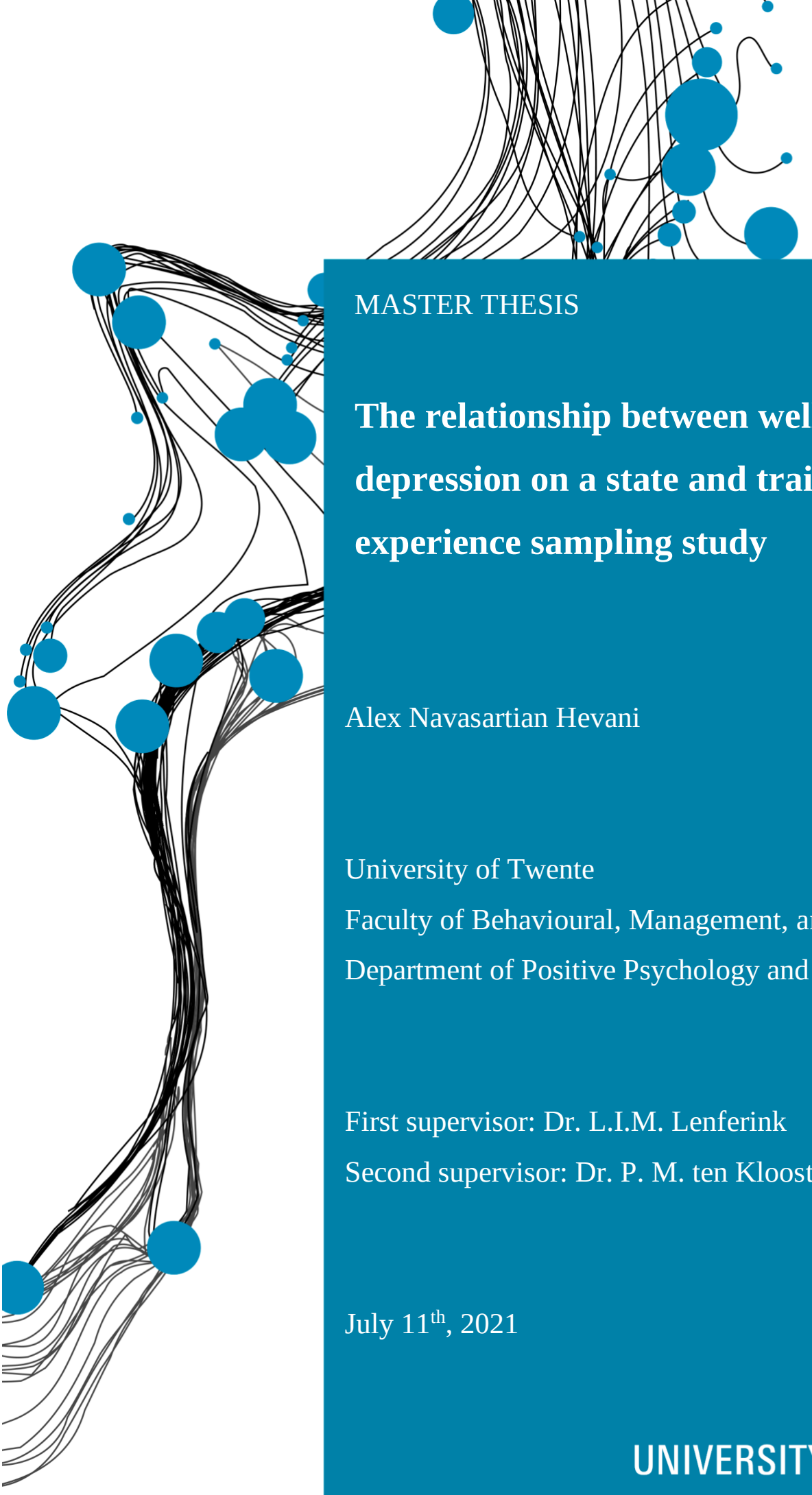

MASTER THESIS

The relationship between well-being and depression on a state and trait level: an experience sampling study

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Abstract

Background: Depression is a growing problem among students. According to the two-continua model, depression and well-being are two negatively correlated, yet distinct dimensions. However, research has not made attempts yet to directly compare whether these two dimensions are more valid on a state or trait level.

Aim: This study aims to investigate whether the relationship between depression and well-being and the two-continua model are more applicable to a state or trait level.

Methods: The sample consisted of 25 university students. The experience sampling method was employed to capture the momentary nature of well-being and depression. For this, interval-contingent sampling was used for a 14-day measurement period. Well-being was measured using the Short Warwick Edinburgh Mental Well-being Scale. Depression was measured using a single-item depression scale. These items were administered to students three times a day. The data was then analysed for associations using a series of Linear Mixed Model analyses. Selected individual participant cases were plotted into line graphs.

Results: The analyses revealed that depression and well-being were significantly and negatively associated on both a trait and state level. Yet, this association was stronger on a state level (β =-0.51) than on a trait level (β=-0.36). The investigation of participant cases revealed that depression and well-being levels were negatively associated for some students and made substantial and quick changes. For others, a positive or no association could be observed.

Conclusion: The relationship between depression and well-being is stronger on a state level than a trait level. With regard to the two-continua model, it appeared valid on both a trait and state level, yet more applicable to a trait level because well-being and depression were more distinct on this level. Thus, this study further supports the two-continua model. Research and mental health care should investigate well-being and symptomatology simultaneously since the two variables are not simply opposites.

Keywords: depression, well-being, university students, two-continua model, experience sampling method, state association, trait association

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Introduction

Depression is one of the most common mental health issues. Depression is characterized by a decrease in positive affect and a loss of interest in the experiences of daily life (Ibrahim, Kelly, Adams, & Glazebrook, 2013). According to a meta-analysis, the lifetime prevalence for depression lies at 11% (Lim et al., 2018). This high prevalence becomes especially apparent when looking at depression among university students. Students have to face many new challenges as young adults such as an increase in responsibility, academic pressure and financial difficulties which have been shown to elevate depression levels (Alsubaie, Stain, Webster, & Wadman, 2019). Accordingly, it was found that 30% of students experienced depressive symptoms within a period of 14 days (Alusbaie et al., 2019). This highlights how common feelings of depression are among students. Thus, despite the existing research, depression remains an important issue that requires further research for better understanding. One point for further research that has been suggested is the association between depression and other relevant psychological variables among students (Makhubela, 2020).

