone-based intervention helped users to make progress toward their desired change goals. Building on this, Stieger et al. (2021b) further extended their smartphone-based intervention to a three-month digital personality change app called PEACH. It contained a digital personality coach who accompanied participants in achieving their change goal. To promote and sustain the change process, similar evidence-based micro-interventions as in the previous study (e.g., individual feedback on goal progress) were delivered. The intervention group showed greater changes than the waitlist control group and the changes aligned with the intended goals. However, it was not clear whether the app in general or one specific micro-intervention helped participants to reach their self-set targets, since different interventions were used each day. Furthermore, although the waitlist control group already selected and indicated their change goals before a one-month waiting period, they only showed small, nonsignificant changes during this time. This finding indicates that having the desire to change one's personality and selecting a specific change goal does not necessarily lead to actual personality changes. In line with this, Baranski and colleagues (2020) showed that being motivated to change without having a solid plan and support to achieve the goal does not result in subsequent change.

Based on the above-mentioned findings, I assume that EverGoal supports the goal progress of its users. First, based on the MAT, EverGoal provides people with an action plan to attain their self-set goals by instructing the user to indicate subgoals or necessary steps for each goal. By reminding users of their plan, they know exactly how to get closer to their goal and it will help them to work more systematically toward achieving it. Second, as in the earlier presented studies, the goal reminders will draw people's attention to the gap between their current state and their desired goal state. Subsequently, app users will be motivated to narrow this gap, showing in increased effort and persistence in the pursuit of these goals, which will ultimately increase the goal progress. The following hypothesis is derived:

H1b: Participants using a smartphone application with goal reminders report greater goal progress over time than participants in the control condition (no app).

Goal Striving and Subjective Well-Being

Human behaviour is organised around the pursuit of specific goals which influence thoughts and emotions (Emmons, 1986). Without goals, we lack orientation in life, the experience of a fulfilled and self-determined life, and the drive to use our mental and physical resources (Brunstein & Maier, 2002). Thus, being aimless is a stressful mental state, with feelings of emptiness and dissatisfaction with life (Klinger, 1977). Specifically, low personal goal striving has been shown to be associated with depressive symptoms (Dickson & Moberly, 2013; Monti & Rudolph, 2017) and reduced well-being (Hennecke & Brandstätter, 2017; Steca et al., 2016). In line with this, MacLeod et al. (2008) showed that participants in an intervention for developing goal setting and planning skills, reported significant increases in subjective well-being compared to a control group.

Diener's (1984) telic theories of subjective well-being address the key function of personal goals for happiness. He defines subjective well-being as a relatively stable state containing cognitive (i.e., evaluative judgment of life satisfaction) and affective (i.e., experience of positively or negatively valenced emotions) components. According to him, people show a positive reaction when they make progress towards their goals and a negative reaction when they do not to achieve their goals.

Several studies support the assumption that successfully striving for personally meaningful goals is linked to the development and stability of subjective well-being (Little, 1983; Brunstein, 1993; Wallenius, 2000).

However, research indicates that the rate of goal progress, rather than goal attainment, accounts for differences in affect (e.g., Hsee & Abelson, 1991) and subjective well-being (e.g., Klug & Maier, 2015). Consistent with this idea, Brunstein (1993) showed that residual change in progress towards personal goals across two testing periods was a significant predictor of changes in students' subjective well-being. Additionally, he found that goal progress mediated the effect of the conjoint influence of goal commitment and goal attainability on subjective well-being. In line with this, Steca et al. (2016) found that individuals whose goal progress increased, regardless of their previous level of goal progress, later reported greater subjective well-being than individuals who experienced no increase. This indicates that changes in goal progress are pivotal in determining following levels of subjective well-being rather than the levels of perceived progress. These findings are in line with the above-mentioned cybernetic model of self-regulation by Carver and Scheier (1998), according to which actions are constantly monitored to determine whether and at what rate the current state is approaching the desired target state.

Based on the presented literature, I assume that reminders of self-set goals delivered via a smartphone app, help people with successful goal striving. Constantly reminding app users of the discrepancy between their current state and their desired goal state will motivate them to reduce this discrepancy by making progress towards their goal. Ultimately, people will experience increased subjective well-being due to getting closer to their desired target. The following hypotheses are proposed:

H1c: Participants using a smartphone application with goal reminders report greater subjective well-being over time than participants in the control condition (no app).

H2: Goal progress will mediate the relationship between app use and subjective well-being.

Research Model

The following research model summarizes the derived hypotheses of this study. Figure 1 provides an overview of all propositions made based on the reviewed literature and the current body of research. The postulated mediation effect of goal progress on the relationship between app use and subjective well-being is shown in the right model.

Figure 1

Research Model



Note. Right model includes mediation effect

Method

Participants and Design

The most used method in investigating personal goals is an idiographic-nomothetic approach (Brandstätter et al., 2018; Brunstein & Maier, 2002). First, participants list specific personal goals (idiographic). Subsequently, they are repeatedly assessed according to various goal characteristics (nomothetic, e.g., commitment, progress). In this way, interindividual differences in the pursuit of goals can be recorded and related to other variables, such as subjective well-being. The longitudinal design allows the causal interpretation of data on the relationship between goal characteristics and well-being (Brandstätter et al., 2018).

Therefore, to empirically verify my research model and the developed hypotheses, my research partner and I conducted a two-wave longitudinal online study with one-month intervals (three time points: T_0 , T_1 , T_2). Prior to the actual study, a pilot study was conducted with 10 respondents to ensure that all scales and items employed were comprehensible and free of errors. The study received the approval of the Ethics Committee of the University of Vienna. Data was collected between April 11th and June 20th, 2022, using Qualtrics XM software, version 2022.

375 participants completed the baseline survey (T_0) of the study. Only those who were enrolled at a university at the first measuring point and were at least 18 years old were included in the study. In total, 21 participants were excluded because they did not meet the specified inclusion criteria. Of the remaining 354 participants at T_0 , 100 participants dropped out at T_1 and 30 participants dropped out at T_2 due to not answering the surveys. In the analysis part of this thesis the dropout will be explained in more detail.

The final sample consisted of $N = 224$ students enrolled in different fields of study at several German-speaking universities from the DACH region ($M_{\text{age}} = 26.33$ years; $SD_{\text{age}} = 6.04$, 91% female; range: 18 - 55 years). The sample size was appropriate according to the software G*power 3.1 (Faul et al., 2009), which proposed a sample size of roughly $n = 142$ participants to reach a power of $\beta = .80$ for the present study.

At baseline, participants were randomly assigned to either the app group ($n = 127$), which used the smartphone app with goal reminders, or to the waitlist control group ($n = 97$), which was not given access to the app until all data was collected and the study was completed. Considering the educational background, 60% of our final sample were first-generation students, meaning that their parents did not go to college (Cataldi et al., 2018). Regarding the occupational status, 54%

of the participants were part-time employed, 19.5% job-seeking, 13.7% full-time employed, 8% self-employed, and 4.4% civil servant.

Procedure

Participants were recruited online in mid-March 2022 via social platforms like Facebook, Instagram, and LinkedIn. Additionally, some participants were recruited through announcements during seminars and through our own circle of acquaintances. They were informed that they are participating in a personal goal pursuit study and that participation requires a smartphone (Android/iOS), is voluntary, anonymous and can be cancelled at any time. Following, they were asked to give their informed consent, provide their data for analysis and to register with their email address. They received the baseline questionnaire via email in mid-April (T_0). Participants answered questions concerning their personal goals, subjective well-being, and demographics. Self-efficacy was measured by the remaining items, but it is not considered in this study (for details see Gruber, 2022). In addition to the questionnaire, at T_0 the app group had to download the EverGoal app to their private smartphone and enter their goals. The link to the second questionnaire was sent out in mid-May (T_1) and the link to the last questionnaire was sent out in mid-June (T_2), both assessing the same items as the baseline questionnaire. Participants had one week to complete each survey. Non-responding participants received an e-mail reminder two, four, five, and six days after the initial survey link was sent out. After completing all three surveys, participants were thanked for participation and informed about the research's aim. A three hundred euros wish voucher was raffled among the participants who took part in all three measuring points.

The surveys and EverGoal were in German. Hence, German scales were used, or English items were translated into German. Please consult the supplementary material for the complete documents.

Measures

List of Personal Goals

According to previous research, personal goals are accessible to conscious awareness and can be inferred from an individual's self-report (Brunstein, 1998; Brunstein & Maier, 2002). Therefore, an idiographic approach was used to assess participants' personal goals. Following previous studies, participants were provided with a description of the goal concept and then instructed to list two personally meaningful goals, which are subsequently referred to as goal I

and goal II (see the following for similar procedure: Brunstein, 1993; 1998; Sieber et al., 2019; Steca et al., 2016). Due to the considerable length of the survey, we decided to ask participants to rate only their two most important goals that they plan to continuously pursue within the next two months (Monzani et al., 2015). According to Doran's (1981) S.M.A.R.T method, we instructed participants to describe their goals by considering the following statement: "Is my goal specific, measurable, achievable, and time-bound?". Furthermore, the necessary steps to achieve each goal were listed due to the hierarchical structure of goals (Carver & Scheier, 1998; Kruglanski et al., 2002). In addition, participants assigned each goal to a life domain (e.g., social relationships, leisure activities, work/education) (Sieber et al., 2019).

Following, each goal was separately rated in terms of different goal characteristics, as described below. The app group set their goals in the baseline questionnaire, as well as in the smartphone app. The control group set their goals only in the baseline questionnaire. At T₁ and T₂ participants had to recall their goals from T₀ at the beginning of each survey. Following, we presented them a summary of their goals listed at T₀ and asked them to answer the subsequent items by considering these goals.

Goal Commitment and Goal Progress

For each goal separately, goal commitment and perceived goal progress were measured with a short version of the original Personal Goals Variables Scale (Brunstein, 1993). Participants were asked to rate each item on a 6-point Likert scale (1 = not at all to 6 = completely true). Compared to the original scale with 18 items, the short version by Monzani et al. (2015) consists of 9 positively worded items. In a principal-component analysis by Brunstein (1993) these items showed higher loadings on their respective factors, compared to the negative worded items. An exploratory factor analysis (e.g., Monzani et al., 2015) demonstrated the existence of three different factors (e.g., commitment, attainability, perceived goal progress) like those extracted by Brunstein. Therefore, goal commitment was measured by three items (e.g., "No matter what happens, I will not give up this goal"). The internal consistency was satisfying for both goals and each time point (goal I: T₀: α = .82; T₁: α = .86; T₂: α = .85; goal II: T₀: α = .82; T₁: α = .80; T₂: α = .81).

