Momentary Strength Use and Momentary and Average Subjective Well-being in Students with Anxiety Symptoms: An Experience Sampling Study

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Abstract

Background. The mental health and well-being of university students have considerably decreased over the last decades, specifically anxiety. Strength use has been found to significantly associate with subjective well-being (SWB). However, strength use was predominantly measured cross-sectionally at the trait level (between-person), in which individual momentary fluctuations over time (within person level) were left out. Therefore, the focus of the study was to gain insight into the relationship between state strength-use and state and trait SWB in students with anxiety symptoms.

Method. An online experience sampling study was conducted over the course of one week with a convenient student sample (N = 14) using the mobile application Ethica. For the evaluation of trait scores, the WHO-5, the Strength Use Scale and the HADS-A were used. For the state level, the Single item versions of the Happiness Scale, the HADS-A and the Strength Use Scale were used. For the analysis, a Linear Mixed Model analysis was executed.

Results. Significant positive associations between strength use and SWB were displayed on a between-person level and within-person level. Further, the results implied a negative significant association between strength use and anxiety on a between-person level and within-person level.

Conclusion. In conclusion this study has contributed to the understanding of the relationship between strength use and SWB, as well as strength use and anxiety not only on a between-person level, but further on a within-person level.

Keywords: strength use, well-being, anxiety, experience sampling

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The mental health and well-being of university students have decreased significantly over the last decades. In the 1980s, 10 to 15 percent of young adults had significant mental health problems, whereas today the numbers are between 33 and 40 percent (Steel, Marnane, Iranpour, Chey, Jackson, Patel, & Silove, 2014). University students have become a particularly vulnerable population, which was highlighted in the health report of 2011 by the Techniker Krankenkasse (Techniker Krankenkasse, 2011). This report drew attention to the fact that the usage of psychopharmaceutical drugs among students doubled from 2006 to 2010. Further, the report illustrates that about 21% of students suffer from a mental disorder. These worrying phenomena, displayed in the rising numbers among university students, are referred to as an emerging "mental health crisis" in higher education (Evans, Bira, Gastelum, Weiss, & Vanderford, 2018; Kadison & DiGeronimo, 2004). Specifically, mood disorders, such as depression and anxiety have been prevalent in the mental health problems of students. In the "University Student Mental Health Survey 2020" it was concluded that depression, as well as anxiety disorders, were the most common mental health diagnoses among the students (University Student Mental Health Survey 2020). Moreover, an extensive study on the mental health among German students was conducted, that found notably high psychological distress in female students, in which one-fifth displayed symptoms of generalized anxiety disorder (Grützmacher, Gusy, Lesener, Sudheimer, & Willige, 2018).

In previous research, traditional psychology was primarily focused on identifying causes for mental illnesses rather than on the prevention of symptoms or promoting well-being (Gable & Haidt, 2005; McLaughlin, 2012). Yet, mental health is more than merely an absence of mental disorders (e.g., Bhugra, Till & Sartorius, 2013; Galderisi, Heinz, Kastrup, Beezhold & Sartorius, 2015). Mental health also includes the presence of positive features

and the World Health Organization (WHO) defined this as “a state of well-being in which every individual realizes his or her potential, can cope with the normal stresses of life, can work productively and fruitfully, and can make a contribution to her or his community” (Galderisi et al., 2015; World Health Organization, 2004). Specifically, subjective well-being (SWB) has been the scientific term for happiness and life satisfaction, which based on “people’s beliefs and feelings that they are living a desirable and rewarding life” (Diener, 2012). This further has been on the basis of experiencing more positive emotions in relation to negative (Myers & Diener, 1995).

Positive psychology has a complementary scientific approach to studying human thoughts, feelings, and behaviour that focuses on strengths, instead of weaknesses. Furthermore, it is about building up the positive as well as dealing with the negative of those who are struggling (Park & Peterson, 2008). Rather than focusing on a client’s diagnosis, especially the identification and promotion of an individual’s core strengths have been used as methods of increasing positive affect and decreasing negative affect (Seligman, & Csikszentmihalyi, 2000). Furthermore, Park, Peterson and Seligman (2004), believed “that character strengths are the bedrock of the human condition” and further claimed that character strengths can be understood as a whole assortment of positive traits that are crucial for a fulfilling life. Those traits manifested themselves through a selection of thoughts, feelings, and behaviors that were also universal and morally valued (Park & Peterson, 2008).

Previous literature indicated that obtaining character strengths has been positively associated with experiencing higher levels of SWB (Gillham et al., 2011; Martínez-Martí & Ruch, 2014; Park et al., 2004; Park & Peterson, 2008; Shoshani & Slone, 2013; Shimai, Otake, Park, Peterson, C., & Seligman, 2006; Weber, Ruch, Littman-Ovadia, Lavy & Gai, 2013). Although various studies rather focused on the identification of the strengths of a person (e.g., the values in action inventory of strengths, Peterson & Seligman, 2004; the

StrengthsFinder, Rath, 2007), strength possession has not fully predicted SWB and recent studies identified the use of strengths to lead to more favourable outcomes. When strengths were used positively, they could energize a person, encourage better performance (Linley & Harrington, 2006; Wood, Linley, Maltby, Kashdan, & Hurling, 2011), and support people in reaching their goals by attaining capability (Govindji & Linley, 2007). Moreover, better outcomes were also evident in the SWB, and self-esteem of people when their strength were applied (Govindji & Linley, 2007; Harzer & Ruch, 2013; Wood, Linley, Maltby, Kashdan, & Hurling, 2011). For strength use behaviour, students have to take initiative to actively look for opportunities to use their strengths. This is supported by the research from Luthans, Youssef & Avolio (2007), which implies that students who used their strength, also noticed an increase in their overall performance (Meyers, van Woerkom, de Reuver, Bakk, & Oberski, 2015). When students showed strength use behaviour, by for example adapting to a new and unfamiliar form of assessment of knowledge in their study program, they were able to channel positive emotions and behaviour. This allowed them to expand their abilities (Frederickson, 2001) and further increased their faith in themselves (Kaslow, Falender, & Grus, 2012).