One way of increasing the understanding about depression is investigating its relationship to mental health. Traditionally, and especially in the past century, it has been believed that mental health can be defined as the absence of mental illness, such as depression (Westerhof & Keyes, 2009). However, this view has come into criticism as alternative models of mental health have been proposed. According to Keyes (2002), instead of seeing well-being and symptomatology as two ends of one dimension, the two-continua model considers mental health as consisting of two separate dimensions. These dimensions are well-being and symptomatology of psychopathology. Generally, high levels of mental health in the two-continua model are comprised of high levels on the well-being dimension and low levels on the symptomatology dimension (Keyes, 2002). In this model, well-being and symptomatology are negatively correlated, yet distinct. This highlights the importance to distinguish between these two dimensions, since the two constructs are not viewed as simple opposites. Thus, it would be possible to experience both or neither of the two dimensions at the same point in time, although research that proves this in a robust way is scarce.

There is some empirical evidence supporting the two-continua model. To start with, in a study by Keyes (2005), only two in 10 individuals without a mental illness, such as depression, could be classified as mentally healthy. This means that most participants with low levels of symptomatology did not experience high well-being. Keyes concluded that although well-being and symptomatology are negatively correlated, they are not opposites of

one scale but rather distinct dimensions. Hence, people can experience both low well-being and low symptomatology. Further research found that well-being and symptomatology were moderately and negatively correlated with each other (Lamers, Westerhof, Bohlmeijer, Ten Klooster, & Keyes, 2011). This supports the notion that well-being and symptomatology are correlated, but not complete opposites. This would rather have been reflected if the correlation had been strong or perfect. Other studies that highlight the association between symptomatology and well-being suggest that well-being can serve as a protective factor against symptomatology over time (Schotanus-Dijkstra, Ten Have, Lamers, de Graaf, & Bohlmeijer, 2017). Moreover, higher levels of well-being were shown to be associated with a significantly higher probability of recovering from mental illness (Schotanus-Dijkstra, Keyes, de Graaf, & Ten Have, 2019). Taken together, these findings support that well-being and symptoms of psychopathology are negatively associated with each other, but still two distinct constructs.

Despite the growing popularity of the two-continua model of mental health, research on the two-continua model has barely examined the dynamic nature of its two dimensions. As Curran and Bauer (2011) explain, many studies try to make conclusions about processes and changes that happen within an individual. This is also referred to as within-person or state differences over time. Yet, they conclude that most studies use data that does not allow such conclusions. Many studies use cross-sectional data that is collected at a single time point. This would only allow drawing conclusions about differences between different people, not about changes or processes within a person. These differences between people would be referred to as between-person or trait differences (Curran & Bauer, 2011). When looking at the existing body of research about the association between depression and well-being, the predominance of research that uses between-person data, or between-person analysis only, becomes apparent (Keyes, Eisenberg, Dhingra, Perry, & Dube, 2012; Schotanus-Dijkstra et al., 2017; Suldo & Shaffer, 2008; Westerhof & Keyes, 2009). Hence, data on the two-continua model that investigates within-person (state) processes is scarce.

However, the importance of investigating variables on a state level is highlighted by Larson and Csikszentmihalyi (2014). They state that researchers may assume a relationship is present on a state level simply because it was present on a trait level. They add that failure to differentiate between state and trait relationships is an ecological fallacy, or in this specific case: Simpson's paradox. This means that a pattern that exists on a trait level does not necessarily persist on a state level. It could disappear or reverse when looking at relations within individuals (Mangalam & Ketty-Stephen, 2021). To appropriately deal with this,

relationships need to be addressed on the individual level. Hence, state levels of variables should be statistically separated from trait levels (Mangalam & Ketty-Stephen, 2021). For the relationship between depression and well-being, this could reveal whether different people experience the association between depression and well-being in substantially different ways than existing between-person research would suggest.

Existing studies that investigated the two-continua model in more depth (Schönfeld, Brailovskaia, Bieda, Zhang, & Margraf, 2016) mostly did not focus on how exactly both continua, well-being and symptomatology of psychopathology, fluctuate in daily life. Aside from this, Renshaw and Cohen (2013) investigated the two-continua model specifically among university students in a cross-sectional study. Although their findings validated the model, they only investigated the trait associations of symptomatology of psychopathology and well-being instead of state differences. Hence, research that investigates the two-continua model among students comparing trait and state differences is lacking. Additionally, research investigating in-depth individual experiences in daily life is scarce. Yet, such research could reveal whether the association between the two continua is either stronger or weaker on a state or trait level. This would help to better understand changes in people's well-being and depression in daily life. It would also help to further validate the two-continua model since it could reveal whether it is really possible to experience high or low depression and well-being at the same time point.

A method that could help to collect the required data that is needed to disaggregate state from trait associations is the experience sampling method (ESM). Researchers employ the ESM in order to help them better understand psychological experiences and phenomena in the daily lives of people (Csikszentmihalyi & Larson, 2014). This means that participants repeatedly answer items about their behaviour, thoughts and feelings in their daily lives. This way of collecting data allows for more naturalistic measurements. Additionally, the repeated nature of the method enables researchers to see how momentary feelings fluctuate and correlate with each other over time (Conner & Lehman, 2012). With regard to the relationship between well-being and symptomatology such as depression, this method could help to clarify if the two-continua model holds not only on a trait level but also on a state level. Additionally, using the ESM could explain in what way fluctuations in depression or well-being levels are associated with each other in the daily life of students. This would help to examine the dynamics of these two variables in more depth than before.

The current research

Therefore, the current research investigates the relationship between depression and well-being among university students using the ESM. This is relevant because depression has been described as students' number one health problem (Ibrahim et al., 2013). Further research on how fluctuations in well-being and depression are associated with each other throughout daily life could help to better understand these phenomena among students. To better understand and compare the trait and state association between depression and well-being, the first goal is to investigate how students' well-being and depression are related on a state and a trait level. It is anticipated that well-being and depression are negatively related on both a state and trait level. It is also anticipated that the state association between depression and well-being is stronger than the trait association.

Since the first goal of this research only provides an indication of state processes at the group level, the second goal is to examine if and how patterns in depression and well-being differ between individuals. This will be done by investigating individual case studies. It is hypothesized that for most participants, both variables frequently fluctuate and that changes in either of the two variables are accompanied by an opposite change in the other variable. This assumption is based on prior research that has generally found a negative association between depression and well-being (Perugini, de la Iglesia, Solano, & Keyes, 2017).