Perceived progress was assessed by three items. Two of them were also from Monzani's short version of the Personal Goals Variables Scale (e.g., "I have made a great deal of progress concerning this goal"). The internal consistency of these items was high (goal I: T₀: α = .91; T₁: α

= .93; T₂: α = .92; goal II: T₀: α = .89; T₁: α = .95; T₂: α = .95). The third item was self-developed and asked participants to indicate their current goal progress on a timeline ranging from 0% (I've done nothing for the goal yet) to 100% (I've reached the goal) (goal I: T₀: M = 28.79, SD = 23.44; T₁: M = 42.28, SD = 26.23; T₂: M = 53.44, SD = 29.20; goal II: T₀: M = 27.58, SD = 22.78; T₁: M = 42.58, SD = 28.14; T₂: M = 52.49, SD = 31.84). It was used as a filter item, so that participants, who reached goal one, could skip the goal-related questions, and continue with the questions concerning goal two.

Goal Importance and Goal Feasibility

In addition, two single items assessed each goal's importance (e.g., "This goal is very important to me") and feasibility (e.g., "I will very likely be successful with respect to this goal"). Participants answered on a 6-point Likert scale (1 = not at all to 6 = completely true). These items are often used in goal striving literature and measure the constructs of importance and feasibility accurately (see Sieber et al., 2019). We included them in the survey because they assess very similar constructs to goal commitment and progress and to be able to use them for possible exploratory analyses.

Subjective Well-Being

Like Steca et al. (2016), I assessed the affective and cognitive components of subjective well-being. The affective components I measured with the German version of the Multidimensional Mood Questionnaire (MDMQ; Steyer et al., 1997). It is a well-established tool for the assessment of current mood, with very good psychometric characteristics, especially suited for repeated measures (Meinlschmidt et al., 2016). Current mood is assessed on three dimensions ranging from good to bad (GB), awake to tired (AT), and calm to nervous (CN). The original scale consists of 24 items, but I decided to use the short version with 12 items. Because the focus of the present study was on temporal change rather than on long-term stability in subjective well-being, participants rated how well each adjective (e.g., "content, rested, tired [reverse scored], unwell [reverse scored]") reflected how they had felt in the "last seven days" on a 6-point Likert scale (1 = not at all to 6 = very). A score is calculated for each dimension, ranging from 4 to 24. Thus, high scores indicate positive affectivity, wakefulness, and calmness (T₀: α = .91; T₁: α = .92; T₂: α = .94).

The cognitive components I assessed with the German version of the Satisfaction with Life Scale (SWLS; Diener et al., 1985; Glaesmer et al., 2011). Participants were asked to rate five

items (e.g., “The conditions of my life are excellent”) on a 6-point Likert scale (1 = not at all to 6 = completely true). The scores are summed, and a higher score suggests greater life satisfaction. The scale is a validated measure with high internal consistency ($T_0: \alpha = .87$; $T_1: \alpha = .88$; $T_2: \alpha = .87$).

EverGoal (Smartphone App/Intervention)

Towards the end of the baseline questionnaire, the app group was instructed to download (for free) the smartphone app EverGoal from the Appstore or Google Play Store. They were asked to enter the same goals into the app, which they had just set for themselves in the questionnaire, including the subgoals for each goal. After successfully entering both goals, they received a six-digit code, which had to be entered in the survey to be able to continue with answering the remaining demographic items.

The app tracked every participant’s usage throughout the entire study period (e.g., last login, change/ticking off subgoals) and users received goal reminders via push notification whenever they were inactive in the app for three days. Stieger and colleagues (2020a; 2021b) used daily app interactions in their studies. However, we thought this may be too much for goal setting, since people set different goals of which some require daily work (e.g., personality change) and others do not (e.g., fitness goals). Thus, goal reminders were sent out three days after no activity in the app.

A goal reminder included how many days the person had not looked at their goals and a question asking if they were still working on any of the subgoals of that specific goal (e.g., “You haven't looked at your goals in four days. Are you still working on this [insert subgoal]?”). Please see appendix E for the app interface.

We assumed that the reminders would help the app group to act on their goals. Based on previous studies (Sonnentag & Kühnel, 2016; Sonnentag et al., 2020), we theorised that personal goal striving is also subject to cycles of detachment and reattachment. Hence, we assumed that there may be critical times like the morning hours when a reminder can have stronger effects on personal goals. Therefore, app users received the reminders in the morning.

Demographics

Socio demographics were assessed with a total of six items measuring participants’ gender, age, academic education (if they study and area of study), current occupation, and educational background in their family (e.g., “Do your parents have a university degree?”).

Control Variables

In the main analyses, age was included as control variable, since Monzani et al. (2015) found age differences in goal commitment and goal progress. Furthermore, I controlled for participants' goal progress at T_0 when testing H1a and H1c. When testing H1b, I controlled for participants' goal commitment at T_0 .

Other variables

In addition to the above-mentioned items, measuring the main variables, the following 15 items were included in the surveys: reasons for goal pursuit (Sieber et al., 2019), action crisis scale/obstacles in the goal pursuit (ACRISS; Brandstätter & Schüler, 2013), and self-efficacy (see Gruber, 2022). These items were collected for future research and scientific work linked to this study. However, they were not considered for testing the hypotheses suggested in this master's thesis. Please consult the supplementary material for the complete list of items.

Data Analysis

The statistical analysis was carried out by means of IBM SPSS Statistics 27 software for Windows using Pearson correlations, χ^2 tests, t tests, and the inferential statistics of analysis of variance (ANOVA) for repeated measures. By calculating 2 x 3 repeated measures ANOVAs for each of the dependent variables, I was able to compare the app and control group over time. The group (app vs control) was the between-subjects factor. The repeated measures dependent variables (goal commitment, goal progress, subjective well-being) were the within-subjects factors (time). The significance level was set at .05 for all analyses. For significant results, the effect size r , ϕ , d or partial η^2 was specified and classified as shown in Table 1.

Table 1

Values of Effect Sizes and Their Classification

Test	Index	Small	Medium	Large
Pearson correlation	r	.10	.30	.50
Chi ²	ϕ	.10	.30	.50
t-Test	d	.02	.05	.08
Anova	η^2_p	.01	.06	.14

Note. Classified according to Cohen (1988): r , ϕ , d . Classified according to Lakens (2013): η^2_p .

Results

Preliminary Analyses and Descriptive Statistics

Regarding the life domains, most goals were assigned to either leisure activities (goal I: 54%; goal II: 61%) or work/education (goal I: 44%; goal II: 34%). The remaining were assigned to social relationships (goal I: 2%; goal II: 5%). Examples of responses included “lose weight”, “pass my master’s degree” or “meet friends more often”.

Descriptive statistics and zero order correlations for all main and exploratory variables at T_0 are depicted in Table 2. Goal commitment and goal progress showed a significant positive correlation for goal I ($r(222) = .28, p < .001$) and goal II ($r(222) = .35, p < .001$). Satisfaction with life and goal progress were significantly positively related for goal I ($r(222) = .26, p < .001$) and goal II ($r(222) = .24, p < .001$). The good-bad subscale of the MDMQ and goal progress significantly and positively correlated for goal I ($r(222) = .16, p = .019$) and goal II ($r(222) = .26, p < .001$). The other two subscales of the MDMQ demonstrated to be significantly and positively related with goal progress, only for goal II (AT: $r(222) = .19, p = .005$; CN: $r(222) = .18, p = .007$). Each subscale showed a significant positive correlation with satisfaction with life, supporting the assumption that they both measure a subconstruct of subjective well-being (GB: $r(222) = .48, p < .001$; AT: $r(222) = .29, p < .001$; CN: $r(222) = .34, p < .001$). Similar results can be found for T_1 and T_2 (see appendix B).

Moreover, no significant correlation was found for goal commitment at T_0 between goal I and goal II, $r(222) = -.01, p = .865$. For goal progress, the two goals weakly positively correlated, $r(222) = .20, p = .002$. Therefore, I decided to run the repeated measures ANOVAs for commitment and progress separately for each goal.

Additionally, age showed a significant positive correlation with goal commitment (goal II) at T_1 , $r(222) = .17, p = .015$, and a significant negative correlation with goal progress (goal II) at T_0 , $r(222) = -.20, p = .003$. Thus, I decided to control for age when running the repeated measures ANOVA for commitment and progress, only for goal II.

Strong significant and positive correlations were found for importance and commitment for both goals (goal I: $r(222) = .75, p < .001$; goal II: $r(222) = .71, p < .001$). Weaker correlations were found for importance and progress (goal I: $r(222) = .19, p = .004$; goal II: $r(222) = .23, p < .001$). Feasibility and progress strongly and positively correlated for both goals (goal I: $r(222) =$

.46, $p < .001$; goal II: $r(222) = .52, p < .001$). Slightly weaker correlations were found for feasibility and commitment (goal I: $r(222) = .42, p < .001$; goal II: $r(222) = .45, p < .001$).

Further correlation analyses, including all time points, showed that the stability over the period of 10 weeks ($T_0 - T_2$) was high for goal commitment (goal I: $r(204) = .46, p < .001$; goal II: $r(202) = .60, p < .001$), goal progress (goal I: $r(204) = .45, p < .001$; goal II: $r(202) = .37, p < .001$), satisfaction with life ($r(222) = .84, p < .001$), and multidimensional mood (GB: $r(222) = .41, p < .001$; AT: $r(222) = .45, p < .001$; CN: $r(222) = .43, p < .001$).

Table 3 presents descriptive statistics for the dependent variables at all three time points by experimental group. Commitment for both goals, SWLS and MDMQ (GB) showed high scores at baseline in both groups.

Table 2

Pearson Correlations and Descriptive Statistics – T_0 (first measurement)

	<i>M (SD)</i>	1	2	3	4	5	6	7	8	9	10	11
1 Commitment (I)	4.76 (1.11)	--										
2 Commitment (II)	4.53 (1.19)	-.01	--									
3 Progress (I)	3.37 (1.40)	.28**	-.03	--								
4 Progress (II)	3.33 (1.46)	-.06	.35**	.20**	--							
5 SWLS	4.08 (1.11)	.12	.10	.26**	.24**	--						
6 MD (GB)	4.11 (1.15)	-.02	.08	.16*	.26**	.48**	--					
7 MD (AT)	3.22 (1.16)	-.04	-.06	.12	.19**	.29**	.54**	--				
8 MD (CN)	3.67 (1.19)	-.01	.01	.12	.18**	.34**	.61**	.56**	--			
9 Importance (I)	5.23 (1.09)	.75**	-.04	.19**	-.11	.01	-.07	-.08	-.06	--		
10 Importance (II)	5.15 (1.05)	.09	.71**	-.06	.23**	.04	.04	-.04	.01	.15*	--	
11 Feasibility (I)	4.46 (1.08)	.42**	.06	.46**	.06	.28**	.19**	.06	.11	.25**	.01	--
12 Feasibility (II)	4.46 (1.01)	-.06	.45**	.04	.52**	.18**	.18**	.01	.06	-.12	.32**	.17*

Note. I = goal one, II = goal two, SWLS = satisfaction with life, MD = multidimensional mood (GB = good-bad, AT = awake-tired, CN = calm-nervous). $N = 224$.

* $p < .05$ ** $p < .01$ (2-sided).

