Can using a mobile self-help game improve your well-being? A randomized controlled trial to test the effectiveness of a mobile self-help intervention to increase psychological and affective well-being over time.

Leah Masselink
s2443805
l.masselink@student.utwente.nl
Msc. Communication Science, University of Twente

Supervisor: dr. H. Scholten (Hanneke)
Second supervisor: dr. H. A. van Vuuren (Mark)

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Abstract

At some point in life, all Individuals over the world struggle with difficulties on emotional and behavioural level. Experiencing these over a longer period can result in impactful long-term problems with mental health and well-being. Therefore, it is important to seek appropriate resources in time. Especially now the COVID-19 pandemic and its after-effects have put more strain onto the mental health and well-being of individuals. As the availability of traditional resources in mental health care decreases, the digitalisation of mental health via smartphone apps is seen as one of the important solutions for relieving pressure on the field. As a result, the number of digital resources that are designed to help prevent struggles with mental health and well-being is rapidly increasing. To add more scientific evidence to this, the current study tested the beneficial effects of using a digital self-help game (Betwixt) on the well-being of individuals between 22 and 50 years old via a Randomized Controlled Trial. Depression, anxiety, stress, positive well-being, self-awareness, self-reflection, self-compassion, affirmation of self-aspects and value-awareness were assessed before and after an intervention period of two weeks. In addition, Betwixt was evaluated by participants who were part of the intervention group. Results indicated that using Betwixt for two weeks significantly decreased depression, stress, and self-reflection levels. Furthermore, there was a marginally significant increase of self-compassion. These results show that a digital self-help intervention such as Betwixt can help enlighten well-being difficulties. However, since the decrease in self-reflection was not as expected and the effect for self-compassion was marginally significant, more research is warranted to find out what mechanisms instigated these results. Moreover, future research should focus on how strong the effects of self-help interventions such as Betwixt will stay over time by including longer intervention periods and conduct follow-ups after more time has passed.

Contents

Introduction

According to the World Health Organization (2022), mental health and well-being are essential and integral components of health. However, a large number of previous research shows that 75% of individuals struggle with social and mental well-being before the age of 24 (Denovan & Macaskill, 2016; Kessler et al., 2005; Stalmann, 2010; Tran et al., 2017; Williams et al., 2018). Issues such as anxiety, depression, stress, and other difficulties on emotional and behavioural level are rather universal than uncommon in some point of life (Schaefer et al., 2017). When individuals experience well-being issues over a longer period or more often, it is possible that these eventually become impactful long-term mental health problems (Gustavson et al., 2018; Patton et al., 2016).

The explanations for issues on emotional and behavioural level are diverse: financial problems (Heckman et al., 2014), academic (Misra & McKean, 2000) or work pressure, relationships, transitions in life, staying on schedule (Wilks et al., 2009) and different social events such as losing a job, the dead of a close friend or relative (Kendler et al., 2001), divorce, marital problems (Honkalampi et al., 2005) or experienced trauma (Dohrenwend, 2000). During the COVID-19 pandemic of the past years, social and mental well-being from people all over the world has been put to the test even more (Jacobsen et al., 2020). The possibility of getting infected, the need to keep distance from others, not being able to go to work, school, the gym, or restaurants, and not being able to socialize or travel made people feel more lonely, depressed, stressed, and anxious (Fried, 2020; Nelson et al., 2020). It is expected that people experience more problems with well-being because of COVID-19 regulations than there will be actual physical consequences of the virus (Grover et al., 2020).

The COVID-19 pandemic is expected to have short- and long-term consequences for mental health and well-being (Galea et al., 2020). Disasters on a large scale, whether traumatic (for example mass shootings), environmental (great oil spills) or natural (hurricanes), commonly cause an increase in mental and behavioural disorders (Neria et al., 2008). With this knowledge, it is therefore important to encourage individuals to seek appropriate help and resources in time (Vanheusden et al., 2008; Sehmi et al., 2019). Recent publications predict that the level of stress caused by the

COVID-19 pandemic will become problematic and cause psychological distress that might progress into anxiety and serious mood disorders (Qiu et al., 2020; Wang et al., 2020). Focusing on preventing new cases of mental disorders as well as strengthening mental well-being for people who experience well-being difficulties is therefore of great importance (Carbone, 2020).

During the COVID-19 pandemic and because of its social distancing regulations, communication over digital resources has become more important than ever (Beyens et al., 2020; Fried, 2020; Jacobsen et al., 2020). Digital resources such as smartphones have given individuals the opportunity to deal with issues such as stress, depression, loneliness, or anxiety (Nelson et al., 2020) and can help with increasing social and mental well-being. Thus, as the availability of traditional mental health care decreases, technology-based resources can play an important role in mental health care and prevention of well-being issues on a large scale (Bakker et al., 2016; Simon & Ludman, 2009; Watss et al., 2014). Especially the prevention potential of digital resources is large, since most individuals over the world have not been diagnosed with psychological disorders but do experience unpleasant psychological distress from time to time (Gellatly et al., 2007). Apps that can help prevent this distress growing into bigger issues over time, possibly can relieve pressure on the field of physical mental health care.

Therefore, in the current study, we test the effect of the mobile self-help game Betwixt. Betwixt was developed with a combined science-based approach using evidence-based psychological mechanisms and a design thinking approach to increase engagement and retention. In this study, we focus on measuring the effect of app-use on individuals' depression, anxiety, stress, positive well-being, self-awareness, self-reflection, self-compassion, affirmation of self-aspects, value awareness and overall psychological and affective well-being and mental health.

Theoretical framework

Experiencing anxiety, depression, or stress on regularly basis can cause long lasting, impactful well-being issues over time (Gustavson et al., 2018; Howland et al., 2017; Moitabai et al., 2016; Polanczyk et al., 2015). For example, dysfunctional responses to stressful situations (Hofmann et al.,

2012), hopelessness (Mathews & MacLeod, 2005), and rumination (Nolen-Hoeksema et al., 2008) can result in persisting negative mood states. Over the past years, there has been an increased need for help with difficulties on an emotional and behavioural level (Schaefer et al., 2017). The need for help with well-being issues is expected to increase even more because of the current COVID-19 pandemic (McKibbin & Fernando, 2020). Persistent stress, anxiety and loneliness caused by measurements such as physical distancing and quarantining are expected to result in more long-lasting well-being issues (Röhr et al., 2020).

Prevention and treatment of well-being issues is important (Holmes et al., 2020; Luykx et al., 2020; Yao et al., 2020). Many studies indicate that digital interventions can play an important role in preventing and improving well-being issues (Kramer et al., 2019), and the tremendous growth of mobile self-help interventions over the past year indicate promising role for these digital interventions (Donker et al., 2013). Mobile interventions are accessible at any time and can be adapted to personal needs (Heron & Smyth, 2010). The easy access and wide range of opportunities for the content makes mobile apps a great resource for preventing well-being issues. For example, by encouraging beneficial habits, guiding, helping individuals gaining motivation, achieving goals or sending reminders throughout the day (Donker et al., 2013; Kapp, 2012). Additionally, a large amount of research in cognitive, clinical science and practices has shown that depression, anxiety, and stress can be improved when certain core issues are addressed (Barlow et al., 2004). Thus, it is important for individuals to manage their cognitions, emotions, and behaviours so that experiencing psychological distress does not result in persistent negative mood states or long-term issues with well-being (Aldao et al., 2010; Gross, 1998; Lougheed & Hollenstein, 2012; McLaughlin et al., 2011).

To impact psychological well-being over time, the proposed study will therefore include several underlying psychological mechanisms (Gross, 1998; Gross, 1999) embedded in the mobile self-help intervention Betwixt: 1) self-awareness which targets the ability of self-evaluation and self-criticism which can help individuals control emotions in certain situations (Barrett et al., 2001; Hill & Updegraff, 2012), 2) reflection that will address understanding the self, 3) self-compassion which helps individuals soften the result of negative emotions, 4) affirmation of self-aspects which will help

individuals to stay positive and accept themselves and 5) value-awareness which helps individuals to be in touch with what drives them. When these underlying psychological mechanisms are targeted properly, they can positively impact the well-being of individuals. To have a complete overview of how well-being is affected, we measure for both positive and negative well-being.

In the following paragraphs we discuss the measures that will be tested in the current study and describe how these measures are related to well-being. We will furthermore eport on how other apps in the field of mental health or Betwixt integrate these measures and techniques in different in-game features.

Self-awareness

Early research suggests that self-awareness is a state where individuals are aware of their thoughts, emotions, and behaviours (Fenigstein et al., 1975). When people are self-aware and their attention is focused inward, the self becomes an 'object' that can be evaluated. During this state, individuals can identify, process, and store information about the self (Duval & Wicklund, 1972). For example, people can think about the past, about the future, and about which emotions, thoughts, personality traits, preferences, goals, attitudes, and perceptions they experienced. Heightened self-awareness can produce multiple effects, such as self-evaluation, self-criticism and thinking about the ideal self (Carver, 2002; Silvia & Duval, 2001; Wicklund, 1975, 1978).

Apps that focus on helping individuals become more self-aware often integrate features of self-monitoring. During self-monitoring users are for example asked to track their mood, stress, and daily activities on their phone (Kauer et al., 2012). In the studies of Abueg et al., (1985), Ewart, (1978) and Kadzin, (1974) self-monitoring led to positive changes in behaviour. It helped users understand their feelings and emotions and increased emotional self-awareness, reduced possible symptoms of depression and anxiety, and increased well-being (Bakker & Rickard 2018).

Being self-aware helps individuals point out why they experience certain emotions and how those need to be regulated in the best way (Barrett et al., 2001; Hill & Updegraff, 2012). For example, when people understand what makes them feel sad, it is easier to reduce those feelings (Prochaska &

Diclemente, 1982). Being more aware of how you feel and how you can change that, can result in a higher well-being (Kauer et al., 2012; O'Toole et al., 2014). In turn, people who experience low emotional self-awareness often show lower well-being, which eventually can cause long-term difficulties such as anxiety and other depressive disorders (Suveg et al., 2009).

Being aware of physiological aspects and reactions of the body also can increase self-awareness. Self-coaching and deep breathing are cognitive techniques that are often used in traditional settings (Williams et al., 2003) and included in apps who want to stimulate self-awareness by focusing on physiological aspects (Morris et al., 2010). In other studies, they for example have asked users to focus their breathing speed on a circle that expands and contracts (Morris et al., 2010). In Betwixt, breathing exercises in meditative missions are designed to increase self-awareness.

Self-reflection

Something that relates to self-awareness is being able to reflect on the self. Turning our attention to our own thoughts, memories, feelings, and actions is considered a fundamental aspect of human cognition. Being able to reflect can also enhance being able to perceive social cues in the correct way (Eisenberger & Liebermann, 2004; Lombardo et al., 2010), and generate social emotions such as guilt (Beer et al., 2003; Tracy & Robins, 2004). Self-reflection triggers prosocial behaviour, the ability to form relationships (Baumeister et al., 1994; Keltner, 1972), can increase the amount of self-awareness one has (Duval & Wicklund, 1972; Kauer et al., 2012; Morris et al., 2010), cause self-insight (Beck et al., 2004) and help with regulating emotions (Leary, 2003). According to Mansell (2011), having self-reflection is essential for successful psychotherapy outcomes.

