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Self-efficacy as the moderator between state anxiety, and well-being: an experience sampling study among university students

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Table of Contents

Abstract

Background. Research has shown that university students are more at-risk to develop anxiety disorders and experience lower levels of mental well-being than the general population. Even though the negative association between state anxiety and mental well-being is known, no study examined if the association differs on a within- and between-person level. Additionally, no research has examined if constructs, such as self-efficacy, could moderate and thereby influence the daily relationship of state anxiety and mental well-being. **Objective.** The present study investigated the association between state anxiety and state well-being over two weeks. Furthermore, the association was examined on a within-and between-person level. Last, trait self-efficacy was examined as a moderator of the daily relationship between state anxiety and mental well-being. **Method.** The experience sampling method with 26 university students was used. The Hospital Anxiety and Depression Scale, Short Warwick´s Edinburgh Mental Well-being Scale, and the General Self-Efficacy scale were used to assess anxiety, mental well-being, and self-efficacy. State anxiety was measured with one item, and state mental well-being by using the Short Warwick´s Edinburgh Mental Well-being Scale. State questionnaires were answered three times per day over the course of two weeks. **Results.** State anxiety and mental well-being showed a negative moderate association (β = -.33, N = 26, p < .001). On a within-person level the result showed a significant weak negative correlation (β = -.27, SE = .01, p < .001), and on the between-person level a significant moderate negative correlation (β = -.35, SE = .07, p < .001). The moderation analysis resulted in a non-significant interaction effect. **Conclusion.** The association between **s**tate anxiety and mental well-being has shown to remain significant on a within-and between-person level. However, trait self-efficacy did not moderate the relationship. This suggests that trait self-efficacy might not be a suitable construct for interventions targeting the daily relationship of anxiety and well-being. This novel information contributes to a better understanding of the relationship between the three constructs, although the generalisability of the current results must be established by future research.

Self-efficacy as the moderator between anxiety and well-being: An experience sampling study among University students

It is often said that the time spent at University is the best in one's life that one should enjoy to the fullest. However, research has shown that students experience lower levels of mental well-being than the general population (Maricuțoiu & Sulea, 2019; Soysa & Wilcomb, 2013) with around 31% of the students worldwide developing psychopathologies, such as depression or anxiety if they do not receive the support needed (Lattie et al., 2019).

An important point that must be emphasised here concerns the terms "mental well-being" and "psychopathology". Even though it seems like they are two opposite ends of the same construct, Keyes (2002) showed that mental well-being is not just the absence of psychopathology. In his two-continua model, these two are displayed as separate but correlated constructs. The mental well-being part of the model can be divided into people considered to have complete mental well-being and be "flourishing" or incomplete mental well-being and "languishing". The psychopathological part is divided into having a mental illness or the absence of a mental illness (Westerhof & Keyes, 2010). Both continua affect each other, for instance, incomplete mental well-being makes an individual more vulnerable to develop a mental illness. Thus, even though the focus in psychological treatment is often solely on decreasing symptoms, it is essential to target both the decrease of symptoms as well as the increase of mental well-being (Schotanus-Dijkstra, Ten Have, Lamers, de Graaf, & Bohlmeijer, 2017).

To clarify the construct of mental well-being further, Keyes (2002) conceptualised it as the balance between emotional well-being and appropriate social and psychological functioning. Emotional well-being represents a more subjective component of well-being. Here, well-being is about the experience of pleasure and achievement of happiness. Psychological and social functioning are targeting well-being apart from happiness only. It is about the degree to which people live in accordance with their values and beliefs, and is thus, more about self-

realisation of an individual. A balance between all three parts can act as an important resource to buffer against various challenges (Keyes, 2002; Ryan & Deci, 2001). Especially in a University context, this might be important. Students must face and manage various challenges, such as monetary difficulties or written exams. If they do not have the necessary resources to face them, this can negatively impact their mental well-being. Low levels of well-being over a longer period can make students more vulnerable to stressors, decrease the satisfaction with life, and contribute to the development of psychopathologies (Demirtaş, 2019; Dodge, Daly, Huyton, & Sanders, 2012; Etherton, Steele-Johnson, Salvano, & Kovacs, 2020). However, a high well-being counteracts the development or reoccurrence of psychopathologies, such as anxiety related symptoms (Schotanus-Dijkstra et al., 2017).

In general, anxiety is one of the most basic emotions people experience naturally, ensuring survival and safety (Steimer, 2002). It has been conceptualised on a trait level and state level. Trait anxiety displays how anxious one feels in general over a longer period, whereas state anxiety is describing how a person feels at a given moment. State anxiety can thus fluctuate multiple times during the day and change according to different contexts (Morales-Rodriguez & Perez-Marmol, 2019). If anxiety is heightened over a longer period this can have severe negative consequences, such as diminished problem-solving abilities, attention and information processing (Nechita et al., 2018). Additionally, anxiety affects sleep quality, increases social withdraw, and can also impact the immune system (Nechita et al., 2018). Multiple studies have shown that high levels of state anxiety, as well as trait anxiety, led to a decrease in well-being (Etherton et al., 2020; Lahtinen & Salmivalli, 2019). This might be due to the relation of anxiety and self-doubts in one´s capacities to accomplish certain tasks. Thus, the imbalance between demands and one´s experienced resources to meet them can possibly result in diminished mental well-being (Dodge et al., 2012; Morales-Rodriguez & Perez-Marmol, 2019).

One factor that is supposedly beneficial to act as a buffer in the relationship between anxiety and well-being is self-efficacy. Self-efficacy was defined by Bandura (1994) as the trust

an individual has in his or her abilities to accomplish a certain task or meet a challenge successfully. Generally, self-efficacy consists of an overall stable trait component, as well as a fluctuating state component (Etherton et al., 2020). Higher levels of state and trait self-efficacy can have numerous beneficial outcomes for an individual. People high in self-efficacy have overall increased beliefs in their abilities, are more likely to handle disappointments adaptively (Etherton et al., 2020), experience more positive emotions, and have more trust in successful goal attainment (Demirtaş, 2019; Yu & Luo, 2018). Relating self-efficacy to the challenges students experience, handling anxiety and maintaining well-being can be assumed to be an important mechanism. Research has demonstrated that high self-efficacy decreases anxiety and increases well-being (Demirtaş, 2019). These results seem promising due to the high demands of studying and the importance of trust in one´s abilities to increase student´s abilities to cope with these challenges and their expectations of success rather than failure (Etherton et al., 2020).