However, research has mostly been limited to average strength use and little focus was set on momentary strength use in relation to SWB. Typically, strength use was measured cross-sectionally at the trait level, and subsequently modelled as a between-person variable. In that, the self-reported average strength use of a person was the unit of the analysis and individual momentary fluctuations over time (i.e., within person level) of the participant were left out. Importantly, while character strengths have been considered at the between person level, many theoretical ideas concerning strength regarded day to day fluctuations, thus should be studied at the within person level (Biswas-Diener, Kashdan & Minhas, 2011). The review of Curran and Bauer (2011) highlighted the importance of studying associations

between variables at both the within-person effect and between-person level. This was displayed with empirical evidence of a person that is more likely to have a heart attack while exercising (i.e., within-person effect that occurs in real time), versus the evidence of people that exercise regularly who on average display a lower risk of a heart attack (i.e., between-person effect) (Curfman, 1993; Mittleman et al., 1993). This implies that only looking at one of the effects, would limit the thorough understanding of the concepts and their relations. In opposition to the lack of an analysis of both effects, when measures were collected at multiple points in time from multiple participants, the outcome contained data from both a between-person effect and a within-person effects (Raudenbush & Bryk 2002, p. 183). Various studies used the same paradigm in a positive psychology context to explore the between and within-person effects (Simons, Lataster, Peeters, Reijnders, Janssens, & Jacobs, 2019; Steffen & Smith, 2013).

When applying this to the relationship of strength use and SWB in students, on a group level, students who use their strength often may be happier or happier students are more likely to use their strength. This can also be related to the broaden-and-build theory of positive emotions, which concluded that the experiences of positive emotions broaden people's awareness and response to events as well as building resilience and coping skills over time (Fredrickson, 2001; Conway, Tugade, Catalino & Fredrickson, 2013). Although, this does not necessarily imply whether using one's strength at any given moment is also directly associated with higher SWB at that moment. For example, someone that experiences overall low well-being is less likely to use their strength in general than someone who experiences high well-being. Yet, that does not mean that the same person does not have periods in which they use their strengths. Therefore, it has no indication on the individual level.

The Experience Sampling Method (ESM) has been a practical way to collect data on an individual, daily basis and was ideal for researching whether the state strength use could be associated with SWB on a within-person level. (Hektner, Schmidt, & Csikszentmihalyi, 2007; Larson & Csikszentmihalyi, 2014). Since SWB has been a self-reported measure of well-being, it was typically obtained by self-report surveys. In smartphone ESM studies, participants usually need to answer multiple identical questionnaires upon notification (e.g., smartphone notification) every day for several consecutive days (Berkel, Ferreira, & Kostakos, 2017; Stone, Kessler, & Haythomthwatte, 1991). This method has been explained as a self-report diary procedure, which was designed to evaluate aspects such as symptoms, moods, and context of an individual throughout the day (Myin-Germeys et al., 2018). The method helped to decrease the burden on the memory of participants, which supported them to recall events and experiences, as well as thoughts and feelings more easily. The data has been targeted to the immediate, emotional state the researcher was interested in (Berkel et al., 2017). Also, ESM measurements have the advantage of tracking people in their everyday life rather than in artificial lab conditions (Kubey & Csikszentmihalyi, 2002). Through situational measurements, the ESM study accounted for variations over time, had high ecological validity, and possessed the ability to show a broad picture of participants' behaviour rather than a mere overall assessment (Berkel et al., 2017; Myin-Germeys et al., 2009). Moreover, the approach has been identified to be suited for within-person processes (Scollon, Kim-Prieto, & Diener, 2003).

This paper will focus on the research gap of the within-person effect of strength use and SWB. It will be examined whether momentary daily strength use is associated with momentary SWB or also with average SWB in students with anxiety symptoms. Results could provide insight for further research in the field of positive psychology with a focus on strength use. Based on the previously discussed research, the current study expects that

strengths use on the trait, as well as on the state level will indicate a significant positive association with SWB (H1). Further, this study expects that trait and state strength use are significantly negatively associated with anxiety (H2).

Method

Design

The study was part of a larger study on strength use and SWB, in which each researcher had their individual focus. Only the variables of interest to the current study will be discussed. This study made use of an experience sampling method (ESM) with a cross-sectional survey design. For this study, a trait level questionnaire, as well as a structured repeated-measure questionnaire was utilized. During the study, a three-time per day sampling frequency was adapted for the structured repeated-measure questionnaire. This was done as three times daily was the advised frequency to balance between minimizing participant burden as well as the risk of retention and providing the researcher with enough data (Berkel et al., 2017).

The study was approved by the Ethics committee of the University of Twente with the approval number 201234. Data was collected throughout November 2020, starting at the 5th of November and ending on the 20th of November, which is the average length of ESM studies (Berkel et al., 2017; Scollon et al., 2003). For studies that take longer, the data quality has been found to decline after 4 weeks (Stone et al., 1991).

Participants

All participants were recruited through a convenience sampling method using the social media platforms Facebook, Instagram, and WhatsApp as well as in-person conversations. Due to the high number of repeated measurements throughout the week, a small sample size of 15-20 participants was indicated to provide sufficient reliability (Connor & Lehman, 2012). Furthermore, Berkel and colleagues (2017) found that the median number

of participants for ESM studies includes 19 participants, verifying the proposed number sample size.

Overall, 25 people were willing to participate in the study. All participants were required to be currently enrolled at a university, understand English, experience anxiety symptoms, and not currently be in or previously have taken part in treatment for anxiety symptoms. Furthermore, participants who filled out less than half of the questionnaires or failed to fill in the first or last questionnaire were excluded from the analysis. That resulted in the exclusion of eleven participants.

The final sample consisted of 14 university students between the ages of 18 and 25 years (M = 22.29, SD = 1.90). The gender distribution in the sample was one male (7.1%) and 13 female participants (97.9%). The nationalities were as follows: 11 Germans (78.6%), one Dutch (7.1%), and two participants with a different nationality (14.3%).

Materials

The data collection was done using the mobile application Ethica (Ethica, 2019). Ethica is a free mobile application that has easy accessibility through the phone and can be downloaded with internet access on iOS and Android phones. Moreover, the app offers full offline support and therefore secured measurements on the go. All data in Ethica was encrypted and stored securely. Ethica offered the participants security and privacy by giving them full control over their data, including the option to delete it. To use the Ethica application an e-mail address and phone were needed.

The study included a set of demographic questions, three trait level questionnaires, and a daily questionnaire. The demographic questions assessed the participants' age, gender, and nationality. The trait level questionnaires (conducted on days 1 and 9) consisted of a questionnaire measuring trait depression and anxiety, a questionnaire measuring overall SWB, and a questionnaire measuring trait character strength use. The daily questionnaire

(conducted daily on days 2-8 of the study) consisted of six items and measured the participants' momentary SWB, anxiety, and state-level character strength use and was presented three times a day (see Procedure).