Often, self-distancing is used as a technique for addressing self-reflection. When someone can take an outsider' perspective on the self, their self-reflection increases (Kross et al., 2005). For example, in the study of White et al., (2015) participants who analysed negative experiences from a self-distanced perspective were labelled as more insightful. Betwixt uses this technique in their self-help game by asking users to create and write stories about the self from a distant perspective. This is designed to help users reflect on painful emotions and eventually move past them.

When individuals are being able to reflect in a positive way about their relationships, events, and achievements, their mood, the ability to enjoy life and their overall well-being level increases (Lyubormisky et al., 2005; Seligman et al., 2005). Because of positive outcomes of having self-reflection, stimulating it is often included in apps that focus on improving mental health and well-being (Bakker et al., 2016). Especially facilitating users' self-monitoring is often integrated, since this technique is the focus of multiple evidence-based therapeutic interventions such as Cognitive Behavioural Therapy (Cohen et al., 2013), mindfulness (Erisman & Roemer, 2010), emotion-focused therapy (Paivio, 2013) and acceptance and commitment therapy (Hayes et al., 2011).

Self-compassion

As the studies of Gilbert (2014) and Neff (2012) suggest, self-compassion is a derivative of the more general construct of compassion. People who show compassion are touched by the suffering of others (Goetsz et al., 2010). Individuals with self-compassion show a positive and caring attitude towards their own failures and shortcomings (Neff, 2003a). Having self-compassion can be valuable for well-being levels of individuals, understanding behaviour towards the self can soften the impact of not achieving goals (Emmons, 1986; Michalos, 1980) and a balanced awareness of negative thoughts and feelings can increase a positive mindset (Neff, 2011; Neff & Constigan, 2014).

Having self-compassion, weakens the effect that negative experiences have on well-being and can help with evaluating life more positive. It relates close to self-acceptance and mindfulness, which also learns individuals being kind to themselves (Barnard & Curry, 2011). Often, acceptance- and mindfulness-based interventions are used for increasing self-compassion via smartphone apps (Falsafi, 2016; Koszycki et al., 2016). Therapist guidance and reminders are examples of in-app elements that have increased self-compassion in other studies (Cavanagh et al., 2014).

Processing negative and positive emotion and finding a balance between them influences how individuals feel (Diener, 1984; Diener & Ryan, 2009; Feist et al., 1995). Some experiences are just part of human life, and individuals who focus on the positive and interpret events as more positive as they rekindle memories are more likely to have a higher well-being (Diener, 1984; Diener

& Ryan, 2009). In Betwixt, the user will be guided through emotions and feelings by completing different dreams. There are multiple in-game mindfulness exercises that help individuals to be more positive and compassionate with themselves.

Affirmation of self-aspects

Individuals would like to view themselves as good, stable, free of choice, capable, competent, and so on. When this view is being questioned by threatening information or experiences, people start to rationalize their self-aspects (Gilbert et al., 1998). Self-affirmation is one of the tools for individuals to deal with these threats (Steele, 1998). Sherman & Hartson (2011) defined self-affirmation as a psychological immune system which helps individuals to stay in positive and stay away from negative thoughts about the self.

Apps for increasing well-being use writing and reading tasks or integrate ranking assignments (Springer et al., 2018). Examining values, strengths, goals, or other positive attributes help strengthen self-affirmation (Epton et al., 2014), and have positive outcomes for well-being levels (Nelson et al., 2014). In Betwixt, there are multiple journaling and creative writing assignments that help users find their values and strengths and stimulate them to become more self-affirmative.

Value-awareness

Principles that are important in the life of individuals or groups are known as values (Friedman, 1996; Rokeach, 1973; Schwartz, 1992). When individuals are aware of their own values, it can increase the access to parts of the self, for example being more aware of your own personality (Ryan & Deci, 2008). Individuals who base their actions on their intrinsic motivation, values and psychological needs and pursue healthy attitudes and behaviour tend to have higher well-being (Hodgins & Knee, 2002; Sagiv & Schwartz, 2000). Especially growth-related values such as self-direction, hedonism, stimulation, and benevolence are linked to an increase in well-being (Schwartz & Sortheix, 2018). Individuals who do not keep in touch with their own values, are likely to behave more automatically which can cause people to be sensitive for external pressure and seduction

(Rigby et al., 2014). In-app features such as ranking and explaining values and answering short questionnaires are examples of how digital interventions can assess the value-awareness of individuals (Springer et al., 2018). In Betwixt, the in-game journaling assignment and guided meditation about values help users think about their values and what that means for their well-being.

Betwixt

All underlying psychological mechanisms mentioned previously, were brought together in the self-help game Betwixt. Activating and working with these can result in higher psychological and affective well-being. However, there are still some significant barriers such as engagement of users, fidelity, and retention to consider (Hollis et al., 2017; Scholten & Granic, 2019). For the development of Betwixt, psychological evidence-based mechanisms of change and design thinking principles were combined to build the mobile self-help intervention.

Betwixt consists of multiple exercises which are established from evidence-based scientific techniques (see Table 1). Betwixt draws from research and therapeutic practice and has turned key elements of different theories and practices into parts of the game. For example, increasing users' self-compassion can be done by the in-game guided meditation elements, where journaling and storytelling are targeting self-defeating thoughts which can help increase self-reflection (Gottschall, 2013). Furthermore, users will report on their own thoughts, feelings and behaviours through creative writing assignments or meditation. This can be seen as self-monitoring, a Cognitive Behavioural Theory-based intervention that can increase self-awareness (Cohen et al., 2013; Erisman & Roemer, 2010; Kauer et al., 2012), acceptance of the self (Hayes, Strosahl & Wilson, 2011) and the ability to reflect (Hill & Updegraff, 2012).

Table 1

Mapping of targeted proximal outcomes and related scientific techniques onto game mechanics in Betwixt

Targeted (proximal) outcome	Scientific technique	Game mechanic Betwixt
self-compassion (↑), self-awareness (↑)	- Deep breathing - Muscle relaxation	- Guided meditation (meditative missions)
self-awareness (↑), self-reflection (↑), value-awareness (↑)	- Constructing and restructuring the self (story editing)	- In-game storytelling - Creative writing exercises - Journaling
self-awareness (↑), self-compassion (↑), affirmation of self-aspects (↑)	- Self-identification - Self-compassion	- In-game storytelling - Prompts - Feedback
Reflection (↑), self-awareness (↑), affirmation of self-aspects (↑)	- Self-distancing	- In-game storytelling - Prompts - Feedback - Journaling - Debating your own mind
Reflection (↑) , value-awareness (↑)	- Reflection - Self-identification - Self-affirmation	- In-game prompts - Feedback - Guided mediation about values

Research design and hypotheses

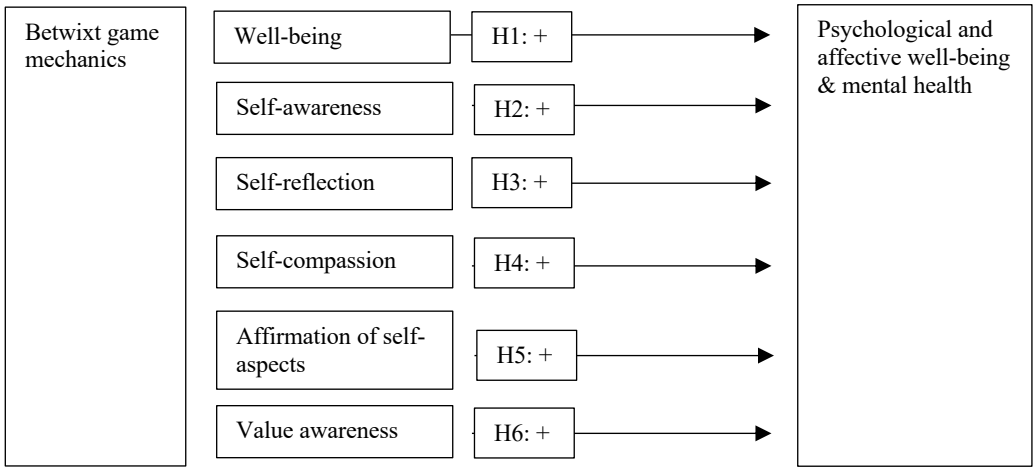
Using a Randomized Controlled Trial (RCT), we tested the intervention potential of the self-help app Betwixt, by comparing a game-group to a control group, on well-being over time (see Figure 1 for the conceptual model). This was partly during a national period of regulated social distancing. Furthermore, we performed an exploratory analysis about the evaluation of Betwixt. Based on theoretical and evidence-based game mechanisms in Betwixt we hypothesized that:

1. Individuals who play Betwixt will have more increased well-being than individuals who do not play Betwixt.
2. Individuals who play Betwixt will experience a higher level of self-awareness than individuals who do not play Betwixt.
3. Individuals who play Betwixt will experience a higher level of reflection than individuals who do not play Betwixt.
4. Individuals who play Betwixt will experience a higher level of self-compassion than individuals who do not play Betwixt.
5. Individuals who play Betwixt will affirm their self-aspects more than individuals who do not play Betwixt.

6. Individuals who play Betwixt will be more aware of their values than individuals who do not play Betwixt.

Figure 1

Conceptual model



Note: this model is based on individuals who will be part of the game-group, where we expect a positive effect in comparison to the control group.

Materials and method

Participants

Participants were recruited through the University of Twente, social media, online shares and contacts of the researcher and developers of Betwixt (See Appendix A for the recruitment poster). The study inclusion criteria were: (a) aged between 22 and 50 years, (b) access to an iPhone, (c) being able to read and understand a sufficient level of the English language and (d) willingness to give informed consent. The study procedure and design were approved by the ethics committee of the University of Twente (request nr. 210933).

After the data collection was finished, the data for the study was checked to see whether all participants finished the pre- and post-test. In total, 9336 individuals filled out the pre-test and 722 participants filled out the post-test. Participants who had missing data were left out of the final

dataset, which resulted in 505 unique participants with complete pre- and post-test data. Thus, in total, 505 people took part in the study (288 female, 204 male, 13 non-binary/third gender), with a mean age of 31 (M_{age} = 30.8; SD_{age} = 6.8; ; $Range_{age}$ = 22-50). On average, participants used their phones 13.7 hours a day ($M_{time\ phone}$ = 13.66; $SD_{time\ phone}$ = 4.34), and used social media 4.4 hours a day ($M_{time\ social\ media}$ = 4.44; $SD_{time\ social\ media}$ = 2.6). Furthermore, participants played games roughly around 10.2 hours a week ($M_{time\ games}$ = 10.19; $SD_{time\ games}$ = 11.75). We also asked participants were about their COVID-19 isolation status. The majority reported that they were not isolating but cut down usual (and social) activities (42.8 %) or lived their life as normal (22.2%). All further participant characteristics are displayed in Table 2.

