Cross-Sectional Study Examining the Relationship between Stress, Mental Well-Being and Academic Self-Efficacy in University Students

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Abstract

Background. In recent years, the mental health of university students has become an increasing concern, as low levels of mental well-being have become more prevalent and severe. This is partly due to the COVID-19 pandemic. One factor negatively associated with mental well-being is stress. Previous research has proposed that self-efficacy might mediate this relationship. As self-efficacy is task-dependent, this paper will specifically focus on the role of academic self-efficacy while focusing on university students.

Aims. This paper aims to investigate the relationships between stress, mental well-being and academic self-efficacy, particularly a potential mediating effect of self-efficacy on the relationship between stress and mental well-being. Thereby, a gap in research investigating this effect after the COVID-19 pandemic is filled.

Methods. These relationships were investigated with a cross-sectional study design. A total of 118 eligible participants were recruited through SONA and social media and had to fill in an online questionnaire consisting of self-report measures. Stress was measured using the Student Life Challenges (SLC), mental well-being was measured with the Mental Health Continuum – Short Form (MHC-SF) and academic self-efficacy was measured using the General Academic Self-Efficacy Scale (GASE). The relationships were investigated by calculating Pearson correlation coefficients and conducting a simple linear regression analysis and a mediation analysis using PROCESS written by Andrew F. Heyes.

Results. Negative relationships between stress and mental well-being and between stress and ASE and a positive relationship between ASE and mental well-being were found. Additionally, results suggest a partial mediation through ASE for the relationship between stress as independent variable and mental well-being as dependent variable. No changes in this relationship to before the pandemic were found.

Conclusions. Investigating the relationships between stress, mental well-being and ASE in university students was particularly interesting considering the increasing levels of stress and the decreasing levels of mental well-being among university students.

Keywords: mental well-being, stress, academic self-efficacy, university students, linear regression, mediation, PROCESS

Cross-Sectional Study Examining the Relationship between Stress, Mental Well-Being and Academic Self-Efficacy in University Students

University students are particularly susceptible to stress compared to the general public, due to stressors intrinsic to student life, including workload, exams, or financial concerns (Denovan & Macaskill, 2016; Freire et al., 2020). Additionally, research suggests that high levels of stress are associated with low levels of mental well-being (Denovan & Macaskill, 2016). However, some studies propose that this relationship is mediated by psychological resources like self-efficacy, i.e. the belief that one can achieve a certain goal or complete a certain task successfully (Freire et al., 2018; Freire et al. 2020). Given the task-dependency of self-efficacy, this study specifically measured academic self-efficacy (ASE) while focusing on university students. Nevertheless, existing research has mostly focussed on general self-efficacy (Denovan & Macaskill, 2016). Thus, this research aims to fill this gap by examining the mediating role of ASE in the relationship between stress and mental well-being among university students. Additionally, this study distinguishes itself from prior studies by investigating mental health as a positive construct that considers mental well-being as a person's emotions and overall functioning, independent from the presence or absence of mental disorders (Westerhof & Keyes, 2009).

Stress in University Students

The World Health Organization (WHO) considers stress to be a common human response to challenges or threats (*Stress*, 2023). According to Lazarus and Folkman's Transactional Model of Stress and Coping (1984), stress arises when an individual perceives their capacity to cope with external or internal demands as inadequate, especially when these demands are thought to be harmful or threatening to one's well-being (Denovan & Macaskill, 2016). Consequently, the occurrence of stress depends on both the situation and the individual's ability to cope (Michie, 2002). Even though stress is a common human experience, some demographic groups are more likely to be affected by stress than others, such as university students (Denovan & Macaskill, 2016).

According to Denovan & Macaskill (2016), university students show elevated stress levels compared to the general population or people of similar age who are working. Additionally, a study examining university students from German and Luxemburgish universities found that 45% of participants experienced increased stress (Schlarb et al., 2017). Stressors university students are faced with include academic demands, such as high workload, time management, exams, and academic performance, and non-academic demands, such as financial concerns, adjustments to a new physical and social environment, and worries about

the future (Beiter et al., 2015; Freire et al., 2018; Freire et al., 2020). The stress resulting from these demands can show in a variety of symptoms.

Even though literature suggests that a moderate level of stress can be beneficial in combatting daily tasks, high stress levels have a negative impact on academic achievements and on physical and mental health (Freire et al., 2020; Karyotaki et al., 2020). Possible physical symptoms are headaches, nausea, heightened heart rate, increased blood pressure, and sweating (Dobson, 1982; Michie, 2002). Psychological symptoms may include fatigue, irritability, anxiety, or difficulty concentrating (Dobson, 1982; Michie, 2002). Especially if stress is consistent, it might induce depressive or anxiety disorders (Pêgo et al., 2009; Michie, 2002). In general, multiple studies suggest that stress is negatively associated with a person's mental well-being (Denovan & Macaskill, 2016; Extremera & Rey, 2015; Malik et al., 2020).

