

**Relationship Between Openness and Perceived Stress through the Mediator of Active
Coping Among University Students**

Anna-Katharina Dudde (s2814579)

Department of Psychology, University of Twente

Bachelor Thesis Positive Clinical Psychology and Technology (202000381)

First Supervisor: Dr. Thomas Vaessen

Second Supervisor: Selin Ayas

4691 Words

June 28, 2024

Abstract

Background. Stress is a universal problem that endangers the physical and mental health of university students. Openness, of the Big Five personality traits, leads to appropriate coping strategies, such as active coping, which in turn has been indicated with decreasing the negative effects of stress and its perception. This study, therefore, investigates the relationship between openness and stress through the mediator of active coping. **Methods.** A cross-sectional study in which university students completed the Big Five Inventory, the Perceived Stress Scale, and the COPE Inventory, examined the associations between openness, stress, and active coping. Linear regressions and mediation analysis were computed. **Results.** A positive association between openness and stress, and a negative association between active coping and perceived stress was found. Moreover, despite an insignificant direct effect (openness and stress), an indirect mediation between openness and stress through active coping was established. **Conclusions.** Findings suggest openness likely leads to employing active coping, which was found to reduce perceived stress. Therefore, high openness does not mitigate perceived stress unless it leads to effective coping strategies (e.g., active coping). It is suggested that future research focuses on a replication study to validate current findings with multiple mediators, as well as a longitudinal study measuring stress levels, and coping strategies at different points in a semester.

Keywords: Perceived stress, openness to experience, coping, active coping, university students, indirect mediation

Contents

Introduction	4
Stress Among University Students	4
Openness and Stress.....	4
Active Coping	5
Openness, Perceived Stress, and Active Coping	6
Current Study	6
Methods	7
Participants.....	7
Procedure and Measures	7
Demographics	8
Openness	8
Perceived Stress	8
Active Coping	8
Data Analysis	9
Data Preparation.....	9
Descriptive Statistics and Assumption Testing.....	9
Hypothesis Testing.....	9
Results	10
Sample Description.....	10
Assumption Testing	12
Hypothesis Testing.....	12
Discussion	15
Insignificant Direct Effect.....	15
Indirect Mediation.....	16
Strengths	17
Limitations	17
Conclusion	18
References	19
Appendix A. Informed Consent	24
Appendix B. Questionnaire	26
Appendix C. Code for Analysis in R	28
Appendix D. Assumption Testing Results	38

Introduction

Stress Among University Students

Excessive stress can make university students more vulnerable to mental health issues (Stallman & Hurst, 2016). Stress, as defined by the World Health Organization (2022), refers to a state of worry or tension brought on by challenging circumstances. According to the transactional model of stress, the perception of stress results from a) the assessment of the external situation and b) the coping resources of the individual (Luo et al., 2022). Böke et al. (2019) elaborate that stress is evoked when individuals perceive their environmental demands to threaten their well-being. A study conducted by Asif et al. (2020), reported that among 500 university students aged 18-24, about 85% experienced stress. Cardoso et al. (2019) explain that individuals undergoing lifestyle changes experience heightened stress levels, making university students particularly sensitive to stress. Students go through a transitional phase from adolescence to adulthood, accompanied by various changes, which are viewed as stressors (Chai and Low, 2015). Stressors, an event or condition causing stress, for students, can be academic (i.e., academic performance pressure, overwork, exams, future employment), as well as non-academic (i.e., adjusting to a new environment, interpersonal relationship problems, or financial difficulties) (*APA Dictionary of Psychology*, n.d.-a; Freire et al., 2020; Wang et al., 2023). These stressors lead to excessive perceived stress which has various negative implications on one's mental, as well as physical health. Excessive stress is associated with decreased mental well-being and quality of life, and heightens the risk of mental health issues, such as depression or anxiety disorders (Ribeiro et al., 2018; Slimmen et al., 2022). Although research can determine groups (e.g., university students) that are susceptible to stress, it remains unclear what makes individuals vulnerable to stress. Wang et al. (2023) report that the same stressor to one individual may not elicit feelings of stress in another and highlight that one's character determines the meaning of a stressor. Therefore, personality appears to play an important role in the perception of stress.

Openness and Stress

Luo et al. (2022) support Wang's et al. (2023) notion and found that some individuals are more likely to encounter and perceive stress compared to others and attribute personality to the individual experience of stress. The Five-Factor Model (FFM), the most widely used framework of personality traits, consists of openness to experience, conscientiousness, extraversion, agreeableness, and neuroticism, also called the Big Five personality traits (Luo et al., 2022). Most literature targets neuroticism, which has been negatively linked to stress and seems to be a risk factor (e.g., Bellingtier et al., 2021; Uliaszek et al., 2010). Less research has

focused on other personality traits, such as openness, which in contrast to neuroticism, appears to be a resilience factor against stress. Although openness has been linked to resilience, which acts as a buffer against stress indicating that its characteristics serve as a protective factor, other findings have been contradictory (Kocjan et al., 2021). Whereas Luo et al. (2022) established a significant negative relationship between openness and stress in their meta-analytical review, Saleh et al. (2017) found no relationship among university students.

Individuals high in openness tend to be curious, flexible, imaginative, and creative, as well as willing to explore novel or atypical experiences or ideas, while possessing independent judgment (Carver & Connor-Smith, 2010; Chu et al., 2015). It serves as a protective factor for mental health and is associated with intelligence and less psychological suffering when confronted with stressors (Chu et al., 2015). These characteristics make individuals high in openness more resilient to stressful situations, as their comfort zone is broader and they are more adaptable to novel situations (Chu et al., 2015). Considering the characteristics of openness are linked with better stress management (i.e., decreased perceived stress), and findings from previous literature are contradictory, it is relevant to evaluate this association further. Individuals high in openness recognise stressors, manage accompanying physiological and emotional reactions and initiate an approach to the stressor (Williams et al., 2009). The action of approaching or dealing with a stressor describes coping, which is the second step in the perception of stress and could explain how openness acts as a protective factor against stress (Luo et al., 2022).

Active Coping

Coping refers to the thoughts and actions used to deal with internal, as well as external stressful situations, whereas coping strategies are the specific methods and techniques individuals consciously employ to manage stress (Algorani & Gupta, 2023; *APA Dictionary of Psychology*, n.d.-b). Abrams et al. (2013) elaborate that these techniques are intended to either alter the stressful situation to make it more manageable, or to reshape one's thoughts and feelings about it to change one's response to it. Being able to effectively cope with stressful situations helps reduce perceived stress, and accordingly, being unable to cope with excessive perceived stress can provoke negative health effects, both psychologically and physically (Chai and Low, 2015). Because coping is dependent on the situation, the individual, as well as the stressor, conceptualising or studying coping strategies proves difficult. Regardless, Carver et al. (1989) conceptualised coping as a multidimensional construct comprised of 15 first-order strategies, one of which is active coping. Active coping entails taking direct action to manage a stressor through appropriately targeted behaviour and accepting responsibility for resolving

the situation with one's internal resources (*APA Dictionary of Psychology*, n.d.-c; Carver et al., 1989). Given that the literature on active coping often focuses on predictors of the strategy, rather than its direct effect on stress, these studies often state further research on active coping and its protective effects on stress may be necessary (e.g., Cheung et al., 2020; Hsieh et al., 2014; Shields, 2001). Although existing literature is lacking, there are still indications of a negative effect of active coping on perceived stress. Li (2008) reports that active coping is important in managing stressful situations and is associated with positive adaptation to college life. Additionally, Akeman et al. (2022) identified that active coping served as a resilience factor against the negative effects of the pandemic on students' mental health. This indicates that active coping serves as a buffer for mental health in stressful situations and could be protective against stressful situations. Thus, although a similar relationship has been established, the relationship between active coping and stress has not been directly investigated, indicating a gap in literature and knowledge despite extensive exploration of the construct.