Table 2.

Participant characteristics and outcome variables per group at pre -test

Participant characteristics			**Game group**	**No-game group**	**Test statistic (*t*-test or x^2-test)**
Gender	n (%)	Female	102 (57.3)	185 (56.7)	
		Male	70 (39.3)	134 (41.1)	
		Non-binary / third gender	6 (3.4)	7 (2.1)	x^2 (2, *n* = 504) = .76, *p* = .682
Age	Mean (*SD*)		30.5 (7.1)	31 (6.7)	*t* (504) = -.86; *p* = .937
Education	n (%)	High school	36 (20.2)	73 (22.4)	
		Bachelor's diploma	94 (52.8)	160 (49.1)	
		Master's diploma	33 (18.5)	59 (18.1)	
		PhD	0 (0.0)	8 (2.5)	
		Other	15 (8.4)	26 (8.0)	x^2 (2, *n* = 504) = 4.98, *p* = .290
Time phone	Mean (*SD*)		13.2 (4.1)	13.9 (4.4)	*t* (502) = -1.70; *p* = .217
Time social media	Mean (*SD*)		4.3 (2.5)	4.5 (2.7)	*t* (502) = -.66; *p* = .802
Time games	Mean (*SD*)		10.2 (11.2)	10.2 (12.04)	*t* (501) < .01; *p* = .430
Working from home	*n* (%)	Yes	98 (55.1)	187 (57.4)	
		No	72 (40.4)	138 (42.3)	x^2 (1, *n* = 495) < .01, *p* = .981

Sample size

Based on a priori power analysis with the help of G*Power 3 (Faul et al., 2007), the target sample size was set at 128 participants (Bostock et al., 2018; ANOVA: repeated measures, between factors, f = 0.2 α = 0.05, power =0.80). In total, 505 participants were enrolled in the study.

Procedure

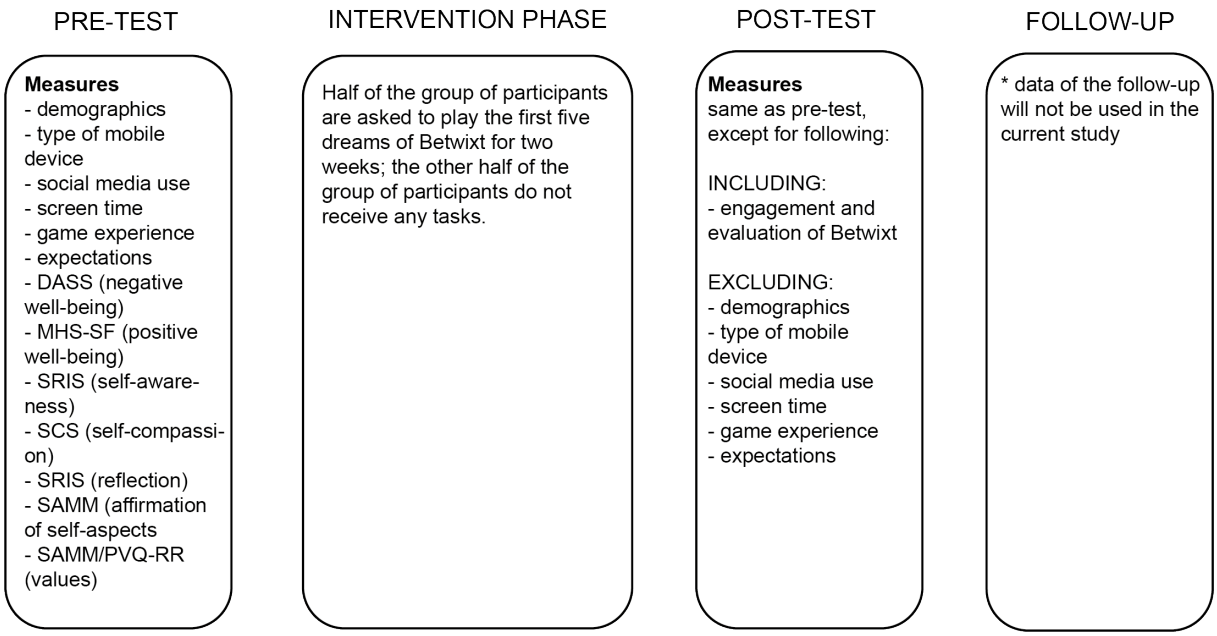
Data were collected through a Randomized Controlled Trial (RCT) design. Potential participants first received information about the study and when they agreed on participation, they were asked to sign the informed consent. After agreeing on the informed consent, participant filled out the pre-test questionnaire. In this questionnaire, we asked participants about their demographics, type of mobile device (only iPhone users could enter), social media use, screen time, game experience and expectations. Additionally, all proximal and distal outcomes were measured through a variety of constructs. Once participants finished the pre-test questionnaire, they were randomly allocated (computer-generated, allocation ratio 1:1) into either the no-game control group (n = 326) or the game intervention group (n = 176). After the randomisation, participants received an email with further explanation of the study, the timeline of the study and information about whether they belonged to the control or the intervention group.

People in the no-game group did not receive any tasks or assignments. Participants in the game group got introduced to the self-help app Betwixt and were asked to play the first five dreams of the game during the two-week intervention period. During the intervention period, participants in the game group received two tailored prompts via email to remind them to play the game and the purpose of the game. The emails that were send to participants can be found in Appendix B.

After the two-week intervention period, all participants were asked to fill out the post-test questionnaire. The content of the post-test was the same as in the pre-test, except the questions about the demographics. Questions about participants' evaluation of Betwixt were added. Three months after the post-test, participants received an email with a link to a follow-up questionnaire. Pre-test and post-test data were collected between September 2021 and December 2021. A schematic overview of the study procedure can be found in Figure 2. Before analyzing the data, this study was pre-registered via the Open Science Framework (registration doi: https://doi.org/10.17605/OSF.IO/JWPDZ).

Figure 2

Schematic overview of study procedure



The intervention: mobile self-help app Betwixt

Betwixt is a mobile self-help app which can be downloaded as iPhone app or used as a webapp. The app is mainly based on storytelling and built around eight different dreams which each has its own focus, mediative missions, and creative missions. Examples of these missions are guided meditation, creative writing, journaling, and debating your own mind. Each of the dreams and additional missions are focused on increasing certain proximal outcomes by addressing corresponding psychological mechanisms and scientific techniques. This current study will focus on the first five dreams (see Table 3).

Table 3

The focus of the first five dreams of Betwixt

Dream	Focus	Proximal outcomes
Dream 1	- Define and clarify problem (negative emotion differentiation) - Define the positive outcome if user gets free of the problem	Self-compassion (↑), self-awareness (↑),

Dream 2	- Brainstorm about inner resources and things you love	Value-awareness (↑), self-awareness (↑)
Dream 3	- Learn about your drivers - Find out your driver and how it gets in the way - Define a counter-driver - Inner resources: favourite place as a child	Self-awareness (↑), affirmation of self-aspects (↑)
Dream 4	- Self-distancing process: journaling about a problem from a self-distancing perspective	Reflection (↑), Self-awareness (↑), affirmation of self-aspects (↑)
Dream 5	- Find the need being satisfied by a destructive habit - Define positive ways to satisfy this need	Reflection (↑), Value- awareness (↑)

In the game, the player will enter the In-Between (see Figure 3), which is designed as a strange, magical world that responds and makes players think about their own thoughts. In the In-Between, a mysterious guide will help players to 1) capture thoughts and feelings in writing, 2) find clarity through self-reflection, 3) discover hidden strengths, 4) face fears and 5) claim the psychological superpower of self-awareness. The mission for the player is to escape the In-Between, but to do so, you will have to face yourself.

Figure 3: Betwixt (the In-Between)

Measures

Well-being

Well-being was assessed at pre-test, post-test, and three-month follow-up in two different ways: positive and negative well-being. Positive mental health and well-being was measured through the Mental Health Continuum – short form scale (MHC-SFC; Lamers et al., 2011) which aims to measure emotional, psychological, and social well-being including 14 items. Two example items are 'How often do you feel happy' and 'How often do you feel that you liked most parts of your personality'. These questions can be answered through a 6-point Likert scale ranging from 1 (never), till 6 (every day) and prior research showed that the instrument is reliable and valid (Keyes et al., 2008).

To assess negative well-being, the Depression Anxiety and Stress Scale was used (DASS; Lovibond & Lovibond, 1995). In the DASS, participants need to indicate how much a certain statement applies to them on a range from 0 (did not apply to me at all) till 3 (applied to me very much or most of the time). The scale has 21 items and examples are: 'I found it hard to wind down', 'I felt that I was using a lot of nervous energy' or 'I felt that I had nothing to look forward to'. Prior research states that the internal consistency for the subscales is stable over time (Brown et al., 1997), typically high (Antony et al., 1998; Brown et al., 1997; Clara, 2001; Lovibond & Lovibond, 1995; Page, 2007) and responsive for treatment which is aimed at mood problems (Ng, 2007). Furthermore, prior research has also found evidence for convergent (Crawford & Henry, 2003) and construct (Lovibond & Lovibond, 1995) validity.

Self-awareness

Measuring self-awareness was done by using the Situational Self-Awareness Scale (SSAS) (Govern & Marsch, 2001). The scale has 9 items, examples of statements are: 'Right now, I am conscious of my inner feelings', 'Right now, I am concerned about what other people think of me' and 'Right now, I am concerned about the way I present myself'. The statements can be answered through a 7-point Likert scale ranging from 1 (strongly disagree) till 7 (strongly agree). Findings in the

study of Govern & Marsch showed that the SSAS has a reliable structure for measuring self-awareness.

Self-reflection

The Self-Reflection and Insight scale (SRIS) (Grant et al., 2002) was used for measuring self-reflection. Examples of these statements are: 'I am usually aware of my thoughts', 'I usually have a very clear idea about why I've behaved in a certain way' and 'I usually know why I feel the way I do'. Statements can be answered through a 6-point Likert scale ranging from 1 (strongly disagree) till 6 (strongly agree). Findings in the study by Grant and colleagues (2002) confirm the convergent validity of the SRIS.

Self-compassion

To assess self-compassion, the Self-Compassion Scale consisting of 12 items by Raes et al., (2011) was used. This self-compassion scale aims to measure how often statements apply to the behaviour of participants and is answered on a 5-point Likert scale ranging from 1 (almost never) till 5 (almost always). Example items are 'When I fail at something important to me, I become consumed by feelings of inadequacy' and 'I'm disapproving and judgmental about my own flaw and inadequacies'. Multiple studies with a wide range of populations have found that the internal reliability of the self-compassion scale is high and suggest that all items are inter-correlated in an adequate manner (Allen et al., 2012; Neff & Pommier, 2012; Werner et al., 2012).