Table 3*Scores of the Dependent Variables by Experimental Group*

	<i>App Group</i>			<i>Control Group</i>		
	<i>T₀</i>	<i>T₁</i>	<i>T₂</i>	<i>T₀</i>	<i>T₁</i>	<i>T₂</i>
	<i>M (SD)</i>	<i>M (SD)</i>	<i>M (SD)</i>	<i>M (SD)</i>	<i>M (SD)</i>	<i>M (SD)</i>
Commitment (I)	4.80 (1.08)	4.54 (1.17)	4.50 (1.23)	4.70 (1.10)	4.46 (1.24)	4.32 (1.40)
Commitment (II)	4.48 (1.19)	4.16 (1.28)	4.05 (1.34)	4.52 (1.19)	4.35 (1.24)	4.33 (1.29)
Progress (I)	3.43 (1.33)	3.52 (1.35)	3.65 (1.55)	3.23 (1.44)	3.20 (1.51)	3.53 (1.49)
Progress (II)	3.13 (1.41)	3.13 (1.53)	3.27 (1.74)	3.41 (1.46)	3.38 (1.50)	3.69 (1.57)
SWLS	4.14 (1.04)	4.25 (0.94)	4.31 (0.90)	4.04 (1.17)	4.06 (1.15)	4.21 (1.10)
MD (GB)	3.99 (1.13)	4.08 (1.21)	4.32 (1.01)	4.20 (1.16)	4.16 (1.13)	4.30 (1.13)
MD (AT)	3.17 (1.19)	3.11 (1.14)	3.50 (1.30)	3.25 (1.15)	3.21 (1.22)	3.42 (1.33)
MD (CN)	3.68 (1.15)	3.55 (1.17)	3.87 (1.18)	3.66 (1.23)	3.55 (1.19)	3.78 (1.41)

Note. I = goal one; II = goal two. T₀ = first measurement, T₁ = second measurement, T₂ = third measurement. SWLS = satisfaction with life. MD = mood (GB = good-bad; AT = awake-tired; CN = calm-nervous). Scale from 1 (not at all) to 6 (completely true/very).

$N_{(I)} = 204$. $N_{(II)} = 202$. $N_{SWLS/MD} = 224$.

Dropout

To be able to rule out systematic dropout, I conducted several analyses with the participants who completed at least T₀ ($n = 354$) and met the above-mentioned inclusion criteria. The analyses revealed that 100 participants dropped out from T₀ to T₁ (63% control group; 37% app group). Of the remaining 254 participants who completed the first two time points, another 30 participants dropped out from T₁ to T₂ (50% control group; 50% app group). This left $N = 224$ participants who completed all three time points of the study. Using chi² tests, I examined whether there were significant differences in dropout between the experimental conditions. No expected cell frequencies were below 5. The analyses revealed no significant results, dropout 1: $\chi^2(1) = 1.48$, $p = .224$, $\phi = 0.07$; dropout 2: $\chi^2(1) = 0.48$, $p = .488$, $\phi = -0.04$.

To compare the dropout and no dropout groups regarding all main variables measured at T₀, I used chi² and t tests. For the first dropout (T₀ to T₁), a significant correlation between dropout and participants' educational background was found, $\chi^2(1) = 3.92$, $p = .048$, $\phi = -0.11$, no expected cell frequencies were below 5. Additional analyses revealed that more than twice as many first-generation students compared to second-generation students dropped out at T₁ ($n_{fg} = 56$; $n_{sg} = 20$) as well as at T₂ ($n_{fg} = 21$; $n_{sg} = 9$). For the second dropout (T₁ to T₂), significant

results were found regarding commitment goal II, $t(44) = 2.56$ $p = .014$, $d = 0.40$, and progress goal II, $t(252) = -2.30$, $p = .022$, $d = -0.45$. Despite the significant results found, no systematic dropout was detected, and subsequent analyses were performed as planned.

Missing Data

The dataset had some missing values due to the use of the third, self-developed, progress item. Once people indicated that they achieved their goal (100%), all subsequent goal-related items in the survey were skipped. We included this item so that participants would not have to answer questions related to a goal they had already achieved (e.g., “I have an urgent feeling that I need to start working on this goal right away”). However, we did not consider the resulting missing values for relevant constructs (e.g., goal progress and goal commitment) for the subsequent analyses. Therefore, only participants who did not reach their goal(s) were included in the analyses of goal commitment and goal progress. This should be kept in mind when interpreting the results presented below. Fortunately, the number of missing values was rather small (T₁: goal I = 7 missing, goal II = 7 missing; T₂: goal I = 18 missing, goal II = 20 missing).

Testing the Hypotheses

Before hypotheses testing, I ran exploratory data analyses to check the data for distribution properties and to identify possible outliers. For goal commitment and SWLS moderate outliers were found. None of the dependent variables were normally distributed, as assessed by the Shapiro-Wilk Test ($p < .05$). Nevertheless, the analyses continued as planned because the ANOVA is considered a relatively robust procedure to normal distribution violations (see Glass et al., 1972). However, this finding should be kept in mind, when interpreting the following results.

I conducted several repeated measures ANOVAs, including the dependent variables (commitment, progress, subjective well-being) as within-subjects factor (time) and group (app vs control) as between-subjects factor.

To test hypothesis 1a, I ran the analysis for each goal separately. Due to the significant correlations found, I controlled for goal progress at T₀ and for age (only for goal II). All test requirements were met, except sphericity. The Greenhouse-Geisser adjustment was used for both goals to correct for violations of sphericity. Table 4 and 5 present the results of the repeated measures ANOVAs for both goals. There was no significant main effect for time and no significant main effect for group. No significant interaction effect between time and group was

found either. Therefore, H1a, claiming that the app group reports greater goal commitment over time than the control group, was not supported. The groups did not differ significantly in how their goal commitment changed over time. Contrary to H1a, goal commitment slightly decreased over time in both groups and for both goals, however non-significant (see Table 3). Regarding the included covariates, a significant main effect for goal progress at T_0 was found for both goals. For goal II, a significant interaction between time and age was found.

Similar results were found when repeating the analyses after excluding outliers (goal I: 22 participants excluded; goal II: 18 participants excluded). In addition, for goal I a significant main effect for time was found, $F(1.92, 342.90) = 12.33, p < .001, \eta^2_p = .064$. Post-hoc Bonferroni-tests revealed that commitment at T_0 ($M = 4.95, SD = 0.06$) was significantly higher ($p < .001, \eta^2_p = .127$) than at T_1 ($M = 4.67, SD = 0.07$), and at T_2 ($M = 4.63, SD = 0.08$). Moreover, a significant interaction between time and goal progress at T_0 was found, $F(1.92, 342.90) = 3.91, p = .006, \eta^2_p = .029$. Nevertheless, as before, no results supporting hypothesis 1a were found. The app group did not report greater goal commitment over time compared to the control group.

Table 4

Results of the repeated measures ANOVA – Commitment (goal I)

	<i>df</i>	<i>F</i>	<i>p</i>	η^2_p
Within-subjects effects				
Commitment	1.807	2.837	.065 ^a	.014
Commitment*GRP	1.807	0.163	.828 ^a	.001
Commitment*PRG _{T0}	1.807	0.309	.712 ^a	.002
Residual	363.129			
Between-subjects effects				
GRP	1	0.243	.623	.001
PRG _{T0}	1	25.163	<.001	.111
Residual	201			

Note. Within-subjects factor: Commitment. Between-subjects factor: GRP (app vs control group). Covariate: Progress T_0 (PRG). $N = 204$.

^a Mauchly's test of sphericity indicates that the assumption of sphericity is violated ($p < .05$).

Table 5*Results of the repeated measures ANOVA – Commitment (goal II)*

	<i>df</i>	<i>F</i>	<i>p</i>	η^2_p
Within-subjects effects				
Commitment	1.851	2.947	.058 ^a	.015
Commitment*GRP	1.851	1.936	.149 ^a	.010
Commitment*PRG _{T0}	1.851	0.836	.426 ^a	.004
Commitment*AGE _{T0}	1.851	3.909	.024 ^a	.019
Residual	366.590			
Between-subjects effects				
GRP	1	0.635	.427	.003
PRG _{T0}	1	25.669	<.001	.115
AGE _{T0}	1	5.844	.017	.029
Residual	198			

Note. Within-subjects factor: Commitment. Between-subjects factor: GRP (app vs control group). Covariates: Progress T₀ (PRG); AGE T₀. *N* = 202.

To test hypothesis 1b, I ran the analysis for each goal separately. Due to the significant correlations found, I controlled for goal commitment at T₀ and for age (only for goal II). All test requirements were met, except sphericity for goal II. The Greenhouse-Geisser adjustment was used for goal II to correct for violations of sphericity. Table 6 and 7 present the results of the repeated measures ANOVAs for both goals. There was no significant main effect for time. No significant main effect for group (goal I) was found either. Regarding goal II, a tendency for a significant main effect for group was found. No significant interaction effect between time and group was found. Therefore, H1b, claiming that the app group reports greater goal progress over time than the control group, was not confirmed. The groups did not differ significantly in how the perceived goal progress for each goal changed over time. In the app group, goal progress for the first goal slightly increased over time. For the second goal, there was only an increase from T₁ to T₂. In the control group, goal progress for both goals increased from T₁ to T₂ only (see Table 3). However, the changes in goal progress were all non-significant. Regarding the included covariates, a significant main effect for goal commitment at T₀ was found for both goals. For the second goal, a significant main effect for age was found.

Table 6*Results of the repeated measures ANOVA – Progress (goal I)*

	<i>df</i>	<i>F</i>	<i>p</i>	η^2_p
Within-subjects effects				
Progress	2	0.729	.483	.004
Progress*GRP	2	0.533	.587	.003
Progress*CMT _{T0}	2	1.093	.336	.005
Residual	402			
Between-subjects effects				
GRP	1	1.241	.267	.006
CMT _{T0}	1	23.385	<.001	.104
Residual	201			

Note. Within-subjects factor: Progress. Between-subjects factor: GRP (app vs control group).
Covariate: Commitment T₀ (CMT). *N* = 204.

Table 7*Results of the repeated measures ANOVA – Progress (goal II)*

	<i>df</i>	<i>F</i>	<i>p</i>	η^2_p
Within-subjects effects				
Progress	1.883	0.963	.378 ^a	.005
Progress*GRP	1.883	0.319	.714 ^a	.002
Progress*CMT _{T0}	1.883	1.068	.342 ^a	.005
Progress*AGE _{T0}	1.883	1.371	.255 ^a	.007
Residual	372.859			
Between-subjects effects				
GRP	1	2.995	.085	.015
CMT _{T0}	1	27.848	<.001	.123
AGE _{T0}	1	4.986	.027	.025
Residual	198			

Note. Within-subjects factor: Progress. Between-subjects factor: GRP (app vs control group).
Covariate: Commitment T₀ (CMT); AGE. *N* = 202.

^a Mauchly's test of sphericity indicates that the assumption of sphericity is violated (*p* < .05).