Openness, Perceived Stress, and Active Coping

Based on the previously explored literature, it is likely that active coping plays a significant role in explaining the association between openness and stress. Personality can predict and impact the coping strategies one chooses, which are crucial in helping students deal with stressful academic situations (Afshar et al., 2015; Meléndez et al., 2020; Struthers et al., 2000). Openness serves as a protective factor for mental health, likely because it leads to appropriate coping. This aligns with the study conducted by Afshar et al. (2015), which identified a positive relationship between openness and active coping. Though research on the relationship between openness and perceived stress is contradictory, a positive relationship between openness and active coping was identified in existing literature. Openness likely leads to appropriate coping strategies which appear to offer stress management and reduced stress perception. Although prior literature on active coping and its direct effects on stress are lacking, a negative direction between active coping and stress was established. Because openness and its characteristics seem beneficial for choosing appropriate coping strategies (i.e., active coping), which serve as a buffer against mental health problems, active coping appears to mediate the relationship between openness and perceived stress.

Current Study

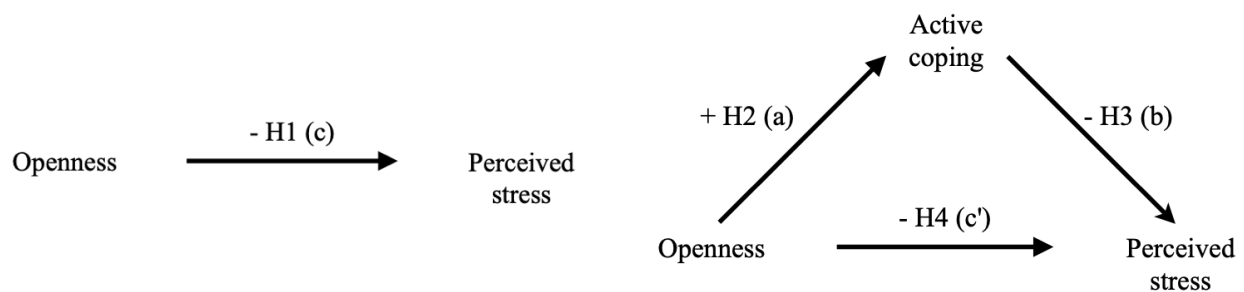
To explore the interplay between active coping and the relationship between openness and perceived stress, the research question guiding this study is: Does active coping mediate the

relationship between openness and perceived stress? Thus, based on the previously explored literature the following hypotheses were set up:

1. High openness is negatively associated with perceived stress (Figure 1, Pathway c)
2. High openness is positively associated with active coping (Figure 1, Pathway a)
3. High active coping is negatively associated with perceived stress (Figure 1, Pathway b)
4. High active coping negatively mediates the relationship between openness and perceived stress (Figure 1, Pathway c')

Figure 1

Expected Association Hypothesis 1, 2, 3, 4



Methods

Participants

To take part in the study, participants had to be of legal age (i.e., 18 years old), be proficient in English, and be university students. Ethical approval was granted by the University of Twente BMS ethical review committee and participants had to give their informed consent to participate. Participants were recruited through various social media platforms, such as WhatsApp and Instagram, as well as through SONA, a university platform that allows individuals to sign up for studies. Therefore, a convenience sample was used.

Procedure and Measures

This study was part of a larger study, including social support, academic motivation, and academic performance. A quantitative online survey was administered. Participants needed electronic access to the survey link, which was distributed through the SONA system or private channels. Moreover, the survey was carried out using the online platform Qualtrics, a website that allows the design of questionnaires, through which primary data was collected. While adhering to ethical guidelines, students were informed about the study, its purpose, and relevant information for giving their informed consent. After completing these measures, participants were debriefed about the study, thanked for their participation, and allowed to contact

researchers for more information. As indicated in the study description, completion of the study took approximately 15-20 minutes.

Demographics

Before completing the questionnaire, participants were asked to answer demographic questions including their age (text entry), gender (i.e., “Female”; “Male”, “Non-binary/Third Gender”, “Prefer not to say”), nationality (i.e., “German”, “Dutch”, “Other, namely”), as well as their education level (i.e., “First year Bachelor”, “Second year Bachelor”, “Third year Bachelor”, “Pre-Master”, “Master”, “PhD”).

Openness

The Big Five Inventory (BFI) is a 44-item measure used to assess an individual on the Big Five personality factors (i.e., openness, conscientiousness, extraversion, agreeableness, neuroticism) (John & Srivastava, 1999). Ten items corresponding to openness were used in this study, which included: “I see myself as someone who is talkative” or “I see myself as someone who has a forgiving nature”. Participants indicate how strongly they agree with an item using a 5-point bipolar scale ranging from 1 = ‘Disagree strongly’ to 5 = ‘Agree strongly’. After reverse-scoring certain items, the responses are scored by summing the answers to all items. Scores can range from one to 50, with lower scores indicating a lower expression of openness in an individual, and higher scores indicating the prominence of openness. Moreover, the BFI shows acceptable score reliability for openness with a Cronbach’s alpha ranging from $\alpha = 0.79$ to 0.85 (Alansari, 2016; Worrell & Cross, 2004). Furthermore, reliability for openness also proved acceptable in this dataset with a Cronbach’s alpha of $\alpha = 0.77$.

Perceived Stress

The Perceived Stress Scale (PSS) was used to assess perceived stress. The PSS consists of ten items. Using a 5-point scale ranging from 0 = ‘Never’ to 4 = ‘Very often’ respondents rank each item, indicating how often they have felt or thought a certain way in the past month. An example item includes: “In the last month, how often have you felt that things were going your way?”. The scale is scored by reversing certain responses and summing the answers to all items. Thus, participant scores can range from zero to 40, with higher scores expressing higher levels of perceived stress and lower scores, low levels of perceived stress. The scale provides acceptable reliability with a Cronbach’s α of $>.70$, (Lee, 2012). In this dataset reliability for perceived stress proved to be good with Cronbach’s $\alpha = 0.85$.

Active Coping

Active coping was assessed using the COPE inventory. It is a 60-item scale with 15 sub-scales, each representing a coping strategy (Carver et al., 1989; Halamová et al., 2022).

Four items corresponding to the subscale ‘active coping’ were included in this study, those being: “I concentrate my efforts on doing something about it”, “I take additional action to try to get rid of the problem”, “I take direct action to get around the problem”, and “I do what has to be done, one step at a time”. These items are scored on a 4-point Likert scale ranging from 1 = ‘I usually don’t do this at all’ to 4 = ‘I usually do this a lot’. Scores are obtained by summing the answers, resulting in a score ranging from 1 to 16 with higher scores indicating more frequent use of active coping and a lower score indicating less or no usage of it. Furthermore, according to Halamová et al. (2022), the COPE inventory shows good psychometric properties, with a Cronbach’s alpha of 0.79 for the subscale of active coping. However, in this dataset, Cronbach’s alpha was questionable with $\alpha = 0.60$.

Data Analysis

Data Preparation

Once data collection was completed, the data were imported from Qualtrics and prepped for analysis using the statistical program RStudio Version 2024.04.0+735. During data cleaning, columns irrelevant to the analysis, incomplete answers, as well as participants who did not give their consent were removed from the dataset. Moreover, variables referring to demographic questions were renamed, categorical answers were recoded into numeric values, and certain items were reverse-coded. Three new variables were created depicting the sum scores for openness, active coping, and perceived stress, which were used for analyses.

Descriptive Statistics and Assumption Testing

To better understand the data, descriptive statistics were generated for each sum variable. Moreover, Cronbach’s alpha was computed to test the reliability of each scale/subscale. Subsequently, the statistical assumptions of linearity, homoscedasticity, independence, and normality were checked for each relationship. Linearity was examined by creating a scatterplot, and independence by running the Durbin-Watson test. In addition to the scatterplot of residuals and predicted values, homoscedasticity was investigated using the Breusch-Pagan test. Finally, the assumption of normality was tested by generating a histogram, as well as running the Shapiro-Wilk test. Openness appeared to be non-linear and influenced its relationship with stress and active coping. Therefore, openness was adjusted using the log transformation, to ensure linearity. Otherwise, all assumptions were met.

Hypothesis Testing

To test Hypothesis 1: ‘High openness is negatively associated with perceived stress’, a linear regression with openness as the independent variable and perceived stress as the dependent variable was run. A linear regression was also computed for Hypothesis 2, which

predicted that ‘High openness is positively associated with active coping’. Here openness was the independent variable and active coping was the dependent variable. To test Hypothesis 3: ‘High active coping is negatively associated with perceived stress’, another linear regression was run with active coping as the independent variable and perceived stress as the dependent variable. Lastly, to test Hypothesis 4 (‘High active coping negatively mediates the relationship between openness and perceived stress’), a mediation analysis using the PROCESS macro was conducted with openness as the independent variable, active coping as the mediator, and perceived stress as the dependent variable.