Methods

This study is based on a secondary analysis of an existing dataset. The data was collected by psychology students at the University of Twente from April 6th, 2020 to April 19th, 2020 in the context of their bachelor theses. Before the start of the data collection, ethical approval was provided by the Ethics Committee of the faculty of Behavioural, Management and Social Sciences of the University of Twente.

Participants

The sample of the study consisted of 34 university students that were recruited from the University of Twente in Enschede, the Netherlands. This sample size was considered as sufficient. ESM studies gain statistical power from the repeated measures that are taken from each participant, making it acceptable to have smaller samples than traditional studies (Conner & Lehman, 2012).

Participants were recruited using convenience sampling. The researchers contacted people in their social environments via mail, in person or through apps like WhatsApp and

asked them to participate in the study. Inclusion criteria were that participants needed to own an Android or iOS smartphone, they needed to be enrolled as students and they needed to speak English so that they could understand and answer the items.

Design and Procedure

The current study employed an online survey design that was combined with the ESM. First, participants received an e-mail that invited them to download the Ethica app and to participate in the study. After that, participants were asked to provide an online informed consent to the study within the Ethica app (see Appendix A). Here, the purpose and procedure of the study were explained. Participants were told that their data will be handled anonymously and that they could withdraw from the study at any given time. If consent was provided, the study started on the next day.

On the first day, participants were asked to answer the baseline questionnaire which took approximately 10 minutes. Then, also on the first day, the state measurement period started. Participants were asked to answer the state items three times a day with a fixed time schedule (10am, 3pm and 8pm). Thus, the variables could be measured in the morning, afternoon and evening during times at which most people would be awake. Using fixed time points in experience sampling is referred to as interval-contingent sampling (Horstmann, 2020). It was chosen because it has been described as the sampling method that adds the least participant burden since participants can anticipate when new items will need to be answered (Conner & Lehman, 2012). Hence, to receive higher response rates and to decrease the risk of missing data or low adherence, the researchers decided on this fixed time schedule.

The experience sampling questionnaires were sent for 14 consecutive days which has been described as a realistic length for interval-contingent sampling (Conner & Lehman, 2012). Whenever items needed to be answered, participants received a push notification on their smartphones. The items were then available for a total of three hours. The items expired after that if no answer was provided. Yet, participants were initially instructed to answer as soon as possible. If no answer had been provided after the first 90 minutes, participants received a second push notification as a reminder. Completing one state questionnaire took approximately two minutes.

Materials

All materials in the current study were administered in English. The study was conducted via the Ethica application (https://ethicadata.com) that is available for Android and

iOS devices**.** Ethica is an experience sampling application that enables researchers to collect data using repeated measurements (Ethica, 2020). The app sends notifications to participants whenever an item needs to be answered. Moreover, Ethica allows researchers to easily invite participants by sending them a link to the study (Ethica, 2020).

Furthermore, the current study was part of a larger study that aimed to predict correlates of mental health in the daily life of students. For the current study, only the following questionnaires were used:

Baseline

Demographics. At baseline, participants were asked about their age, gender, nationality, highest completed level of education and field of study.

Depression. Depression in the past week was measured using the depression subscale of the Hospital Anxiety and Depression Scale (HADS-D; Zigmond and Snaith, 1983). The HADS-D consists 7 items (e.g. item 4: "*I feel as if I am slowed down*"). Participants were instructed to choose an answer that best describes their experience in the past week for each item. The answer possibilities varied in wording but they were scored from 1 through 4. The total scores ranged from 7 through 28. Higher values were indicative of higher depression levels. The HADS-D has proven its clinical utility when compared to other measures of depression such as the Beck Depression Inventory (Oliveira, 2014). Furthermore, the scale has a good internal consistency and good diagnostic qualities (Weber et al., 2018). In the current study, the HADS-D had a good reliability (α=0.84).

Well-being. Well-being in the past week was measured at baseline using the Short Warwick Edinburgh Mental Well-Being Scale (SWEMWBS; Stewart-Brown, Tennant, Tennant, Platt, Parkinson, & Weich, 2009). The scale consists of 7 items (e.g. item 3: "*I've been feeling relaxed*"). Participants were asked to indicate to what extent each item applied to their state in the past week on a 5-point Likert scale ranging from 1 (*none of the time)* through 5 (*all of the time)*. Thus, the total scores could range from 7 through 35 with higher values being indicative of higher well-being. The SWEMWBS was proven to be a valid and reliable instrument for measuring well-being (Fat, Scholes, Boniface, Mindell, & Stewart-Brown, 2016). In the current study, the SWEMWBS displayed a poor reliability (α=0.55) at baseline.

State questionnaire

Depression. Depression was measured in the state questionnaire using a single item that reads "*To what extent do you feel down right now?*". Participants were instructed to provide an answer on a visual analogue scale that ranged from 0 (*not down at all*) to 100 (*extremely down*). This item had been used in previous ESM studies at the University of Twente (Hoppe, 2019). It was chosen because in the ESM, there is a high burden on participants. Participants need to answer items several times a day over a course of several days or weeks instead of just once (van Berkel, Ferreira, & Kostakos, 2017). Thus, including a single-item for depression served the purpose of decreasing the participant burden and increasing the response rate.

Well-being. Well-being was measured in the state questionnaire using the SWEMWBS with an adapted recall period. Participants were instructed to indicate to what extent each item applied to their state within the past 3 hours. With its 7 items, the SWEMWBS is a relatively short measure of well-being. In fact, it already is the short version of the Warwick Edinburgh Mental Well-Being Scale (WEMWBS; Tennant et al., 2007). The SWEMWBS and WEMWBS are highly correlated, showcasing that the short version is just as suitable as the long version to measure well-being since it measures the same construct (Stewart-Brown et al., 2009). Moreover, when compared with each other, both scales showed comparably good levels of internal reliability and relative validity (Fat et al., 2017). Thus, no compromise with regard to the quality of the measurements was made by choosing the shorter scale while the participant burden was further decreased. Yet, the SWEMWBS had a questionable reliability (α=0.67) in the state questionnaires in the current study.

Data analysis

For the analysis, the collected data was extracted to the programme SPSS 24 by IBM. The state measurements were then converted into a long format with measurement occasions as rows to enable further analyses relevant to the ESM. Furthermore, participants that did not provide an answer to at least 50% of the state questionnaires were excluded from the dataset as this is a common cut-off for experience sampling studies (Conner & Lehman, 2012).