Nevertheless, research mostly focused on the associations between the constructs separately, and no study, to the author´s knowledge, focused on the role of self-efficacy as a possible moderator on the relationship between anxiety and well-being throughout the day. This could be beneficial since state anxiety is a fluctuating construct that can change quite flexible in response to multiple stressors throughout the day, and thus, influences state levels of well-being accordingly (Morales-Rodriguez & Perez-Marmol, 2019; Panayiotou & Karekla, 2013). If self-efficacy could act as a moderator, it could possibly act as a buffer for the negative consequences state anxiety can have on well-being and the overall life satisfaction of an individual. With this information, it could be determined if self-efficacy might be of importance and a major component in interventions or preventive programs targeting anxiety and mental well-being.

A method that would be beneficial to study the relationship of the three constructs on a trait and state level, could be provided using the experience sampling method (ESM) (Curran & Bauer, 2011). ESM enables researchers to conduct multiple measurements of several

constructs, such as anxiety and well-being, at different times and contexts. Additionally, it is possible to analyse the association between state constructs on a within- and a between-person level. A between-person level is focused on the average association of the constructs over time, whereas a within-person level is relating to the variation between the constructs within one person over time and not multiple persons (Curran & Bauer, 2011). This distinction is important since interindividual associations cannot always be found on an intraindividual level possibly leading to misinterpretations (Curran & Bauer, 2011). Thus, by using ESM, this study would present novel information about the associations between self-efficacy, anxiety, and mental well-being.

The current study first aims to confirm the negative association between state anxiety and state well-being. Additionally, it will be determined how state anxiety and state well-being are associated on a within- and between-person level. Last, it will be examined if trait self-efficacy could act as the moderator of the relationship between state anxiety and state well-being over the course of two weeks using ESM.

Methods

Participants

The inclusion criteria for the present study were the following: the participants had to be students above the age of 18. Furthermore, they needed proficient English language skills since the questionnaires had to be completed in English and possess a Smartphone to download the app Ethica to complete the study (explained below). Students who did not fulfil these inclusion criteria were excluded from the study.

Participation was voluntarily for all the participants, and everyone had to give informed consent before they were able to take part in the study. The study was approved by the ethical committee of the Behavioural & Management Sciences faculty of the University of Twente (#191314).

Design and Procedure

An experience sampling method was used. After receiving ethical approval, the distribution of the survey and the data collection started. The data collection lasted for two weeks starting on the 6th of April and ending on the 19th of April 2020. Participants were recruited using convenience sampling. They were contacted by the researchers directly. The participants did not receive a compensation for their participation in the study.

Each participant received an invitation to the study via email with which they were able to participate in the study after downloading the Ethica app on their Smartphone. The participants were instructed to complete the registration on the same day because the data collection started for all participants collectively. After registering for the study, the participants were asked to give informed consent to be able to participate in the study (see Appendix F).

On the first day of the study, the participants had to complete the baseline questionnaires, consisting of the trait questionnaires for anxiety and depression, mental well-being, stress, and general self-efficacy as well as a questionnaire about demographic data (see

Appendix D). The participants were free to answer the baseline questionnaire at any time within the two weeks of the study. After completing the full baseline questionnaire, it expired automatically. In total, the baseline questionnaires took approximately ten minutes to complete.

The consecutive days of the study (day 2-15), the participants had to complete the state questionnaires. Here, a fixed time schedule was applied to trigger the state questionnaires every day at the same time for the 14 consecutive days. In total, the participants received prompts to fill in the surveys three times per day. In ESM research, a fixed schedule and three measurement points is the most common research design, wherefore it was chosen in the present study too (Yearick, 2017). The first prompt was activated at 10am, the second one in the afternoon at 3pm, and the last questionnaire was triggered in the evening at 8pm. Every state questionnaire had a set expiration date. Three hours after the first notification, the surveys expired automatically to ensure that the measurements take place at the time intended. The notifications were sent to the participants in form of reminders on their Smartphones. Additionally, participants received a second reminder 90 minutes after the first notification in case they had not completed the questionnaires yet. In total, the daily questionnaires were supposed to take approximately three minutes per measurement occasion to be completed.

Materials and Methods

The questionnaire for the study was designed by using the online research platform Ethica (https://ethicadata.com/). The study comprised four trait questionnaires, and six state questionnaires in total. Since the present study was part of a more extensive research, only the Hospital Anxiety and Depression Scale (HADS), General Self-Efficacy Scale (GSE), Short Warwick-Edinburg Mental Well-Being Scale (SWEMWBS), and the two corresponding state questionnaires are explained further below.

Online Research Platform Ethica

To carry out the experience sampling study, the online research platform "Ethica" was used. Ethica can either be used by researchers to design studies, or by participants to take part in a study. Ethica is beneficial for experience sampling studies since it is accessible via the webpage but most importantly it is downloadable as an app for Android or iOS devices. This way, participants can answer short questionnaires multiple times a day on their own device what can promote higher participation and lowers the burden since they have their smartphones easily accessible (Connor & Lehmann, 2012).

Furthermore, Ethica provides multiple features for the design of experience sampling studies specifically. One can create multiple questionnaires and set specific times when these are triggered. The trigger will occur as a push notification, which participants will receive on their smartphone reminding them to complete the questionnaire. Additionally, it is possible to let questionnaires expire after a certain time frame. By this, it can be ensured that the questions are asked at specific time points and measurements will remain accurate (Ethica, 2019).

Trait Questionnaires

General Self-Efficacy Scale (GSE). The General Self-Efficacy Scale was created by Schwarzer and Jerusalem (1995) and comprises ten items in total (see Appendix A). The GSE has a 4-point Likert scale ranging from 1 (*Not at all true*) to 4 (*Exactly true*). The final score ranges from ten to 40. Scores lower than 24 display a low, and scores above 34 a high level of self-efficacy (Brähler, Schumacher, Albani, Schmid, & Brähler, 2006). Example questions of the GSE would be *"It is easy for me to stick to my aims and accomplish my goals"* or *"I can solve most problems if I invest the necessary effort"*. The questions are based on the general experiences of self-efficacy and no specific recall period was applied. The GSE has shown to be reliable, valid, and homogenous across 25 different nations (Scholz, Gutiérrez Doña, Sud, & Schwarzer, 2002). The test-retest reliability was good with an estimate of .74 (Yildirim & Ilhan,

2010). Cronbach´s alpha indicated good reliability with an estimate of .84 within the sample of the present study.