Affirmation of self-aspects

Affirmation of self-aspects is assessed through the Spontaneous self-affirmation measure (SSAM) by Harris et al., (2018). The SAMM consists of 13 items covering 1) social relations, 2) values, and 3) strengths and example questions are: 'When I feel threatened or anxious by people or events, I find myself… '…thinking about the people who are important to me', '…thinking about my family or

'…thinking about the things I am good at'. Items could be answered with a 7-point Likert scale ranging from 1 (completely disagree) till 7 (completely agree).

Value-awareness

Just as the affirmation of self-aspects, value-awareness will be determined through the spontaneous self-affirmation measure from Harris et al., (2018). The construct contains 13 items, covering three elements: 1) social relations, 2) values, and 3) strengths. Example questions for values are: When I feel threatened or anxious by people or events, I find myself… '…thinking about my principles', '…thinking about what I stand for' or '…thinking about the things I believe in'. The items will be answered through a 7-point Likert scale ranging from 1 (completely disagree) till 7 (completely agree).

Intervention evaluation

An evaluation of the intervention was assessed at post-test, with five questions related to Betwixt. Participants were asked to 1) rank the look, experience and Betwixt in total from 1 till 10, 2) rank in-game assignments from most to least fun, 3) and explain their ranking, 4) rank in-game assignments from most to least useful and 5) explain their ranking. In addition, participants in the intervention group were asked for their opinions about Betwixt in total with questions such as 'What did you think should be improved about Betwixt' and 'What was the most important thing you learned from Betwixt'.

Furthermore, the Intrinsic Motivation Inventory (IMI; McAuley, Duncan & Tammen, 1987; Ryan, 1982) was used to assess the subjective experience regarding Betwixt at post-test. We included the subscales for interest/enjoyment, value/usefulness, and relatedness. Examples for items of these subscales are 'This activity was fun to do' and 'I believe doing this activity could be beneficial to me'. Participants were asked to answer these items on a 7-point Likert scale ranging from 1 (not at all true) to 7 (completely true).

Strategy of analysis

Prior to running the analysis, outliers were checked and participants who did not fill out the post-test or did not have complete data were deleted from the dataset. Only one participant was excluded from the analysis regarding the Self Reflection and Insight Scale (outlier). Descriptive statistics were conducted to discuss the characteristics of the sample. Furthermore, validity and reliability were checked by performing a factor analysis (see Appendix C) and computing Cronbach's Alpha's in SPSS (See Table 5). The sample was also checked on correlations between different participant characteristics: age, gender, education level, time on phone, time on social media, time playing games and country (see Table 4).

We performed chi-square tests and independent sample *t*-tests to examine whether randomization resulted in an equal baseline distribution of relevant participant characteristics across the two intervention groups (see Table 2).

Furthermore, multiple repeated measures ANOVAs for group x time on depression, anxiety, stress, positive well-being, self-awareness, reflection, self-compassion, affirmation of self-aspects and value-awareness were conducted. When interaction effects were found to be significant, we performed follow-up *t*-tests with a Bonferroni correction for multiple comparisons.

Additionally, an exploratory analysis was performed by conducting correlations for the IMI-scores, frequency of playing games and overall well-being measures. At last, text-based evaluations from participants from the game group were summarized and reported to get an overview of how game-group participants evaluated Betwixt.

Results

Descriptive statistics

Table 2 presents the descriptive statistics for the participant characteristics per group at pre-test. No differences were observed at pre-test, which indicates that the random assignment was successful. The correlation analysis in Table 4 showed that spending more time on social media was

associated with younger ages and lower education levels. Spending more time on social media was also associated with more negative well-being. Experiencing higher depression, anxiety or stress was associated with lower self-compassion, self-affirmation, and positive well-being. In turn, being happier and experiencing a high well-being level was associated with having higher levels of self-compassion, self-reflection, and self-affirmation.

Table 4.

Correlations between participant characteristics at pre-test

Measure	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1. Age	1													
2. Time phone	.005 (.919)	1												
3. Time social media	**-.188 (.008)**	**.380 (<.001)**	1											
4. Time games	**-.148 (<.001)**	-.037 (403)	.082 (.068)	1										
5. Education	.049 (156)	-.035 (318)	**-.078 (.033**)	.010 (829)	1									
6. Depression	.015 (.635)	.026 (.964)	**.089 (.047)**	**.136 (.002)**	-.039 (.384)	1								
7. Anxiety	**-.077 (.015)**	.047 (.139)	**.160 (<.001)**	.050 (.262)	.022 (.626)	**.376 (<.001)**	1							
8. Stress	-.007 (.813)	.058 (.070)	**.152 (<.001)**	-.057 (.202)	-.006 (.893)	**.395 (<.001)**	**.650 (<.001)**	1						
9. Positive well-being	.036 (.249)	-.003 (.934)	-.050 (.260)	-.066 (142)	.022 (.517)	**-.285 (<.001)**	**-.226 (<.001)**	**-.156 (<.001)**	1					
10. Self-awareness	-.013 (.683)	.032 (.312)	.066 (.141)	-.072 (.109)	-.058 (.189)	**.**037 (.401)	.083 (.063)	**.096 (.032)**	.014 (.752)	1				
11. Self-reflection	-.003 (.921)	.025 (.430)	.075 (.092)	-.069 (.122)	.010 (.778)	-.058 (.059)	-.053 (.230)	.008 (.788)	**.195 (<.001**)	**.234 (<.001)**	1			
12. Self-compassion	.028 (.368)	.024 (.448)	-.013 (.769)	.004 (.895)	.030 (.375)	**-.331 (<.001)**	**-.223 (<.001)**	**-.214 (<.001)**	**.604 (<.001)**	-.014 (.752)	**.354 (<.001**)	1		
13. Self-affirmation	.035 (.257)	.030 (.335)	.060 (.176)	-.005 (.909)	.012 (.734)	**-.130 (.003)**	**-.103 (.020)**	**-.102 (.022)**	**.470 (<.001)**	**.125 (<.001)**	**.221 (<.001)**	**.411 (<.001)**	1	
14. Value-awareness	**.062 (.048)**	.020 (.530)	.062 (.167)	-.002 (.951)	-.008 (.825)	**-.065 (.041)**	**-.062 (.051)**	-.040 (.209)	**.267 (<.001)**	**.233 (<.001)**	**.159 (<.001)**	**.119 (<.001)**	**.676 (<.001)**	1

Note: We performed bivariate Pearson correlations for continuous variables; Kendal's tau correlations for ordinal variables. *p*-values are represented between parentheses for each correlation. Significant correlations are bold.

Reliability and validity

To measure the validity of the constructs, a factor analysis was conducted via SPSS. Overall items loaded on the correct (sub)scales and therefore we chose to keep the original constructs intact. The factor analysis can be found in Appendix C. The reliability of the scales was tested by calculating the Cronbach's Alpha. What should be recognized is that scales with a higher level of items often have higher Cronbach's Alphas. Higher scores might be a result of the items being a function of more than one construct (Schmitt, 1995). However, the scores in Table 5 also show scores above .70 for the constructs that have a lower number of items and therefore we consider the constructs reliable to work with.

Table 5.

Cronbach's Alpha

	Cronbach's Alpha	*N* (of items)
DASS (Depression, Anxiety & Stress Scale)	.897	21
MHCSF (Mental Health Continuum – Short Form)	.897	14
SCSSF (Self Compassion Scale – Short Form)	.855	12
SRIS (Self Reflection & Insight Scale)	.875	20
SAMM (Spontaneous Self-Affirmation Measure)	.928	13
SASS (Situational Self-Awareness Scale)	.746	9
IMI-interest (Intrinsic Motivation Inventory)	.933	7
IMI-values (Intrinsic Motivation Inventory)	.968	7
IMI-relatedness (Intrinsic Motivation Inventory)	.902	8

Confirmatory analyses

Negative well-being: depression

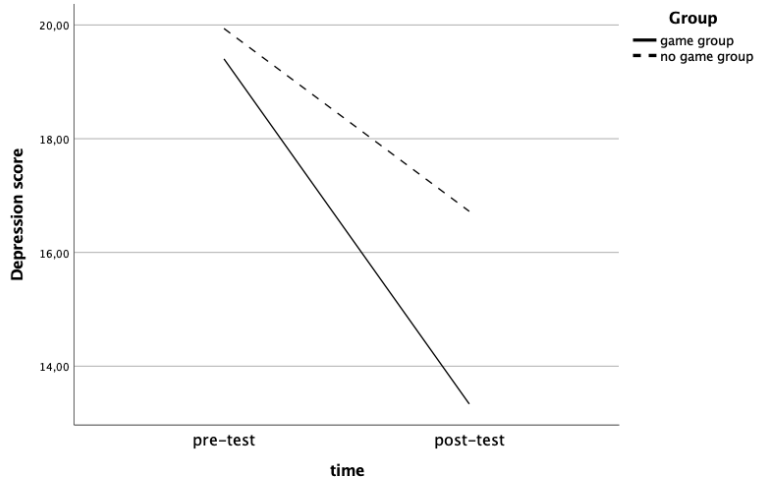
The three DASS components were analysed separately. A group x time repeated measures ANOVA on depression showed that there was a main effect for time (F(1.00, 4959.90) = 129.18, p <.001, η_p^2 = .21). This indicates that there is a general decrease of depression between the pre-test and post-test ($M_{pre-test}$ = 19.67; $SD_{pre-test}$ = .49; $M_{post-test}$ = 15.03; $SD_{post-test}$ = .52). Furthermore, there

was a main effect for group (F(1.00, 885.06) = 4.53, p = .034, η_p^2 = .01). This indicates that the no-game group reported a higher depression level than the game group ($M_{game\ group}$ = 16.37; $SD_{game\ group}$ = .74; $M_{no-game\ group}$ = 18.33; $SD_{no-game\ group}$ = .55).

There was also a significant interaction effect for group x time (F(1, 468.48) = .12.20, p <.001, η_p^2 = .02). This shows that there were significant differences between the game group and no-game group over time (see Figure 4). Follow-up t-tests determined that between the pre-test and post-test depression decreased significantly for both the game group ($M_{game\ group\ pre-test}$ = 19.40; $SD_{game\ group\ pre-test}$ = .79; $M_{game\ group\ post-test}$ 13.34; $SD_{game\ group\ post-test}$ = .83; p = <.001) and no-game group between the pre-test ($M_{no-game\ group\ pre-test}$ = 19.94; $SD_{no-game\ group}$ = .58) and post-test ($M_{no-game\ group\ post-test}$ = 16.72; $SD_{no-game\ group}$ = .61; p = <.001). There were no significant differences at pre-test between the game ($M_{game\ group}$ = 19.40; $SD_{game\ group}$ = .79) and no-game group ($M_{no-game\ group}$ = 19.94; $SD_{no-game\ group}$ = .58; p = .587), but there were significant differences between the game group ($M_{game\ group}$ =13.34; $SD_{game\ group}$ = .83) and no game group ($M_{game\ group}$ = 16.72; $SD_{game\ group}$ = .61; p = .001) at post-test, which demonstrates a larger decrease in depression for the game group compared to the no-game group.

Figure 4.

Scores for depression for the game group and no-game group between pre-test and post-test.