First, descriptive statistics of the demographic variables were computed in order to provide an impression of the demographic characteristics of the sample. Then, to give an insight into depression and well-being levels and how high participants generally scored, the

mean, standard deviation, minimum and the maximum of the baseline measurements of depression and well-being were computed.

To represent the trait scores in in the further analyses, person mean scores (PM) were created in SPSS. To represent the state scores, person mean centred scores (PM-Centred) were created (Curran & Bauer, 2012). This was done by subtracting the person mean from the state score per measurement point using the "compute variable" function. Then, the PM and PM-Centred scores of depression and well-being were transformed into *z*-scores to facilitate the interpretation of the results.

Next, a series of four Linear Mixed Model (LMM) analyses were created to obtain the state depression and state well-being scores per participant and time point. This was done to later visualize the collected data. In the LMMs, a first order autoregressive covariance structure was employed. This covariance structure was also used for all further LMMs in the current study and it was chosen due to the nested and hierarchical nature of the data. Moreover, all values that were used for these and all further LMMs were conducted using *z*-scores. The first model was run with state depression (PM-Centred) as an independent variable and participant id as a fixed factor. The second model was run with state depression (PM-Centred) as an independent variable and time as a fixed factor. The third model was run with state well-being (PM-Centred) as an independent variable and participant id as a fixed factor. The fourth model was run with state well-being (PM-Centred) as an independent variable and time as a fixed factor. Estimated marginal means were obtained for the fixed factors in all four models. Then, the results of these LMMs were visualized using Microsoft Excel. For the scores by participants, bar charts were chosen to be able to better compare different participants' scores with each other. For the scores by time, line graphs were chosen to visualize how the variables fluctuated throughout the measurement period.

Then, for the first goal of testing whether the association between well-being and depression is stronger on a state or a trait level, a LMM analysis was conducted again. The analysis was conducted with *z*-scores. In the LMM, state well-being (PM-Centred) was treated as the dependent variable. Trait depression (PM) and state depression (PM-Centred) were treated as fixed factors. The resulting associations were interpreted as low when the estimate was between 0.30 and 0.50, as moderate with an estimate between 0.50 and 0.70, as high with an estimate between 0.70 and 0.90 and as very high with an estimate of 0.90 and above (Hinkle, Wiersma, & Jurs, 2003). Furthermore, the confidence intervals of the state and trait association were compared with each other to explore whether there is a significant difference between the two estimates.

For the second goal of exploring to what extent patterns in well-being and depression differ between individuals, the depression and well-being scores of selected participant cases were investigated in more depth. A total of five cases were chosen in order to represent a considerable share of the sample (20% of the final sample). For this, participants who scored very high or low on depression or well-being were chosen in order to showcase extreme cases. Also, one participant case was chosen with scores that were close to the mean to represent average scores. A series of two LMMs were used to obtain the individual participants' well-being and depression scores by time point. This was done to be able to visualize them. Again, only *z*-scores were employed in the LMMs. In the first model, state depression (PM-Centred) was set as the dependent variable and time and participant id were both set as fixed factors. In the second model, state well-being (PM-Centred) was set as the dependent variable and time and participant id were set as fixed factors. In both models, estimated marginal means were obtained for both fixed factors. The participant cases were then visualized by creating line graphs in Microsoft Excel.

Results

Characteristics of the study group

Of the 34 initial participants, 25 completed the baseline measurements and reached the cut-off of completing at least 50% of the state measurements. The analyses for this study were thus conducted with these 25 participants who formed the final sample. The demographic characteristics of this sample and the average depression and well-being scores at baseline can be found in Table 1. The baseline scores for depression indicated a low level of depression and can be defined as no case (Weber et al., 2018). For the SWEMWBS, the cut-off lies at 19.25, with all scores lower than 19.25 indicating poor well-being (Wilding, 2019). The average well-being score of the sample was above this, indicating a moderate to high well-being level at baseline.

Table 1

Demographic characteristics of the study group and HADS-D and SWEMWBS scores at baseline (N=25)

Variable		*M (SD)*	Min/Max	Frequency	%
Age		23.52 (2.82)	19/32		
Gender	Male			11	44
	Female			14	56
Nationality	German			22	88
	Australian			1	4
	Other			2	8
Highest completed level of education	Bachelor's degree			10	40
	High school			15	60
Field of study	Social sciences			18	72
	Natural sciences			1	4
	Arts			1	4
	Other			4	16
	Not applicable			1	4
HADS-D		11.40 (2.50)	8/18		
SWEMWBS		24.28 (2.79)	19/29		

Note. Min = minimum score in the sample; *Max* = maximum score in the sample

State well-being and depression

The average state well-being and depression scores per participant over all measurement points can be found in Figure 1. In the sample, high well-being was often accompanied by low depression. In turn, high depression was often accompanied by low well-

being. Yet, there were also participants who had both below average depression and well-being (e.g. participant 12), or participants who had both above average depression and well-being (e.g. participant 1). Thus, different patterns in depression and well-being among the participants could be found.

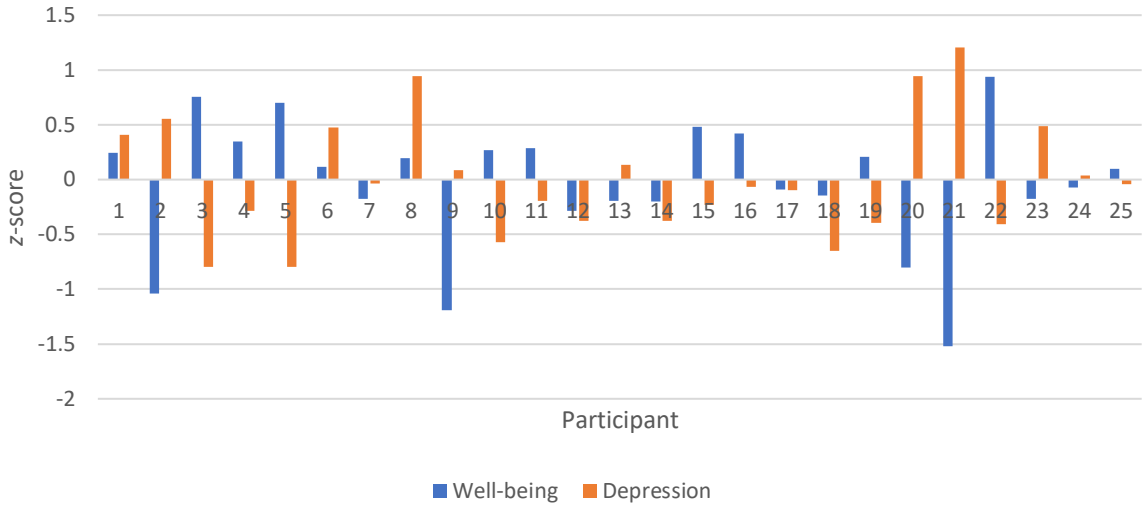

Figure 1. Depression and well-being mean *z*-scores by participant

Additionally, the sample's average depression and well-being by measurement point can be found in Figure 2. Looking at the range of scores reveals that high depression was often accompanied by low well-being. In turn, high well-being was often accompanied by low depression. However, a negative association could not consistently be observed over time. For instance, from measurement point 4 to 5, both variables increased and from 5 to 6, both variables decreased simultaneously.