Hospital Anxiety and Depression Scale (HADS). The HADS was invented by Zigmond and Snaith (1983) and can assess the severity of anxiety and depression. The HADS has two subscales, one for depression and one for anxiety. In the present study, only the anxiety subscale was used (Appendix B). The items can be answered with a 4-point Likert scale ranging from 0 (*Often*) to 3 (*Very seldom*) (Michopoulos et al., 2008). The total scores for the subscale anxiety range from zero to 21. A score higher than eleven indicates high anxiety. A score of seven and lower indicates low levels of anxiety. The questions had to be answered based on experiences made in the past week. An example question of the HADS is *"I feel tense or ´wound up´"*. The test-retest reliability of the HADS is high with an estimate of .89 (Herrero et al., 2003; Michopoulos et al., 2008). Additionally, the subscale anxiety has displayed good internal consistency within this sample with a Cronbach´s alpha of .80.

Short Warwick-Edinburgh Mental Well-being Scale (SWEMWBS). The SWEMWBS comprises seven items in total which can be answered on a 5-point Likert scale from 1 (*none of the time*) to 5 (*all of the time*) (see Appendix C). The recall period of the SWEMWBS covers the past two weeks. The total score can range from seven to 35. Scores below 20 display a low mental well-being, and scores above 27 a high mental well-being (Vaingankar et al., 2017). The test-retest reliability of the SWEMWBS was high (.83) (Tennant et al., 2007). Cronbach´s alpha was questionable within this sample with an estimate of .62.

State Questionnaires

State anxiety was measured by answering the question *"How anxious do you feel right now"* on a scale from zero (*not at all*) to 100 (*extremely*). This item has been used in prior ESM research (Cox, Sterba, Cole, Upender, & Olatunji, 2018) and has shown to be an efficient tool to identify state levels of anxiety. Mental well-being as state was measured by using the total

seven items of the SWEMWBS with the corresponding 5-point Likert scale (see Appendix E). For the state mental well-being scores, the same interpretation criteria as for the SWEMWBS were used. Based on prior studies, state anxiety scores below 27 were interpreted as low, and scores above 62 as high (Cox et al., 2018; Edmondson, Arndt, Alcantara, Chaplin, & Schwartz, 2015).

Statistical analyses

The analyses of the data were performed using IBM SPSS Statistics (Version 24). The participants that fulfilled the inclusion criteria and had a response rate above 50% were included in the study. This response rate was set to ensure that a sufficiently large number of participants, for an ESM study, as well as enough measurements per participant could be included. A clear guideline for response rates in ESM studies does not exist but the importance of more measurements per participant is communicated (Berkel, Ferreira, & Kostakos, 2017). Five participants had to be excluded since their response rate was below 50%. The data of these participants were deleted prior to any further analyses.

Next, descriptive analyses were performed to get an overview of the data in general. Means and standard deviations for the age, gender, nationality, occupation, trait anxiety, trait well-being, and trait self-efficacy were estimated. To perform within- and between-person analyses, the person mean (PM) and the person mean-centred (PMC) for state anxiety and state well-being were created. The PM shows the average state level of anxiety and well-being over two weeks and can be used to perform between-person analyses. The PMC displays the variation of both state levels from the mean score at different measurement points (Curran & Bauer, 2011). The scores of the PMC were used for within-person analyses. Additionally, the mean, PM and PMC scores for state well-being and state anxiety, and the trait self-efficacy scores were standardised for the following analyses.

For the following analyses, linear mixed model (LMM) analyses were used. First,

Estimated Marginal (EM) means were calculated for state well-being and state anxiety for each participant and each day to get an overview of the data. Therefore, ID and day were set as fixed factors separately, as well as state anxiety and state well-being as dependent variable individually.

To examine the first research aim, a LMM analysis was performed using the repeated covariate type of first-order autoregressive AR(1). The standardised score for state anxiety was used as the dependent variable, and the standardised score for well-being as the covariate. To interpret the resulting association, Cohens (1988) interpretation for standardised association was used as a basis: $\beta < .30$ demonstrates a weak, $\beta > .30$ a moderate, and $\beta > .50$ a strong association.

Furthermore, to examine the second research aim another LMM was performed. Here, the standardised state score of anxiety was used as the dependent variable and the standardised PM and PMC scores of state well-being were entered as fixed covariates into the model.

To analyse the third research aim, namely, the effect of self-efficacy as a possible moderator in the relationship between state anxiety and state well-being, another LMM was performed. The raw standardised state anxiety score was set as the dependent variable, and the raw standardised score of state well-being as independent variable. The standardised mean score for trait self-efficacy was included as an additional predictor. The standardised state well-being score and trait self-efficacy were defined as main effects and the interaction effect of state well-being and self-efficacy was included as well to determine if self-efficacy acts as a moderator in the relationship between state anxiety and well-being.

Results

Descriptive Statistics

The final sample comprised a total of 26 students between the ages of 19 to 32. The demographics of this sample are displayed in Table 1, as well as the mean, minimum, and maximum for the trait self-efficacy, anxiety, and mental well-being.

Table 1

Demographics including the minimum, maximum scores, and means of trait self-efficacy, anxiety, and mental well-being

Item	*n*	%	*M*	Minimum	Maximum
Age	26		23.54	19	32
Gender					
Female	11	42.3			
Male	15	57.7			
Nationality					
German	23	88.5			
Australian	1	3.8			
Other	2	7.7			
Highest degree					
High School	15	57.7			
Bachelor	11	42.3			
Field of study					
Natural Sciences	1	3.8			
Social Sciences	19	73.1			
Arts	1	3.8			
Other	1	3.8			
Not applicable	1	3.8			
Trait self-efficacy	26		31.04	25	38
Trait mental well-being	26		24.54	19	31
Trait anxiety	26		13.96	9	20