Results

Sample Description

A total of 189 people participated in the study. However, 50 participants were removed because they did not finish the survey, four others because they were outliers, and two more because they did not give their consent. Therefore, only 133 participant responses were appropriate for analysis. The majority of these were female, German, and/or in their third year of their Bachelor program. Moreover, participants were between the ages of 18 and 31 ($M_{Age} = 22.06$, $SD_{Age} = 2.08$). Further participant data is depicted in Table 1.

Table 1*Participant Characteristics After Data Cleaning*

Participants	Number	Percent (%)
Total	133	100
<i>Gender</i>		
Male	45	33.8
Female	85	63.9
Non-binary/Third gender	3	2.3
<i>Nationality</i>		
Dutch	6	4.5
German	110	82.7
Other	17	12.8
<i>Study level</i>		
First year Bachelor	20	15.0
Second year Bachelor	25	18.8
Third year Bachelor	67	50.4
Pre-Master	11	8.3
Master	9	6.8
PhD	1	0.8

Visualized in Table 2 are the sample means and standard deviations for openness, active coping, and perceived stress. Compared to a Dutch sample between the ages of 20 and 30 ($M = 37$), the mean for openness appears to be average ($M_{Openness} = 36.62$, $SD_{Openness} = 6.04$) (Denissen et al., 2008). Moreover, the mean for active coping ($M_{AC} = 11.62$, $SD_{AC} = 2.22$) also appeared to be average when compared to a group of U.S. university students aged 18 to 51 ($M = 20.84$) (Litman, 2006). Finally, compared to an American norm group between the ages of 18 and 29 years ($M = 14.2$) the mean scores for perceived stress appear to be above average ($M_{PSS} = 23.59$, $SD_{PSS} = 5.88$) (Cohen et al., 1983). Furthermore, no flooring or ceiling effects were identified.

Table 2*Table of Means, Standard Deviations, and Correlation Coefficients*

	M	SD
Openness	36.62	6.04
Active coping	11.62	2.22
Perceived stress	23.59	5.88

Note. Openness range: 1-50; Active coping range: 1-16; Perceived stress range: 0-40

Assumption Testing

Before conducting the analyses, the parametric assumptions were checked for each relationship within the model i.e., openness and perceived stress (O_PSS), openness and active coping (O_AC), and active coping and perceived stress (AC_PSS). All assumptions except for linearity between O_PSS and O_AC were met. To account for these violations, openness was transformed using the log function. As all statistical assumptions were either met or adjusted, a linear regression for each relationship and a mediation analysis could be run. Further results concerning assumption testing are depicted in Appendix A.

Hypothesis Testing

In contrast to Hypothesis 1, results from a linear regression showed that the relationship between openness and perceiving stress was insignificant ($p = 0.63$) (see Table 3). Thus, Hypothesis 1 is rejected.

Table 3*Output Linear Regression Analysis for Openness and Perceived Stress*

	B	SE	t	p	95% CI
Intercept	28.49	10.19	2.80	0.01	[8.33, 48.65]
Openness	-1.37	2.84	-0.48	0.63	[-6.98, 4.25]

Note. $R^2 < 0.01$; $R^2_{adj} = -0.01$; $F(1,131) = 0.23$; $p = 0.63$

In line with Hypothesis 2, the linear regression was statistically significant [$F(1,131) = 4.73$, $p = 0.03$] and revealed a significant positive relationship between openness and active coping (Table 4). This shows that for every unit that openness increases, active coping increases by 2.29 units ($b = 2.29$, $p = 0.03$). In addition, 3% of the variance is explained by openness ($R^2 = 0.03$).

Table 4*Output Simple Linear Regression Analysis for Openness and Active Coping*

	B	SE	t	p	95% CI
Intercept	3.39	3.79	0.90	0.37	[-4.10, 10.89]
Openness	2.29	1.06	2.17	0.03	[0.21, 4.38]

Note. $R^2 = 0.03$; $R^2_{adj} = 0.03$; $F(1,131) = 4.73$; $p = 0.03$

As expected, the results for Hypothesis 3 indicated a significant negative relationship between active coping and perceived stress (Table 5). This shows that for every unit that active coping increased, stress decreased by 1.05 units ($b = -1.05$, $p = <0.01$). Additionally, the overall model was significant [$F(1,131) = 24.25$, $p < 0.01$]. Hence, Hypothesis 3 is accepted. Here, 16% of the variance in perceived stress is explained by active coping ($R^2 = 0.16$).

Table 5*Output Simple Linear Regression Analysis for Active Coping and Perceived Stress*

	B	SE	t	p	95% CI
Intercept	35.73	2.51	14.23	<0.01	[30.77, 40.70]
Active Coping	-1.05	0.21	-4.93	<0.01	[-1.47, -0.63]

Note. $R^2 = 0.16$; $R^2_{adj} = 0.15$; $F(1,131) = 24.25$; $p < 0.01$

Finally, to test Hypothesis 4, a mediation analysis generated significant results (see Table 6). The results of Step 1, confirmed that the relationship between openness and active coping proved significant [$F(1, 131) = 5.09$, $p = 0.03$]. Moreover, 4% of the variance in active coping can be explained by openness [$R^2 = 0.04$]. Step 2 outlines the relationship between active coping and perceived stress while controlling for openness. This confirmed the significant negative relationship [$F(2, 130) = 12.41$, $p = 0.00$]. Similar to the regression analysis above, for each unit where active coping increases, stress decreases by 1.08 ($b = -1.08$). In Step 3 the direct effect of openness on perceived stress, while controlling for active coping, confirmed that, although the effect of openness on perceived stress was weaker compared to the previous regression analysis, the relationship remained insignificant [$p = 0.43$, 95% CI (-0.06, 0.14)]. In Step 4, the results confirmed Hypothesis 4. As the Bootstrap

Confidence Interval [-0.09, -0.01] did not include zero, there was a significant indirect mediation between openness and perceived stress through active coping. For each unit that openness increases, perceived stress decreases by 0.05, due to the indirect effect of active coping ($b = -0.05$). For a visual representation of the findings, refer to Figure 2.

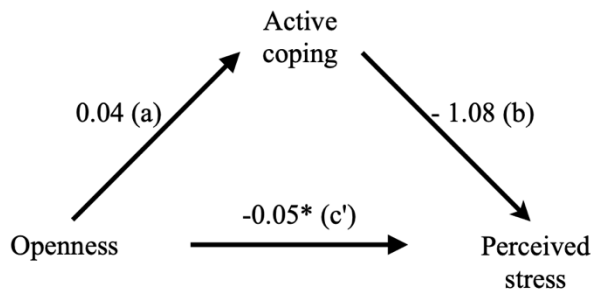
Table 6

Output Mediation Analysis for Openness and Perceived Stress Through Active Coping

	B	SE	t	p	95% CI	R ²	F
Step 1						0.04	(1, 131) 5.09
Constant	5.45	2.74	1.99	0.049	[0.03, 10.87]		
Openness	0.04	0.02	2.26	0.03	[0.01, 0.08]		
Step 2						0.16	(2, 130) 12.41
Constant	30.60	6.90	4.44	0.00	[16.96, 44.25]		
Openness	0.04	0.05	0.80	0.43	[-0.06, 0.14]		
AC	-1.08	0.22	-4.98	0.00	[-1.51, -0.65]		
Step 3							
	0.04	0.05	0.80	0.43	[-0.06, 0.14]		
Step 4							
AC	-0.05	0.02*			[-0.09, -0.01]**		

Note. Step 1 = regression analysis for openness (IV) and stress (DV); Step 2 = regression analysis for openness (IV), active coping (IV) and stress (DV); Step 3 = Direct effect of openness on stress; Step 4 = Indirect effect of openness on stress, mediated by active coping;

*Bootstrap Std. Error; ** Bootstrap Confidence Interval

Figure 2*Model of Mediation Analysis Results*

Note. *Significant indirect effect CI [-0.09, -0.01]

Discussion

The aim of the paper was to determine whether active coping mediated the relationship between openness and perceived stress among university students. Findings suggest that a positive association between openness and active coping (a) as well as a negative association between active coping and perceived stress (b) was established. Specifically, this means that high openness likely leads to employing active coping strategies and active coping decreases stress perception. Moreover, although the direct effect of openness and perceived stress was insignificant in this dataset, an indirect-only mediation through active coping was found (c'). In other words, openness mainly affects perceived stress, due to its impact on active coping, instead of having a direct effect on stress levels. Therefore, individuals high in openness are more likely to adopt more appropriate coping strategies, such as active coping, which in turn decreases one's stress perception.