Well-being

The participants' SWB was assessed through the 5-item World Health Organisation Well-Being Index (WHO-5), which is one of the most widely used questionnaires assessing mental well-being (Topp, Østergaard, Søndergaard, & Bech, 2015). The WHO-5 consisted of five items which were measured on a 6-point Likert scale. The Likert scale ranged from 0 = "at no time" to 5 = "all of the time". An example item was "I woke up feeling fresh and rested". The raw score ranged from 0 to 25 and was multiplied by 4 to give the final score, where 0 represented the lowest well-being and 100 the highest well-being. A review by Hall, Krahn, Horner-Johnson & Lamb (2011), displayed a high clinical validity of the WHO-5, since the scale could be implemented regardless of underlying illness (or lack of illness) and across various different settings. Overall, the WHO-5 was displayed with adequate validity, both as a measurement tool for depression, as well as an outcome measure in clinical trials (Topp, Østergaard, Søndergaard, & Bech, 2015; Krieger, Zimmermann, Huffziger, Ubl, Diener, Kuehner, & Holtforth, 2014). In this study, the Cronbach's alpha for the 5-item scale WHO-5 was .72.

Abdel-Khalek's (2006) Single Item Happiness Scale was used to measure state-level wellbeing in the daily questionnaire. The single item was measured on an 11-point Likert scale ranging from 0-10. The original question in the scale was "Do you feel happy?". However, to adapt to the momentary EMS format, the question was changed to "Do you feel happy at the moment?". The single item scale has been found to have strong concurrent validity with longer measurements of SWB, such as the Oxford Happiness inventory and the Satisfaction with Life Scale (Khalek, 2006). Moreover, the single item scale has also been

found to correlate positively with optimism and mental health and correlate negatively with anxiety. Finally, the scale was reliable, valid, and viable in cross-cultural comparisons (Khalek, 2006).

Anxiety

The Hospital Anxiety and Depression Scale (HADS) was used to measure anxiety and depression. Seven of the fourteen items measured anxiety and the other seven measured depression. For this study, only the seven items measuring anxiety were used. A 4-point scale was used, which ranged from 0 to 3. The answer options varied from question to question. When scoring, the multiple reversed items needed to be considered. The results could range from 0-7 (normal), 8-10 (borderline abnormal), and 11-21 (abnormal). Example questions were “I still enjoy things I used to enjoy” (depression) or “I feel tense or wound up” (anxiety). In many studies, the HADS displayed good performance in assessing the severity of anxiety disorder symptoms in somatic, psychiatric and primary care patients, as well as in the general population (Bjelland, Dahl, Haug, & Neckelmann, 2002; Zigmond, & Snaith, 1983). Further, a literature review showed that Cronbach's alpha for HADS-A varied from .68 to .93 with a mean of .83 (Bjelland, Dahl, Haug, & Neckelmann, 2002). In the current study, the 7-item HADS-A questionnaire showed a Cronbach's alpha of .57.

In the daily questionnaire, anxiety and depression were measured through the reduced item version of the HADS, which consisted of one question for anxiety and one question for depression: “I feel anxious at the moment”. Only the item for anxiety was used in this study. This item was derived from a study by Cox, Sterba, Cole, Upender, and Olatunji (2018). The responses were shown on a 4-point Likert scale and the scoring ranges from 0 = “Not at all” to 3 = “Very much”.

Strength Use

The Strength Use Scale developed by Govindji and Linley (2007) was used to measure the use of character strengths. The scale consisted of 14 items measured on a 7-point Likert scale. The scale ranged from 1 = “Strongly Agree” to 7 = “Strongly Disagree”. An example of an item was “I am regularly able to do what I do best”. The Strengths Use Scale has been found to have strong predictive validity (Wood et al., 2011). The 14-item Strength Use Scale showed a Cronbach's alpha of .95 in the current study.

A shortened version of the Strength Use Scale was used to measure the state-level strength use for the daily questionnaires. A 7-point Likert scale was used to record the answers. The two items used in the daily questionnaire were “I am regularly able to do what I do best” and “I regularly feel able to use my strengths in different ways”. These two items had a factor loading of .79 and .75, respectively, which were the items with the highest factor loadings of the 14 original items. As with Abdel-Khalek’s (2006) Single-Item Happiness Scale, both items were reformulated to be more suitable for the EMS format. Thus, the items used in the questionnaires were “At the moment I am able to do what I do best” and “At the moment I feel able to use my strengths in different ways”. These items were used as they indicate the perceived strength-use in this particular moment.

Procedure

First, participants downloaded the Ethica application, registered for an account, entered the survey code of the study and were instructed to turn on notifications. Then, the participants were given an informed consent (Appendix A) which explained the purpose of the study, the study requirements, and the participants’ rights such as anonymity and being able to withdraw from the study at any point in time. The participants were given the opportunity to contact the researchers. After the demographic questions, the participants were asked to fill in the first trait-questionnaire.

The daily questionnaires were asked three times a day for seven days. The first questionnaire needed to be filled in between 09:00 and 11:00, the second between 14:00 and 16:00, the third between 20:00 and 22:00. The participants received a notification when they were supposed to fill out the questionnaire. If the participants did not fill out the questionnaire initially, they received two reminders, 30 minutes and 60 minutes after the initial notification. If the participants did not fill out the questionnaire within 90 minutes, the questionnaire expired.

On the final day of the study, the participants were once again asked to fill out the trait-questionnaire they filled out at the beginning of the study. Once the participants had filled out the final questionnaire, they were given another opportunity to contact the researchers with any questions or remarks.

Data Analysis

The data was exported from Ethica to the statistical program for social sciences (IBM SPSS 27), which was used to analyse the dataset. Descriptive statistics were calculated for the demographics of the participants. Afterward, sum scores for the state and trait level questionnaires were calculated, as well as means for each participant. Further, Cronbach's alpha was computed for the trait level questionnaires. Participants with less than 50% valid measures were removed from the dataset. Conner and Lehman (2012) mentioned that a cut-off point at 50% is commonplace in ESM studies. This cut-off point allowed for a reasonable amount of data to be collected while simultaneously excluding participants whose response rate was considerably below average (mean response rate = 50%).

A visual analysis was conducted with Microsoft Excel 2020. A bar graph was created, which displayed the average state levels of strength use, SWB, and anxiety for each

participant across the study period. Further, two line graphs were created that each presented the participant's average state levels of SWB, anxiety, and strength use over time.

To answer the research question of whether momentary strength use was associated with momentary SWB and or average SWB in students with anxiety symptoms, Linear Mixed Modelling (LMM) was used. The LMM was chosen as the data is longitudinal, meaning it is multi-levelled (Cnaan, Laird, & Slasor, 1997; Curran, & Bauer, 2011). The LMM was used to examine whether the relationship between a) character strength-use and SWB and b) character strength-use and anxiety most resembled a trait like (between-person) or state like (within-person) association. To conduct the analysis, new variables were created, the Person Mean (PM) and the Person Mean Centred (PMC) (Curran, & Bauer, 2011, p. 590). The PM variables were created for state strength use, state anxiety, and state SWB by calculating mean scores for each participant across all time points. The three new PM values for state-level were then subtracted from the individual state strength use, state anxiety, and state SWB scores, resulting in three PMC variables. The PM variables were then applicable for a between-person analysis and the PMC variables for a within-person analysis. Moreover, Z-scores were calculated for all of the state-level variables, the PM-variables and the PMC-variables. The linear mixed model was applied with a) PM-strength use and PMC-strength use Z-scores as the predictor variables and the state SWB Z-score as the outcome variable and b) PM-strength use and PMC-strength use Z-score as the predictor variables and the state anxiety Z-score as the outcome variable. Hereby, the strength of the trait-like association (PM) and state-like association (PMC) could be compared.