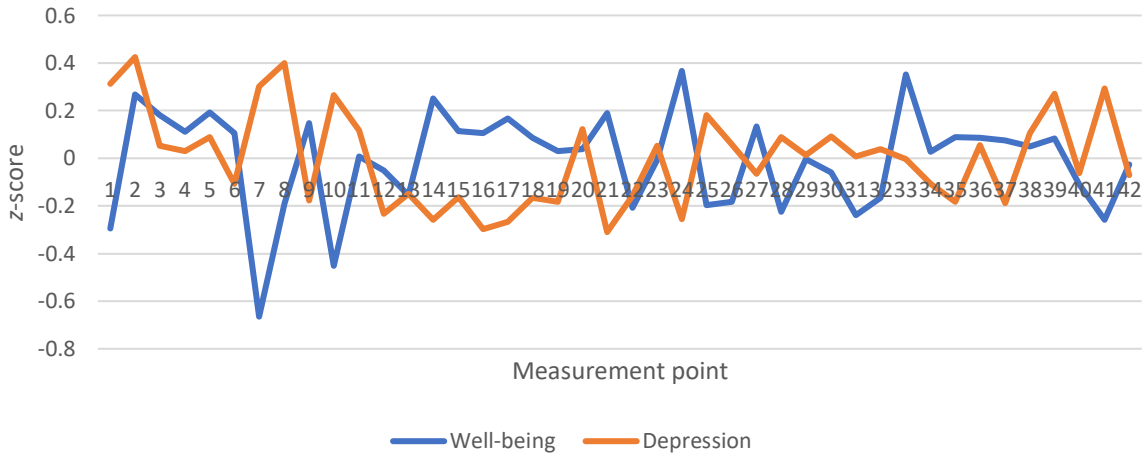

Figure 2. Depression and well-being mean *z*-scores by measurement points

The association between depression and well-being on a state and trait level

To test whether the association between depression and well-being is stronger on a state or a trait level, a LMM analysis was conducted (see Table 2). The model showed that both state and trait depression were significantly and negatively associated with well-being at the group level. Thus, higher levels of well-being were consistently associated with lower levels of depression. Yet, this association was stronger for state depression (β =-0.51) than for trait depression (β=-0.36). Furthermore, the confidence interval of trait depression did not overlap with the confidence interval of state depression. Thus, both effects were significantly different from each other.

Table 2

Linear Mixed Model analysis with well-being as dependent variable and person mean (trait) and person mean centred (state) depression as fixed effects (N=25)

Parameter	β	*df*	*t*	*p*	95% Confidence Interval	
					Lower Bound	Upper Bound
Intercept	-.01	187.78	-0.18	.859	-0.08	0.07
Trait depression	-.36	198.40	-9.36	<.001	-0.43	-0.28
State depression	-.51	854.70	-20.60	<.001	-0.56	-0.46

Note. β = parameter estimate; *df* = degrees of freedom; *t* = t-value; *p* = significance

Depression and well-being fluctuations in daily life

In order to examine differences in depression and well-being patterns between students, five individual cases of the state measurements were investigated in more depth.

First, participant 21 was investigated (Figure 3). The depression and well-being levels of this participant moved in opposing directions almost continuously. The pattern of one variable decreasing while the other one increases can be found for almost every measurement point of this participant. Moreover, big changes in one variable were often accompanied by big changes in the other (e.g. measurement point 25 to 26). Small changes in one variable were often accompanied by small changes in the other (e.g. measurement point 26 to 27). Overall, this participant case highlights the negative association between well-being and depression. It can be observed not only in big changes but also in small fluctuations.

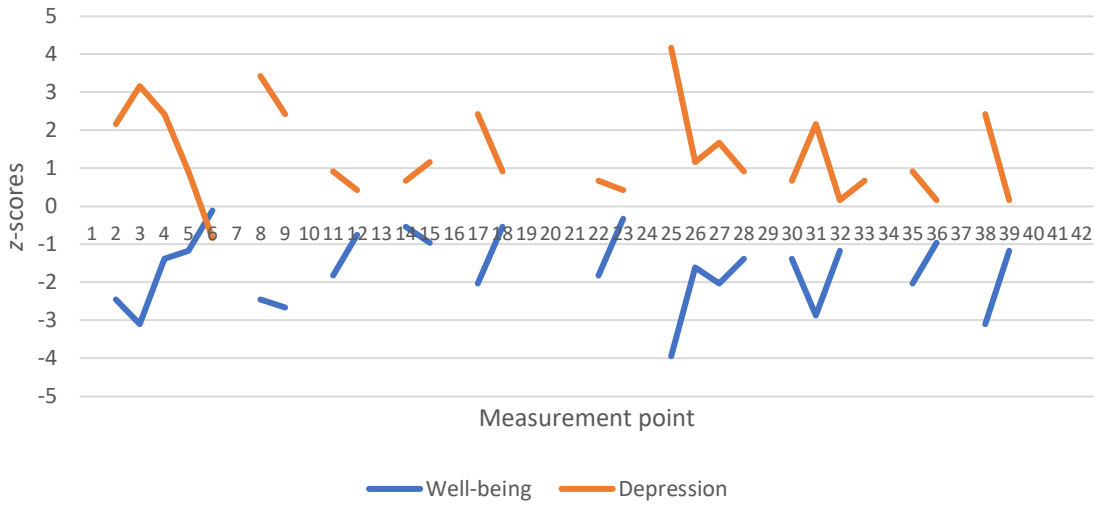

Figure 3. Well-being and depression *z*-scores of participant 21

Second, participant 22 had the highest well-being (Figure 4). In comparison to participant 21, the depression and well-being of participant 22 were not as clearly negatively associated. On the one hand, there were occurrences where a negative association between depression and well-being could be observed (e.g. measurement point 20 to 23). However, there were also times where both variables decreased and times where both variables increased. This indicates a positive association between depression and well-being. Thus, this case shows that the relationship between depression and well-being is partly, yet not consistently, negative.