To test hypothesis 1c, I conducted four analyses, one for SWLS and three for MDMQ (each subscale separately). All test requirements were met except for homogeneity of the error variances when testing SWLS and MDMQ (CN) (Levene's test $p < .05$). Nevertheless, I proceeded with the analyses, since homogeneous variances can be assumed due to the sufficiently large sample size. The Greenhouse-Geisser adjustment was used for MDMQ (AT) to correct for violations of sphericity.

Due to the significant correlations found, I controlled for goal progress at T_0 (for both goals) when running the analysis for SWLS. Table 8 presents the results of the repeated measures ANOVA. There was a significant main effect for time. No statistically significant main effect for group was found. There was also no statistically significant interaction between time and group. The groups did not differ significantly in how satisfaction with life changed over time. In the app group as well as in the control group satisfaction with life slightly increased over time (see Table 3). Regarding the included covariates, significant main effects for goal progress at T_0 showed for both goals. Contrary to the findings of the exploratory data analysis, no outliers were found.

Table 8

Results of the repeated measures ANOVA – Satisfaction with Life Scale

	<i>df</i>	<i>F</i>	<i>p</i>	η^2_p
Within-subjects effects				
SWLS	2	5.508	.004	.024
SWLS*GRP	2	1.322	.268	.006
SWLS*PRG _I	2	2.023	.134	.009
SWLS*PRG _{II}	2	2.181	.114	.010
Residual	440			
Between-subjects effects				
GRP	1	1.258	.263 ^a	.006
PRG _I	1	8.280	.004 ^a	.036
PRG _{II}	1	10.232	.002 ^a	.044
Residual	220			

Note. Within-subjects factor (time): SWLS. Between-subjects factor: GRP (app vs control group). Covariate: Progress T_0 (PRG; I = goal one, II = goal two). $N = 224$.

^a Levene's test indicates that the assumption of homogeneity of the error variances is violated ($p < .05$).

Table 9 presents the results of the repeated measures ANOVAs for the MDMQ subscales. For the good-bad subscale, there was a significant main effect for time. No statistically significant main effect for group was found. There was also no statistically significant interaction between time and group. For the awake-tired subscale as well as for the calm-nervous subscale, similar results were found with significant main effects for time. There were no statistically significant main effects for group. Between time and group no statistically significant interaction effects were detected.

In summary, for the cognitive and affective components of subjective well-being, only significant main effects for time were found, indicating that subjective well-being changed between the measurement points. Post-hoc Bonferroni-tests revealed significant increases in SWLS and MDMQ between T_0 and T_2 and between T_1 and T_2 (see appendix C for detailed mean differences). However, no significant interaction effects showed. Therefore, the results did not support H1c, claiming that the app group reports greater subjective well-being over time than the control group.

The analyses to test H2 were not conducted because the predictions for the mediation analysis were not given. The previous hypotheses testing did not reveal any group differences on the postulated mediator goal progress, which invalidates the mediation analysis. Accordingly, I did not test H2 and assume that like the other hypotheses, it cannot be confirmed.

Table 9*Results of the repeated measures ANOVA – Multidimensional Mood Questionnaire*

	<i>df</i>	<i>F</i>	<i>p</i>	η^2_p
Within-subjects effects				
MDMQ _{GB}	2	4.239	.015	.019
MDMQ _{GB} *GRP	2	0.942	.391	.004
Residual	444			
MDMQ _{AT}	1.934	6.862	.001 ^a	.030
MDMQ _{AT} *GRP	1.934	0.639	.523 ^a	.003
Residual	429.452			
MDMQ _{CN}	2	5.162	.006	.023
MDMQ _{CN} *GRP	2	0.139	.870	.001
Residual	444			
Between-subjects effects				
GRP _{GB}	1	0.514	.474	.002
Residual	222			
GRP _{AT}	1	0.061	.804	<.001
Residual	222			
GRP _{CN}	1	0.082	.775 ^b	<.001
Residual	222			

Note. Within-subjects factor (time): MDMQ (GB = good-bad; AT = awake-tired; CN = calm-nervous). Between-subjects factor: GRP (app vs control group). $N = 224$.

^a Mauchly's test of sphericity indicates that the assumption of sphericity is violated ($p < .05$).

^b Levene's test indicates that the assumption of homogeneity of the error variances is violated ($p < .05$).

Additional Results

Beyond hypotheses testing, further analyses were conducted. I investigated whether there is a significant correlation between people who achieved their goal(s) and app usage. At the last time point, 18 participants reported having achieved their first goal, including 8 participants from the app group. Twenty participants reported having achieved their second goal, including 10 participants from the app group. A χ^2 test was used to compare the app group and the control group, regarding goal achievement at T₂. No expected cell frequencies were below 5. In line with the previous results, no statistically significant correlation between participants reaching their goal(s) at T₂ and app usage was found, goal I: $\chi^2(1) = 0.01$, $p = .919$, $\phi = 0.01$; goal II: $\chi^2(1) = 0.40$, $p = .527$, $\phi = 0.04$. Accordingly, the experimental groups were statistically

independent of each other with respect to goal achievement, suggesting that the progress in terms of goal achievement was similar in both groups.

Furthermore, I exploratorily investigated whether the groups differed in terms of each goal's importance and feasibility over time, since the preliminary analyses revealed strong correlations between importance and commitment and between feasibility and progress. Descriptive statistics revealed high baseline scores for each goal's importance and feasibility in both groups (see appendix D). Like the main analyses, I ran four ANOVAs for each goal separately, to see if there was a significant interaction between group and time on the dependent variables (importance and feasibility). Significant main effects for time were found in all four analyses, revealing that each goal's importance and feasibility decreased over time. The second goal's importance and the first goal's feasibility slightly increased again from T₁ to T₂ in the control group (see appendix D for detailed results). A significant main effect for group revealed a higher feasibility for goal I in the app group ($M = 4.51$, $SD = 0.11$) compared to the control group ($M = 4.15$, $SD = 0.09$), $F(1, 202) = 5.80$, $p = .02$, $\eta^2_p = .03$. In line with the previous main findings, no significant interaction effects were found, suggesting that changes in goal importance and feasibility over time were not influenced by the app usage.

After excluding outliers, similar results were found. Additionally, a significant main effect for group (goal II) showed, with higher goal importance in the control group ($M = 5.34$, $SD = 0.07$) than in the app group ($M = 5.09$, $SD = 0.08$), $F(1, 174) = 5.26$, $p = .02$, $\eta^2_p = .03$.

Discussion

Summary of Results and Theoretical Implications

The current study was the first to evaluate the newly developed smartphone app EverGoal for personal goal pursuit. Based on the current body of research, it was assumed that the app usage would improve participants' personal goal pursuit and increase their subjective well-being. Specifically, it was hypothesised that app users would experience greater goal commitment, goal progress and subjective well-being over time compared to a control group. In summary, the findings contradict the study's assumptions, showing that pursuing personal goals with the help of EverGoal did not result in greater goal commitment, goal progress or subjective well-being over time. No significant differences were found between the app group and the control group. Therefore, none of the suggested hypotheses could be confirmed. The additional findings also did not reveal any significant effects attributable to the app use.

My research contributes to the understanding of personal goal striving in many ways, and its theoretical advances will be discussed below. Practical implications on how the app can be improved to support successful goal striving will be provided as well.

Hypothesis 1a, claiming that participants in the app group report greater goal commitment over time than the control group, could not be supported. Different than expected, the results showed that goal commitment slightly decreased over time for both goals among app user, however significant changes in commitment were found for the first goal only and after excluding outliers. Moreover, no significant interaction between the changes in goal commitment over time and the groups were found, indicating that the goal reminders did not have any effect on goal commitment. Although non-significant, when looking at the descriptive statistics, it seems that goal commitment slightly decreases over time, independently of the receipt of goal reminders and independently of the goal someone strives for. Here, it needs to be highlighted that the high baseline scores for goal commitment indicate ceiling effects, leaving not much room for improvement in following measurement points. This could possibly serve as an explanation as to why no significant increase over time in goal commitment was found in the app group.

Interestingly, from the first to the second time point commitment decreased more than from the second to the third time point. This suggests that people need to be motivated to pursue their goals, especially at the beginning of the goal pursuit process, as their commitment decreases over time and a greater drop-off can be seen at the beginning of the goal pursuit process. One

possible explanation for this finding is that it seems harder to maintain committed or to keep a goal cognitively activated (i.e., Kruglanski et al., 2002; Sonnentag & Kühnel, 2016; Sonnentag et al., 2020) the further away goal achievement is perceived. Therefore, further research should investigate whether goal reminders that draw attention to the distance to goal achievement (e.g., "You are already halfway to achieving your goal ") are more likely to increase goal commitment than the reminders used in this study.

According to the MAT, a goal gets increased activation through the detection of discrepancies (DeShon & Gillespie, 2005). When looking at the study's results, it seems that the reminders did not manage to keep the goals activated, as goal commitment did not increase in the app group. It remains unclear, however, whether commitment did not increase because the reminders failed to sufficiently draw attention to the gap between the current state and the desired end state. When looking at the design of the goal reminders, the structure of each reminder was always the same, starting with a statement about how many days you haven't looked at your goals, followed by a question about whether you are still working on a particular subgoal. This may have led to the fact that app users quickly got used to the reminders and therefore their possible goal-activating effect decreased. Moreover, as the reminder was displayed as push notification, it may not have stood out clearly enough from other push notifications, so participants may not have noticed the reminder at all. However, this is assumed with caution since app users' perception of goal reminders was not measured. To get a better understanding of the interplay between goal reminders and goal activation further research is needed. A first step would be to measure the activation level of a self-set goal, operationalised as cognitive accessibility, before and after receiving a goal reminder. In an experiment, Förster et al. (2005) demonstrated the assessment of a goal's cognitive accessibility. By measuring the reaction time until the recognition of goal-related words, he was able to show that an increased cognitive activation of a goal leads to faster recognition of goal-related words compared to non-goal-related words. Thus, further studies should examine whether the reaction time for recognising goal-related words significantly decreases after receiving a goal reminder, indicating an increased cognitive accessibility and activation of that goal.

The additional analyses of this study revealed high goal importance scores among all participants. Although a significant decrease over time was detected, the goal importance scores remained quite high across all time points. This implies that the study instruction to list

particularly important goals worked. Moreover, according to the theory, the activation of goals determines their current importance and action is directed toward the goal with the highest activation level (DeShon & Gillespie, 2005). When looking at the goal importance scores, it can be suggested that app users started off with high activation levels regarding their self-set goals, which decreased in the first half of the goal striving process and remained unchanged in the second half of the goal striving process. It therefore seems possible that the goal reminders had their desired effect in the second half of the goal pursuit process, namely by ensuring that the activation level did not significantly drop any further. However, this assumption should be made with caution and investigated in further research.

As anticipated, another finding of this study revealed a strong positive correlation between commitment and importance. In addition, the baseline scores of goal commitment were quite high. In line with previous research (e.g., Monzani et al., 2015), it can be inferred that individuals are highly committed to goals they evaluate as particularly important. However, since this finding does not allow for a causal interpretation, it would be interesting to look at a possible reciprocal effect between goal commitment and importance. Additionally, often people are already highly committed to self-set goals (Locke & Latham, 2013). Since an idiographic approach was used in this study, asking people to self-generate a list of personal goals, this could also explain the high commitment scores at baseline.