Negative well-being: anxiety

A repeated measure ANOVA for anxiety showed that there is a main effect for time (*F*(1, 751.05) 25.76, *p* <.001, $\eta_p^2 = .05$), which indicates that there is a general decrease of anxiety between the pre-test and post-test ($M_{pre-test}$ = 11.98; $SD_{pre-test}$ = .371; $M_{post-test}$ = 10.17; $SD_{post-test}$ = .39). There was no main effect for group *(F*(1, 165.71) 1.62, *p* = .204 $\eta_p^2 = .00$), nor an interaction effect (*F*(1, 24.00) .82, *p* = .365 $\eta_p^2 = .00$). Thus, there is no statistically significant difference between the game and no-game group for anxiety between the two tests.

Negative well-being: stress

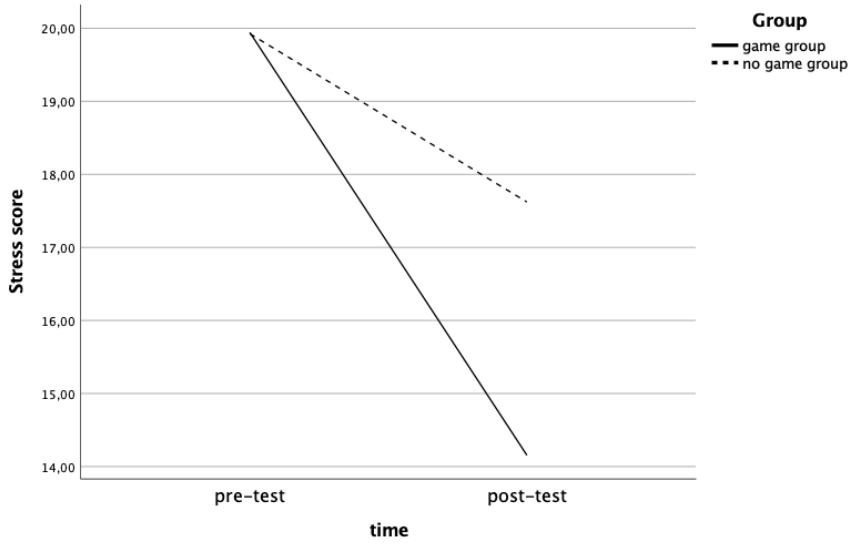
The repeated measure ANOVA for stress indicated that there is a main effect for time (*F*(1, 3212.47) 105.46, *p* <.001, η_p^2 = .19). This indicates that there is a general decrease of stress between the pre-test ($M_{pre-test}$ = 19.93; $SD_{pre-test}$ = .45) and post-test ($M_{post-test}$ = 15.89; $SD_{post-test}$ = .44). There was also a main effect for group (*F*(1, 583.69) 4.58, *p* = .033 η_p^2 = .01). This indicates that the game group overall reported lower levels of stress than the no-game group ($M_{game\ group}$ = 17.05; $SD_{game\ group}$ = .67; $M_{no-game\ group}$ = 18.74; $SD_{no-game\ group}$ = .44).

Furthermore, there was a significant interaction effect for group x time (*F*(1, 595.65) 19.55, *p* <.001 η_p^2 = .04), which indicates that there were statistically significant differences between the game and no-game group for stress. The follow-up *t*-tests showed that between the pre-test and post-test stress decreased significantly for both the game group ($M_{game\ group\ pre-test}$ = 19.94; $SD_{game\ group\ pre-test}$ = .76; $M_{game\ group\ post-test}$ = 14.16; $SD_{game\ group\ post-test}$ = .74) and no-game group ($M_{no-game\ group\ pre-test}$ = 19.93; $SD_{no-game\ group\ pre-test}$ = .50; $M_{no-game\ group\ post-test}$ = 17.62; $SD_{no-game\ group\ post-test}$ = .49; *p* = <.001). However, the follow-up *t*-test also indicated that there were no significant differences at pre-test between the game ($M_{game\ group}$ = 19.94; *SD* = .76) and no-game group ($M_{no-game\ group}$ = 19.93; *SD* = .50; *p* = .985), but there were significant differences between the game group ($M_{game\ group}$ = 14.16; *SD* = .74) and no

game group ($M_{no-game\ group}$ = 17.62; *SD* = .49; *p* < .001) at post-test. This indicates that the stress level decreased for both groups, but more in the game group then in the no-game group (see Figure 5).

Figure 5

Scores for stress for the game group and no-game group between time point 1 and 2.



Positive well-being

The repeated measure ANOVA for positive well-being showed that there is main effect for time (*F*(1, 2.50) 5.34, *p* = .021, $\eta_p{}^2 = .01$). This shows that there is a general increase of positive well-being between the pre-test ($M_{pre-test}$ = 2.394; $SD_{pre-test}$ = .036) and post-test ($M_{post-test}$ = 2.498; $SD_{post-test}$ = .038). There was no main effect for group (*F*(1, 2.77) .3.54, *p* = .061, $\eta_p{}^2 = .01$) and no significant interaction effect for group x time (*F*(1, 0.55) .12, *p* = .732 $\eta_p{}^2 = .00$). Thus, there was no statistically significant difference between the game group and no-game group over time regarding positive wellbeing.

Self-awareness

As the repeated measure of ANOVA for situational self-awareness shows, there is a main effect for time (F(1, 314.36) 6.18, p = .013, $\eta_p^2 = .01$). This means that there was a general decrease of self-awareness between the pre-test ($M_{pre-test}$ = 46.40; $SD_{pre-test}$ = .37) and post-test ($M_{post-test}$ = 45.23; $SD_{post-test}$ = .36). There was no main effect for group (F(1, 3.01) .04, p = .838, $\eta_p^2 = .00$), nor an interaction effect for group x time (F(1, .88) .02, p = .896 $\eta_p^2 < .01$), which indicates that there were no significant differences between the game group and no-game group for self-awareness between the two time points.

Self-reflection

A repeated measures ANOVA for self-reflection and insight showed that there was a main effect for time (F(1, 1762.94) 25.77, p <.001, $\eta_p^2 = .05$). This reveals that there was a general decrease of self-reflection between pre-test ($M_{pre-test}$ = 48.83; $SD_{pre-test}$ = .39) and post-test ($M_{post-test}$ = 46.06; $SD_{post-test}$ = .44). Additionally, there was a main effect for group (F (1, 1321.04) 14.47, p <.001, $\eta_p^2 = .03$), which indicates that in general the game group had lower self-reflection than the no-game group ($M_{game\ group}$ = 46.24; $SD_{game\ group}$ = .51; $M_{no-game\ group}$ =48.64; $SD_{no-game\ group}$ = .37).

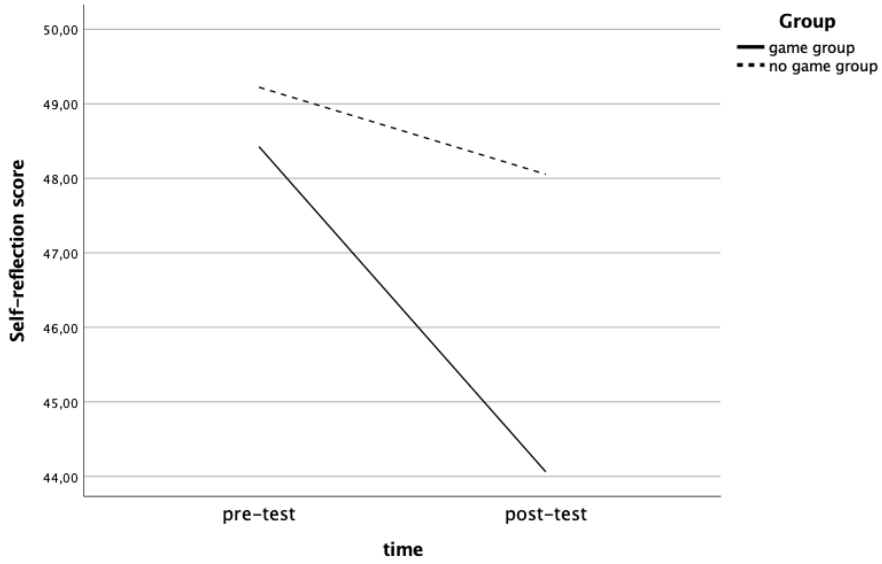
Furthermore, we found an interaction effect for group x time (F(1, 588.19) 8.60, p = .004 $\eta_p^2 = .02$), which shows that there were significant differences between the game group and no-game group for self-reflection. As the follow-up t-tests reveals, between the pre-test and post-test self-reflection decreased significantly for the game group ($M_{game\ group}$ = 44.06; $SD_{game\ group}$ = .88; p = <.001) but not for the no-game group ($M_{no-game\ group}$ = 48.06; $SD_{no-game\ group}$ = .65; p = <.072).

Furthermore, there were no significant differences at pre-test between the game ($M_{game\ group\ pre-test}$ = 48.43; $SD_{game\ group\ pre-test}$ = .63) and no-game group ($M_{no-game\ group\ pre-test}$ = 49.22; $SD_{no-game\ group\ pre-test}$ = .47; p = .311). Yet, we did found significant differences between the game group ($M_{game\ group\ post-test}$ = 44.06;

$SD_{game\ group\ post-test}$ = .71) and no game group ($M_{no-game\ group\ post-test}$ = 48.06; $SD_{no-game\ group\ post-test}$ = .52; *p* <.001) at post-test. Self-reflection decreased more in the game group then it did in the no-game group (see Figure 6).

Figure 6.

Scores for self-reflection for the no-game and game group between pre-test and post-test.



Self-compassion

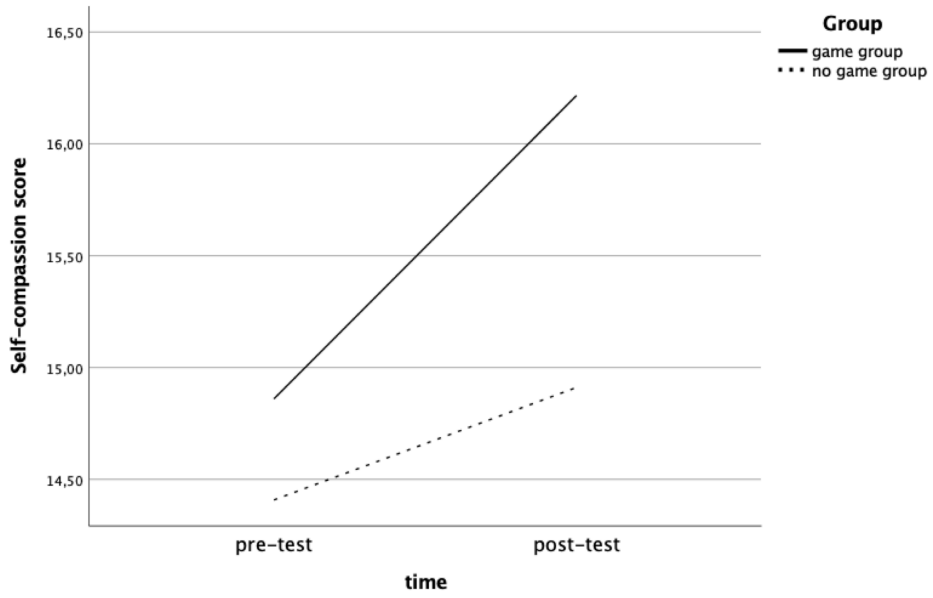
A repeated measure of ANOVA for self-compassion shows that there is a main effect for time (*F* (1, 199.12) 16.12, *p* <.001, $\eta_p^2 = .03$). Thus, there is a general increase of self-compassion between the pre-test ($M_{pre-test}$ = 14.63; $SD_{pre-test}$ = .18) and post-test ($M_{post-test}$ = 15.56; $SD_{post-test}$ = .18). Additionally, there was a main effect for group (*F*(1, 177.68) 10.69, *p* = .001, $\eta_p^2 = .02$), which indicates that in general, the game group had higher self-compassion than the no-game group ($M_{game\ group}$ = 15.54; $SD_{game\ group}$ = .22; $M_{no-game\ group}$ = 14.66; $SD_{no-game\ group}$ = .16). Furthermore, a borderline significant interaction effect was found (*F*(1, 41.95) 3.40, *p* = .066 $\eta_p^2 = .007$). The follow-up *t*-tests showed that between the pre-test and post-test self-compassion increased significantly for

the game group ($M_{game\ group}$ = 16.22; $SD_{game\ group}$ = .37; *p* <.001), but not for the no-game group ($M_{no-game\ group}$ = 14.91; $SD_{no-game\ group}$ = .275; *p* = .068).