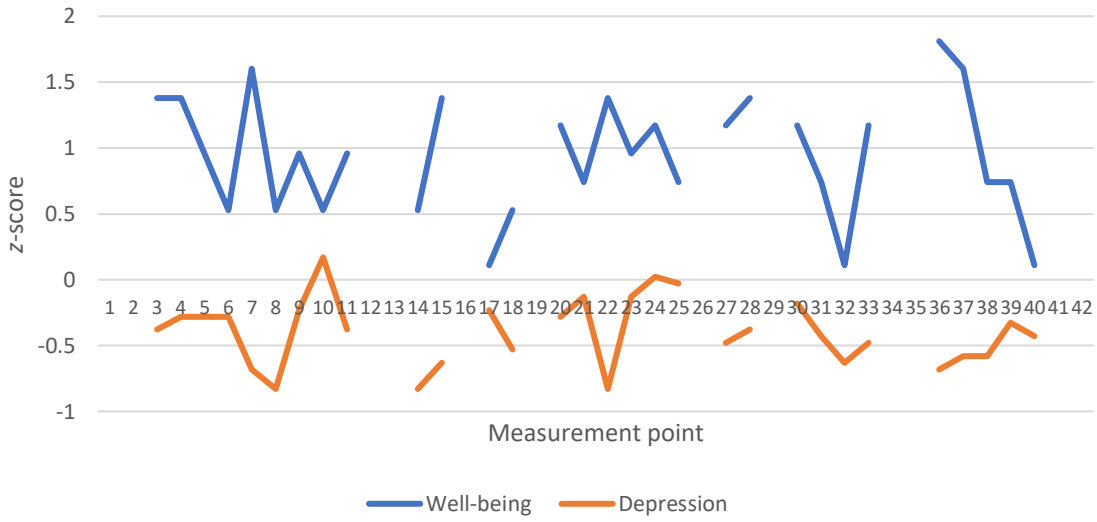

Figure 4. Well-being and depression *z*-scores of participant 22

Third, participant 8 had one of the highest depression mean scores in the sample (Figure 5). It is noticeable that the depression and well-being of this participant made very

quick changes and fluctuations at times. In contrast to this, there were several occurrences where depression and well-being were very close to each other or almost identical (e.g. measurement points 3, 5 or 31). Hence, this pattern highlights that depression and well-being are not necessarily always opposed to each other but can both be at a very similar level at the same time.

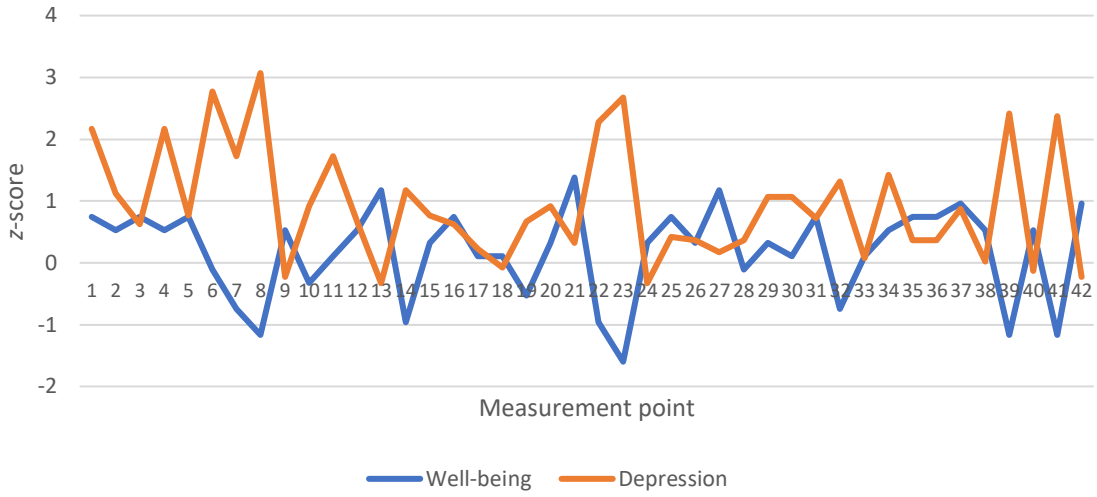

Figure 5. Well-being and depression *z*-scores of participant 8

Similarly, the pattern of depression and well-being being at similar levels can be seen in the scores of participant 1 (Figure 6). During many of the measurement points, the depression and well-being of this participant were very close to each other. Especially noteworthy are measurement points 12 and 25 since both times, the participant experienced the exact same level of depression and well-being at the same time. On another note, it was not apparent whether the association between both variables was rather positive or negative. There were times when a negative association could be observed and other times when a positive association could be observed.

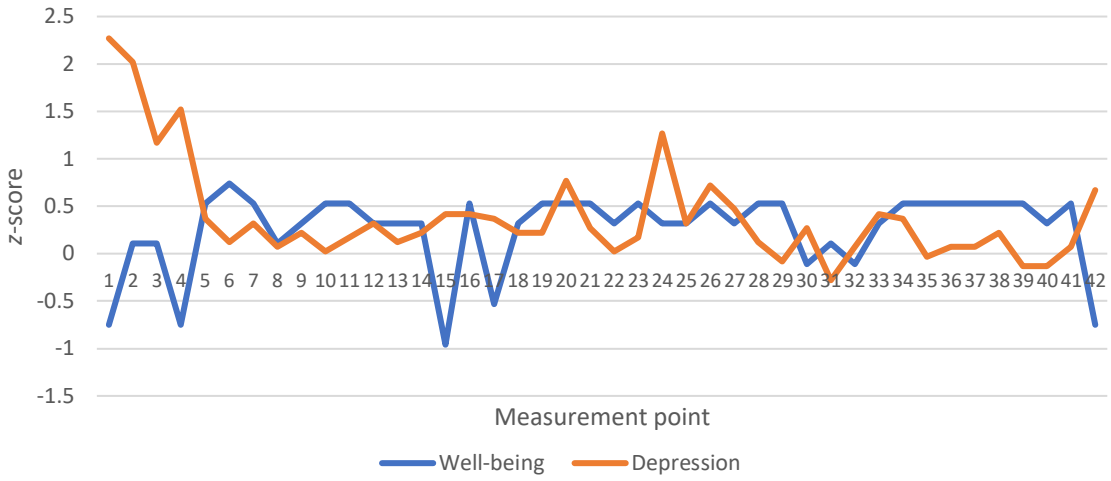

Figure 6. Well-being and depression *z*-scores of participant 1

Finally, figure 7 depicts the depression and well-being *z*-scores of participant 3. This participant was one of the two participants with the lowest depression in the sample. In this participant's case, it is very striking that depression was constant over most of the study period at z=-0.83. In contrast to that, the participant's well-being made large changes and sudden fluctuations throughout most of the study period. Hence, one variable was changing while the other was constant. This stands in contrast to the negative association that was observed in other cases (e.g. participant 21). It suggests less of a dynamic relationship between depression and well-being in daily life.