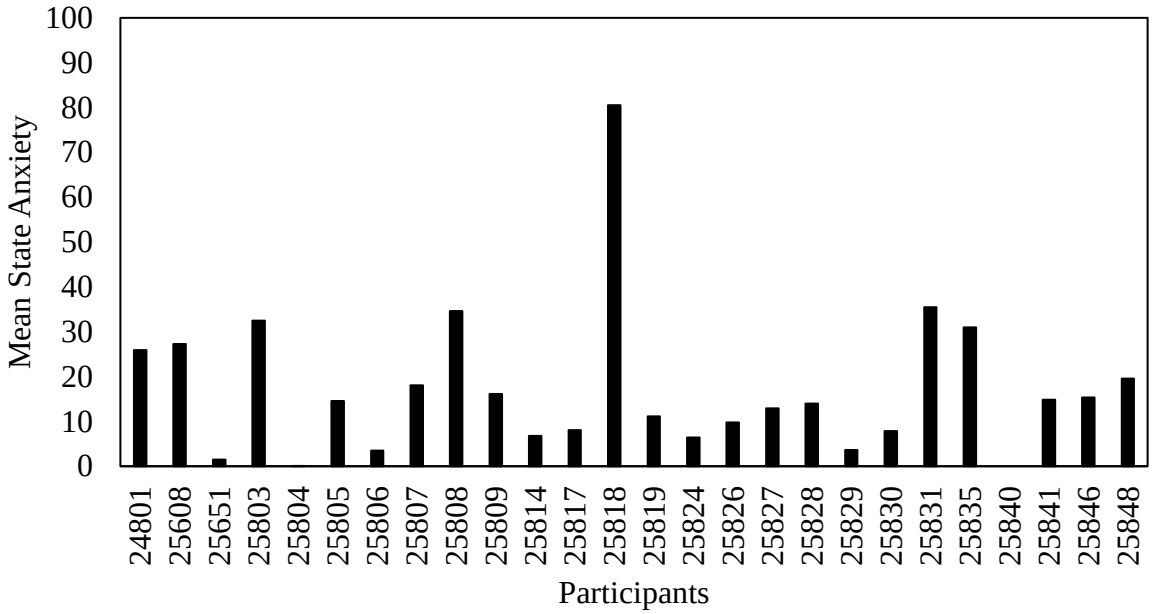
Note. *n* and *M* are used to represent the total number of individuals and means, respectively.

Visual Analyses

Mean state anxiety. Figure 1 shows the mean scores for state anxiety over the course of two weeks for every participant. It shows that the average scores varied across the participants. The minimum score was 0.05 for participant 25804, and the highest scores was reached by participant 25818 with a maximum score of 80.51. The maximum score deviates far from the average level of state anxiety (M = 17.37; SD = 16.88). This implies that participant 25818 had much higher levels of state anxiety compared to the other participants in this sample.

Figure 1

Average levels of state anxiety for individual participants over two weeks (N = 26)

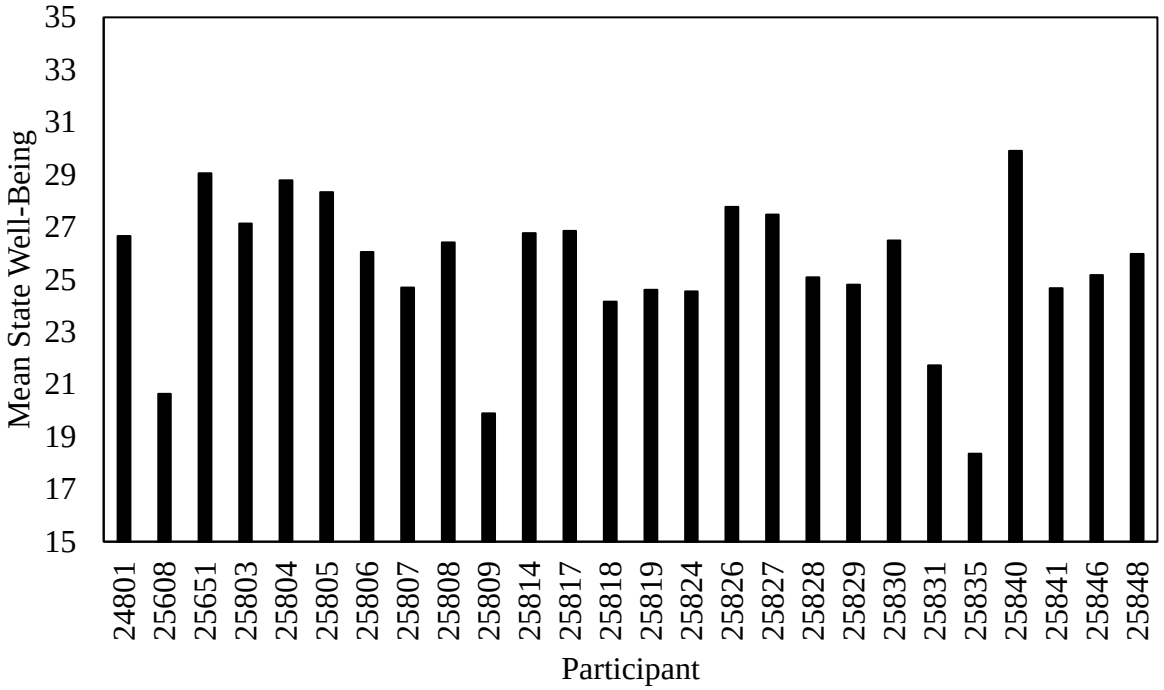


Mean state well-being. The mean scores for well-being for every participant are displayed in Figure 2. The minimum score for well-being was 18.18, and the maximum score was 30 in this sample. The mean score of state well-being was 25.52 (SD = 4.70). The results indicate an average level of state well-being for this sample, using the interpretation of Warwick Medical School (2021). Participant 25809 and 25835 display well-being scores below 20 what indicates a low level of well-being. Participants 25651, 25804, 25805, and 25840 showed state

well-being scores above 28 what can be interpreted as high levels of well-being. The remaining participants displayed average levels of state well-being, as indicated by the overall mean score within this sample.