Mental Well-Being and Mental Health

Westerhof and Keyes (2009) propose that mental well-being consists of three components, namely emotional, social, and psychological well-being, thereby integrating the hedonic and the eudaimonic approaches to mental well-being. Emotional well-being, stemming from the hedonic approach, is concerned with the extent to which people feel happy and satisfied with life. Social and psychological well-being, both attributable to the eudaimonic approach, pertain to the individual and social functioning (Westerhof & Keyes, 2009). While social well-being focuses on a person's relationships and social environment, psychological well-being is concerned with a person's ability to self-actualize (Keyes, 1998; Westerhof & Keyes, 2009). According to these definitions, mental disorders do not play a defining role in mental well-being. It is therefore important to specify how mental well-being and mental disorders are related.

In the Two Continua Model by Keyes, mental well-being forms the continuum of mental health, which is separate from the continuum of mental illness. While mental illness represents the presence or absence of mental disorders, mental health is a positive construct representing the emotions and overall functioning of a person, independent of psychopathologies (Westerhof & Keyes, 2009). As per this perspective, a person can exhibit high levels of mental well-being, despite the presence of a mental disorder, and vice versa (Yeo & Suárez, 2022). Research supporting this perspective suggests that levels of mental well-being are sometimes, but not necessarily, associated with symptoms of mental disorders and that mental disorders like anxiety and depression have other causal determinants than mental well-being (Kinderman et al., 2015; Weich et al., 2011). For instance, anxiety and depression can be caused by negative

life events whereas poor mental well-being might be the result of social isolation (Kinderman et al., 2015).

Over the past years, concerns about university students' mental health have increased (Freire et al., 2020). As mentioned above, mental well-being is negatively associated with stress (Denovan & Macaskill, 2016; Schiffrin & Nelson, 2008). In university students, both academic and non-academic stressors have an impact on mental well-being (Freire et al., 2020). Furthermore, the effect of daily stressors on students' mental well-being was found to be stronger than the effect of life events (Denovan & Macaskill, 2016). Additionally, it was found that the relationship between stress and mental well-being is mediated by psychological resources, such as resilience, optimism, and self-efficacy (Denovan & Macaskill, 2016).

Academic Self-Efficacy in University Students

Self-efficacy was first introduced by Albert Bandura in 1977, who defined it as "people's judgments of their capabilities to organize and execute courses of action required to attain designated types of performances" (Artino, 2012). According to Bandura, besides the skills required to take a certain action, people must also possess the confidence that they are able to achieve the desired outcome. Thus, self-efficacy is a key factor in a person's motivation to act. It is important to note, that self-efficacy pertains to a person's belief about their capabilities rather than their actual capabilities (Artino, 2012).

As mentioned above, self-efficacy was found to be related to stress and mental well-being. For instance, two studies conducted in the US and Australia revealed that general self-efficacy is positively associated with mental well-being and negatively associated with stress (Morton et al., 2013; Roddenberry & Renk, 2010). However, a person's level of self-efficacy is task-dependent, meaning that the same individual may have high self-efficacy in one domain and low self-efficacy in another (Macaskill & Denovan, 2013). Consequently, when examining stressors experienced by university students, it is logical to focus on academic self-efficacy (ASE).

According to Denovan and Macaskill (2016), ASE refers to a person's level of trust in their ability to successfully complete tasks or achieve desired outcomes within an academic context. Additionally, Denovan and Macaskill (2016) suggested a negative relationship between ASE and stress. According to them, students with high ASE tend to use more effective coping strategies, such as problem-focused coping, in response to stress, and to evaluate stressors as challenges rather than threats, thereby lowering feelings of stress. Moreover, previous research found a positive association between ASE and mental well-being in students (Denovan & Macaskill, 2016). Additionally, ASE was found to be positively associated with life satisfaction

and negatively associated with symptoms of mental illness (Denovan & Macaskill, 2016; Roddenberry & Renk, 2010).

ASE is specifically relevant for university students, as it is positively related with academic performance (Yokoyama, 2019). This is explained through the fact that students with high levels of academic self-efficacy tend to work harder and more efficiently, do not shy away from challenges, and set higher yet achievable goals for themselves, which results in more successful academic outcomes. Consequently, confidence in their academic performance increases which in turn is beneficial for future academic performances (Denovan & Macaskill, 2016).