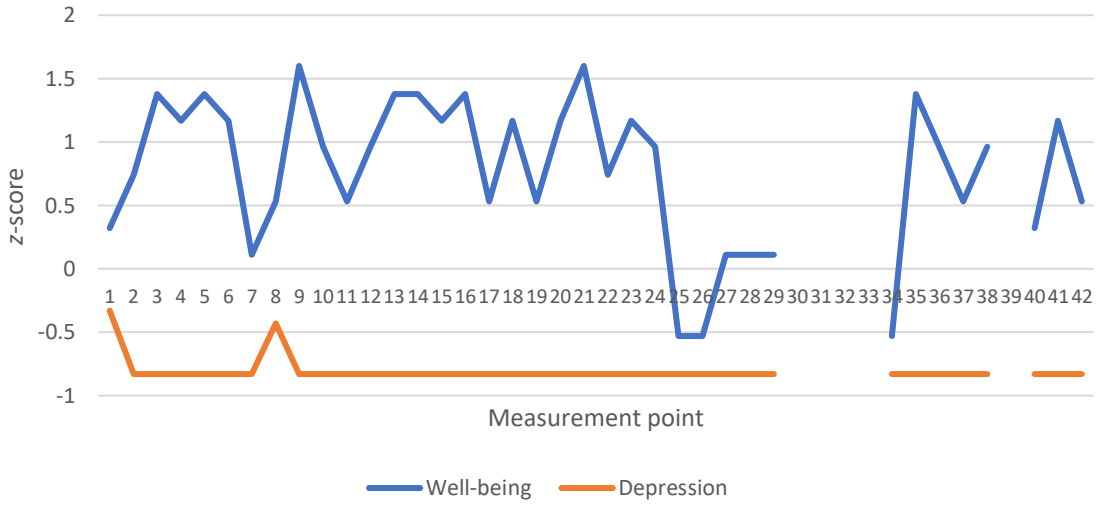

Figure 7. Well-being and depression *z*-scores of participant 3

Discussion

The current study investigated depression and well-being on a state and a trait level among university students using the ESM. It was the first study that directly compared whether the two-continua model is more applicable to a state or a trait level. The first goal was to investigate to what extent well-being and depression are related on state and a trait level. The results showed that higher well-being was consistently associated with lower depression. This confirms the researchers' expectations that depression and well-being are negatively associated as prior research suggests (Franken, Ten Klooster, Bohlmeijer, & Westerhof, 2018; Perugini et al., 2017; Spinhoven, Elzinga, Giltay, & Penninx, 2015).

Aside from that, as Ryu, West, and Sousa (2012) state, differentiating state and trait associations often reveals a difference in the magnitude of the relationship. Accordingly, the current study found that the relationship between depression and wellbeing was moderate on a state level and low on a trait level. Similarly, Keyes et al. (2008) also found a low association (p =-0.22) between depression and well-being on a trait level. These findings argue against the two-continua model on a state level. The two-continua model suggests that well-being and symptomatology are somewhat independent despite their association (Keyes, 2002). The moderate state association that was found suggests less independence of the two continua than the low trait association. Thus, the two-continua model is more valid on a trait level than a state level.

There are several implications from the findings of the first goal. Research and practice should bear in mind that the applicability of two-continua model differs when investigating state and trait associations. Existing findings on the two-continua model on trait level may therefore not always be translatable to a state level. Moreover, the current study was conducted with a non-clinical sample. If the study would be replicated with a depressed sample, further support for the two-continua model could not be expected. Research that used between-person data has shown that in clinical samples, well-being and symptoms of psychopathology were more highly correlated than in the general population (van Erp Taalman Kip & Hutschemaekers, 2018). In the current study, the state association between depression and well-being was stronger than the trait association. Therefore, among depressed people, an even stronger correlation could be expected between depression and well-being when investigating state processes.

The second goal of this paper was to investigate how patterns in well-being and depression differ between students. The investigation of five participant cases revealed that the relationship between depression and well-being was predominately negative for some

participants. For others, a positive association could be observed. Moreover, for some participants, the depression levels were constant and barely fluctuated. For others, depression and well-being levels made frequent and quick fluctuations. Thus, the association between depression and well-being can differ considerably from individual to individual. Clear explanations for these different patterns are scarce. Yet, research suggests that coherent with the two-continua model, personality characteristics such as low neuroticism and high extraversion can predict high well-being independent of the levels of symptomatology (Spinhoven et al., 2015). Furthermore, gratitude has been identified as a possible, yet weak factor when it comes to differences in well-being and symptomatology of psychopathology patterns (Jans-Beken, Lataster, Peels, Lechner, & Jacobs, 2018).

These findings can be of great value for research and practice. Researchers should not make conclusions about individual state processes based on trait data. Rather, they should keep in mind that the dynamic between depression and well-being can be very individual. Furthermore, when developing apps that target mental health, practice should consider that the experience of depression and well-being in daily life may significantly differ between students. Apps should therefore cater to the spectrum of needs of students. For instance, students who's well-being and depression quickly fluctuate might profit more from quick and easy to administer interventions. Others with a constant low level of well-being could possibly prefer more extensive interventions.

Finally, investigating selected participant cases revealed that it is possible to experience the exact same level of depression and well-being at the same time. Similarly, de Vos, Radstaak, Bohlmeijer, and Westerhof (2018) found that the majority of their participants experienced both high well-being and high symptomatology or high well-being and moderate symptomatology. Thus, despite an overall negative association, it is possible to experience similar or identical depression and well-being just as it was found in the current study. This supports the notion of the two continua model that symptomatology and well-being form two distinct dimensions. It once again highlights that depression and well-being should not be assumed to simply be opposites. Hence, research should investigate well-being and symptomatology separately and simultaneously instead of making assumptions about any of the two variables based on the other. Healthcare practice should also focus on improving both dimensions of the two-continua model to sustainably improve mental health instead of just focusing on e.g. symptomatology and assuming that improved well-being automatically results.