Figure 2

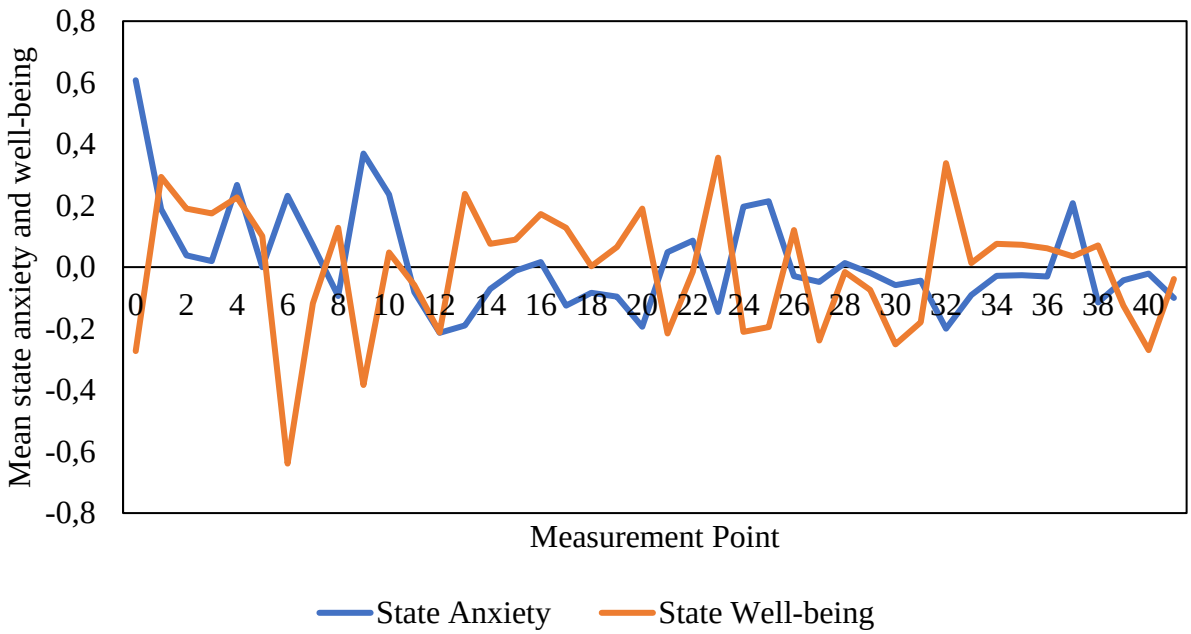
Average levels of state well-being for individual participants over two weeks (N = 26)



Mean state anxiety, and well-being. Fluctuations of state anxiety and state well-being across the 42 different measurement points are illustrated in Figure 3. Overall, the negative association between anxiety and well-being could be confirmed further. As levels of well-being decrease, the levels for anxiety increase and vice versa. Examples for this are disambiguated at the time points 6, 23, and 32, where a clear increase in well-being and at the same time a decrease in anxiety could be displayed.

Figure 3

Standardised mean levels of state anxiety and state well-being over the course of two weeks (N = 26)



Linear mixed model analyses

To examine the association between state anxiety and state well-being, a LMM analysis with the corresponding standardised scores of the variables of interest was performed. The results are displayed in Table 2. A significant moderate negative effect was found between state well-being and state anxiety. This shows that the higher the level of state well-being, the lower the level of state anxiety and vice versa. Furthermore, further LMM analyses were performed to identify the association between state anxiety and state well-being on a within- and between person level. The results showed a significant moderate negative association on a between-person level and a weak negative association on a within-person level. This suggests that the association between state anxiety and state well-being is stronger on a between-person level than on a within-person level.

Table 2

Linear Mixed Model analyses for associations between state anxiety and well-being in general, between-person, and within-person level (N = 26)

Parameter	Estimate	Std. Error	*df*	*p*	95% Confidence Interval Lower Bound	95% Confidence Interval Upper Bound
Association state anxiety and well-being	-.33	.02	817.92	.00	-.37	-.29
Between-person association	-.35	.07	86.69	.00	-.49	-.21
Within-person association	-.27	.02	756.12	.00	-.31	-.23

Note. *df* = degrees of freedom; *p* = significance; Std. Error = standard error

Next, a LMM analysis with an interaction effect between the standardised scores of trait self-efficacy and the standardised raw state well-being scores was performed to examine if self-efficacy moderates the association between state well-being and state anxiety. The results are displayed in Table 3. Self-efficacy could not be confirmed as a moderator since the interaction effect was non-significant.

Table 3

Moderation analysis between standardised scores of trait self-efficacy, state well-being, and state anxiety as the dependent variable (N = 26)

Parameter	Estimate	Std. Error	*df*	*p*	95% Confidence Interval	
					Lower Bound	Upper Bound
Intercept	.63	.29	19	.04	.03	1.23
Standardised trait self-efficacy	-.20	.29	19	.50	-.82	.41
Standardised well-being	-.08	.41	19	.84	-.93	.77
State Well-being*trait Self-efficacy	-.28	.43	19	.53	-1.18	.63

Note. Std. Error = Standard Error; *df* = degrees of freedom; *p* = significance

Case Studies

Because of the non-significant moderation analysis, case studies for three individual participants were conducted. These participants were chosen based on their trait levels of self-efficacy. Participant 25818 represented a medium, participant 25808 a low, and participant 25830 a high trait level of self-efficacy. Based on these three different self-efficacy levels, it was analysed if there would be differences in the association between state anxiety and state well-being depending on the corresponding self-efficacy level of the participant.