Insignificant Direct Effect

Although the mediation was accepted it was surprising that no significant direct effect between openness and perceived stress was found. While these results are in line with Saleh et al. (2017), who found no significant relationship between openness and perceived stress among French university students, they contradict more recent findings of Luo et al. (2022), who identified a significant negative relationship. In their meta-analytical review of the association between the Big Five personality traits and stress, Luo et al. (2022) examined 250 studies, which may explain discrepancies in findings. Considering that 250 studies were investigated, little attention was paid to subtle differences in samples, age, gender, cultural differences, varying measurements or analyses etc., which likely influenced the results. For example, openness was not measured in all 250 studies and personality traits were often examined in relation to health issues, which is not comparable to university students with academic

stressors. Therefore, any inferences should be made tentatively and checked with original studies.

Moreover, when looking at other studies investigating openness and stress, it becomes clear that mediators play an important role. For example, the study conducted by Ebstrup et al. (2011) investigated the relationship between openness and stress through self-efficacy. Like the current study, the authors were unable to establish a relationship between openness and stress. Only when the mediator of self-efficacy was included in the analysis, was an indirect mediation with a significant direct effect between openness and stress found. Similarly, a study conducted by Kocjan et al. (2021) found an indirect effect on openness and stress through resilience and suggested that high openness may lead to seeking more resources to better respond to stressful situations. Likewise, the present study indicates that high openness does not directly reduce perceived stress unless it leads to effective coping strategies (e.g., active coping). This is likely because they feel they have more resources at their disposal to better combat the problem (Chu et al., 2015). Findings, therefore, also contribute to the literature that underlines the significance of mediators, particularly coping, in the relationship between personality and stress levels (e.g., Ebstrup et al., 2011).

Due to contrasting findings between Luo et al. (2022), Saleh et al. (2017), and the current study, conducting an in-depth study on openness and stress which incorporates multiple mediators (e.g., self-efficacy) in addition to coping may be beneficial to clarify the connection between openness and stress. Additionally, a study comparing all five personality traits with active coping may prove advantageous in personalising interventions for stress reduction through coping. These insights may help design interventions to alleviate perceived stress among university students by enhancing coping strategies and resilience to stress while incorporating their personal strengths and weaknesses (Chen et al., 2022).

Indirect Mediation

The result of an indirect mediation may be controversial, considering that traditional views on mediation analyses suggest that there can be no mediation if the direct effect is insignificant (e.g., Baron & Kenny, 1986; Schuler et al., 2024). However, more modern approaches disagree and extend traditional mediation by focusing on broader identification strategies based on the potential outcome framework (Huber, 2019). For instance, Schuler et al. (2024) explain that causal mediation, a broader framework in which indirect mediation is possible, distinguishes between three steps. First, the definition of causal effects (i.e., the difference between two potential outcomes), their identification, as well as their estimation. Modern mediation theories emphasise the significance and indications of an indirect effect.

Igartua and Hayes (2021) explain that the outcome of neither the total effect nor the direct effect is relevant if the hypothesis is concerned with mediation. They elaborate that modern mediation focuses on the statistical inference of, in this case, the associations between openness and active coping (a), as well as active coping and perceived stress (b). Additionally, the bootstrap confidence interval used in the current study to test mediation is the strongest and preferred test when varying results are present (Hayes and Scharkow, 2013). Thus, despite a missing significant direct effect, findings agree with modern mediation theories, which acknowledge a significant indirect effect. An example of this in practice is Nemtcan et al. (2020) who looked at self-efficacy as a mediator for the relationship between time management skills and attrition intentions (i.e., drop-out and transfer intentions). The indirect effect between openness and perceived stress through active coping is, therefore, an acceptable mediation. However, to further validate the present findings, a replication study with a bigger sample is suggested.

Strengths

A strength of this study was that the findings provide a foundation for future research on the role that active coping plays in the relationship between openness and perceived stress. Moreover, it adds to the literature on the significance of indirect-only mediation, as well as mediators' roles in stress and openness. Active coping specifically has not been investigated with personality and stress, which fills a gap in the literature and reveals a clear relationship between active coping and stress (e.g., Bakhtiar and Asriani, 2015; Chao, 2011). Considering its positive effect in mitigating the experience of stress, insights on active coping may be crucial in helping university students better manage stress. Additionally, the current study adds to more modern approaches to mediation, which highlight the relevance and implications of indirect mediation (e.g., Hayes and Scharkow, 2013).

Lastly, the current study used scales with good psychometric properties. The Big Five Inventory and the Perceived Stress Scale are both reliable and validated measures. Accordingly, it can be assumed that the data accurately reflects the subject's level of stress and openness at the time of data collection.

Limitations

In contrast, a limitation identified was that a convenience sample was used, which may yield biased results. Therefore, the sample may not be representative and limit generalisability. The sample consisted of mainly females and was distributed within interconnected networks. Considering differing levels of openness were found for gender or study programs in existing literature, it may be worthwhile for future research to include these constructs when examining

the relationship between personality, coping, and perceived stress (Kaufman et al., 2015; Kawamoto et al., 2015).

Furthermore, this study was a one-time measure, through which causality cannot be established. Therefore, this report can only indicate associations, rather than a relationship between variables. To account for this limitation, future research could conduct a longitudinal study throughout a semester, measuring stress levels, stressors, and coping strategies at different points in time.

Finally, when checking the reliability of scales within the current dataset, the reliability of active coping was questionable. However, other studies showed good reliability (e.g., Halamová et al., 2022). Nevertheless, inaccuracies regarding active coping at the time of data collection may be present. This may be due to the size of the scale, as it only consists of four items.

Conclusion

The purpose of this study was to investigate openness and stress with active coping as a mediator. Although no total effect was established, the associations with active coping were significant (i.e., O_AC and AC_PSS). An indirect mediation through active coping suggests that high openness does not reduce perceived stress unless it leads to appropriate coping strategies. An indirect mediation effect is in line with modern mediation theories, which do not require a total or direct effect to accept the mediation. This fills a gap in the literature on active coping in relation to personality and especially perceived stress. Findings on active coping may help mental health professionals better support university students, particularly those high in openness, with stress management. Interventions on enhancing the use of active coping could help mitigate perceived stress, as well as the problems associated with excessive stress. Future research could include further mediators in the relationship between openness and perceived stress. This research could also be broadened to include all five personality traits to establish their relationship to active coping before introducing further mediators. Finally, findings may be beneficial in developing preventative programs for university students, like an intervention focusing on enhancing coping strategies among university students. Effective coping strategies could be selected and enhanced to provide personalised support, according to students' dominant personality traits. Furthermore, a replication study with a bigger sample with attention to gender and study program may be beneficial to validate current findings and account for limitations.