There were no significant differences at pre-test between the game ($M_{game\ group\ pre-test}$ = 14.86; $SD_{game\ group\ pre-test}$ =.29) and no-game group ($M_{no-game\ group\ pre-test}$ = 14.41; $SD_{no-game\ group\ pre-test}$ = .213; *p* = .208), but there were significant differences between the game group ($M_{game\ group\ post-test}$ = 16.22; $SD_{game\ group\ post-test}$ = .28) and no game group ($M_{no-game\ group\ post-test}$ = 14.91; $SD_{no-game\ group\ post-test}$ = .21; *p* <.001) at post-test. This shows that self-compassion increased more in the game group then it did in the no-game group (see Figure 7).

Figure 7.

Scores for self-compassion for the no-game and game group between pre-test and post-test.



Affirmation of self-aspects

A repeated measure ANOVA for self-affirmation shows that there is a main effect for time (*F*(1, 18.94) 14.03, *p* < .001, $\eta_p^2 = .03$) which indicates that there is a general increase for self-affirmation between the pre-test ($M_{pre-test}$ = 3.51; $SD_{pre-test}$ = .06) and post-test ($M_{post-test}$ = 3.80;

$SD_{post-test}$ = .06). There also is a main effect for group (*F*(1, 15.57) 8.04, *p* = .005, $\eta_p^2 = .02$). This means that in general, the game group had higher affirmation of self-aspects then the no-game group did ($M_{game\ group}$ = 3.79; $SD_{game\ group}$ = .07; $M_{no-game\ group}$ = 3.53; $SD_{no-game\ group}$ = .06). Furthermore, there was no interaction effect for group x time (*F*(1, 2.21) 1.64, *p* = .201, $\eta_p^2 = .00$). This shows that there were no significant differences between the game group and no-game group between the two tests.

Value awareness

A repeated measure ANOVA for the value items of the Spontaneous Self-Affirmation Measure indicates that there is a main effect for time (*F*(1, 10.54) 4.43, *p* = .036, $\eta_p^2 = .01$), which suggests that there is a general increase for value-awareness between the pre-test ($M_{pre-test}$ = 3.66; $SD_{pre-test}$ = .08) and post-test ($M_{post-test}$ = 3.87; $SD_{post-test}$ = .08). There also was a main effect for group (*F*(1, 12.45) 3.86, *p* = .050, $\eta_p^2 = .01$), which indicates that in general, the game group had higher value-awareness then the no-game group did ($M_{game\ group}$ = 3.88; $SD_{game\ group}$ = .09; $M_{no-game\ group}$ = 3.65; $SD_{no-game\ group}$ = .07). Furthermore, there was no interaction effect for group x time (*F*(1, .28) .12, *p* = .734, $\eta_p^2 = .00$). This means that there were no statistically significant differences between the game and no-game group for value-awareness between the two tests.

Exploratory Analyses

Betwixt evaluation – game group only

The subscales interest/enjoyment, value/usefulness, and relatedness of the Intrinsic Motivation Inventory (IMI) were used to assess the subjective experiences of game-group participants related to Betwixt at post-test. Correlational analyses were performed for the frequency of playing games, the IMI-subscales, and the outcome measures (See Table 6). The correlational analysis showed that the frequency of playing games correlated significantly with stress. Playing more games is related

to experiencing higher stress levels. The IMI-interest measure correlated significantly with the IMI-value and relatedness measures. This shows that if game-group participants were interested, they valued the game more and felt more related to the game. This also applies for the IMI-value and IMI-relatedness. if individuals valued Betwixt more, they also felt more related to it. Furthermore, high value of Betwixt also related to having a higher positive well-being. A remarkable result of the correlational analysis is that the IMI-interest correlated negatively with value-awareness which can indicate that valuing Betwixt more is related to users having a lower value-awareness of the self.

Table 6.

Correlations between the intervention evaluation and well-being measures for the game-group at post-test

Measure	1	2	3	4	5	6	7	8	9	10	11	12	13
1. Frequency of playing games	1												
2. IMI-interest	.025 (.813)	1											
3. IMI-value	-.102 (.324)	**.683 (<.001)**	1										
4. IMI-relatedness	.124 (.232)	**.569 (<.001)**	**.405 (<.001)**	1									
5. Depression	.096 (.074)	-.109 (.148)	-.115 (.148)	-.037 (.658)	1								
6. Anxiety	.100 (.065)	-.033 (.925)	.008 (.925)	-.033 (.698)	**.390 (<.001)**	1							
7. Stress	**.137 (.024**)	-.038 (.634)	.006 (.941)	.002 (.983)	**.434 (<.001)**	**.422 (<.001)**	1						
8. Positive well-being	-.098 (.063)	.136 (.079)	**.201 (.010)**	.055 (.501)	**-.535 (<.001)**	**-.220 (<.001)**	**-.347 (<.001)**	1					
9. Self-awareness	-.015 (.776)	.062 (430)	.069 (.383)	-.042 (.606)	-.004 (.946)	-.007 (.889)	-.046 (.446)	.069 (.186)	1				
10. Self-reflection	-.042 (429)	.082 (.288)	.110 (.158)	-.107 (.189)	**-.148 (.005)**	**-.278 (<.001)**	**-.212 (<.001)**	**.110 (.034)**	**.293 (<.001)**	1			
11. Self-compassion	-.093 (.077)	.080 (.300)	.063 (.413)	.046 (.568)	**-.347 (<.001)**	-.072 (.171)	**-.321 (<.001)**	**.361 (<.001)**	-.007 (.896)	-.018 (.726)	1		
12. Self-affirmation	-.040 (.448)	.106 (.171)	.117 (.134)	.068 (.406)	**-.263 (<.001)**	-.097 (.067)	**-.240 (<.001)**	**.401 (<.001)**	.046 (.380)	**.108 (.037)**	**.303 (<.001)**	1	
13. value-awareness	-.056 (.303)	-.099 (.210)	**-.192 (.017)**	-.032 (.701)	.027 (.622)	.074 (.170)	-.027 (.655)	.073 (.165)	.000 (.997)	-.071 (.180)	-.014 (792)	.094 (.075)	1

Note: numbers represent correlations for the game group only. IMI = Intrinsic Motivation Inventory, IMI-scores were obtained for the game-group only. p-values are represented between parentheses for each correlation. Significant correlations are bolded

Game-group participants were asked to rank Betwixt and give additional textual feedback. The look of Betwixt was rated with an average score of 8.2 out of 10 ($M_{Betwixt\ look}$ = 8.15; SD= 8.00), whereas the game experience got graded averagely with a 8.2 out of 10 ($M_{Betwixt\ experience}$ = 8.20; SD= 9.00) and the overall experience of Betwixt received an average score from 8.4 out of 10 ($M_{Betwixt\ overall}$ = 8.35; SD= 9.00). The game group was also asked to rank the game mechanisms (journaling, guided meditation, and extra information) in order from most fun to least fun and most to least useful. Analysis showed that the in-game feature 'information' was ranked most fun. Participants gave text feedback such as *"It's fun to read all the special tips and tricks."* or "*I liked understanding the method behind the madness of it all"*. Ranked second was 'journaling', feedback for this was for example *"I'm already interested in journaling and get a lot out of it, so it was pretty accessible"* and *"I did not do the journaling. I was concerned about where that info would be stored and who would have access to it."* 'Guided meditation' was ranked third, examples of feedback about this in-game feature were: *"I am not a person for meditation"* or *"I struggle with meditation, but when it's guided, I find it more enjoyable."*

The game-group additionally ranked the game mechanisms to most to least useful. The result was equal to the rank question for most fun to least fun. Extra information was found to be most useful, and participants gave feedback such as: *"I like that extra information expands on the story"* and *"getting a better understanding of the psychology behind the dreams."* Journaling was ranked second; an example of feedback is *"Journaling helps me remember past thoughts and feelings that I've had and helps me reflect further on myself."* Ranked third was meditation, and feedback examples are: *"The guided meditation added to the value of the main quests"* and *"Because the meditation actually helped me be more immersed than the actual game play."*

In addition, we asked the game-group open evaluation questions about what they liked the most, least, and what could be improved about Betwixt. For feedback about what they liked the most, participants mentioned the *"the atmosphere and sense of calmness that the story gives"* or *"it allowed for some structure and self-reflection*". Participants who gave feedback on what they liked

the least about Betwixt mentioned things such as *"the language in the quests felt repetitive and lost my concentration"* and "*I least liked that the conversation bubbles progress on their own accord and I could not pause them or progress them more quickly. There were times when something came up in my immediate surroundings and the clip of the new bubbles coming in made it difficult to catch up with the prior unless I let the game finish and come to a stopping point."* Suggestions for improvement were also mentioned by the game group, examples are: *"a pause button in dreams", "have a recommended schedule for the dreams so I know if I should be doing them daily, every other day, etc."* or *"as a choose your own adventure goes, I think it might be benefit with alternate paths if possible. I don't know if these were already implemented, but I felt like the dreams were on rails."*

Discussion

The current RCT tested the effectiveness of the mobile self-help game Betwixt, on improving overall well-being of individuals between 22 and 50 years old. Participants using Betwixt were compared to participants not using Betwixt and we measured their levels of depression, anxiety, stress, positive well-being, self-awareness, self-reflection, self-compassion, affirmation of self-aspects and value-awareness. We found that there were significant decreases for the depression level, stress level and self-reflection of game-group participants. Furthermore, we also found a borderline significant increase of self-compassion in the game group. Contrary to our expectations, no differences were found between participants in the game group and no-game group on anxiety, positive wellbeing, self-awareness, affirmation of self-aspects and value-awareness.