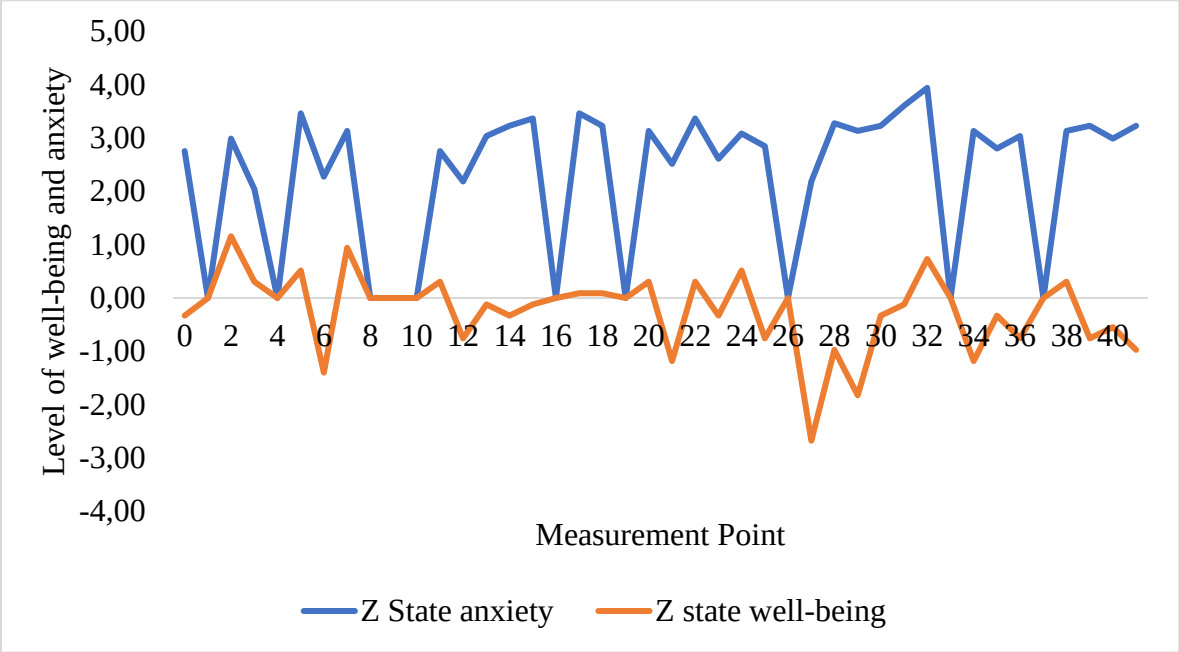
Participant 25818

Participant 25818 had higher state levels of anxiety compared to the rest of the sample with a mean state anxiety level of 80.47. In addition, the trait anxiety score based on the HADS showed a relatively high trait level of anxiety too (11.00). Trait well-being (26.00) and trait self-efficacy (28.00) can be interpreted as medium level, and the mean state well-being score displayed a medium level as well with an estimate of 24.06. Interestingly, despite the confirmed

negative association of state well-being and state anxiety within this sample, this association is not as clearly visible for participant 25818 (see Figure 4). State levels of both constructs decrease and increase at several measurement points simultaneously. Examples of this can be seen at measurements points 6 and 7, or 20, and 21.

Figure 4

State levels of well-being and anxiety over the course of two weeks of participant 25818



Participant 25808

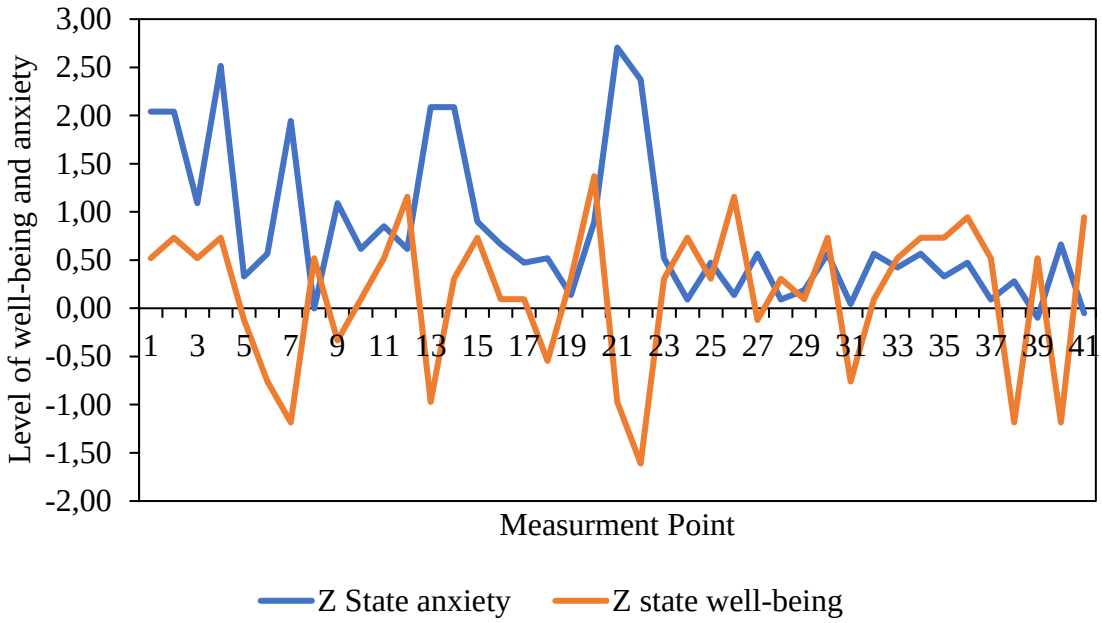
Analyses using the three trait questionnaires resulted in a low level of trait self-efficacy (25.00), a medium level of mental well-being (24.00), and a high level of trait anxiety (13.00) for participant 25808. The mean level of state anxiety was low to moderate (34.48), and the mean for state well-being was moderate with an estimate of 26.38. Over the course of two weeks, state anxiety varied significantly, displaying very high to low levels of state anxiety (see Figure 5). State levels of well-being were ranging between 20 and 32 indicating moderate to high levels of state well-being.

Overall, the negative association between state well-being and state anxiety is visible in

Figure 5. Examples for this can be seen between the measurement points 7 to 9, 13 to 15, and 22 to 25 were an increase in anxiety as well as a decrease in well-being can be viewed.

Figure 5

State levels of well-being and anxiety over the course of two weeks of participant 25808



Participant 25830

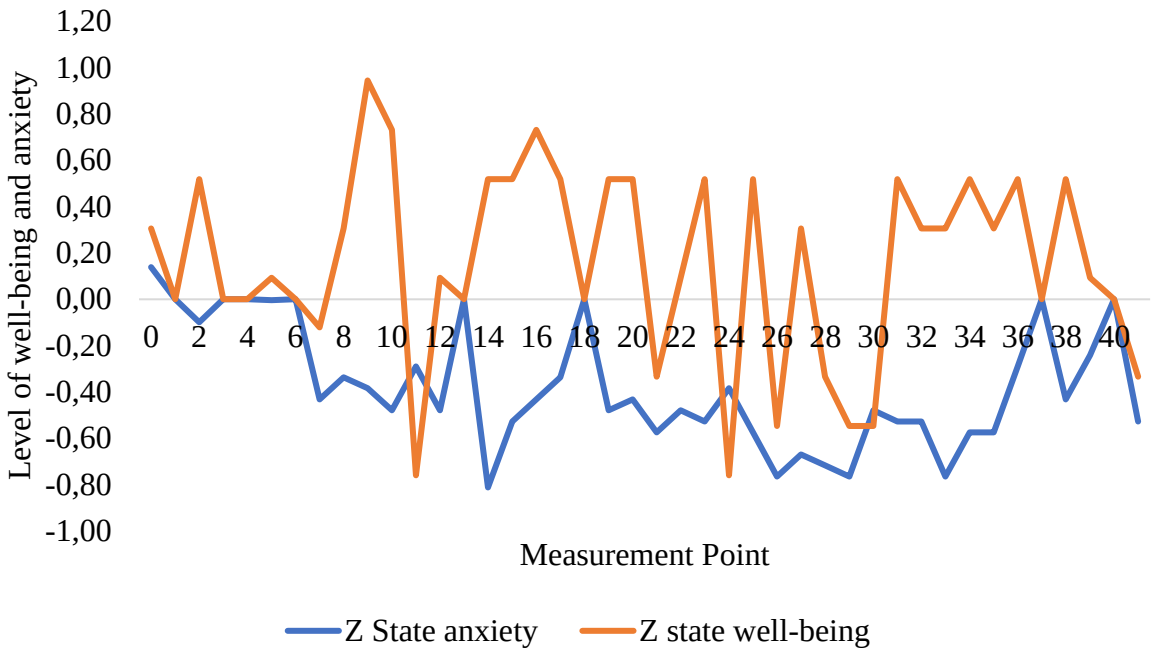
Participant 25830 showed a high trait level of self-efficacy (37.00), a medium trait level of mental well-being (23.00), and a medium level of trait anxiety (9.00). Mean state levels of anxiety were low with an estimate of 7.32, and mean state levels of well-being were moderate (26.47). Figure 6 illustrates the association of anxiety and well-being for participant 25830 and shows that the well-being levels were generally higher than the anxiety levels. Overall, the scores for state well-being ranged from moderate to high scores since they varied between 22 and 30, whereas the state scores for anxiety were low with estimates from 0 to 20.