References

- Abrams, D. B., Turner, J. R., Baumann, L. C., Karel, A., Collins, S. E., Witkiewitz, K., Fulmer, T., Tanenbaum, M. L., Commissariat, P., Kupperman, E., Baek, R. N., Gonzalez, J. S., Brandt, N., Flurie, R., Heaney, J., Kline, C., Carroll, L., Upton, J., Buchain, P. C., . . . Wiebe, D. J. (2013). Active coping. In *Springer eBooks* (p. 21). https://doi.org/10.1007/978-1-4419-1005-9_1085
- Afshar H, Roohafza HR, Keshteli AH, Mazaheri M, Feizi A, Adibi P. (2015). The association of personality traits and coping styles according to stress level. *Journal of Research in Medical Sciences*. 20(4), 353-8. PMID: 26109990; PMCID: PMC4468450.
- Akeman, E., Cannon, M. J., Kirlic, N., Cosgrove, K. T., DeVille, D. C., McDermott, T. J., White, E. J., Cohen, Z. P., Forthman, K. L., Paulus, M. P., & Aupperle, R. L. (2022). Active coping strategies and less pre-pandemic alcohol use relate to college student mental health during the COVID-19 pandemic. *Frontiers in Psychology*, 13. <https://doi.org/10.3389/fpsyg.2022.926697>
- Alansari, B. (2016). The Big Five Inventory (BFI): Reliability and validity of its Arabic translation in non clinical sample. *European Psychiatry*, 33(S1), S209–S210. <https://doi.org/10.1016/j.eurpsy.2016.01.500>
- Algorani, E. B., & Gupta, V. (2023, April 24). *Coping mechanisms*. StatPearls - NCBI Bookshelf. <https://www.ncbi.nlm.nih.gov/books/NBK559031/#:~:text=Coping%20is%20defined%20as%20the,which%20aim%20to%20reduce%20or>
- APA Dictionary of Psychology*. (n.d.-a). <https://dictionary.apa.org/stressor>
- APA Dictionary of Psychology*. (n.d.-b). <https://dictionary.apa.org/coping-strategy>
- APA Dictionary of Psychology*. (n.d.-c). <https://dictionary.apa.org/active-coping>
- Asif, S., Muddassar, A., Shahzad, T. Z., Raouf, M., & Pervaiz, T. (2020). Frequency of depression, anxiety and stress among university students. *Pakistan Journal of Medical Sciences*, 36(5). <https://doi.org/10.12669/pjms.36.5.1873>
- Bakhtiar, M. I., & Asriani, A. (2015). Efektivitas Strategi Problem Focused Coping Dan Emotion Focused Coping Dalam Meningkatkan Pengelolaan Stress Siswa Di Sma Negeri 1 Barru. *Guidena*, 5(2), 69. <https://doi.org/10.24127/gdn.v5i2.320>
- Baron, R. M., & Kenny, D. A. (1986). The moderator–mediator variable distinction in social psychological research: Conceptual, strategic, and statistical considerations. *Journal of Personality and Social Psychology*, 51(6), 1173–1182. <https://doi.org/10.1037/0022-3514.51.6.1173>

- Bellingtier, J. A., Mund, M., & Wrzus, C. (2021). The role of extraversion and neuroticism for experiencing stress during the third wave of the COVID-19 pandemic. *Current Psychology*, 42(14), 12202–12212. <https://doi.org/10.1007/s12144-021-02600-y>
- Böke, B. N., Mills, D. J., Mettler, J., & Heath, N. L. (2019). Stress and coping patterns of university students. *Journal of College Student Development*, 60(1), 85–103. <https://doi.org/10.1353/csd.2019.0005>
- Cardoso, J. V., Gomes, C. F. M., Pereira, R. J., & Da Silva, D. A. (2019). Estresse em estudantes universitários: uma abordagem epidemiológica. *Journal of Nursing UFPE on Line*, 13. <https://doi.org/10.5205/1981-8963.2019.241547>
- Carver, C. S., & Connor-Smith, J. K. (2010). Personality and coping. *Annual Review of Psychology*, 61(1), 679–704. <https://doi.org/10.1146/annurev.psych.093008.100352>
- Carver, C. S., Scheier, M. F., & Weintraub, J. K. (1989). Assessing coping strategies: A theoretically based approach. *Journal of Personality and Social Psychology*, 56(2), 267–283. <https://doi.org/10.1037/0022-3514.56.2.267>
- Chai, M. S., & Low, C. S. (2015). Personality, coping and stress among university students. *American Journal of Applied Psychology*, 4(3), 33. <https://doi.org/10.11648/j.ajap.s.2015040301.16>
- Chao, R. C. (2011). Managing stress and maintaining well-being: Social support, problem-focused coping, and avoidant coping. *Journal of Counseling and Development*, 89(3), 338–348. <https://doi.org/10.1002/j.1556-6678.2011.tb00098.x>
- Chen, L., Qu, L., & Hong, R. Y. (2022). Pathways linking the Big Five to psychological distress: Exploring the mediating roles of stress mindset and coping flexibility. *Journal of Clinical Medicine*, 11(9), 2272. <https://doi.org/10.3390/jcm11092272>
- Cheung, K., Ng, J., Tsang, H., Pang, K. K. L., Wan, C. L. J., & Moser, K. (2020). Factors affecting direct and transfer entrants' active coping and satisfaction with the University. *International Journal of Environmental Research and Public Health / International Journal of Environmental Research and Public Health*, 17(8), 2803. <https://doi.org/10.3390/ijerph17082803>
- Chu, X., Ma, Z., Li, Y., & Han, J. (2015). Openness, conscientiousness, extraversion, stressor and psychological stress response. *International Journal of Business Administration*, 6(4). <https://doi.org/10.5430/ijba.v6n4p11>
- Cohen, S., Kamarck, T., & Mermelstein, R. (1983). A global measure of perceived stress. *Journal of Health and Social Behavior*, 24(4), 385. <https://doi.org/10.2307/2136404>

- Denissen, J. J. A., Geenen, R., Van Aken, M. a. G., Gosling, S. D., & Potter, J. (2008). Development and validation of a Dutch translation of the Big Five Inventory (BFI). *Journal of Personality Assessment, 90*(2), 152–157. <https://doi.org/10.1080/00223890701845229>
- Ebstrup, J. F., Eplov, L. F., Pisinger, C., & Jørgensen, T. (2011). Association between the Five Factor personality traits and perceived stress: is the effect mediated by general self-efficacy? *Anxiety, Stress, and Coping/Anxiety, Stress & Coping, 24*(4), 407-419. <https://doi.org/10.1080/10615806.2010.540012>
- Freire, C., Del Mar Ferradás, M., Regueiro, B., Rodríguez, S., Valle, A., & Núñez, J. C. (2020). Coping strategies and self-efficacy in university students: A person-centered approach. *Frontiers in Psychology, 11*. <https://doi.org/10.3389/fpsyg.2020.00841>
- Halamová, J., Kanovský, M., Krizova, K., Greškovičová, K., Strnádelová, B., & Baránková, M. (2022). The factor structure and external validity of the COPE 60 inventory in Slovak translation. *Frontiers in Psychology, 12*. <https://doi.org/10.3389/fpsyg.2021.800166>
- Hayes, A. F., & Scharkow, M. (2013). The relative trustworthiness of inferential tests of the indirect effect in statistical mediation analysis. *Psychological Science, 24*(10), 1918–1927. <https://doi.org/10.1177/0956797613480187>
- Hsieh, H., Zimmerman, M. A., Xue, Y., Bauermeister, J. A., Caldwell, C. H., Wang, Z., & Hou, Y. (2014). Stress, active coping, and problem behaviors among Chinese adolescents. *American Journal of Orthopsychiatry, 84*(4), 364–376. <https://doi.org/10.1037/h0099845>
- Huber, M. (2019). A review of causal mediation analysis for assessing direct and indirect treatment effects. *FSES Working Papers*. <https://ideas.repec.org/p/fri/fribow/fribow00500.html>
- Igartua, J., & Hayes, A. F. (2021). Mediation, moderation, and conditional process analysis: concepts, computations, and some common confusions. *The Spanish Journal of Psychology, 24*. <https://doi.org/10.1017/sjp.2021.46>
- John, O. P., & Srivastava, S. (1999). The Big-Five trait taxonomy: History, measurement, and theoretical perspectives. In L. A. Pervin & O. P. John (Eds.), *Handbook of personality: Theory and research* (Vol. 2, pp. 102–138). New York: Guilford Press.
- Kaufman, S. B., Quilty, L. C., Grazioplene, R. G., Hirsh, J. B., Gray, J. R., Peterson, J. B., & DeYoung, C. G. (2015). Openness to experience and intellect differentially predict creative achievement in the arts and sciences. *Journal of Personality, 84*(2), 248–258. <https://doi.org/10.1111/jopy.12156>