Hypothesis 1b, claiming that the app group reports greater goal progress over time than the control group, was not supported either. In contrast to previous research (e.g., Stieger et al., 2020a; 2021b), the present study did not provide evidence that a smartphone-based intervention helps people to make progress toward their desired goals. The results revealed no significant increase in goal progress in the app group, indicating that the goal reminders did not have a promoting effect on goal progress as assumed.

Replicating previous findings (Brandstätter et al., 2018; Monzani et al., 2015), the correlation analyses of this study revealed that goal commitment and goal progress strongly positively correlated at all measuring points. Nevertheless, a correlative relationship does not allow causal conclusions to be drawn. Specifically, the current study did not investigate whether changes in goal commitment predict subsequent changes in goal progress or vice versa. Research provides evidence that highly committed individuals are more likely to engage in further goal pursuit rather than pursuing alternative goals when progress is satisfactory (Fishbach & Dhar,

2005). This raises the question of whether goal commitment did not increase over time because there was no satisfactory increase in goal progress in the first place. Following this notion, the causal interplay of commitment and progress remains unclear and should be examined further. Specifically, the question if commitment and progress are reciprocal dependent or if one conditions the other needs to be answered.

In Monzani et al.'s (2015) study goal progress was positively influenced by goal commitment with highly goal committed individuals reporting subsequently more goal progress than less committed individuals. In the present study, a strong positive correlation between goal commitment and goal progress was also found at all three time points. However, although commitment scores in the app group remained quite high throughout the study, no significant increases in goal progress in the app group showed and the experimental groups did not differ significantly in their perceived goal progress. This implies that goal commitment alone is not sufficient to increase goal progress. In line with this idea, Brandstätter et al. (2018) assumed that perceived feasibility, e.g., favourable conditions in the goal striving process, is just as important for goal progress as goal commitment. High feasibility means, for example, that a person can organise his or her everyday life in such a way that it offers sufficient time and opportunity to do something about personal goals (Brunstein & Maier, 2002). The interaction between commitment and feasibility proved to be a significant predictor of students' subsequent goal progress in Brunstein's (1993) study. The greatest progress was made by students who were committed to achieve their goals and who saw their living conditions as favourable for doing so. In contrast, no significant goal progress was made under unfavourable conditions, even with high goal commitment. Thus, to arrive at a more comprehensive understanding of the relationship between goal commitment and goal progress, it seems necessary to ask whether and to what extent a person has a life situation that makes it either favourable or difficult to achieve personal goals (Brunstein & Maier, 2002).

Following on from this, the influence of environmental circumstances needs to be mentioned as well. According to DeShon and Gillespie's (2005) postulated feedback-loop, the environment is changed through the person taking actions to reduce the detected discrepancy between the current state and the desired goal state as well as by naturally occurring environmental forces far off the person's control. Thus, the possibility that other variables apart from goal commitment influenced participants' goal progress cannot be excluded. Specifically, it

is possible that participants encountered difficulties and obstacles in pursuing their goals (Brandstätter & Schüler, 2013), which need to be considered as confounding variables. In addition, some people may face more difficulties than others on their goal striving journey, which may impede progress toward the desired goals. As these obstacles can vary greatly, it is difficult to control for them. Nevertheless, further research is needed to investigate which environmental circumstances have a positive or negative influence on the relationship between goal commitment and goal progress.

Furthermore, the MAT (DeShon & Gillespie, 2005) suggests that the pursuit of an activated goal continues until the activation level of other goals becomes higher either through the effective reduction of the discrepancy on the current goal or environmental changes that increase the activation of other goals. The latter stresses the widespread and empirically proven assumption that goals are not separate units, but rather embedded in a goal network (Klug & Maier, 2015; Kruglanski et al., 2002; Locke & Latham, 2013). Accordingly, humans pursue several goals at once, and these goals may support or impede their reciprocal realisation (Riediger & Freund, 2004). When looking at EverGoal, it may therefore be possible that the pursuit of two goals at a time may have hindered the realisation of both goals. Specifically, it seems reasonable that the reminder for one goal may have decreased the activation of the other goal, resulting in less goal progress. Perhaps, it may be more effective to instead focus on pursuing only one goal and receiving reminders only for this goal. However, this assumption needs further investigation.

Although this study focused on goal progress rather than on goal attainment, another finding underpins that the app usage did not seem to affect goal progress. Specifically, no significant correlation between participants reaching one or both of their goals at the end of the study and app usage was detected. This result indicates that the app group and the control group were statistically independent of each other with respect to goal achievement, suggesting that the progress in terms of achieving a goal was similar for both groups.

Just like the first two hypotheses, hypothesis 1c, suggesting that the app group reports greater subjective well-being over time than the control group, was not confirmed. For all participants, there were significant changes over time in ratings of satisfaction with life and multidimensional mood. Satisfaction with life increased significantly over time. Regarding multidimensional mood, significant increases from the first to the third time point and from the second to the third time point were detected for the good-bad and the awake-tired subscale. For

the calm-nervous subscale, significant increases between the second and third time point were found. However, no significant interaction between time and group was found, suggesting that the increases in subjective well-being are not due to the smartphone-based intervention, contradicting previous research (Howells et al., 2014). This is emphasised when looking at the descriptive statistics, which show increases of both subjective well-being components in the app group as well as in the control group. Thus, it can be inferred that subjective well-being increased regardless of whether participants used the app or not.

Interestingly, post-hoc tests revealed no significant increases between the first and second measurement neither in SWLS nor in MDMQ. Therefore, the possibility needs to be considered that changes in goal progress may not affect subjective well-being directly. Rather at a later point in time. However, it remains unclear whether a perceived increase in goal progress in the first half of the goal striving process positively influences subjective well-being scores in the second or in the first half of the goal striving process. Further research, considering the different measuring points, is needed to answer this question.

Another possible explanation for the significant increases in subjective well-being among both groups could be that all participants received the instruction to pursue their most important goals over the course of two months. As described earlier, the goal importance scores were quite high in both groups, indicating that all participants pursued highly valued goals. Emmons (1986) found that simply having valued goals, independent of past success regarding goal progress, was associated with higher life satisfaction. Different than expected, no significant increases in goal progress among app users were found in this study. Thus, the perceived goal progress does not seem to be responsible for the increases in subjective well-being and contradict previous studies (Brunstein, 1993; Steca et al., 2016). Since subjective well-being increased in both groups and participants did not differ significantly in any goal characteristics, it remains unclear what lead to the increase. Ultimately, further research is needed.

Moreover, correlation analyses revealed only small to medium significant and positive correlations between satisfaction with life and goal progress across all time points. In contrast, no stable relationship between multidimensional mood and progress could be identified. Correlations between mood and progress were small and significant only at some measuring points and for some subscales. These findings contradict Klug & Maier's (2015) meta-analysis, which showed that the overall effect of successful goal pursuit, operationalised as goal progress,

on subjective well-being, yields a medium-to-large average effect size ($r = .43$). Therefore, the proposed relationship between goal progress and subjective well-being cannot be confirmed in this study.

Practical Implications

My research contributes to the understanding of personal goal striving and based on the presented findings practical implications for improving the app can be derived.

In general, the goal reminders should be designed differently so that people are more motivated to commit to their personal goal and to pursue it constantly. As the study results show, it can be assumed that motivation decreases due to significant decreases in goal importance and non-significant decreases in goal commitment. Therefore, there must be a rise in motivation which could be achieved by increasing the reminders over time, i.e., by becoming denser and stronger in terms of content (e.g., including pictures of the goal; motivational slogans related to the goal; increase in the number of reminders sent out). In addition, the reminders could include stronger motivational reasons (e.g., why or for what/who one wants to achieve the goal; the efforts that have already been put into the goal) especially at the beginning of the goal pursuit phase as commitment seems to decrease more at the beginning of the goal striving process.

It is conceivable that people need different reminders depending on where exactly they are on their goal striving journey. This can be explained by the distance to goal achievement, which is longer right at the start of pursuing a goal than when a person is already halfway to reaching the desired target. The closer the person gets to the target, the more motivated he or she might be to continue pursuing it, because reaching the goal is within reach. Hence, the reminders might need to be more individualised, giving the app user a feeling of individual attention. Perhaps, reminders that focus on the distance already covered on the way to achieving the goal by saying i.e., “You are already more than halfway to your goal” would be more likely to increase goal commitment among app users than the simple reminders used in this study.

Furthermore, data regarding users’ interaction with the app needs to be collected in future studies. This makes it possible to personalise the reminders by adapting them to the usage behaviour of each individual. It is likely, that people have different preferences regarding the content, the frequency, and the duration of a reminder. By tracking user behaviour, it will be possible to adapt the reminders to the corresponding preferences of everyone using the app.

The above-mentioned proposals for improving EverGoal are in line with ideas from previous studies (e.g., Stieger et al., 2020). Accordingly, it is suggested for future smartphone-based interventions to be more diversified, individualised, and provide more support throughout the goal striving process. One possible approach includes using a smartphone application with a text-based conversational tool (chat). It is further proposed to design an app more interactive with delivering a wider variety of micro-interventions over longer time periods to keep participants motivated.

Another line of research proposes the use of more advanced techniques, like gamification, where game playing elements are included in tasks, and can be used to improve personal goal pursuit in interactive ways (Howells et al., 2014). Empirical evidence on gaming exists and provides positive results regarding intervention engagement and behaviour change across diverse contexts (Mohr et al., 2013). Currently, in EverGoal's app interface there is nothing to do for the user except ticking off the subgoals. Thus, the intention to log into the app and work with it may increase by including gamification elements (e.g., collecting points per achieved subgoal; competition with friends/other users; rankings). All implications listed here should be tested in further studies to get a deeper insight into people's app usage behaviour.

Stieger and his team (2018) already stressed the importance of the use of mobile devices in research since they allow to collect smartphone usage data to investigate whether self-reported or observer-reported changes are consistent with behavioural data that are derived from sensing data. Therefore, it is generally encouraged to continue using mobile devices for psychological research since they allow to intervene in people's everyday life. Overall, smartphone applications are flexible, interactive, accessible, dynamic, and cheap (Howells et al., 2014), so they offer great potential for new research directions and open new opportunities in the field of psychology.

Limitations and Future Research

The present study is limited in ways that give rise to suggestions for future research. First, a total of 130 participants dropped out from the sample over the course of two months. Although, no systematic dropout was found, losing participants during a study is always accompanied by a loss of statistical test power and consequently, higher rates of type II error. However, the final sample size was still sufficient compared to the previously calculated sample size with G*Power. The dropout could have been due to the lack of face-to-face interaction, the voluntary study participation, or perhaps reflected methodological limitations such as distraction, loss of interest,

the study's length, a lack of compatibility between the individual's device and the survey set-up, or poor internet connection. A laboratory study could have circumvented some of these limitations and increased the internal validity, but at the same time the ecological validity of the study would have decreased as soon as it was conducted in the laboratory instead of in a real-world context. Designing a randomised controlled trial helped to minimise the lack of internal validity whilst maintaining an acceptable level of internal validity.