The negative association between anxiety and well-being is visible across the measurement points for participant 25830 too, for instance between measurement points 10 and

12, and 22 and 24.

Figure 6

State levels of well-being and anxiety over the course of two weeks of participant 25830



Discussion

The purpose of this study was to gain a better understanding of the association between state anxiety and state well-being in daily life of University students, as well as the effect of trait self-efficacy as a possible moderator of the relationship. There are three key findings resulting from the present study. The first main finding was a negative association between state well-being and state anxiety. This means that if state levels of anxiety are high, state levels of well-being are low, and vice versa. This result can be linked to the theory underlying the two-continua model of Keyes (2002). State anxiety represents the psychopathology continua and state mental well-being the second continua of the model. Both are clearly distinct constructs but are still connected to each other, as represented by the moderate association. Furthermore, previous studies demonstrated the power of a stable and high mental well-being as a buffer against the onset and reoccurrence of psychopathologies, such as anxiety (Etherton et al., 2020; Lahtinen & Salmivalli, 2019; Schotanus-Dijkstra et al., 2017). The present study adds to this pattern of knowledge by demonstrating that even on a state level, a high mental well-being was associated with low state anxiety levels and vice versa. Even though no causality can be assumed, this finding indicates that the two continua are linked and that there seems to be an overall protective power of a high mental well-being against psychopathologies such as anxiety on a state level too.

The second main finding of the study was that the negative association between state anxiety and state well-being exists on a between-person (trait-like) and within-person (state-like) level but with a slightly stronger association on a between-person level. The trait-like association implies that people with higher average levels of state anxiety, will experience lower average levels of state well-being and vice versa. Simultaneously, the state-like association displays that people with a higher (or lower) state level of anxiety at a given moment, will indicate lower (or higher) state levels of well-being at the same moment too. Relating this back to the two-continua model, these results show that psychopathological symptoms and wellbeing

are not only correlated on a between-person but also on a within-person level. Consequently, the theory underlying the model that psychopathology and mental well-being are separate but correlated constructs (Keyes, 2002) remained valid on a state-like level too.

Possible interpretations for the applicability of the two-continua model for anxiety and well-being on a trait and state level could be provided on the basis of previous studies that focused on the interaction and functions of the two constructs on average and individually. They showed that individuals with higher anxiety on average tend to be more reactive to stressors and cope more maladaptively (Morales-Rodriguez & Perez-Marmol, 2019; Nechita et al., 2018). These maladaptive reactions have negative effects on emotional, psychological, and social well-being, such as withdrawal from social interactions or increased expectancies to fail (Nechita et al., 2018). On a state-like level, this association of the two continua, here, anxiety on well-being and vice versa, can be seen too. For instance, Vancampfort et al. (2011) analysed the effect of progressive muscle relaxation (PMR) on state anxiety and well-being. They showed that once levels of anxiety dropped after the PMR, state levels of well-being increased due to an attentional shift away from anxiety towards more pleasant or neutral aspects. They concluded that the ability to reduce levels of state anxiety can increase levels of well-being (Vancampfort et al., 2011). Consequently, the previous studies illustrate that both continua of anxiety and well-being show similar associations on trait- and state-like levels.

Contrasting our expectations, the third main finding indicates a non-significant moderation of self-efficacy on the relationship between state well-being and anxiety. Although this was the first study to analyse this moderation, it was suggested that a general stronger belief in ones capacities could weaken the negative association between anxiety and well-being (Demirtaş, 2019). However, the case studies show that neither high nor low trait self-efficacy levels led to differences in the association between state anxiety and well-being. One explanation that could account for this finding could be that self-efficacy was underpowered within this sample. In the present study, one measurement for trait self-efficacy was taken for

each participant, resulting in 26 measurement points in total. In comparison, for state anxiety and state well-being, 42 measurements were taken per participant, what cumulates in 2184 data points in total. Additionally, trait self-efficacy showed lowed variance within this sample since the scores ranged from medium to high scores only. This imbalance between the measurements of the different variables, and the underpowered data for self-efficacy, could explain the non-significant moderation effect within this sample.

Alternatively, it could be considered if state self-efficacy would be more suitable as a moderator, initiating that trust in oneself at a given moment moderates between state anxiety and state well-being. Although, no study explored this yet, research by Hawker, Merkouris, Youssef, and Dowling (2021) yields promising results. They showed that state self-efficacy has the same properties as its trait component. This would imply that higher state self-efficacy weakens the association between anxiety and well-being for students too because they would have more confidence in their abilities and successful goal attainment at that moment. Additionally, self-efficacy would not be underpowered anymore since it would be measured multiple times a day what could increase the accuracy and power of the results. Nevertheless, due to the lack of research this is just a suggestion and must be investigated further.

Strengths and limitations of the study

One of the major advantages is the ESM that was used as a study design. With ESM, psychological constructs and their interactions can be analysed more in detail than in cross-sectional studies because it is possible to analyse psychological constructs across different and longer periods and on state- and trait-like levels. This information is essential for the development and expansion of psychological interventions because these can be designed in such a way that they can target the constructs directly since, for instance, more information about their interaction with each other in daily life or in response to different contexts is known. Furthermore, with 86% the study has a high response rate compared to other ESM studies (e.g.,

65.3% in Tollmar & Huang, 2015). This is beneficial since it provides researchers with more in situ measurements and therefore more information about the constructs of interest (Berkel et al., 2017). Despite these strengths, there are several limitations. First, the sample was recruited via convenience sampling. This limits the heterogeneity and generalisability of the sample and increases the risk of biases since it is likely that most of the participants have fairly similar backgrounds (Etikan, 2016). Second, the present study was conducted during the first COVID-19 related lockdown. Research showed that the lockdown had strong negative effects on levels of anxiety and well-being (Sumen & Adibelli, 2020). Therefore, the present results must be interpreted carefully since the circumstances deviated far from everyday life what could have worsen daily levels of anxiety, and well-being. It could be possible that levels of well-being were higher and anxiety levels much lower before the lockdown what could possibly lead to different results if the study would have taken place then.