- Kawamoto, T., Oshio, A., Abe, S., Tsubota, Y., Hirashima, T., Ito, H., & Tani, I. (2015, June 1). *Age and Gender Differences of Big Five Personality Traits in a Cross-Sectional Japanese Sample*. | *Japanese Journal of Developmental Psychology / Hattatsu Shinrigaku Kenkyū* | EBSCOhost.
<https://openurl.ebsco.com/EPDB%3Aagcd%3A12%3A7678508/detailv2?sid=ebsco%3Aplink%3Ascholar&id=ebsco%3Aagcd%3A108400723&crl=c>
- Kocjan, G. Z., Kavčič, T., & Avsec, A. (2021). Resilience matters: Explaining the association between personality and psychological functioning during the COVID-19 pandemic. *International Journal of Clinical Health Psychology*, 2(1), 00198.
<https://doi.org/10.1016/j.ijchp.2020.08.002>
- Lee, E. (2012). Review of the psychometric evidence of the perceived stress scale. *Asian Nursing Research*, 6(4), 121–127. <https://doi.org/10.1016/j.anr.2012.08.004>
- Li, M. (2008). Helping college students cope: Identifying predictors of active coping in different stressful situations. *Research Gate*. <https://www.researchgate.net/publication/237284239>
- Litman, J. A. (2006). The COPE inventory: Dimensionality and relationships with approach- and avoidance-motives and positive and negative traits. *Personality and Individual Differences*, 41(2), 273–284. <https://doi.org/10.1016/j.paid.2005.11.032>
- Luo, J., Zhang, B., Cao, M., & Roberts, B. W. (2022). The stressful personality: A meta-analytical review of the relation between personality and stress. *Personality and Social Psychology Review*, 27(2), 128–194.
<https://doi.org/10.1177/10888683221104002>
- Meléndez, J. C., Satorres, E., & Delhom, I. (2020). Personality and coping. What traits predict adaptive strategies? *Directory of Open Access Journals*.
<https://doi.org/10.6018/analesps.36.1.349591>
- Nemtcan, E., Sæle, R. G., Gamst-Klaussen, T., & Svartdal, F. (2020). Drop-out and Transfer-Out Intentions: The role of Socio-Cognitive Factors. *Frontiers in Education*, 5.
<https://doi.org/10.3389/educ.2020.606291>
- Ribeiro, Í. J. S., Pereira, R., Freire, I. V., De Oliveira, B. G., Casotti, C. A., & Boery, E. N. (2018). Stress and quality of life among university students: A systematic literature review. *Health Professions Education*, 4(2), 70–77.
<https://doi.org/10.1016/j.hpe.2017.03.002>
- Saleh, D., Romo, L., & Camart, N. (2017). Is perceived stress of French university students related to personality traits? *Psychology Research* 7(1).
<https://doi.org/10.17265/2159-5542/2017.01.004>

- Schuler, M. S., Coffman, D. L., Stuart, E. A., Nguyen, T. Q., Vegetabile, B., & McCaffrey, D. F. (2024). Practical challenges in mediation analysis: a guide for applied researchers. *Health Services and Outcomes Research Methodology*.
<https://doi.org/10.1007/s10742-024-00327-4>
- Shields, N. (2001). Stress, active coping, and academic performance among persisting and nonpersisting college students. *Journal of Applied Biobehavioral Research*, 6(2), 65–81. <https://doi.org/10.1111/j.1751-9861.2001.tb00107.x>
- Slimmen, S. R., Timmermans, O., Mikołajczak-Degrauwe, K., & Oenema, A. (2022). How stress-related factors affect mental wellbeing of university students: A cross-sectional study to explore the associations between stressors, perceived stress, and mental wellbeing. *PLOS ONE*, 17(11), e0275925.
- Stallman, H. M., & Hurst, C. (2016). The university stress scale: Measuring domains and extent of stress in university students. *Australian Psychologist*, 51(2), 128–134.
<https://doi.org/10.1111/ap.12127>
- Struthers, C. W., Perry, R. P., & Menec, V. (2000). An examination of the relationship among academic stress, coping, motivation, and performance in college. *Research in Higher Education*, 41(5), 581–592. <https://doi.org/10.1023/a:1007094931292>
- Uliaszek, A. A., Zinbarg, R. E., Mineka, S., Craske, M. G., Sutton, J. M., Griffith, J. W., Rose, R., Waters, A., & Hammen, C. (2010). The role of neuroticism and extraversion in the stress–anxiety and stress–depression relationships. *Anxiety, Stress, and Coping/Anxiety, Stress & Coping*, 23(4), 363–381. <https://doi.org/10.1080/10615800903377264>
- Wang, Y., Wang, X., Wang, X., Guo, X., Yuan, L., Gao, Y., & Pan, B. (2023). Stressors in university life and anxiety symptoms among international students: a sequential mediation model. *BMC Psychiatry*, 23(1). <https://doi.org/10.1186/s12888-023-05046-7>
- Williams, P.G., Rau, H. K., Cribbet, M. R., & Gunn, H. E. (2009). Openness to experience and stress regulation. *Journal of Research in Personality*, 43(5), 777–784.
<https://doi.org/10.1016/j.jrp.2009.06.003>
- World Health Organization. (2022, June 17). *Stress*. <https://www.who.int/news-room/questions-and-answers/item/stress#:~:text=Stress%20can%20be%20defined%20as,experiences%20stress%20to%20some%20degree.>
- Worrell, F. C., & Cross, W. E. (2004). The reliability and validity of Big Five inventory scores with African American college students. *Journal of Multicultural Counseling and Development*, 32(1), 18–32. <https://doi.org/10.1002/j.2161-1912.2004.tb00358.x>

Appendix A. Informed Consent

Informed consent for the study: “Stress in University Students: Focus on personality, academic performance, social support & coping”

You are being invited to participate in a research study titled “**Stress in University Students: Focus on personality, academic performance, social support & coping**”. This study is administered by **Elan Bozhkov, Anna-Katharina Dudde, Jana Milke** under the supervision of **Thomas Vaessen** from the Faculty of Behavioural, Management and Social Sciences at the University of Twente.

The purpose of this research study is to inspect the relationship between stress and other variables including personality, academic performance, coping, and social support. The study will take you approximately 20 minutes to complete. The data will be used for an academic report.

Your participation in this study is entirely voluntary and you can withdraw at any time.

We believe there are no known risks associated with this research study; however, as with any online-related activity, the risk of a breach is always possible. To the best of our ability, your answers in this study will remain confidential amongst the project members. We will minimise any risks by **anonymizing all answers of the participants and deleting the results two years after the study is completed.**

Study contact details for further information:

Elan Bozhkov – e.bozhkov@student.utwente.nl Anna-Katharina Dudde – a.m.dudde@student.utwente.nl Jana Milke – j.milke@student.utwente.nl

Taking part in the study

I have read and understood the study information dated between 25.03.2024 and 31.05.2024, or it has been read to me.

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

I understand that taking part in the study involves answering the questions and that the responses to those questions will be saved and used for an academic report.

Use of the information in the study

I understand that the information I provide will be used for an academic report.

I understand that personal information collected about me that can identify me, such as [e.g. my name or where I live], will not be shared beyond the study team.

Future use and reuse of the information by others

I give permission for the **anonymized answers** that I provide to be archived in the project member's database for two years, so it can be used for future research and learning.

Please tick the appropriate box, whether you agree with the above statements and give your consent. By ticking "Yes", you are giving your informed consent.

Yes No

Appendix B. Questionnaire

Demographics

What is your age? (in numbers)

What do you identify as?

What is your nationality?

What is your education level?

Big Five Personality Inventory (Openness subscale)

I see myself as someone who...

1. Is original, comes up with new ideas
2. Is curious about many different things
3. Is ingenious, a deep thinker
4. Has an active imagination
5. Is inventive
6. Values artistic, aesthetic experiences
7. Prefers work that is routine
8. Likes to reflect, play with ideas
9. Has a few artistic interests
10. Is sophisticated in art, music, or literature

Perceived Stress Scale

1. In the last month, how often have you been upset because of something that happened unexpectedly?
2. In the last month, how often have you felt that you were unable to control the important things in your life?
3. In the last month, how often have you felt nervous and “stressed”?
4. In the last month, how often have you felt confident about your ability to handle your personal problems?
5. In the last month, how often have you felt that things were going your way?
6. In the last month, how often have you found that you could not cope with all the things that you had to do?
7. In the last month, how often have you been able to control irritations in your life?
8. In the last month, how often have you felt that you were on top of things?

9. In the last month, how often have you been angered because of things that were outside of your control?
10. In the last month, how often have you felt difficulties were piling up so high that you could not overcome them?

COPE Inventory (Active coping subscale)

1. I concentrate my efforts on doing something about it.
2. I take additional action to try to get rid of the problem.
3. I take direct action to get around the problem.
4. I do what has to be done, one step at a time.