Results

Participant Flow

In total, 25 participants enrolled in the present study. Three participants were excluded because they had been diagnosed with anxiety prior to the study. Additionally, three participants were excluded since they did not meet the criteria for the anxiety symptoms and scored under the borderline cases for anxiety. Moreover, three participants were excluded as they responded to less than 50% of the state items. Next, checks for suspicious answering patterns by utilizing frequency tables were executed and no unusual responses could not be found. This led to a total of 14 participants that were used for the analysis.

Demographics

Table 1

Descriptive Statistics of Trait and State-like Variables for SWB, Anxiety, and Strength-use

	Variable	Minimum	Maximum	Mean	Std. Deviation
Trait	SWB	48.00	88.00	70.00	11.50
State		0.00	10.00	5.57	2.39
Trait	Anxiety	8.00	18.00	12.75	2.71
State		0.00	3.00	1.17	0.90
Trait	Strength Use	29.00	86.00	60.00	16.07
State		2.00	14.00	8.24	3.18

The descriptive statistics for the trait- and state like variables SWB, anxiety, and strength use, including minima, maxima, means, and standard deviations, are displayed in Table 1. For the state level anxiety, it stands out that participants scored quite low with a

mean of 1.17 (SD = 0.90). For reference, the single item HADS-A scale lays between 0 and 3 and therefore the participants of this study experienced low anxiety throughout the study.

Visual Representation

Figure 1

Average State Scores per Participant aggregated over Time

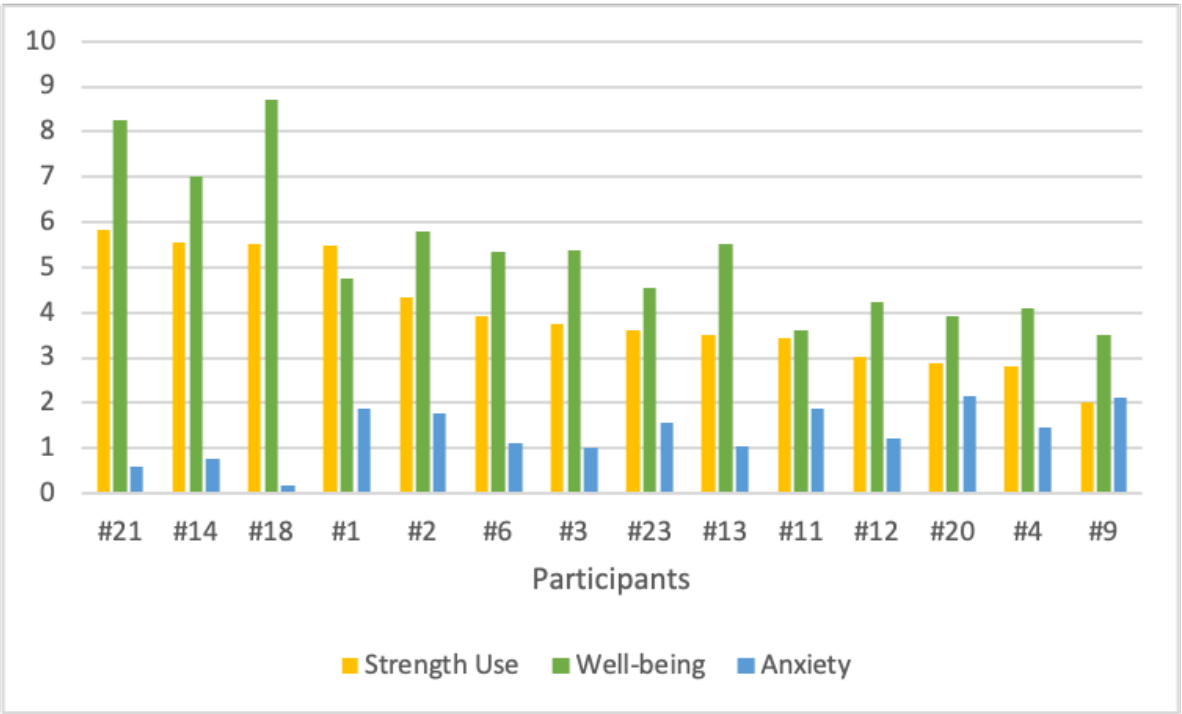


Figure 1 demonstrates the average state levels of SWB, strength-use, and anxiety for each participant over the course of the study ordered on the variable strength use. Although there were some visible differences in the participants, the graph provided an indication for an overall positive association between the variable state strength use and state SWB, which could be indicated for most of the participants. This could be particularly observed in the first three participants (#21, #14, #18), which used their state strength (range 5.5-5.82) the most and also experienced the highest SWB (range 7-8.69). In contrast, participant #1 displayed higher strength (M = 5.47) use than SWB (M = 4.75). This participant will be further investigated in detail to examine if there was a positive association between the state strength use and state SWB over the course of the week as well.