The Current Study

The relationships between stress, mental well-being and ASE established through existing literature give reason to presume that ASE might mediate the relationship between stress and mental well-being among university students. More concretely, it can be assumed that the negative relationship between stress and mental well-being in university students might partly or fully be attributable to a negative relationship between stress and ASE and a positive relationship between ASE and mental well-being.

However, studies examining the relationships between stress, mental well-being and ASE have mostly been conducted prior to the COVID-19 pandemic. Therefore, this study aims to fill the gap by investigating the relationship after the pandemic. Due to lockdowns and other measures that were taken in response to the Coronavirus, university life drastically changed (Browning et al., 2021; Son et al., 2020). As a result, university students reported increased stress levels as a consequence of the pandemic and the measures enforced by governments (Son et al., 2020). Additionally, COVID-19 did not only pose a threat to the physical health but also to the mental health of university students, increasing psychological distress (Xiong et al., 2020). The impact the pandemic had on the levels of stress and mental well-being in university students give reason to assume that it might had an impact on the relationships involving these constructs. Thus, the mediating role of ASE in the relationship between stress and mental well-being will be the focus of this paper. Consequently, the following research questions were established, and expectations were formulated.

RQ1: "What are the mean levels of stress and mental well-being among university students?"

Existing research indicates that university students experience elevated levels of stress compared to the average population (Denovan & Macaskill 2016). However, as the experience of elevated stress levels seems to be universal, it can be expected that the stress level in this sample will be similar to those found in other university students (Denovan & Macaskill, 2016;

Schlarb et al., 2017). Furthermore, considering the negative relationship between stress and mental well-being, it was anticipated that university students tend to exhibit lower levels of mental well-being, suggesting a below-average mean for the sample in this study (Denovan & Macaskill, 2016; Extremera & Rey, 2015; Malik et al., 2020).

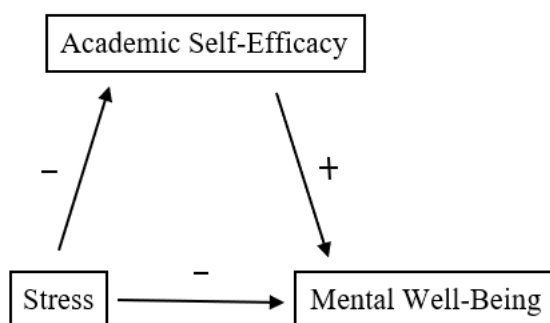*RQ2: "How are stress, mental well-being and ASE related among university students?"*

Based on the literature presented it could be expected that stress and mental well-being are negatively associated among university students (Denovan & Macaskill, 2016; Extremera & Rey, 2015; Malik et al., 2020). Furthermore, previous research has shown a negative association between ASE and stress and a positive association between academic ASE and mental well-being, which was therefore expected in this study (Denovan & Macaskill, 2016).

RQ3: "Does ASE mediate the relationship between stress and mental well-being among university students?"

Previous studies hint at a potential mediating effect of ASE on the relationship between stress and mental well-being in university students, with a negative relationship between stress and ASE and a positive relationship between mental well-being and ASE (Morton et al., 2013; Roddenberry & Renk, 2010). These expectations are visualized in Figure 1.

Figure 1

Expected Relationships between the Variables

Methods

Study Design

A cross-sectional study design was selected to examine the relationship between stress, mental well-being and ASE in university students. Data was collected using a one-time administered online survey consisting of self-report scales measuring the constructs of interest.

Participants

A total of 164 participants filled out the survey, 118 (71.95%) of which were included in the final data set. To be included in the study, participants must be (1) university students, (2) enrolled in a bachelor's or master's degree programme, (3) study at a university in the Netherlands or Germany, and (4) be at least 18 years of age. These criteria ensured that the sample represents the research population, i.e. university students. Participants were excluded from the study if they (1) did not meet these criteria, (2) did not consent, or (3) had missing data on the scale items. Consequently, 46 participants were excluded, mostly because they failed to answer all scale items.

As reported in Table 1, the ages of participants ranged from 18 years old to 27 years old, with a mean age of 21.76 years ($SD = 1.99$). Most participants identified as female (69.49%). Furthermore, the majority of participants were German (72.88%) followed by Dutch participants (21.19%). Other participants were Spanish, Chilean, or American, among others. However, all participants were studying at a German or Dutch university, most of them at the University of Twente in the Netherlands (47.46%). Moreover, all participants were either bachelor or master students, the large majority being bachelor students (83.05%). Regarding study fields, most participants studied psychology (37.29%). Other study fields included law, communication science, and biology.