Positive and negative wellbeing

As mentioned, there was a decrease for both depression and stress in the game group compared to the no-game group. Before the intervention period, game group participants had higher levels of depression and higher levels of stress than after the intervention period. As the scoring guide for the DASS-21 scale of Lovibond & Lovibond (1995) shows, the actual scores for the game

group moved from moderate depression at pre-test tot mild depression for post-test. For stress, the scores went from moderate at pre-test to close to mild at post-test. The DASS-21 cut-off scores were developed to characterize the degree of severity for the population. 'Mild' for example does not mean a mild level of a disorder but indicates that the person is above the population mean and still below the state where people typically seek help (Lovibond & Lovibond, 1995).

These scores indicated that the current study was able to reach a group of participants with moderate depression and stress levels and playing Betwixt might helped them convert these to (almost) mild levels after a two-week intervention period. These findings are promising, however – as this is just the first study on Betwixt and its potential to improve wellbeing – replication of these findings is warranted. Especially, since a recent meta-analysis from Abd-Alrazaq et al., (2022) has shown that similar studies in the past have suffered from overall risk of bias and low-quality evidence because of assessing participants without depression.

What is important to acknowledge is that we also saw a significant decrease in depression and stress for individuals in the no-game group. This is not what was hypothesized but can be explained by two factors. First, asking questions during the pre-test could have encouraged participants to think more in-dept about their thoughts and feelings. Having a certain mindset about feelings, thoughts or behaviour can influence its effect. For example, people who believe that stress is good for your performance, eventually perform better (Crum et al., 2013). Asking participants about well-being in the pre-test, could have created a certain mindset in which made participants think better about themselves and thus report differently during the post-test. Second, the passing of time also can have an influence. Between the pre-test and post-test, events that happened could have influenced how people feel and therefore report on the questions in the survey. Despite the significant results for both groups, we still saw that the game group had a larger decrease in depression than the no-game group.

We did not find any significant differences between the game and no-game group for anxiety. This might have been caused by Betwixt mainly focusing on physiological regulation and

being compassionate to yourself which address depression and stress but focuses less on mechanisms that help deal with anxiety. At last, we also did not find any significant results regarding positive well-being. This might have been caused by the focus on defining problems, drivers, and destructive habits in in-game exercises.

Self-awareness, self-reflection, and self-compassion

We assumed that examining feelings, thoughts and behaviour should improve the way we feel about ourselves and being more self-reflective should make individuals more self-aware (Kauer et al., 2012; O'Toole et al., 2014). Yet, in this study we found that self-reflection decreased significantly for the game group participants between the pre-test and post-test. This can be explained by the line of research that states that people who self-reflect more, are reporting worse on other well-being measures, tend to have higher anxiety and feel more negative towards themselves (Eurich, 2018; Grant, 2002; Wilson et al., 1989). As it is hard to reflect on unconscious thoughts, feelings, and motives, trying to find out what they mean and reflect on them can cause individuals to draw wrong conclusions about themselves (Nisbett & Wilson, 1977). As Eurich (2018) argues, individuals who are more self-reflective, more often get trapped in ruminative thoughts. Thinking too much about the self was in the study of Ingram (1990) even labeled as a risk factor for developing and maintaining mental disorders.

Furthermore, in line with the significant decrease for self-reflection we also saw a decrease for self-awareness between the pre-test and post-test. The self-awareness result is not significant, nevertheless it fits the results for self-reflection. Perhaps having lower self-reflection causes individuals to also be less self-aware, since having more self-reflection makes individuals more self-aware (Kauer et al., 2012; O'Toole et al., 2014).

The significant decrease for self-reflection and the general decrease for self-awareness are interesting findings, since Betwixt integrated several techniques that help individuals to gain more self-reflection and self-awareness. Different in-game features help users remove users away from problems and reflect on painful emotions. In-game meditation and mindfulness mechanisms are

designed to helps users improve symptoms of ruminative thinking and eventually cause individuals to be more self-aware. In this study, the purpose of the in-game design and mechanisms seem to unfold in a different way than first initiated. The decrease can be explained by the rationale mentioned above, however more research with focus on the effect of Betwixt on self-reflection and self-awareness is desired to find out what in-game techniques or features cause the effects that we saw in this study.

Our findings regarding the borderline significant increase in self-compassion in the game group compared to the no-game group fit our previous line of reasoning nicely, since individuals who can be aware of painful thoughts and feelings without starting to over-identify them, are likely to have more self-compassion (Neff, 2003b). Furthermore, our findings for self-compassion might show that the mindfulness and meditation mechanisms in Betwixt help individuals be more self-compassionate, as the in-game guided meditation was designed to affect this (see Table 1). Since we only found a borderline significant effect, more research is warranted to investigate the working mechanisms of Betwixt on self-compassion.

Affirmation of self-aspects and value-awareness

We did not find any significant results regarding affirmation of self-aspects and value-awareness. The explanation for this could be that the focus of the first five dreams that were included in this study was more focused on self-awareness, self-reflection, and self-compassion. In the dreams (6 till 8) that were developed during the current study, there will be more focus on affirmation of self-aspects and value-awareness. A follow-up study including these dreams might give more insight in whether Betwixt is able to affect these measures or not.

Intervention evaluation

The current study also examined the experience of game group participants with playing Betwixt. The correlation analysis showed that participants who were interested in Betwixt also valued the game and felt related to it. Furthermore, we found a negative significant correlation

between the IMI-value and the value-awareness of game-group participants. This might indicate that participants valued Betwixt less when they were aware of their own values. Evaluation analysis indicated that the overall experience with Betwixt is positive since game group participants graded the look, game experience and overall experience with an 8 or higher out of 10. Furthermore, we learned from qualitative feedback from participants that they experienced Betwixt as immersive and intriguing. The feedback from participants also showed that there were some suggestions for the design of Betwixt, as for example including a pause button or improving the app-navigation or the possibility to speed up the dreams. To hold engagement of participants over time, these suggestions should be considered in new versions or updates of the app.

Strengths, limitations, and recommendations

The current study had several notable strengths. First, we used a Randomized Controlled Trial which is considered to be the gold standard for studies that measure the effectiveness of a new intervention or treatment (Hariton & Locascio, 2018). Randomly assigning participants to the no-game or game group reduces bias and helps examining the cause-effect relationship between an intervention and an outcome. Second, we had a large sample size. The power analyses resulted in setting a target for 128 participants and we eventually collected complete and usable data from 505 participants. Third, the large sample size yielded several statistically significant results which provides a useful insight in how the use of digital interventions such as Betwixt influence the well-being of individuals.

A limitation of the current study is that we included a broad range of ages in our sample. Although we did not find any associations between age and outcome measures, a narrower age sample can provide different results for the well-being measures and game experience. Someone who is 22 years old might experience the game very differently from an individual who is 50 years old. Their needs, motivations and preferences probably differ and by including a less broad age

sample, Betwixt might be able to address these more specifically. Also, most well-being issues start during youth (Patel et al., 2007) and are often detected later in life. Targeting young people specifically can increase the prevention potential of Betwixt. On the other hand, the results we found within the broad age sample of this study do indicate that Betwixt can be used by a large group of individuals. Thus, the beneficial effects of Betwixt can be shared with a broad target audience what can contribute to the actual intervention or prevention impact of this app.

Furthermore, this study only included users who had access to an iPhone, because the Android version of the app was not ready for the market yet. However, there are differences between iOS and Android users. For example, iOS and Android users differ in their socio-demographics and their use of apps (Sims, 2013). Furthermore, iPhone users are more likely to have a graduate degree and be more knowledgeable about technology than Android users (Alexander, 2022). These factors might influence the engagement and participants' ability to understand how to play Betwixt. Also, in-app design elements can come across differently in other operating systems and this might have an influence on the usability and effect of the app (Kortum & Sorber, 2015). The difference in use might influence the level of effectiveness of Betwixt. As the plan is to build the Android app in the future, a usability study should be conducted whether to see the operating system does not influence the effect that Betwixt has on its users.

In addition, a large group of the participants was recruited via a game community on Reddit. These individuals possibly were more interested in playing games than others, which might have influenced the results of the study, or evaluation of Betwixt. On the other hand, we can state that the evaluation of Betwixt is done by more critical participants, since the sample is skewed in the direction of people who like and possibly know more about gaming.

Also, what should be noted is that the current study was done during the global COVID-19 pandemic. Outcomes for certain measures at pre- and post-test might be influenced by COVID-19 restrictions that were applied and changed before or during the intervention period. Individuals' social and mental well-being was put to the test during this pandemic (Jacobsen et al., 2020) and it is

expected to have both short- and long-term consequences for mental health and well-being (Galea et al., 2020). The COVID-19 measures could have had an influence on certain outcome levels at pre- and post-test, however this probably happened for both groups.

Finally, the intervention period of this current study was two weeks. The results of this study therefore can only say something about the effects over a short period of intervention time. We did not find out if these effects will stay or fade away once someone uses Betwixt for over a longer period. During the research period, Betwixt has been expanded and there are currently more dreams available then measured in this study. Therefore, a longer intervention period and a longer follow-up study would be useful to find out if effects will be more pronounced with a longer intervention period.

Conclusion

In conclusion, the current study showed that using digital interventions such as Betwixt can have beneficial effects on the well-being of individuals between 22 and 50 years old. We found that depression and stress levels decreased significantly and revealed a marginally significant increase for self-compassion. However, this study also showed a significant decrease in self-reflection for game-group participants. This result is not what we initially expected. Yet, it reinforces literature that states that people who are more self-reflective tend to experience more negative feelings about the self and are more likely to get trapped in ruminative thoughts. One of the focuses of Betwixt is reducing negative perspective and ruminative thoughts, however more research is warranted to find out if the in-game techniques that address this focus indeed induced the decrease in self-reflection.

Altogether, the results of this study are promising and show that using digital interventions such as Betwixt can be beneficial for individuals who struggle with well-being difficulties. In only two weeks we found significant results. To find out if apps such as Betwixt really can be used as a (prevention) intervention, more research is warranted. Therefore, future work should focus on

measuring if the effects found in the current study will stay over a longer period of time. Furthermore, listening to feedback from users and conducting more focused follow-up research will allow Betwixt, and similar digital interventions, to add value to the daily lives of as many individuals as possible.

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Appendices

Appendix A
Emails to participants

Information email participants (game group, after pre-test)
Hi ,

You receive this email because you have agreed on the informed consent and filled in the questionnaire for the research about Betwixt. Thank you for participating!

During this study, we will try to measure the beneficial effect of the mobile self-help app Betwixt. This app is mainly based on storytelling and built around seven different dreams which each has its own focus, mediative missions and creative missions. When playing Betwixt, you will enter the In-Between, a strange and magical world that will try to help you with capturing thoughts, find clarity through self-reflection, discover hidden strengths and become self-aware. The mission is to escape the In-Between, but in order to do so, you will have to face yourself.