Figure 2

State Scores over Time for Participant #1

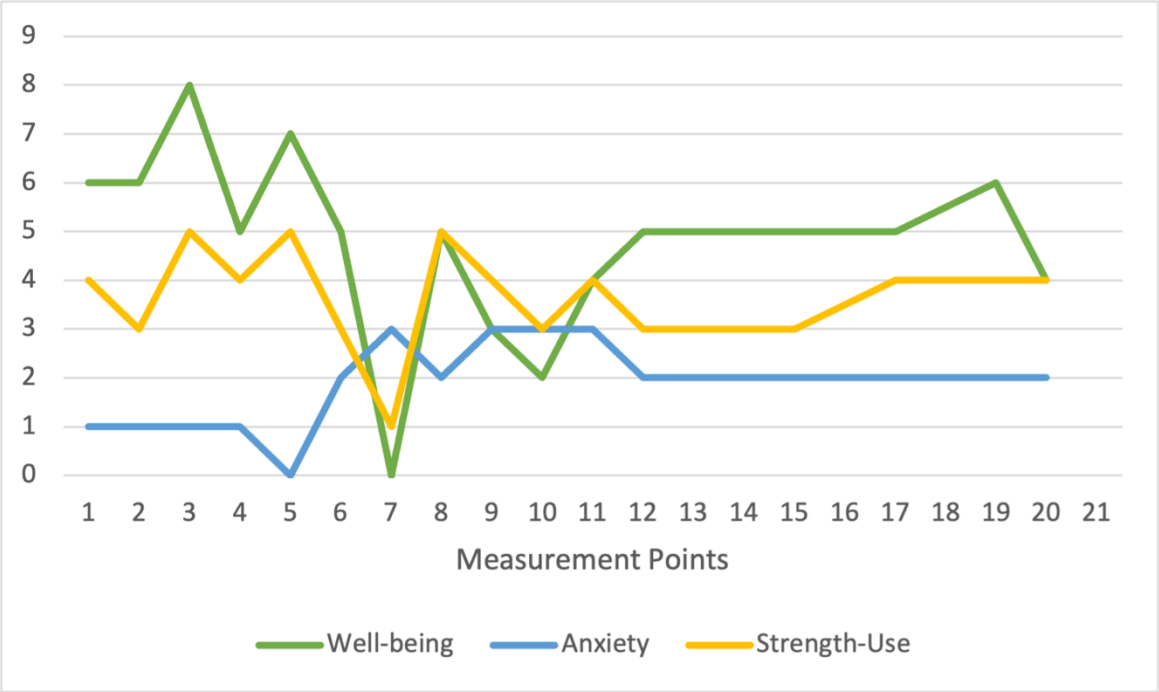
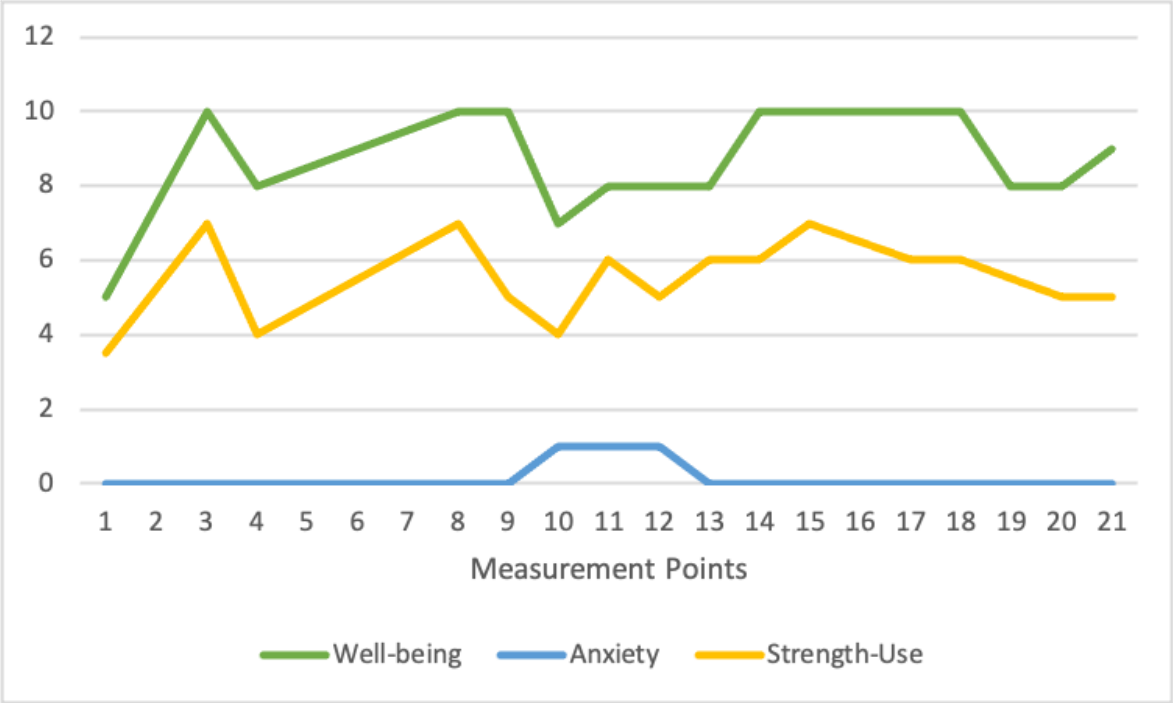


Figure 2 illustrates the relationship between SWB, anxiety, and state strength-use over time for participant #1. As displayed in the graph, the variables fluctuated notably throughout the week. Yet, an association between the state strength use (range 1-5) and the state SWB (range 0-8) variable were visible with similar fluctuations. For example, the evening of day one indicated an association between the variables with a high level of state SWB and a high level of state strength use. Similarly, at midday on day two, the graph displayed high levels of state SWB and high levels of state strength use, as well as an association with low state anxiety levels. Moreover, on the morning of day 3, there was an evident low level of strength use, which associated with a score of 0 for well-being and a high level of state anxiety.

Figure 3

State Scores over Time for Participant #18



Overall, Figure 1 also indicates a negative association between strength use and anxiety. Also, the same three participants that were mentioned before (#21, #14, #18) experienced the lowest anxiety score (range 0.19-0.75). Here, participant #18 stood out with the lowest anxiety score ($M = 0.19$) from the sample and will be inspected further. Figure 3 illustrates the relationship between state SWB, state anxiety, and state strength-use over time for participant #18. Of note were the consistently low levels of state anxiety (range 0-1) experienced by this participant throughout the study period, which seemed to have encountered some floor effects. State SWB was much less constant and fluctuated over the week of data collection (range 5-10). Similar fluctuations could be identified in state strength use (range 3.5-7). Notably, high levels of SWB, for example in the evening of day 1, associated with higher levels in strength use. At the same time, low levels in SWB (morning of day 3) displayed an association with low levels in strength use as well.

Linear Mixed Models

Within- and Between Person Effect

A linear mixed model was used to measure the strength of the concepts between-person (PM) and within-person associations (PMC) between state level strength use and state level SWB, as well as between state level strength use and state level anxiety. Table 3 displays a summary of the LMM analysis for the state-like Z-score variables PM strength use and SWB, PMC strength use and SWB, PM strength use and anxiety, and PMC strength use and anxiety. The table includes the Estimates, Confidence Intervals (CI) and p-vales.

As indicated by Table 3, the first analysis predicted that there is a significant positive association between strength use and SWB on a between-person level. Furthermore, the outcome between strength use and SWB on a within-person level, displayed a significant positive association. Also, the second analysis showed that there was a negative significant association between strength use and anxiety on a between-person level. A similar outcome was found between strength use and anxiety on a within-person level, which also displayed a significant negative association.