Table 1

Participant Demographics

Demographics	n	%	M	SD
Age	110*	93.22	21.76	1.99
Gender	118	100.00		
Male	31	26.27		
Female	82	69.49		
Non-Binary/Third Gender	4	3.39		
Prefer not to Say	1	0.85		
Nationality	118	100.00		
Dutch	25	21.19		
German	86	72.88		
Other	7	5.93		
University	118	100.00		
University of Twente, Netherlands	56	47.46		
Other Dutch University	5	4.24		
German University	57	48.30		
Educational Level	118	100.00		
Bachelor Student	98	83.05		
Master Student	20	16.95		
Study Field	118	100.00		
Psychology	44	37.29		
Other	74	62.71		

Note. Sample size: 118; *eight participants excluded due to missing data

Materials

The survey comprised demographic questions and three self-report scales used to measure the three constructs, namely stress, mental well-being, and academic self-efficacy. The full questionnaire is presented in Appendix A.

Demographics

Regarding demographic information, participants were asked to indicate their age, their nationality ("Dutch", "German", and "Other"), and their gender ("Male", "Female", "Non-binary/third gender", and "Prefer not to say"). Additionally, they were asked to provide information about their study, including which study phase they were in (ranging from "Bachelor year 1" to "Master year 2" and the option "Other"), their study field, in what year they started their study, and the name of the university they were enrolled at.

Student Life Challenges

To measure stress, the Student Life Challenges (SLC) was used, which measures stress elicited by academic as well as non-academic challenges related to student life (Porru et al., 2022). This scale consists of a total of 22 items that cover six areas, namely faculty shortcomings (seven items), worries about future (three items), unsupportive climate (five items), high workload (three items), low commitment (two items), and financial concerns (two items). However, based on the results of a factor analysis (Appendix B), the subscale financial concerns was excluded. Example items include "The teachers often fail to clarify the aims of the activities" for faculty shortcomings, "I am worried that I will not acquire all the knowledge needed for my future profession" for worries about future, and "Studying has created a climate of anonymity and isolation among the students" for unsupportive climate. Furthermore, "The literature is too difficult and extensive" for high workload and "I am satisfied with my choice of career" as a reversed item for low commitment.

Participants indicated to what extent they agreed with these statements on a four-point Likert scale ranging from 1 ("totally disagree") to 4 ("totally agree"). Subscale scores were calculated by taking the average score of the raw scores of the corresponding items. The score of the whole scale was retrieved by calculating the mean score of the five subscale scores, which were each calculated by taking the mean of the corresponding items. Thereby, scores could range from 1 to 4 with higher scores indicating higher stress levels.

Regarding the scale's psychometric properties, findings by Porru et al. (2022) indicated moderate internal reliability for the subscales faculty shortcomings, worries about future, unsupportive climate, and high workload (Cronbach's α = .65-.74), as well as for low commitment (Spearman's r_s = .60). Similarly, in the current dataset moderate internal reliability

was shown for each subscale, namely faculty shortcomings (Cronbach's α = .66), worries about future (Cronbach's α =.73), unsupportive climate (Cronbach's α = .74), high workload (Cronbach's α = .76), and low commitment (Cronbach's α = .77). For the total scale, internal reliability was high (Cronbach's α = .83).

Mental Health Continuum – Short Form

For mental well-being, the 14-item Mental Health Continuum – Short Form (MHC-SF) by Keyes et al. (2008) was used, as it allows to measure aspects of emotional, psychological, and social well-being on separate subscales (Lamers et al., 2010). Participants indicated how often they have felt a certain way, for instance, "happy" or "satisfied with life", during the past month on a six-point scale ranging from 0 ("never") to 5 ("every day"). The scores of the whole scale and subscales were computed by taking the mean scores of the respective items. Therefore, scores could range from 0 to 5. Higher scores indicated higher levels of well-being.

Regarding psychometric properties, in research by Lamers et al. (2010) the MHC-SF was shown to have high internal reliability for the whole scale (Cronbach's α = .89), and the subscales emotional well-being (Cronbach's α = .83) and psychological well-being (Cronbach's α = .83). The internal reliability was moderate for the subscale social well-being (Cronbach's α = .74). Furthermore, the MHC-SF demonstrated discriminant validity, indicating that mental health and mental illness are two separate factors and that the MHC-SF serves well to measure mental health (Lamers et al., 2010). In the dataset of the current study, internal reliability was high for the total scale (Cronbach's α = .89), as well as the subscale emotional well-being (Cronbach's α = .86), and moderate for the subscales social well-being (Cronbach's α = .78), and psychological well-being (Cronbach's α = .79).