Appendix C. Code for Analysis in R

```
#Bachelor Analysis
library(tidyverse)
library(ggplot2)
library(lmtest)
library(broom)
library(dplyr)
library(psych)
library(car)
library(ggplot2)
library(mediation)
library(htmltools)
library(Hmisc)

setwd("/Users/a-k/Desktop/M12 (Bachelor)/Analysis ")
data1 <- read.csv("Bachelor Dataset.csv")

#DATA CLEANING
#Removing columns (i.e. extra info)
data2 <- subset(data1, select = -c(StartDate, EndDate, Status, IPAddress,
Duration..in.seconds., UserLanguage))

#Renaming variables
data5 <- data2 %>%
  rename(
    Consent = Q2,
    Age = Q3,
    Gender = Q4,
    Nationality = Q5,
    Nationality_Text = Q5_3_TEXT,
    Education = Q6
  )

#Remove participants with progress less than 72
```

```

data6 <- data5[data5$Progress >= 72 | data5$Progress == 100, ]

#Remove first rows due to outliers (not really part of the data (preview, question, etc.))
data7<- data6[-c(1, 2, 3, 4), ]

# Create a mapping of response categories to numeric values
response_mapping <- c("Not at all true" = 1, "Hardly true" = 2, "Moderately true" = 3,
"Exactly true" = 4)

#Recode categorical answers into numerical values
data8 <- data7 %>%
  mutate_at(vars(Q7_5:Q10_11), ~ recode(., "Strongly disagree" = 1, "Disagree a little" = 2,
"Neither agree nor disagree" = 3, "Agree a little" = 4, "Strongly agree" = 5))%>%
  mutate_at(vars(Q11_1:Q11_10), ~ recode(., "Never" = 0, "Almost never" = 1, "Sometimes"
= 2, "Fairly often" = 3, "Very often" = 4))%>%
  mutate_at(vars(Q12_1:Q13_10), ~ recode(., "I usually don't do this at all" = 1, "I usually do
this a little bit" = 2, "I usually do this a medium amount" = 3, "I usually do this a lot" = 4))

#Reverse score 2 items of Openness, PSS
items_to_reverse <- c("Q10_2", "Q10_8","Q11_4", "Q11_5", "Q11_7", "Q11_8")
data9 <- data8 %>%
  mutate(
    across(all_of(items_to_reverse), ~ max(.) + 1 - .)
  )
#Calculate sum scores for Openness
DataSum1 <- data9 %>%
  mutate(
    SumOpenness = rowSums(across(c(Q7_5, Q7_10, Q8_4, Q8_9, Q9_3, Q9_8, Q10_2,
Q10_7, Q10_8, Q10_11)), na.rm = TRUE)
  )

#Calculate sum scores for PSS
DataSum2 <- DataSum1 %>%
  mutate(

```

```

SumPSS = rowSums(across(Q11_1:Q11_10), na.rm = TRUE)
)

#Calculate sum scores for active coping
DataSum3 <- DataSum2 %>%
  mutate(
    SumAC = rowSums(across(c(Q12_2, Q12_8, Q13_6, Q13_10)), na.rm = TRUE)
  )

#(Calculate sum problem-focused coping )
DataSum4 <- DataSum3 %>%
  mutate(
    SumProblemCoping = rowSums(across(Q12_1:Q13_10), na.rm = TRUE)
  )

#Remove participants who did not give their consent
FinalDataset <- DataSum4 %>%
  filter(Consent == "I agree to take part in this survey study.")

#RELIABILITY TESTING
#Reliability testing Subscale Openness
Openness <- FinalDataset[, c("Q7_5", "Q7_10", "Q8_4", "Q8_9", "Q9_3", "Q9_8", "Q10_2",
"Q10_7", "Q10_8", "Q10_11")]
alpha_resultO <- psych::alpha(Openness)
alpha_valueO <- alpha_resultO$total$raw_alpha
print(alpha_valueO)

#Reliability testing subscale Active coping
AC <- FinalDataset[, c("Q12_2", "Q12_8", "Q13_6", "Q13_10")]
alpha_resultAC <- psych::alpha(AC)
alpha_valueAC <- alpha_resultAC$total$raw_alpha
print(alpha_valueAC)

```

```

#Reliability testing subscale PSS
PSS <- FinalDataset[, c("Q11_1", "Q11_2", "Q11_3", "Q11_4", "Q11_5", "Q11_6",
"Q11_7", "Q11_8", "Q11_9", "Q11_10")]
alpha_resultPSS <- psych::alpha(PSS)
alpha_valuePSS <- alpha_resultPSS$total$raw_alpha
print(alpha_valuePSS)

#(Reliability testing problem-focused coping)
PFC <- FinalDataset[, c("Q12_1", "Q12_2", "Q12_3", "Q12_4", "Q12_5", "Q12_6",
"Q12_7", "Q12_8", "Q12_9", "Q12_10", "Q13_1", "Q13_2", "Q13_3", "Q13_4", "Q13_5",
"Q13_6", "Q13_7", "Q13_8", "Q13_9", "Q13_10")]
alpha_resultPFC <- psych::alpha(PFC)
alpha_valuePFC <- alpha_resultPFC$total$raw_alpha
print(alpha_valuePFC)

#DESCRIPTIVE STATISTICS
#Mean & SD Openness
mean_SumOpenness <- mean(FinalDataset$SumOpenness, na.rm = TRUE)
print(mean_SumOpenness)
SD_SumOpenness <- sd(FinalDataset$SumOpenness, na.rm = TRUE)
print(SD_SumOpenness)

#Mean & SD Active coping
mean_SumAC <- mean(FinalDataset$SumAC, na.rm = TRUE)
print(mean_SumAC)
SD_SumAC <- sd(FinalDataset$SumAC, na.rm = TRUE)
print(SD_SumAC)

#Mean & SD PSS
mean_SumPSS <- mean(FinalDataset$SumPSS, na.rm = TRUE)
print(mean_SumPSS)
SD_SumPSS <- sd(FinalDataset$SumPSS, na.rm = TRUE)
print(SD_SumPSS)

```

```

#Correlation coefficient Openness & AC
correlation_coefficient_O_AC <- cor(Openness, AC)
mean_correlation_O_AC <- mean(correlation_coefficient_O_AC)
print(mean_correlation_O_AC)

#Correlation coefficient Openness & PSS
correlation_coefficient_O_PSS <- cor(Openness, PSS)
mean_correlation_O_PSS <- mean(correlation_coefficient_O_PSS)
print(mean_correlation_O_PSS)

#Correlation coefficient AC & PSS
correlation_coefficient_AC_PSS <- cor(AC, PSS)
mean_correlation_AC_PSS <- mean(correlation_coefficient_AC_PSS)
print(mean_correlation_AC_PSS)

#ASSUMPTION TESTING
#Assumption testing for Openness & PSS
#Linearity -> Scatterplot
plot(FinalDataset$SumOpenness, FinalDataset$SumPSS,
     xlab = "SumOpenness",
     ylab = "SumPSS",
     main = "Scatterplot of Openness vs. PSS")
#Scatterplot with line + different visuals
ggplot(FinalDataset, aes(x = SumOpenness, y = SumPSS)) +
  geom_point() +
  theme(panel.grid.major = element_blank(), panel.grid.minor = element_blank()) +
  theme(plot.background = element_blank(), panel.background = element_blank()) +
  geom_smooth(method = "lm", se = FALSE)

#Scatterplot with smoother
ggplot(FinalDataset, aes(x = SumOpenness, y = SumPSS)) +
  geom_point() +
  geom_smooth(method = "loess")