Table 3

Summary for the within- and between-person Effect between State-like Z-score Variables

State-like Z-score variables	β	95% CI	p
PM SU and SWB	0.67	[0.57, 0.76]	<0.001
PMC SU and SWB	0.46	[0.38, 0.53]	<0.001
PM SU and A	-0.55	[-0.68, -0.43]	<0.001

PMC SU and A	-0.37	[-0.47, -0.28]	<0.001

Note. CI= Confidence interval; SU= Strength-use; SWB= Subjective Well-being; A=Anxiety.

Discussion

The purpose of the study was to gain insight into the relationship between state strength-use and state and trait subjective well-being (SWB) in students with anxiety symptoms. Overall, the study demonstrates a significant positive association between strength use and SWB on a between-person level, as well as on a within-person level. Further, the data indicates a significant negative association between strength use and anxiety on a between-person level and on a within-person level. Therefore, the analysis supports the hypotheses that there is both a between-person and within-person effect between the variables strength use and SWB, as well as the variables strength use and anxiety.

Interpretation and Implications

For the between- and within-person effect, the data suggests that between-person and within-person strength use both significantly predict state SWB. For the between-person effect, it can be said that people who use their strength more on average have higher SWB on average. Or conversely, people who have higher SWB all the time, find more opportunities to use their strengths. The findings can be related to the broaden-and-build theory of positive emotions, which was already introduced in the beginning of the study (Fredrickson, 2001; Conway et al., 2013). Further, it was indicated that the theory does not imply whether using one's strength at any given moment is also directly associated with higher SWB at that moment and therefore has no indication on the individual level. However, this can be indicated by the outcome of the within-person effect of this study, which means that people who use their strength more at a given moment are more likely to also experience higher SWB at that moment. These findings are in line with previous research by Bakker, Hetland,

Kjellevold-Olsen, and Espevik (2019), in which they found a significant relationship within-person relationship between strength use and SWB. Additionally, while previous research has mostly focused on the between-person effect of strength use and SWB, these results demonstrate a new finding for the within-person effect for strength use and SWB as well.

Further, the study indicates that between-person and within-person strength use both significantly predict state anxiety. For the between-person effect, it can be understood that people who use their strength more on average have lower anxiety on average. Vice versa, people who have lower anxiety all the time, use their strengths more. It can be interpreted that people who use their strength more at a given moment are also more likely to experience lower anxiety at that moment. These results should be taken into account when considering the effect of the broaden-and-build theory of positive emotions (Fredrickson, 2001). Since there is a negative association on a between-person level between strength use and anxiety, it supports the assumption of the theory that positive emotions broaden people's awareness and response to events as well as building resiliency and coping skills over time (Conway et al., 2013)

Strengths and Limitations and Recommendations

One of the main strengths of this study is the experience sampling method (ESM) that was implemented. The usage of the ESM is reported with high ecological validity and therefore benefits the study (Berkel et al., 2017). Further, through using this method, it was possible to assess the participants' state-levels of strength use, SWB and anxiety three times a day, which therefore assessed within daily circumstances and fluctuations of these variables (Myin-Germeys et al., 2018). Moreover, a more in-depth analysis was possible since the data can be targeted to the immediate, emotional state the researcher is interested in (Berkel et al., 2017). Accordingly, future research should focus more on interventions based on within-person analyses, such as the ESM. To make interventions the most effective, it is essential

that they meet the needs of the individual person instead of generalizing the interventions to the population as a whole. The interventions would be more tailored and therefore improve the effectiveness in tackling the problem.

A further positive element of the study is the new insight into the association between strength use and anxiety. Hence, the current study can be considered a preliminary step to fill the knowledge gap in investigating the association between strength use and anxiety. To build on these findings, it would be recommended to examine other mental health aspects that might be related to strength use. Previous research shows that character strength use is often linked with, for example, lower levels of depression (Douglas & Duffy, 2015). Moreover, another study by Bromley, Johnson and Cohen (2006) found that youths who had an increased number of character strengths showed a lower risk for psychiatric disorders than those with fewer strengths.

On the other hand, there are some limitations that need to be discussed. The methodological choices are constrained by the recruitment of the participants through convenience sampling. This is reflected in the notably uneven gender distribution in the sample between 1 male and 13 female participants, as well as the nationalities that were represented with 11 Germans, one Dutch, and two other nationalities. Further, given that the participants were all known to the researchers, they might have been particularly motivated to display socially desirable behaviour in terms of fitting into the anxiety spectrum. This is also supported by Etikan, Musa & Alkassim (2016), who suggest that a convenience sampling method oftentimes leads to hidden biases in the participant selection, which negatively influences the representativeness of the sample (Etikan et al., 2016). For future research, more focus should be laid on a different or additional sampling method that ensures better representativeness of the sample.

This research, however, is also subject to some technical limitations. Problems arose with the ESM survey platform Ethica, which might affect the validity. In the course of the study, some participants reported issues with receiving notifications for daily questionnaires. Technical hurdles can be one of the reasons for 11 individuals having insufficient data points out of the total 25 participants who signed up for the study. However, this is comparable to the average levels of adherence in longitudinal study designs, which is often very poor (Johnson, 2010). Despite the comparable average levels of other studies, it is advisable for further research to set up a pilot study prior, in order to rule out technical difficulties.

Furthermore, it is debatable whether the reliability of the trait-level data is impacted by the 7-item HADS-A questionnaire, that has a low Cronbach's alpha, since the dataset (N = 14) is quite small and also could have an influence on the Cronbach's alpha. Further, the HADS-A was used in many studies and displayed a Cronbach's alpha that varied from .68 to.93 (Bjelland, Dahl, Haug, & Neckelmann, 2002). Therefore, switching to a different measurement is advised against.

However, despite the good reliability of the WHO-5, the validity of the measurement might be questionable. This is because the WHO-5 well-being index is a short self-reported measure of current mental wellbeing instead of SWB (Topp, et al., 2015). For the trait level measurement of SWB, for example, the 5-item satisfaction with life questionnaire (SWLS) would be recommended for future research. The SWLS measures the different components of SWB (Diener, Emmons, Larsen & Griffin, 1985; Pavot & Diener, 1993).

There may be also some possible limitations for the measurement of the state variable anxiety. For the variable, the reduced single-item version of the HADS-A was implemented in the ESM study. A 4-point Likert scale with scoring ranges from 0 to 3 was used. This small range brought some challenges with it, such as an overall low state-level anxiety score and some floor effects. A reason for that may be the small range of the state anxiety score, in

which “3” is already considered as experiencing the highest anxiety. Participants have only four choices, one of them being zero, and therefore not much room between the values. When participants experience only low anxiety to moderate anxiety, choosing two or three might be interpreted as too extreme. The study by Cox and colleagues (2018) shows the successful implication of the single-item version, which is one of the reasons why it was implemented in this study. Yet, Cox and his colleagues (2018) used a continuous scale from 0 (“not anxious at all”) to 100 (“extremely anxious”) to indicate the level of momentary anxiety of participants in their study. Further research is needed to establish a different scale or implement the successful implication by Cox and his colleagues (2018). The broader scale would give participants more room to report their different levels of anxiety.