Practical limitations and directions for future research

Taking the limitations into account, the present study highlights several theoretical and practical implications. First, it was the first study to analyse the association between self-efficacy, state anxiety, and state well-being. Thereby, more in-depth information about their interaction in daily life was gathered that can be used for future research and the development of interventions that target the state constructs directly in daily life. In terms of future research, it would be useful to extend the current findings by examining state self-efficacy instead of trait self-efficacy as a possible moderator between anxiety and well-being. This research has implications on interventions in such a way that it could be determined if it would be beneficial to target state self-efficacy and increase it in order to weaken the effect of anxiety and well-being on each other or if self-efficacy is in general not an efficient component in interventions.

Additionally, there is a need to replicate the study because it was the first study that addressed the daily interaction of anxiety, well-being, and self-efficacy directly. Therefore, the

results cannot be generalised to the general population because they were conducted at one point in time covering a time frame of two weeks with 26 participants. With more studies, it could be determined if the results remain stable among different populations and what differences could lead to other results.

Conclusion

All in all, the present study has provided clear support for the relationship between state anxiety and state well-being on a within- and between-person level. Furthermore, a first understanding of self-efficacy and its effect on anxiety and well-being in daily life was gained, stimulating further investigation of this important area.

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Appendices

Appendix A

General Self-Efficacy Scale (GSE)

1. I can always manage to solve difficult problems if I try hard enough.
2. If someone opposes me, I can find the means and ways to get what I want.
3. It is easy for me to stick to my aims and accomplish my goals.
4. I am confident that I could deal efficiently with unexpected events.
5. Thanks to my resourcefulness, I know how to handle unforeseen situations.
6. I can solve most problems if I invest the necessary effort.
7. I can remain calm when facing difficulties because I can rely on my coping abilities.
8. When I am confronted with a problem, I can usually find several solutions.
9. If I am in trouble, I can usually think of a solution.
10. I can usually handle whatever comes my way.

Appendix B

Hospital Anxiety and Depression Scale (HADS)

**Items with reversed scoring*

1. I feel tense or “wound up”.
2. I get a sort of frightened feeling as if something awful is about to happen.
3. Worrying thoughts go through my mind.
4. I can sit at ease and feel relaxed*.
5. I get a sort of frightened feeling like “butterflies” in the stomach.
6. I feel restless as if I have to be on the move.
7. I get sudden feelings of panic.

Appendix C

Short Warwick´s Edinburgh Mental Well-Being Scale (SWEMWBS)

1. I´ve been feeling optimistic about the future.
2. I´ve been feeling useful.
3. I´ve been feeling relaxed.
4. I´ve been dealing with problems well.
5. I´ve been thinking clearly.
6. I´ve been feelings close to other people.
7. I´ve been able to make up my own mind about things.

Appendix D

Demographics

1. How old are you?
2. Please indicate your gender.
    - Male
    - Female
    - Other
3. What is your nationality?
    - Dutch
    - German
    - Australian
    - Other
4. What is the highest degree or level of school you have completed? *If currently enrolled, mark the highest degree already received.*
    - High school graduate
    - Bachelor´s degree
    - Master´s degree
    - Doctorate degree or higher
    - Other
5. If you are currently enrolled as student, what is your field of study?
    - Social sciences (e.g., psychology, sociology, economics, social work, or political sciences)
    - Natural sciences (e.g., biology, physics, or chemistry)
    - Medical sciences
    - Computer science
    - Mathematics or statistics
    - Arts
    - Law
    - Philosophy
    - Theology
    - Other
    - Not applicable, I am currently not enrolled as a student

Appendix E

Daily ESM Questions

How anxious do you feel right now?

Below are statements about feelings and thoughts. Please tick the box that best describes your experience of each **over the past 2 hours.**

1. I´ve been feeling optimistic about the future.
2. I´ve been feeling useful.
3. I´ve been feeling relaxed.
4. I´ve been dealing with problems well.
5. I´ve been thinking clearly.
6. I´ve been feeling close to other people.
7. I´ve been able to make up my own mind about things.

Appendix F

Informed Consent

Dear participant,

Thank you for your participation in this study. Before you participate, it is important that you understand the goal of this research and what the study will ask from you. The purpose of this study is to find out how different components of mental health are related to each other. To explore this relationship, we want to measure fluctuations in mental health in daily life to gather a more detailed picture of the dynamics of mental health.

For this study, we will ask you to fill in several questionnaires on your mobile phone. All questionnaires will be completed in the Ethica app. The study will start with a questionnaire concerning your demographics and general mental health. This initial questionnaire will take about 10 minutes to complete. After that, you will receive three daily (short) questionnaires each day for a period of two weeks. Notifications will remind you about the next questionnaire. The questionnaires will be provided in the morning, afternoon and evening. One daily questionnaire takes approximately 2 minutes to complete.

For the purpose of this study, it is important that you answer the questionnaires as soon as possible after the notification. Make sure that you have switched on your notifications for the Ethica app on your mobile device, as you will receive a notification on your mobile device when to fill in the questions. We would also like to ask you to regularly check the Ethica application to see whether new questionnaires to answer are ready.

The information that we collect from this research project will be kept confidential. This means that only the researchers have insight into your answers. All personal data (such as age, gender etc.) will be anonymized and will not be published and/or given to a third party. Also, for the researchers it will not be possible to determine which data belongs to which participant. Your participation in this study is voluntary. You are free to withdraw from this study at any time and without giving a reason.

Contact information

If you have any questions regarding this study, you can contact the principal investigators of this project Sina Völker (s.volker@student.utwente.nl) and Jonas Möller (j.moller@student.utwente.nl).

Consent

I have read and understood the information provided and had the opportunity to ask questions. I understand that my participation is voluntary and that I am able to withdraw at any time, without a reason or cost. I hereby voluntarily agree to take part in this study.