Strengths and limitations

A strength of the current study was the use of the ESM. State data is scarce when it comes to the two-continua model and the repeated nature of the ESM allows investigating state processes (Horstmann, 2020). Using the ESM enabled the researchers to discover differences in depression and well-being between and within individuals. It also proved that high or low well-being and depression can be experienced simultaneously. Thus, the use of the ESM added valuable new insights to the two-continua model.

Another strength was the low participant burden. Of the 34 initially recruited participants, 25 participants completed enough items to be included in the study. This makes up almost 70 % of participants of the initial sample. This is also an average response rate for ESM studies (van Berkel et al., 2017). This suggests that measures taken to decrease the participant burden such as the interval-contingent sampling method and the short questionnaires were effective. Consequently, the data provided many possibilities to investigate individuals' experience of well-being and depression in daily life. .

However, the sampling method was also a limitation of the study. Although interval-contingent sampling is the least burdensome sampling method, it can also be a threat to the validity of the responses. This is because being able to anticipate when one needs to answer items can cause participants' responses to become less spontaneous (Palmier-Claus, Haddock, & Varese, 2019). For instance, participants may alter their routine according to the sampling schedule. Thus, it is possible that some responses would have been different if another sampling method had been chosen.

Another weakness was the poor reliability of the SWEMWBS. Hence, the well-being levels measured may be attributable to random error rather than participants' real well-being levels. However, the current study only had a small sample due to the ESM. The effect of one participant answering at random would therefore be much higher than in a larger sample. Thus, the reliability scores were much more susceptible to be low.

Finally, the study was conducted during the first outbreak of COVID-19 in Europe. This may have affected the results since the purpose of the study was to measure depression and well-being in the daily life of students. However, students could no longer go to university, go out on weekends, or see their peers on campus. Hence, the results may not be representative of the usual daily life of students in times without a pandemic.

Recommendations for future research

The current study explored state processes of depression and well-being. Future studies could further research these state processes and conduct an N-of-1 study, also called

single case studies. Such studies are useful to better describe within-person processes in greater detail (McDonald, Vieira, & Johnson, 2020). Since state data about the two-continua model is scarce, such a study could add meaningful insights. A single case study could help to follow the development of the two-continua in more detail than the current research design allowed.

Next, the association between depression and well-being in the current study was very individual. Thus, it would be useful to explore explanations for these differences. Finding clinically relevant variables for the relationship between depression and well-being that are amendable to change through treatment could help to increase students' mental health more efficiently. For instance, optimism and self-compassion have been proven as important positive psychological constructs that can be increased through positive psychological interventions (Bohlmeijer & Hulsbergen, 2018).

Finally, the current study could be replicated after the COVID-19 pandemic. Lukács (2021) conducted a study on students' mental health during the pandemic and found no decrease in well-being compared to pre-pandemic mental health. Yet, his conclusions were based on trait data. As previously stated, associations may alter or reverse when looking at state processes (Mangalam et al., 2021). Hence, a follow-up study after the pandemic could help to get a clearer insight into how much students were affected by the pandemic. It could be compared to what extent the well-being and depression levels of the current study differ from the levels after the pandemic.

Conclusion

In sum, the relationship between depression and well-being was stronger on a state level than a trait level. Since neither the trait or state association between the two variables were strong, but both were significant and negative, the two-continua model appears applicable to both a trait and state level. Yet, the model was more valid on a trait level because the degree of independence between both variables was stronger here. Thus, future research that further explores the two-continua model should keep this difference in mind when using and interpreting this model. Moreover, investigating depression and well-being in daily life showed that the relationship between the two variables can be very individual. The fact that some participants experienced the same levels of depression and well-being at the same time further validated the two-continua model. This knowledge highlights that research and mental health care practice should investigate well-being and depression or other symptomatology separately and simultaneously.

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Appendices

Appendix A: 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.

or 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.

Appendix B: SWEMWBS

Below are some statements about feelings and thoughts. Please tick the box that best describes your experience of each over the last week.

1: I've been feeling optimistic about the future
1) ○ None of the time
2) ○ Rarely
3) ○ Some of the time
4) ○ Often
5) ○ All of the time

2: I've been feeling useful
1) ○ None of the time
2) ○ Rarely
3) ○ Some of the time
4) ○ Often
5) ○ All of the time

3: I've been feeling relaxed
1) ○ None of the time
2) ○ Rarely
3) ○ Some of the time
4) ○ Often
5) ○ All of the time

4: I've been dealing with problems well
1) ○ None of the time
2) ○ Rarely
3) ○ Some of the time
4) ○ Often
5) ○ All of the time

5: I've been thinking clearly
1) ○ None of the time
2) ○ Rarely
3) ○ Some of the time
4) ○ Often
5) ○ All of the time

6: I've been feeling close to other people
1) ○ None of the time
2) ○ Rarely
3) ○ Some of the time
4) ○ Often
5) ○ All of the time

7: I've been able to make up my own mind about things
1) ○ None of the time
2) ○ Rarely
3) ○ Some of the time
4) ○ Often
5) ○ All of the time

Appendix C: HADS-D

Tick the box beside the reply that is closest to how you have been feeling in the past week. Don't overthink - your immediate is best

1: I still enjoy the things I used to enjoy
1) ○ Definitely as much
2) ○ Not quite as much
3) ○ Only a little
4) ○ Hardly at all

2: I can laugh and see the funny side of things
1) ○ As much as I always could
2) ○ Not quite so much now
3) ○ Definitely not so much now
4) ○ Not at all

3: I feel cheerful
1) ○ Not at all
2) ○ Not often
3) ○ Sometimes
4) ○ Most of the time

4: I feel as if I am slowed down
1) ○ Nearly all the time
2) ○ Very often
3) ○ Sometimes
4) ○ Not at all

5: I have lost interest in my appearance
1) ○ Definitely
2) ○ I don't take as muche care as I should
3) ○ I may not take quite as much care
4) ○ I take just as much care as ever

6: I look forward with enjoyment to things
1) ○ As much as I everd did
2) ○ Rather less then I used to
3) ○ Definitely less than I used to
4) ○ Hardly at all

7: I can enjoy a good book or radio or TV program
1) ○ Often
2) ○ Sometimes
3) ○ Not often
4) ○ Very seldom

Appendix D: State depression item on a visual analogue scale