Second, the study's homogeneous student sample may limit the generalisability of the findings to the general population. A sample bias also needs to be considered, especially when looking at the goal commitment scores. It is possible that by targeting students only, the results were biased because it is likely that students may be generally more goal focused and committed than other population groups, which could explain the overall high commitment scores across all participants. In addition, the sample was predominantly female. Further analyses should target participants with diverse social backgrounds, age, and gender to get a more heterogeneous and normally distributed sample. In general, the study's results must be interpreted with caution due to the lack of normally distributed data.

Third, it cannot be ruled out that some of the survey questions were suggestive. Thus, it may have been possible for participants to infer the aim of the study, resulting in biased data. Additionally, the online self-report, although extensively used in psychological research, may partially compromise the reliability of the collected data. Specifically, it was not possible to control whether each participant filled out the questionnaires alone and in the same setting. The lack of standardisation may lead to less reliable data.

Fourth, the present study had only a waitlist-control group. If practical and financially feasible, future studies should include an active control group that receives a comparative intervention to the one received in the app group, namely a "placebo app" that is not expected to have an overly large effect, but also to do no harm. This will enhance the comparability of the study groups since the active control group will engage with an app between the measurements as well. Nevertheless, as in the present study, there should still be a non-active control group that uses no app during the whole study period. Using this kind of study design rules out the possibility that the behaviour of the app group may simply change due to a placebo effect and the external validity of the study results will likely increase.

Fifth, because idiographic personal goals, regarding content and the level of abstraction (i.e., hierarchically), are highly heterogeneous and, furthermore, may refer to desired outcomes, future events, or ongoing processes (i.e., binary, or quantitative variables), it was impossible to objectively assess goal progress and goal commitment (see Herrmann & Brandstätter, 2015). Only subjective measures of goal dimensions were used, which may be influenced by social desirability and acceptance, and may partially limit the study's validity. Therefore, future research should aim to objectively assess goal characteristics, for example, by considering context-specific goals (Steca et al., 2016).

Sixth, the missing values in the dataset need to be stressed as a further limitation. Due to the self-developed progress item (filter item), goal-related items, assessing relevant constructs for main analyses, were skipped once people indicated the achievement of one or both goals. The original idea behind this was that participants would not have to answer items related to the goal they had already achieved. However, it was not considered that this would result in missing data. Therefore, participants who already achieved their goal(s) were not included in the analyses regarding H1a and H1b. This limitation should be kept in mind when interpreting the study's results since they might be biased. Nevertheless, I decided not to statistically replace the missing values because the presented literature indicates that goal progress rather than goal attainment influences subjective well-being. Therefore, investigating a sample which consists of people who are still in the process of attaining their goal, seems reasonable. Additionally, an app like EverGoal does not target individuals who are naturally very good in achieving their desired goals, but rather those who struggle with pursuing their goals and need assistance with effective goal striving. Furthermore, goal commitment is expected to decrease rapidly once the goal is achieved, and the rate of goal progress cannot exceed goal achievement. Therefore, it seemed reasonable to continue the analyses without participants who reached their goal(s).

Seventh, the study did not assess the total personal goal repertoire of each participant but instead only the two most important goals. It may be advanced that selecting personal goals based on their importance limits the variability and variance of goal scores, reducing the likelihood of finding significant associations with goal-related variables and subjective well-being. This could possibly explain why none of the suggested hypotheses of this study were confirmed. Future research may evaluate the suggested research model by considering the entire set of participants'

personal goals to analyse the effect of the smartphone application on goal commitment, perceived progress, and its links with subjective well-being more in-depth.

Eight, participants reported pursuing several types of goals. However, it was not evaluated how qualitative differences in the pursued goals influence changes in subjective well-being. In this research most of the pursued goals were assigned to either work/education or leisure activities. Heady's (2008) study demonstrated that pursuing goals that express commitment to friends and family results in higher levels of life satisfaction compared to pursuing goals that indicate commitment to career success and material gain. Therefore, the study should be replicated with a more diverse sample regarding the goal types, including more goals that express commitment to social relationships. Moreover, qualitative differences between goals within the same life domain need to be considered as well.

As further limitation, it was not possible to track participants' app usage (e.g., duration, frequency) throughout the entire study period. Thus, we have no insights into who interacted with the app, when and for how long. It is possible that some people have not used the app at all or only a little, which could be another explanation for why no hypothesis-compliant results were found. Therefore, it would improve future studies to collect each participant's app usage data to have an objective measure for the analysis. With a hierarchical regression analysis, it would then be possible to test whether the frequency of app use predicts goal progress over time. The first step would be to include goal progress at T_0 as a predictor in the model to control for participants' baseline goal progress. In a second step, the frequency of app use for each participant would be included as main predictor. The same could be tested with goal commitment and subjective well-being. To go one step further, follow-up measurements should be included as well. To be able to state whether an app intervention has a sustained long-term effect, future research needs to conduct several follow-up measurements after participants' last app usage.

As a final limitation, it should be mentioned that no comparable studies in the literature, regarding the duration and intensity of goal reminders, exist. Thus, it remains unclear how often a reminder should be sent out. In this study, the number of days that passed between the last app use and receiving a goal reminder were chosen arbitrarily. Therefore, three days before participants were reminded of their goals may have been too short or too long. Future research should address this question and investigate, whether there is a generally applicable amount of time that is optimal between the last app use (engaging with the goal) and a reminder.

Additionally, it might be useful to obtain participants' feedback regarding the number of received goal reminders and to assess whether repeated reminders are generally well tolerated. It seems possible that people have different preferences regarding the number of reminders. Thus, future research should try to find a way to tailor goal reminders more to the preferences of each individual.

Possible Further Analyses

The limitations mentioned above, and the additional data collected throughout this study encourage further analyses. Several ideas have already been raised about how to further explore the collected data. In the following, I will revisit these suggestions and give an outlook for future research on possible further analyses with my study's data set.

The participants indicated different types of goals within different life domains. Thus, it would be interesting to look at the goal content itself. In addition to general goal characteristics (e.g., goal commitment), content characteristics (e.g., approach vs avoidance goal, learning vs performance goal, continuous/maintaining vs new goal, difficult vs less difficult goal) may also play an important role in personal goal pursuit. It could be, for example, that an effect of the goal reminders only becomes apparent with difficult goals. Therefore, it seems necessary to analyse if EverGoal's reminders support some goal types better than others. Steca et al. (2016) already highlighted that the influences of goal types on subjective well-being need to be further examined. By categorising the listed goals and running the analyses for each goal category separately, one could thus compare the results and see if differences between the goal types appear. This could help to identify possible moderating effects of goal types on the interplay between goal commitment, goal progress and subjective well-being.

Furthermore, the analyses of this study controlled for baseline age, goal commitment and goal progress. Possible effects of other confounding variables on the dependent variables could be examined as well (e.g., personality dimensions or autonomous/intrinsic vs controlled/extrinsic motivation). Specifically, it seems possible that, for example, people who pursue their goals out of intrinsic motivation (own conviction/interest) might show more goal commitment than people who pursue their goals out of extrinsic motivation (duty, reward/incentives). It would also be interesting to investigate whether specific personality dimensions (e.g., conscientiousness, neuroticism, self-efficacy) influence goal progress.

With regard to the relationship between goal commitment and goal progress, it would make sense to carry out the analyses again using a hierarchical regression model. In contrast to the ANOVA, this would make it possible to test whether the level of goal commitment predicts subsequent changes in goal progress. The same procedure could be used to test whether changes in goal progress predict subsequent changes in subjective well-being. Furthermore, one could investigate possible moderators that might influence the relationship between goal commitment and goal progress. In Brunstein's (1993) study the greatest progress was made by students who were committed to achieve their goals and who saw their living conditions as favourable for doing so. Since the present study assessed feasibility as well as obstacles in the goal pursuit, it is encouraged to include these constructs in further analyses. Interestingly, the additional analyses of my study showed a decrease in each goal's feasibility between the first and the last measurement. Furthermore, the correlation analyses showed that feasibility was significantly and positively correlated with both commitment and progress. However, the causal interaction remains unclear, and should be further analysed.

As mentioned earlier, the study lacked normally distributed data. Although, the ANOVA is thought to be relatively robust against normal distribution violations, future studies might consider transforming the variables or using bootstrapping for further analyses.

Regarding the missing values in this study, it would be an idea for further research to include the missing data in hypotheses testing by setting the missing values to 100% (maximum goal progress). The analyses for goal commitment and goal progress should then be conducted again, including the participants who reached one or both of their goals throughout the study, to see if different results occur.

Conclusion

The purpose of the present study was to explore how a smartphone app with goal reminders can help people to make progress towards their personal goals. Moreover, it was investigated whether the assumed goal progress results in greater subjective well-being among app users. Only few studies investigated the use of exclusively smartphone-based interventions to modify mood or satisfaction with life (e.g., Meinschmidt et al., 2016), thus this study contributes to this research gap. Furthermore, this is the first study to investigate an intervention based solely on goal reminders. Overall, the results were different than anticipated and did not confirm the suggested research model. The findings did not indicate that the newly developed smartphone app EverGoal helps to increase users' goal commitment, goal progress or subjective well-being. In the future, additional research is needed to better understand the psychological mechanisms underlying personal goal pursuit on the one hand and app use behaviour on the other. Specifically, it is necessary to clarify the mechanisms of action between specific goal dimensions and subjective well-being. Nevertheless, this study contributes to the current body of research by gaining knowledge about students' personal goal pursuit, highlighting further research directions in the context of goal striving and smartphone-based interventions, and providing practical implications for app developers. In conclusion, the findings offer new insights that add to the current understanding of the interplay between the individual, the use of technology, personal goal pursuit and well-being enhancement.

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Appendix A

Abstract English

Goal striving literature proposes that goals motivate people and are direct regulators of human action. It is assumed that individuals monitor their progress toward goals and change their behaviour if previous efforts have proved unsuccessful. Personal goals are considered subjectively meaningful aspirations and previous research indicates their leading role in directing human behaviour and promoting well-being. Therefore, the impact of a smartphone application (EverGoal) aimed at improving the pursuit of personal goals was investigated. Specifically, this study examined the effect of goal reminders on goal commitment, goal progress and subjective well-being. In a randomised controlled trial with 224 German-speaking students from the DACH region, the proposed hypotheses could not be supported. Different than anticipated the findings did not show that app users reported greater goal commitment, goal progress or subjective well-being over time compared to a waitlist-control group. Instead, goal commitment decreased, goal progress and subjective well-being increased but no significant differences in the changes of the dependent variables were found between the groups. Moreover, post-hoc analyses revealed that the experimental groups did not differ in achieving the goals by the end of the study. Thus, the results could not confirm that the app with goal reminders improves participants' personal goal striving and subsequently their subjective well-being. Nevertheless, the study provides new insights into the pursuit of personal goals with the help of a smartphone app and sheds light to future research directions.