```



```
#Scatterplot residuals vs. predicted values (relevant for linearity, equal variance AND
independence)
#Fit linear model
model_O_PSS <- lm(SumPSS ~ SumOpenness, data = FinalDataset)
summary(model_O_PSS)
#Obtain residuals
residuals_O_PSS <- resid(model_O_PSS)
#Obtain predicted values
predicted_O_PSS <- predict(model_O_PSS)
#(Create scatterplot of residuals vs. predicted values)
plot(predicted_O_PSS, residuals_O_PSS, main = "Residuals vs. Predicted Values", xlab =
"Predicted Values", ylab = "Residuals")

#Additionally for equal variance, the Breusch-Pagan test was run
bptest(model_O_PSS)

#Independence -> The Durbin-Watson test
durbinWatsonTest(residuals_O_PSS)

#Check for normality -> histogram
hist(residuals_O_PSS, main = "Histogram of Residuals", xlab = "Residuals")

#Additionally for normality: Shapiro-Wilk test
shapiro.test(residuals_O_PSS)

#Assumptions testing for Openness & Active coping (AC)
#Linearity -> #Linearity -> Scatterplot
plot(FinalDataset$SumOpenness, FinalDataset$SumAC,
     xlab = "SumOpenness",
     ylab = "SumAC",
     main = "Scatterplot of Openness vs. AC")
```

```

#Scatterplot with line + different visuals
ggplot(FinalDataset, aes(x = SumOpenness, y = SumAC)) +
  geom_point() +
  theme(panel.grid.major = element_blank(), panel.grid.minor = element_blank()) +
  theme(plot.background = element_blank(), panel.background = element_blank()) +
  geom_smooth(method = "lm", se = FALSE)

# Scatterplot with smoother
ggplot(FinalDataset, aes(x = SumOpenness, y = SumAC)) +
  geom_point() +
  geom_smooth(method = "loess")

#Scatterplot residuals vs. predicted values (relevant for linearity, equal variance AND
independence)
#Fit linear model
model_O_AC <- lm(SumAC ~ SumOpenness, data = FinalDataset)
#Obtain residuals
residuals_O_AC <- resid(model_O_AC)
#Obtain predicted values
predicted_O_AC <- predict(model_O_AC)
#Create scatterplot of residuals vs. predicted values
plot(predicted_O_AC, residuals_O_AC, main = "Residuals vs. Predicted Values", xlab =
"Predicted Values", ylab = "Residuals")

#Additionally for equal variance, the Breusch-Pagan test was run
bptest(model_O_AC)

#Independence -> The Durbin-Watson test
durbinWatsonTest(residuals_O_AC)

#Check for normality -> histogram
hist(residuals_O_AC, main = "Histogram of Residuals", xlab = "Residuals")

```

```

#Additionally for normality: Shapiro-Wilk test
shapiro.test(residuals_O_AC)

#Assumption testing Active coping & Stress
#Linearity -> Scatterplot
plot(FinalDataset$SumAC, FinalDataset$SumPSS,
     xlab = "SumAC",
     ylab = "SumPSS",
     main = "Scatterplot of Active coping vs. PSS")
#Scatterplot with line + different visuals
ggplot(FinalDataset, aes(x = SumAC, y = SumPSS)) +
  geom_point() +
  theme(panel.grid.major = element_blank(), panel.grid.minor = element_blank()) +
  theme(plot.background = element_blank(), panel.background = element_blank()) +
  geom_smooth(method = "lm", se = FALSE)

# Scatterplot with smoother
ggplot(FinalDataset, aes(x = SumAC, y = SumPSS)) +
  geom_point() +
  geom_smooth(method = "loess")

#Scatterplot residuals vs. predicted values (relevant for linearity, equal variance AND
independence)
#Fit linear model
model_AC_PSS <- lm(SumPSS ~ SumAC, data = FinalDataset)
#Obtain residuals
residuals_AC_PSS <- resid(model_AC_PSS)
#Obtain predicted values
predicted_AC_PSS <- predict(model_AC_PSS)
#Create scatterplot of residuals vs. predicted values
plot(predicted_AC_PSS, residuals_AC_PSS, main = "Residuals vs. Predicted Values", xlab =
"Predicted Values", ylab = "Residuals")

```

```

#Additionally for equal variance, the Breusch-Pagan test was run
bptest(model_AC_PSS)

#Independence -> The Durbin-Watson test
durbinWatsonTest(residuals_AC_PSS)

#Check for normality -> histogram
hist(residuals_AC_PSS, main = "Histogram of Residuals", xlab = "Residuals")

#Additionally for normality: Shapiro-Wilk test
shapiro.test(residuals_AC_PSS)

#Participant data (gender, nationality, education)
gender_counts <- table(FinalDataset$Gender)
print(gender_counts)
nationality_counts <- table(FinalDataset$Nationality)
print(nationality_counts)
education_counts <- table(FinalDataset$Education)
print(education_counts)
age_counts <- table(FinalDataset$Age)
print(age_counts)
FinalDataset$Age <- as.numeric(FinalDataset$Age)
FinalDataset %>% summarise(mean = mean(Age, na.rm = TRUE), sd = sd(Age, na.rm =
TRUE))

#ANALYSES
# Transform SumOpenness to meet linearity requirements
FinalDataset$Log_SumOpenness <- log(FinalDataset$SumOpenness)

#Hypothesis 1
# Linear regression analysis adjusted Openness & PSS
model_adjO_PSS <- lm(SumPSS ~ Log_SumOpenness, data = FinalDataset)
summary(model_adjO_PSS)
confint(model_adjO_PSS)

```

```
#Hypothesis 2
```

```
#Linear regression for adjusted Openness and AC
```

```
model_adjO_AC <- lm(SumAC ~ Log_SumOpenness, data = FinalDataset)
```

```
summary(model_adjO_AC)
```

```
confint(model_adjO_AC)
```

```
#Hypothesis 3
```

```
#Linear regression for AC & PSS
```

```
model_AC_PSS <- lm(SumPSS ~ SumAC, data = FinalDataset)
```

```
summary(model_AC_PSS)
```

```
confint(model_AC_PSS)
```

```
#Hypothesis 4
```

```
#Mediation analysis -> non-parametric mediation analysis using 'process' file
```

```
process (data = FinalDataset, y = "SumPSS", x = "SumOpenness", m = "SumAC", model = 4)
```

Appendix D. Assumption Testing Results

Figure 3

Scatterplot of O_PSS

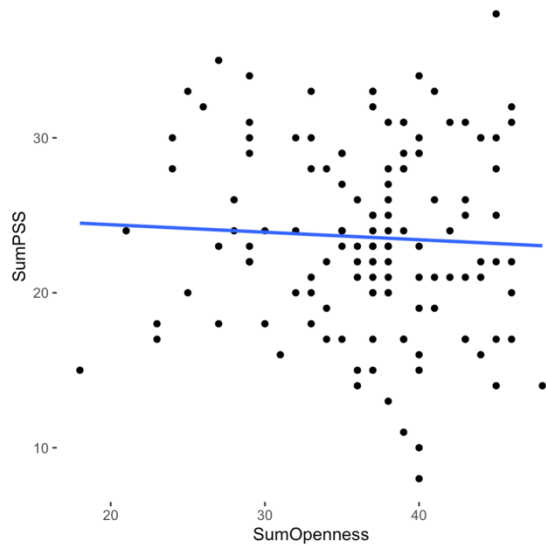


Figure 4

Scatterplot of O_AC

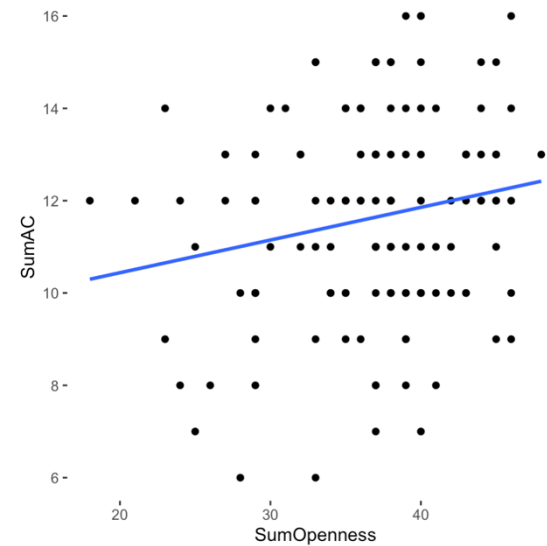


Table 7

Statistical test results to confirm homoscedasticity, independence, and normality

	Breusch-Pagan test	Durbin-Watson test	Shapiro-Wilk test
O_PSS	BP = 0.85 p-value = 0.36	$d = 1.84$	W = 0.99 p-value = 0.31
O_AC	BP = 0.39 p-value = 0.53	$d = 1.89$	W = 0.99 p-value = 0.27
AC_PSS	BP = 3.74 p-value = >0.05	$d = 1.81$	W = 0.99 p-value = 0.27