Moreover, regarding the low variability in the concept of anxiety, it would be useful for further research to consider a longer time frame for the daily questionnaire. A duration of 2 to 3 weeks is most commonly advised as a balance between participant retention and capturing sufficient measurement points for detailed 25 analysis of the relationship between variables and if a specific context that occurs regularly is taken into account as well (Berkel et al., 2017). Additionally, a longer data collection period could be interesting for observing the fluctuations of the state variables in further research. In this study, strength use and SWB fluctuate throughout the study, however the variable anxiety does not so much.

There are some additional thoughts and recommendations on how future research in this matter can be expanded. For future research, there are some indications that (using) certain strengths is more beneficial to SWB than others. However, not all character strengths reported by Park, Peterson, and Seligman (2004) are associated with SWB. The five-character strengths that can be associated to life satisfaction the most are hope, zest, gratitude, curiosity, and love. According to Park and colleagues (2004), those are the strengths that consistently and repeatedly show a robust, consistent relationship with life satisfaction.

Further, the character strengths that can be the least associated to life satisfaction are modesty/humility, creativity, appreciation of beauty and excellence, judgment/open-mindedness, and love of learning (Park et al., 2004). A recommendation for future research could be to implement a more tailored strength use scale, in order to examine which character strength participants used and how this is associated with their outcome levels of the state-level strength use over the course of the week.

There may be some possible aspects for further researcher regarding the inclusion of the situational context. It is now known by the current study that strength use and SWB and strength use and anxiety associate, but less is known about what triggers both. Participants might demonstrate different within-person scores of SWB or anxiety when faced with a particular type of situation, such as stress traumatic event, etc. This could have a crucial impact on the ESM measurements, which cannot be explained by this study. However, this study gave a considerable starting point and for future research it is recommended to include additional categorical context variables such as the presence or absence of social, study or personal stressors. This way, the situational context of participants could be evaluated.

Finally, it is essential for the limitations of this study consider that the research of this study was conducted during the Corona Virus crisis (COVID-19) and its countermeasures. The governmental regulations, including physical distance to others, travel restriction, quarantine, and the closure of most facilities, led to new challenges, stressors and an overall restricted in one's life. On that account, it should be noted that the use of strength could have been negatively affected during this study. Meaning, that because of the restrictions, participants might not have been able to apply their strength to the full extend. Hence, when people cannot use their strength as they would like to, the measures would have been affected. Moreover, a recent study by Son Hegde, Smith, Wang, and Sasangohar (2020) evaluated 195 university students, from which 138 (71%) reported increased stress and

anxiety due to the corona outbreak. In their research, various stressors were found to contribute to the increased levels of stress, anxiety, and depressive thoughts among students. Because of this reported increased stress, it would be expected that the anxiety measurement of this study would be exceptionally high. This is also supported by a recent survey overseen by the National Association of Student Personnel Administrators, in which a large number of 3500 students have been assessed (College Pulse, Course Hero, & NASPA, 2020). When being asked about COVID-19, 25% of students reported feeling “slightly anxious”, 35% described feeling “somewhat anxious”, and 21% described feeling “very anxious”. Therefore, it was surprising that despite the expected increase in anxiety levels, participants of this study reported very little to no trait anxiety. Yet, this can be referred to the methodological issue with the single-item HADS-A that was already discussed. Besides the impact on anxiety levels, a decline in SWB since the start of the outbreak should be considered in light of the pandemic. A recent paper by Yang and Ma (2020) supports this assumption. Here, it is stated that in China for instance “the onset of the coronavirus epidemic led to a 74% drop in overall emotional well-being” (Yang, & Ma, 2020).

For further research, a replication of the present study would be desirable. Specifically, a study after the corona crisis could enable a comparison between crisis and post-crisis state- and trait-levels.

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Appendices

Appendix A

Informed Consent

Goal

The goal of this study is to collect information about the use of character strengths and the well-being of young adults who experience symptoms of depression and/or anxiety. Further, the study wants to examine possible correlations and possible bi-directional relationships between character strengths use and perceived well-being.

Procedure

You will be asked several questions through the online application "Ethica" for seven days. The study will consist of multiple questions asking about your perceived well-being, character strengths use, as well as about possible depressive or anxiety symptoms. The first questionnaire will consist of some more general questions about your perceived well-being, character strengths use and your depressive and anxiety symptoms. This will likely take around 15 minutes. For the following seven days you will receive three questionnaires. You will get the first reminder for filling out the questionnaire between 7am and 10am, the following reminder between 1pm and 4pm, and the third reminder will be sent between 7pm and 10pm. Each questionnaire will again ask about your perceived well-being, how you are feeling in terms of your symptoms and your character strengths use. Altogether, these questionnaires will probably take around three to five minutes. On the seventh day you will receive the same questionnaire as on the first day, which will again take around 15 minutes to complete.

You can withdraw from the study at any time. You can ask questions at any moment.

Recording

Your data will only be used for the purpose of this study. The data will only be seen by the researcher and their supervisor and will not be shared outside the research team.

Participation is not expected to have any risks or consequences for you

- Your answers and details will be processed anonymously.
- We are just interested in the possible correlations of the variables, not your performance or your daily routine

Informed consent

I have read or the study has been read to me and understood the study. I have been able to ask questions about the study and my questions have been answered to my satisfaction.

- Yes, I consent.
- No, I do not consent.

I consent voluntarily to be a participant in this study and understand that I can refuse to answer questions and I can withdraw from the study at any time, without having to give a reason.

- Yes, I consent.
- No, I do not consent.

I understand that taking part in this study involves the recording of information through the application Ethica. I understand that I need to fill in questionnaires provided to me for seven days to complete the study.

- Yes, I consent.
- No, I do not consent.

I understand that the information collected about me will be processed anonymously and will not be shared beyond the study team.

- Yes, I consent.
- No, I do not consent.

Appendix B

Trait Questionnaire

Hello!
Thank you for your participation in this study!
Today you will be asked some more general questions about your overall well-being And character strength use.
This first questionnaire will probably take around 15 minutes to complete. Please stick through it and answer the questions honestly.
Have fun!

In the next pages you will be presented with a set of statements asking you about your last week. Please select the statements that fit most to you.
Tick the box beside the reply that is closest to how you have been feeling in the past week.
Don't take too long over your replies: your immediate is best.