Keywords: smartphone application, goal pursuit, personal goals, goal commitment, goal progress, subjective well-being

Abstract German

Aus der Literatur zum Zielstreben geht hervor, dass Ziele Menschen motivieren und das menschliche Handeln direkt steuern. Es wird angenommen, dass Menschen ihre Fortschritte bei der Zielverfolgung überwachen und ihr Verhalten ändern, wenn sich Bemühungen als erfolglos erweisen. Persönliche Ziele werden als subjektiv bedeutsame Bestrebungen betrachtet und frühere Forschungsergebnisse deuten auf ihre führende Rolle bei der Steuerung des menschlichen Verhaltens und der Förderung des Wohlbefindens hin. Daher wurde die Wirkung einer Smartphone-App (EverGoal) zur Verbesserung der persönlichen Zielverfolgung untersucht. Insbesondere wurde die Wirkung von Zielerinnerungen auf die Zielbindung, den Zielfortschritt und das subjektive Wohlbefinden untersucht. In einer randomisierten kontrollierten Studie mit 224 deutschsprachigen Studierenden aus der DACH-Region konnten die aufgestellten Hypothesen nicht bestätigt werden. Anders als erwartet zeigten die Ergebnisse, dass die App-Nutzer im Vergleich zu einer Wartekontrollgruppe weder eine höhere Zielbindung, einen größeren Zielfortschritt noch ein höheres subjektives Wohlbefinden berichteten. Stattdessen nahm die Zielbindung ab, der Zielfortschritt und das subjektive Wohlbefinden nahmen zu, jedoch wurden keine signifikanten Gruppenunterschiede in den zeitlichen Veränderungen der abhängigen Variablen festgestellt. Darüber hinaus zeigten weitere Analysen, dass es keinen signifikanten Gruppenunterschied mit Blick auf die Zielerreichung gab. Die Ergebnisse konnten somit nicht bestätigen, dass die App mit Zielerinnerungen das persönliche Zielstreben der Teilnehmenden und folglich ihr subjektives Wohlbefinden verbessert. Dennoch liefert die Studie neue Erkenntnisse über die Verfolgung persönlicher Ziele mit Hilfe einer Smartphone-App und gibt Anreize für zukünftige Forschungsrichtungen.

Stichworte: Smartphone App, Zielverfolgung, persönliche Ziele, Zielbindung, Zielfortschritt, Subjektives Wohlbefinden

Appendix B**Pearson Correlations and Descriptive Statistics (T₁, T₂)****Table B1***Pearson Correlations and Descriptive Statistics – T₁ (second measurement)*

	<i>M (SD)</i>	1	2	3	4	5	6	7	8	9	10	11
1 Commitment (I)	4.52 (1.22)	--										
2 Commitment (II)	4.30 (1.25)	.16*	--									
3 Progress (I)	3.41 (1.46)	.45**	-.05	--								
4 Progress (II)	3.38 (1.57)	.01	.42**	.01	--							
5 SWLS	4.14 (1.07)	.07	.05	.24**	.21**	--						
6 MD (GB)	4.12 (1.16)	.04	.06	.19**	.18**	.46**	--					
7 MD (AT)	3.17 (1.19)	.02	.01	.16*	.13	.37**	.63**	--				
8 MD (CN)	3.55 (1.18)	-.06	.05	.05	.09	.34**	.61**	.56**	--			
9 Importance (I)	5.08 (1.17)	.77**	.04	.47**	-.13	-.02	-.03	-.09	-.10	--		
10 Importance (II)	4.92 (1.22)	.11	.72**	-.03	.36**	.05	.09	.05	.06	.10	--	
11 Feasibility (I)	4.28 (1.26)	.67**	.06	.64**	-.03	.21**	.18**	.15*	.03	.53**	.04	--
12 Feasibility (II)	4.30 (1.25)	.06	.54**	.03	.69**	.24**	.20**	.13	.09	-.01	.51**	.03

Note. I = goal one, II = goal two, SWLS = satisfaction with life, MD = multidimensional mood (GB = good-bad, AT = awake-tired, CN = calm-nervous). *N* = 224 (SWLS; MD), *N* = 217 (Commitment, Progress, Importance, Feasibility).

* $p < .05$ ** $p < .01$ (2-sided).

Table B2*Pearson Correlations and Descriptive Statistics – T₂ (third measurement)*

	<i>M (SD)</i>	1	2	3	4	5	6	7	8	9	10	11
1 Commitment (I)	4.40 (1.32)	--										
2 Commitment (II)	4.21 (1.31)	.15*	--									
3 Progress (I)	3.59 (1.51)	.50**	-.01	--								
4 Progress (II)	3.51 (1.64)	-.02	.42**	.01	--							
5 SWLS	4.25 (1.02)	.14	.08	.23**	.23**	--						
6 MD (GB)	4.31 (1.08)	.07	-.01	.20**	.13	.51**	--					
7 MD (AT)	3.45 (1.31)	-.02	-.10	.10	.03	.33**	.62**	--				
8 MD (CN)	3.82 (1.31)	.12	.02	.13	.09	.37**	.74**	.63**	--			
9 Importance (I)	4.97 (1.32)	.81**	.07	.45**	-.10	.01	.02	-.06	.07	--		
10 Importance (II)	4.94 (1.26)	.03	.80**	-.04	.44**	.06	-.04	-.13	-.01	.03	--	
11 Feasibility (I)	4.24 (1.38)	.66**	.07	.68**	-.04	.31**	.20**	.11	.20**	.51**	-.01	--
12 Feasibility (II)	4.17 (1.40)	.07	.53**	.01	.72**	.29**	.15*	.03	.12	-.01	.55**	.07

Note. I = goal one, II = goal two, SWLS = satisfaction with life scale, MD = multidimensional mood (GB = good-bad, AT = awake-tired, CN = calm-nervous). $N = 224$ (SWLS; MD), $N = 206$ (Commitment, Progress, Importance, Feasibility goal I), $N = 204$ (Commitment, Progress, Importance, Feasibility goal II).

* $p < .05$ ** $p < .01$ (2-sided).

Appendix C

Estimates and Pairwise Comparisons (Post-Hoc-Bonferroni-Tests) for Significant Main Effects of the Within-Subject Factor (Time)

Table C1

Estimates - Satisfaction with Life Scale and Multidimensional Mood Questionnaire

	SWLS	MDMQ (GB)	MDMQ (AT)	MDMQ (CN)
<i>Time</i>	<i>M (SD)</i>	<i>M (SD)</i>	<i>M (SD)</i>	<i>M (SD)</i>
T ₀	4.09 (0.07)	4.10 (0.08)	3.21 (0.08)	3.67 (0.08)
T ₁	4.16 (0.07)	4.12 (0.08)	3.16 (0.08)	3.55 (0.08)
T ₂	4.26 (0.07)	4.31 (0.07)	3.46 (0.09)	3.83 (0.09)

Note. GB = good-bad, AT = awake-tired, CN = calm-nervous. T₀ = first measurement, T₁ = second measurement, T₂ = third measurement. *N* = 224.

Table C2

Pairwise Comparisons - Satisfaction with Life Scale

(I) Time	(J) Time	Mean Difference (I-J)	<i>SD</i>	<i>p</i>	partial η^2
T ₀	T ₁	-0.065	0.044	.431	.065
	T ₂	-0.168*	0.044	<.001	.065
T ₁	T ₂	-0.103*	0.040	.032	.065

Note. Based on estimated marginal means. Adjustments for multiple comparisons: Bonferroni. T₀ = first measurement, T₁ = second measurement, T₂ = third measurement.

Table C3

Pairwise Comparisons – Multidimensional Mood Questionnaire (GB)

(I) Time	(J) Time	Mean Difference (I-J)	<i>SD</i>	<i>p</i>	partial η^2
T ₀	T ₁	-0.020	0.081	1.000	.037
	T ₂	-0.212*	0.082	.030	.037
T ₁	T ₂	-0.192*	0.079	.048	.037

Note. Based on estimated marginal means. Adjustments for multiple comparisons: Bonferroni. T₀ = first measurement, T₁ = second measurement, T₂ = third measurement.

Table C4*Pairwise Comparisons – Multidimensional Mood Questionnaire (AT)*

(I) Time	(J) Time	Mean Difference (I-J)	SD	<i>p</i>	partial η^2
T ₀	T ₁	0.048	0.078	1.000	.050
	T ₂	-0.247*	0.088	.016	.050
T ₁	T ₂	-0.295*	0.091	.004	.050

Note. Based on estimated marginal means. Adjustments for multiple comparisons: Bonferroni.

T₀ = first measurement, T₁ = second measurement, T₂ = third measurement.

Table C5*Pairwise Comparisons – Multidimensional Mood Questionnaire (CN)*

(I) Time	(J) Time	Mean Difference (I-J)	SD	<i>p</i>	partial η^2
T ₀	T ₁	0.122	0.082	.420	.043
	T ₂	-0.158	0.091	.252	.043
T ₁	T ₂	-0.279*	0.088	.005	.043

Note. Based on estimated marginal means. Adjustments for multiple comparisons: Bonferroni.

T₀ = first measurement, T₁ = second measurement, T₂ = third measurement.

Appendix D

Additional Results: Estimates, Within-Subjects Effects, and Between-Subjects Effects

Table D1

Importance and Feasibility Scores by Experimental Group

	<i>App Group</i>			<i>Control Group</i>		
	<i>T₀</i>	<i>T₁</i>	<i>T₂</i>	<i>T₀</i>	<i>T₁</i>	<i>T₂</i>
	<i>M (SD)</i>	<i>M (SD)</i>	<i>M (SD)</i>	<i>M (SD)</i>	<i>M (SD)</i>	<i>M (SD)</i>
Importance (I)	5.23 (1.09)	5.14 (1.03)	5.13 (1.09)	5.22 (1.06)	4.99 (1.28)	4.85 (1.48)
Importance (II)	5.08 (0.96)	4.72 (1.34)	4.71 (1.37)	5.15 (1.11)	5.03 (1.16)	5.09 (1.15)
Feasibility (I)	4.62 (1.01)	4.51 (1.20)	4.40 (1.35)	4.31 (1.13)	4.05 (1.28)	4.10 (1.40)
Feasibility (II)	4.40 (1.10)	4.03 (1.32)	3.95 (1.53)	4.47 (0.96)	4.36 (1.15)	4.33 (1.28)

Note. I = goal one; II = goal two. $N = 202$ (goal II). $N = 204$ (goal I). Scale from 1 (= not at all) to 6 (= completely true).