Explanation of participation
We try to measure the effect by comparing two groups of participants. You are randomly selected to be part of the **game group.** This means the following:
During the upcoming two weeks, we would like you to play the first five dreams of Betwixt.

- You can download via this link: https://apps.apple.com/app/id1540472983
  - **Please send me an email if you have downloaded the app.**
  - Remember to put your notifications on
- After these two weeks, you will receive another questionnaire by email, similar to the one you already filled in.

Take note that you can stop participating in the research at any point, and that if you have additional questions you can reply to this email.

Thank you for your time,
Greetings

Leah Masselink
Student Msc Communication Science | University of Twente

Information email participants (no game group, after pre-test)
Dear …/Hello…

You receive this email because you have agreed on the informed consent and filled in the questionnaire for the research about Betwixt. Thank you for participating!

During this study, we will try to measure the beneficial effect of the mobile self-help app Betwixt. This app is mainly based on storytelling and built around seven different dreams which each has its own focus, mediative missions and creative missions. When playing Betwixt, you will enter the In-Between, a strange and magical world that will try to help you with capturing thoughts, find clarity through self-reflection, discover hidden strengths and become self-aware. The mission is to escape the In-Between, but in order to do so, you will have to face yourself.

Explanation of participation
We try to measure the effect by comparing two groups of participants. You are randomly selected to be part of the **no game group.** This means the following:

- After two weeks, you will receive another questionnaire by email, similar to the one you already filled in. In the meantime, you do not have to do anything.

Take note that you can stop participating in the research at any point, and that if you have additional questions you can reply to this email.

Thank you for your time,
Greetings

Leah Masselink
Student Msc Communication Science | University of Twente

E-mail game group
Hi name,

You receive this email because you have filled in the pre-test of the Betwixt study. **Thank you for your time and willingness to participate!**

During this study, we try to measure the effect of comparing two groups of participants. You are randomly selected to be part of the **game group.**

Currently, our development team is doing busy with the last tests. Once this is completed and Betwixt is ready to use, you will **receive an em**ail from me **with further explanation** of the study. If you have any questions regarding the study please let me know.

Kind regards,
Leah Masselink
Student Msc Communication Science | University of Twente

Prompt e-mail
Hi!

You are participating in the study about the beneficial effect of Betwixt. I hope you are on your journey and are facing the in-Between.

Please keep in mind that if you have any questions, you can contact me!

Greetings,
Leah Masselink
Student Msc Communication Science | University of Twente

Reminder e-mail
Hi!

You are participating in the study about the beneficial effect of Betwixt, in the **game group**. Did you managed to download the app and started playing?

If you did not already, here you can find the download link:
https://apps.apple.com/app/id1540472983

Please keep in mind that if you have any questions, you can contact me!

Greetings,
Leah Masselink
Student Msc Communication Science | University of Twente

Information email participants (before post-test)
Dear …/Hello…

You receive this email because in the past two weeks you participated in the study about the beneficial effect of Betwixt. Thank you very much for participating!

To complete the study, we would like to ask you to fill in this the post-questionnaire.
https://utwentebs.eu.qualtrics.com/jfe/form/SV_dcCYH7wXbV0RpxI
In this questionnaire, you do not have to fill in any personal information. We anonymized our data, and therefore we would like you to fill in your participant number:

- **Number of participant**

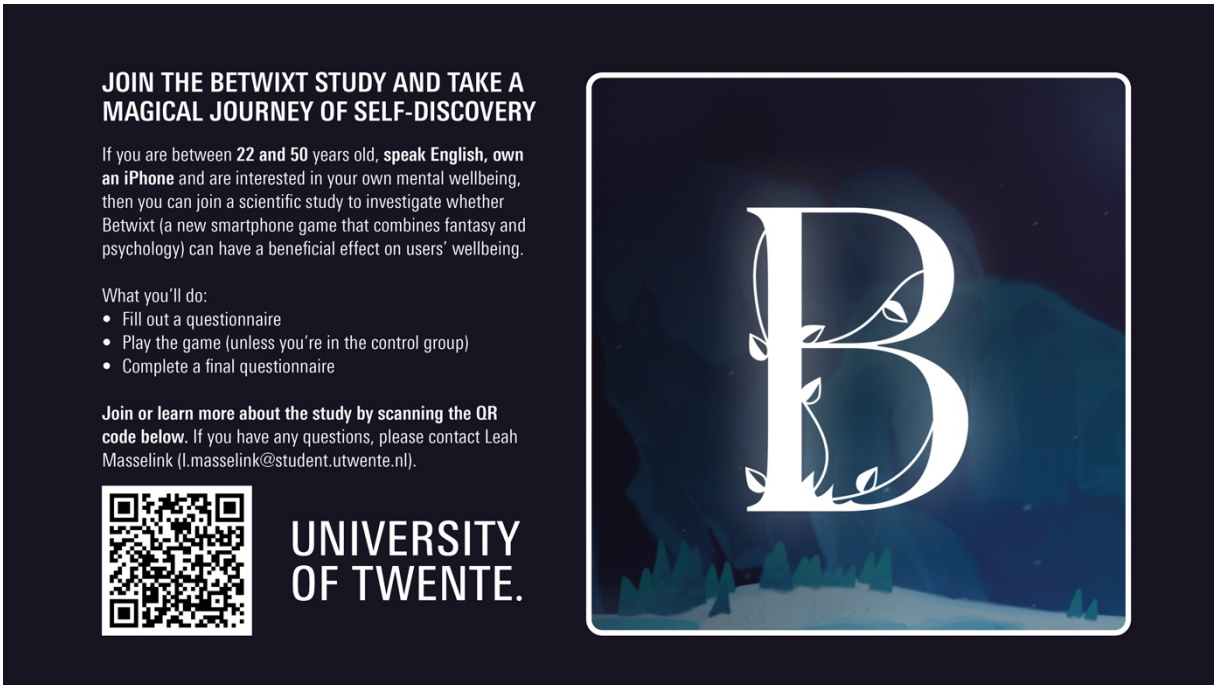
Three months after filling in this questionnaire, you will receive an email from Hanneke Jansen, researcher at the University of Twente with another link to a shorter questionnaire. In that way, we are able to measure the effect over Betwixt over time.

Take note that you can still stop participating in the research at any point, and that if you have additional questions you can reply to this email.

Thank you for your time,
Greetings

Leah Masselink
Student Msc Communication Science | University of Twente

Appendix B
visual for recruiting participants



Appendix C
Factor analysis

Construct /Item	Factor loadings (component)		
DASS	1	2	3
I felt that I was using a lot of negative energy	.745		
I was aware of the action of my heart in the absence of physical exertion	.662		
I experienced breathing difficulty	.640		
I felt I was close to panic	.635		
I found it difficult to relax	.592		
I experienced trembling	.575		
I found it hard to wind down	.548		
I was worried about situations in which I might panic and make a fool of myself	.539		
I was aware of dryness in my mouth	.482		
I tended to over-react to situations	.479		.310
I found myself getting agitated	.469		
I felt that I had nothing to look forward to		-.874	
I was unable to become enthusiastic about anything		-.867	
I couldn't seem to experience positive feelings at all		-.853	
I felt downhearted and blue		-.812	
I felt I wasn't much worth as a person		-.721	
I found it difficult to work up the initiative to do things		-.687	
I felt scared without any good reason			.776
I felt that life was meaningless			.684

I felt that I was rather touchy	.390	.418
I was intolerant of anything that kept me from getting on with what I was doing		.406

Construct /Item	Factor loadings (component)		
MHCSF	1	2	3
Confident to think or express your own ideas and opinions?	.769		
That you have experiences that challenge you to grow and become a better person?	.768		
That your life has sense of direction or meaning to it?	.713		
That you had something important to contribute to society?	.683		
That you belonged to a community?	.609		
That you had warm and trusting relationships with others?	.444		.321
Good at managing the responsibilities of your daily life?	.401		.314
That the way our society works makes sense to you?		.866	
That our society is becoming a better place?		.815	
That people are basically good?		.699	
Happy?			.940
Satisfied?			.833
Interested in life?			.799
That you liked most part of your personality?			.574

Construct /Item	Factor loadings (component)					
SCSSF	1	2	3	4	5	6
I'm intolerant and impatient towards those aspects of my personality I don't like	.851					
I'm disapproving and judgmental of my own flaws and inadequacies	.842					
When I fail at something that is important to me, I become consumed by feelings of inadequacy	.604			.350		
When I'm feeling down, I tend to obsess and fixate on everything that is wrong	.601			.338		
When I feel inadequate in some way, I try to remind myself that feelings of inadequacy are shared by most people		.879				
I try to see my fallings as part of the human condition		.828				
When something upsets me, I try to keep my emotions in balance			.962			

When I'm feeling down, I tend to feel most other people are probably happier than I am	.801		
When I'm going through a very hard time, I give myself the caring and tenderness I need		.895	
When I fail at something important to me, I tend to feel alone in my failure	.376	.446	
When something painful happens, I try to take a balanced view of the situation			-.678
I try to be understanding and patient towards those aspects of my personality I don't like		.323	-.616

Construct /Item	Factor loadings (component)		
SRIS	1	2	3
I rarely spend time in self-reflection	.853		
I often think about the way I feel about things	.778		
I frequently take the time to reflect on my thoughts	.764		
I don't really think about why I behave the way I do	.696		
I frequently examine my feelings	.678		
I don't often think about my thoughts	.669		
I am usually aware of my thoughts	.428		
Often, I find it difficult to make sense of the way I feel about things		.854	
My behaviour often puzzles me		.802	
I'm often confused about the way that I really feel about things		.778	
I usually know why I feel the way I do		.747	
Thinking about my thoughts makes me more confused		.728	
I am often aware that I have a feeling, but I often don't quite know what it is		.679	
I usually have a very clear idea about why I've behaved in a certain way		.646	
It is important to me to be able to understand what my feelings mean			.861
It is important to me to understand how my thoughts arise			.863
I am very interested in examining what I think about			.841
I have definite need to understand the way that my mind works			.834
I am not really interested in analyzing my behaviour			.596

It is important for me to evaluate the things that I do	.546

Construct /Item	Factor loadings (component)		
SSAS	1	2	3
I am keenly aware of everything in my environment	.915		
I am conscious of all objects around	.872		
I am self-conscious of what is going on around me	.790		
I am concerned about what other people think of me		.856	
I am self-conscious about the way I look		.835	
I am concerned about the way I present myself		.806	
I am reflective about my life			.852
I am aware of my innermost thoughts			.816
I am conscious of my inner feelings			.771

Construct /Item	Factor loadings (component)		
SAMM	1	2	3
Thinking about people that I love	.973		
Thinking about the people that I trust	.928		
Thinking about the people who are important to me	.844		
Thinking about my friends	.833		
Thinking about my family	.799		
Thinking about the things I am good at		.952	
Thinking about my strengths		.909	
Thinking about the things I like about myself		.896	
Remembering things, I have succeeded at		.774	
Thinking about what I stand for			-.960
Thinking about my principles			-.947
Thinking about the things I believe in			-.939
Thinking about my values			-.786