<u>I have felt cheerful and in good spirits.</u>

○ All of the time
○ Most of the time
○ More than half of the time
○ Less than half of the time
○ Some of the time

○ At no time

I have felt calm and relaxed.
○ All of the time
○ Most of the time
○ More than half of the time
○ Less than half of the time
○ Some of the time
○ At no time

I have felt active and vigorous.
○ All of the time
○ Most of the time
○ More than half of the time
○ Less than half of the time
○ Some of the time
○ At no time

I woke up feeling fresh and rested.
○ All of the time
○ Most of the time
○ More than half of the time
○ Less than half of the time
○ Some of the time
○ At no time

My daily life has been filled with things that interest me.
○ All of the time
○ Most of the time
○ More than half of the time
○ Less than half of the time
○ Some of the time
○ At no time

I feel tense or 'wound up'.
○ Most of the time
○ A lot of the time
○ From time to time, occasionally
○ Not at all

I feel as if I am slowed down.
○ Nearly all the time
○ Very often
○ Sometimes

○ Not at all

I still enjoy the things I used to enjoy.
○ Definitely as much
○ Not quite so much
○ Only a little
○ Hardly at all

I get a sort of frightened feeling like ‘butterflies' in the stomach.
○ Not at all
○ Occasionally
○ Quite often
○ Very often

I get a sort of frightened feeling as if something awful is about to happen.
○ Very definitely and quite badly
○ Yes, but not too badly
○ A little, but it doesn't worry me
○ Not at all

I have lost interest in my appearance.
○ Definitely
○ I don't take as much care as I should
○ I may not take quite as much care
○ I take just as much care as ever

I can laugh and see the funny side of things.
○ As much as I always could
○ Not quite so much now
○ Definitely not so much now
○ Not at all

I feel restless as I have to be on the move.
○ Very much indeed
○ Quite a lot
○ Not very much
○ Not at all

Worrying thoughts go through my mind.
○ A great deal of the time
○ A lot of the time
○ From time to time, but not too often
○ Only occasionally

I look forward with enjoyment to things.
○ As much as I ever did
○ Rather less than I used to
○ Definitely less than I used to
○ Hardly at all

I feel cheerful.
○ Not at all
○ Not often
○ Sometimes
○ Most of the time

I get sudden feelings of panic.
○ Very often indeed
○ Quite often
○ Not very often
○ Not at all

I can sit at ease and feel relaxed.
○ Definitely
○ Usually
○ Not often
○ Not at all

I can enjoy a good book or radio or TV program.
○ Often
○ Sometimes
○ Not often
○ Very seldom

The next couple of questions will be directed to your character strength and use. Stick through
Please choose one option in response to each statement. All of the questions reflect statements that many people would find desirable, but we want you to answer only in terms of whether the statement describes what you are like. Please be honest and accurate!

I have a clear picture in my mind about what I want to happen in the future.
○ Very much unlike me
○ Unlike me
○ Neutral
○ Like me
○ Very much like me

I am regularly able to do what I do best.
○ Strongly agree
○ Agree
○ More or less agree
○ Neither agree nor disagree
○ More or less disagree
○ Disagree
○ Strongly disagree

I always play to my strength.
○ Strongly agree
○ Agree
○ More or less agree
○ Neither agree nor disagree
○ More or less disagree
○ Disagree
○ Strongly disagree

I always try to use my strengths.
○ Strongly agree
○ Agree
○ More or less agree
○ Neither agree nor disagree
○ More or less disagree
○ Disagree
○ Strongly disagree

I achieve what I want by using my strengths.
○ Strongly agree
○ Agree
○ More or less agree
○ Neither agree nor disagree
○ More or less disagree
○ Disagree
○ Strongly disagree

I use my strengths every day.
○ Strongly agree
○ Agree
○ More or less agree
○ Neither agree nor disagree
○ More or less disagree
○ Disagree
○ Strongly disagree

I use my strengths to get what I want out of life.
○ Strongly agree
○ Agree
○ More or less agree
○ Neither agree nor disagree
○ More or less disagree
○ Disagree
○ Strongly disagree

My work gives me lots of opportunities to use my strengths.
○ Strongly agree
○ Agree
○ More or less agree
○ Neither agree nor disagree
○ More or less disagree
○ Disagree
○ Strongly disagree

My life presents me with lots of different ways to use my strengths.
○ Strongly agree
○ Agree
○ More or less agree
○ Neither agree nor disagree
○ More or less disagree
○ Disagree
○ Strongly disagree

Using my strengths comes naturally to me.
○ Strongly agree
○ Agree
○ More or less agree
○ Neither agree nor disagree
○ More or less disagree
○ Disagree
○ Strongly disagree

I find it easy to use my strengths in the things I do.
○ Strongly agree
○ Agree
○ More or less agree
○ Neither agree nor disagree
○ More or less disagree
○ Disagree

○ Strongly disagree

I am able to use my strengths in lots of different situations.
○ Strongly agree
○ Agree
○ More or less agree
○ Neither agree nor disagree
○ More or less disagree
○ Disagree
○ Strongly disagree

Most of my time is spent doing the things I am good at doing.
○ Strongly agree
○ Agree
○ More or less agree
○ Neither agree nor disagree
○ More or less disagree
○ Disagree
○ Strongly disagree

Using my strengths is something I am familiar with.
○ Strongly agree
○ Agree
○ More or less agree
○ Neither agree nor disagree
○ More or less disagree
○ Disagree
○ Strongly disagree

I am able to use my strengths in lots of different ways.
○ Strongly agree
○ Agree
○ More or less agree
○ Neither agree nor disagree
○ More or less disagree
○ Disagree
○ Strongly disagree

Thank you for filling in the first questionnaire!
For the next 7 days you will receive 3 short questionnaires a day.
Do not worry, today you are done with answering our survey.
See you tomorrow morning!

State Questionnaire

Welcome back!

Please fill in the few next questions. This will only take a couple of seconds.

Do you feel happy at the moment?

○ 0
○ 1
○ 2
○ 3
○ 4
○ 5
○ 6
○ 7
○ 8
○ 9
○ 10

At the moment I feel able to do what I do best.

○ Strongly Agree
○ Agree
○ Somewhat agree
○ Neutral
○ Somewhat disagree
○ Disagree
○ Strongly Disagree

At the moment I feel able to use my strengths in different ways.

○ Strongly Agree
○ Agree
○ Somewhat agree
○ Neutral
○ Somewhat disagree
○ Disagree
○ Strongly Disagree

I feel important to other people at the moment.

○ Strongly Agree
○ Agree
○ Somewhat agree
○ Neutral
○ Somewhat disagree
○ Disagree
○ Strongly Disagree

How anxious do you feel right now?
○ Very much
○ Quite a lot
○ Not very much
○ Not at all

To what extend do you feel down right now?
○ Very much
○ Quite a lot
○ Not very much
○ Not at all

Thank you!!!
Until next time!