Table D2

Within-Subjects Effect (Time) and Between-Subjects Effect (Group) – Importance and Feasibility

	Effect	Sum of Squares	<i>df</i>	Mean Square	<i>F</i>	<i>p</i>	partial η^2
Importance (I) ^a	Time	5.787	1.807	3.203	4.726	.012	.023
	Group	3.017	1	3.017	0.986	.322	.005
Importance (II) ^a	Time	6.672	1.939	3.441	5.248	.006	.026
	Group	9.615	1	9.615	3.284	.071	.016
Feasibility (I) ^a	Time	5.322	1.787	2.979	3.948	.024	.019
	Group	18.943	1	18.943	5.795	.017	.028
Feasibility (II) ^a	Time	9.298	1.895	4.907	6.428	.002	.031
	Group	9.797	1	9.797	3.227	.074	.016

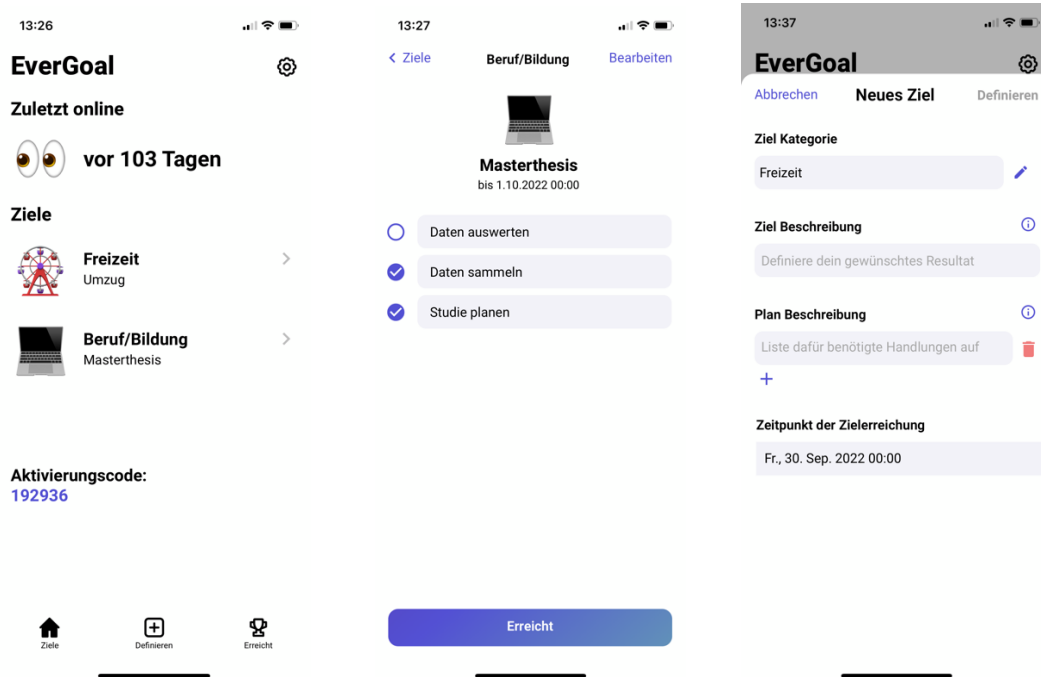
Note. I = goal one; II = goal two; Type III Sum of Squares. $N = 204$ (Importance and Feasibility goal I); $N = 202$ (Importance and Feasibility goal II).

^a Mauchly's test of sphericity indicates that the assumption of sphericity is violated ($p < .05$).

Appendix E

Smartphone Application EverGoal

App Interface (Home Menu, Goal with Subgoals, Defining New Goal)



Goal Reminder via Push Notification



(EverGoal KG, 2021)

Appendix F

Survey Items

List of Personal Goals (self-developed)

Bitte formulieren Sie im Folgenden zwei persönliche Ziele, die Sie innerhalb der nächsten 2 Monate erreichen möchten. Bitte geben Sie auch die nötigen Schritte zur Zielerreichung an.

Beispiel:

Stichwort: Handstand

Zielformulierung: "Ich möchte in den kommenden 2 Monaten einen Handstand schaffen und diesen für min. 3 Sekunden halten."

Nötige Schritte:

- Trainingsplan aufstellen
- 2 bis 3x pro Woche üben

Item	Response Format
Stichwort Ziel 1/Ziel2	[Offene Texteingabe]
Zielformulierung Ziel 1/Ziel2	[Offene Texteingabe]
Nötige Schritte Ziel 1/Ziel 2	[Offene Texteingabe]

Goal-related questions: Life domain, filter item, importance, feasibility (Sieber et al., 2019)

Bitte beantworten Sie folgende Aussagen in Bezug auf ihr erstes/zweites Ziel.

Item	Response Format
Das Ziel ist aus dem Bereich...	soziale Beziehungen (Familie/Freunde/Partner/in) Freizeit (Hobbies/Gesundheit/Fitness) Beruf/Bildung
Wo befinden Sie sich gerade bezüglich des Zielfortschritts? (Filteritem Progress; self-developed)	0% = noch nichts gemacht 100% = Ziel erreicht
Dieses Ziel ist mir sehr wichtig. (Importance)	1 = stimmt gar nicht 2 3 4
Sehr wahrscheinlich werde ich in Bezug auf dieses Ziel erfolgreich sein. (Feasibility)	5 6 = stimmt voll und ganz

Short Personal Goals Variables Scale (Monzani et al., 2015)

Bitte beantworten Sie folgende Aussagen in Bezug auf ihr erstes/zweites Ziel.

Item	Response Format
Egal, was passiert, ich werde dieses Ziel nicht aufgeben. (<i>Commitment</i>)	1 = stimmt gar nicht 2 3
Ich habe das dringende Gefühl, dass ich sofort mit der Arbeit an diesem Ziel beginnen muss. (<i>Commitment</i>)	4 5 6 = stimmt voll und ganz
Auch, wenn es viel Aufwand bedeutet, werde ich alles tun, um dieses Ziel zu erreichen. (<i>Commitment</i>)	
In Bezug auf dieses Ziel bin ich ein gutes Stück vorangekommen. (<i>Progress</i>)	
Ich hatte bei der Verfolgung dieses Ziels ziemlich viel Erfolg. (<i>Progress</i>)	

Reasons for the Goal Pursuit (Sieber et al., 2019)

Bitte beantworten Sie folgende Aussagen in Bezug auf ihr erstes/zweites Ziel.

Item	Response Format
Ich verfolge dieses Ziel, weil es mir Freude und Vergnügen bereitet. (<i>intrinsic motivation</i>)	1 = stimmt gar nicht 2 3
Ich verfolge dieses Ziel, weil ich glaube, dass es wichtig und sinnvoll ist. (<i>intrinsic motivation</i>)	4 5 6 = stimmt voll und ganz
Ich verfolge dieses Ziel, weil ich mich sonst schlecht fühle (schuldig, beschämt oder ängstlich). (<i>extrinsic motivation</i>)	
Ich verfolge dieses Ziel, weil es von mir verlangt wird oder, weil es die Situation erfordert. (<i>extrinsic motivation</i>)	

ACRISS Scale (Brandstätter & Schüler, 2013)

Bitte denken Sie nun an ihre bisherigen Erfahrungen mit ihrem ersten/zweiten Ziel.

Item	Response Format
Die Verfolgung meines Ziels verläuft für mich reibungslos.	1 = stimmt gar nicht
	2
Bei der Verfolgung meines Ziels kommt es immer wieder zu Situationen, in denen ich nicht mehr weiterweiß.	3
	4
	5
Ich denke immer wieder einmal daran, mein Ziel aufzugeben.	6 = stimmt voll und ganz
Ich habe häufig nichts für mein Ziel getan, obwohl ich es mir vorgenommen hatte.	

Generalized Self-Efficacy Scale (Schwarzer & Jerusalem, 1995; adapted to goal-related self-efficacy by Regina Gruber)

Bitte beantworten Sie folgende Aussagen in Bezug auf ihr erstes/zweites Ziel.

Item	Response Format
Wenn sich mir Widerstände bei der Verfolgung dieses Ziels auftun, kann ich Mittel und Wege finden, mich durchzusetzen.	1 = stimmt gar nicht
	2
	3
Ich habe das Gefühl, dass es mir keine Schwierigkeiten bereiten wird, dieses Ziel zu erreichen.	4
	5
	6 = stimmt voll und ganz
Ich bin zuversichtlich, dass ich effizient mit unerwarteten Ereignissen während der Verfolgung dieses Ziels umgehen kann.	
Wenn ich bei der Verfolgung dieses Ziels auf Schwierigkeiten stoßen würde, bin ich zuversichtlich, dass ich eine Lösung finden kann.	

ASKU Scale – General Self-Efficacy short scale (Beierlein et al., 2012)

Die folgenden Aussagen können mehr oder weniger auf Sie zutreffen. Bitte geben Sie bei jeder Aussage an, inwieweit diese auf Sie persönlich zutrifft.

Item	Response Format
In schwierigen Situationen kann ich mich auf meine Fähigkeiten verlassen.	1 = stimmt gar nicht 2 3
Die meisten Probleme kann ich aus eigener Kraft gut meistern.	4 5
Auch anstrengende und komplizierte Aufgaben kann ich in der Regel gut lösen.	6 = stimmt voll und ganz
Wenn ich bei der Verfolgung dieses Ziels auf Schwierigkeiten stoßen würde, bin ich zuversichtlich, dass ich eine Lösung finden kann.	

Multidimensional Mood Scale – MDMQ short version A (Steyer et al., 1997)

Nun möchten wir gerne von Ihnen wissen, wie Sie sich in den letzten Tagen gefühlt haben. Im Folgenden finden Sie eine Liste von Wörtern, die verschiedene Stimmungen beschreiben. Bitte geben Sie an...

Item	Response Format
Zufrieden	1 = gar nicht
Gut	2
Ausgeruht	3
Munter	4
Gelassen	5
Entspannt	6 = sehr
Schlecht	
Unwohl	
Schlapp	
Müde	
Ruhelos	
Unruhig	

Satisfaction with Life Scale - SWLS (Diener et al., 1985)

Nutzen Sie die Antwortskala, um das Ausmaß ihrer Zustimmung zu den folgenden Aussagen anzugeben.

Item	Response Format
In den meisten Bereichen entspricht mein Leben meinen Idealvorstellungen.	1 = stimmt gar nicht 2 3
Meine Lebensbedingungen sind ausgezeichnet.	4 5
Ich bin mit meinem Leben zufrieden.	6 = stimmt voll und ganz
Bisher habe ich die wesentlichen Dinge erreicht, die ich mir für mein Leben wünsche.	
Wenn ich mein Leben noch einmal leben könnte, würde ich kaum etwas ändern.	

Sociodemographics

Item	Response Format
Wie alt sind Sie?	[Ziffern 18-99]
Welchem Geschlecht fühlen Sie sich zugehörig?	männlich weiblich divers
Studieren Sie?	Ja/Nein
Was studieren Sie?	[Offene Texteingabe]
Haben Ihre Eltern einen Abschluss von einer Universität? (z.B. Bachelor, Master)	Ja, min. 1 Elternteil hat einen Universitätsabschluss Nein, kein Elternteil hat einen Universitätsabschluss
Ihr derzeitiger Beschäftigungsstatus? (Mehrfachnennungen möglich)	arbeitssuchend Angestellte/r (Vollzeit) Angestellte/r (Teilzeit) Beamter/in selbstständig