General Academic Self-Efficacy Scale

The General Academic Self-Efficacy Scale (GASE) served to quantify ASE, aiming to measure the extent to which students feel confident and capable in their academic abilities. It comprises five items, such as "I generally manage to solve difficult academic problems if I try hard enough" (Van Zyl et al., 2022). On a five-point Likert scale ranging from 1 ("strongly agree") to 5 ("strongly disagree"), participants must indicate to what extent they agreed with given statements. The total score was calculated as the mean of the five items, and could thus range from 1 to 5. A higher score indicated a higher level of ASE.

This scale is a reliable and valid measure, with high internal consistency reliability (Cronbach's α = .81) and satisfying concurrent and predictive validity found in previous research. Furthermore, it was shown to be a consistent measure over time (Van Zyl et al., 2022). In this study, the internal reliability was moderate (Cronbach's α = .73).

Procedure

Participants were recruited through SONA, a system used to distribute studies among students from the Behavioural, Management, and Social Sciences Faculty at the University of Twente through which they receive human research participant credits in return for participation, as well as social media platforms, such as WhatsApp and Instagram. The period of recruitment and data collection lasted 20 days, starting on the 20th of March, 2024 and ending on the 8th of April, 2024.

After being recruited, respondents were provided a link that led them to the online survey in Qualtrics, a website used for creating and publishing online surveys. They filled it in independently, using their own electrical device with internet access (e.g. laptop or smartphone), at a place and time of their choice. The survey started with a comprehensive introduction, providing information about the purpose and content of the survey, data handling, contact information, eligibility criteria, and participant rights, in order to familiarize participants with the contents of the survey and minimize discomfort regarding the topics addressed. Additionally, the researchers' contact information was provided, in case participants had further questions or other issues regarding the study.

After having read the introduction, participants were asked to give consent, thereby indicating that they were 18 years of age or older, had read and understood the information provided in the introduction, and agreed to participate voluntarily. This consent form (Appendix C) complied with ethical standards and was approved by the ethics committee BMS, domain humanities and social sciences of the University of Twente, application number 240232.

Subsequently, participants were required to specify demographic information, such as age and gender, and fill in the scales described above, namely the Student Life Challenges (SLC) the Mental Health Continuum – Short Form (MHC-SF), and the General Academic Self-Efficacy Scale (GASE). At the end, participants were thanked for their participation. The survey was answered in one session that approximately took 20 to 30 minutes. Those recruited through SONA were rewarded 0.25 human research participant credits after completing the survey.

Data Analysis

The collected data was analysed using the statistical programme RStudio version 2023.12.1. As a first step, the data was cleaned by removing all participants who did not meet the eligibility criteria or had missing data on the scale items. Additionally, some items must be reversed, namely items 1, 3, 5, 7, 19, and 20 of the SLC.

Before conducting statistical analyses, the assumptions of normality, independence, linearity, and equal variance were tested for each relationship between the three variables. The

assumption of linearity was tested by plotting residual vs. fitted values plots. The assumption of independence was investigated using the Durbin-Watson test. For the assumption of normality, the Shapiro-Wilk test was conducted, and histograms of the residuals were plotted. Lastly, the assumption of equal variance was examined using the Breusch-Pagan test. Thereafter, descriptive analyses were performed, which entailed calculating means and standard deviations for each variable and Pearson correlation coefficients for the relationships between the variables.

Afterwards, appropriate analyses to answer the research questions were performed. To answer RQ1, i.e. *"What are the levels of stress and mental well-being among university students?"*, the means of the SLC and MHC-SF of this sample were compared to the means of norm groups. For stress, the mean scores of the SLC were compared to the mean scores of a sample of 568 Italian university students, the majority of which (78.7%) identified as female. Data was collected through an online questionnaire in June 2019 (Porru et al., 2022). Regarding mental well-being, the mean scores of the MHC-SF were compared to the means of a sample taken from the Dutch population. It consisted of 1802 participants, with a mean age of 47.2 years (SD = 17.7) and 50.7% of participants identifying as female (De Beurs et al., 2022).

For RQ2, i.e. *"How are stress, mental well-being, and ASE related among university students?"*, the Pearson correlation coefficients for the relationships between these three constructs were calculated to determine their directions and strengths.

RQ3, i.e. *"Does ASE mediate the relationship between stress and mental well-being among university students?",* was explored with a mediation analysis. At first, a simple linear regression analysis with stress as the independent variable and mental well-being as the dependent variable was conducted, to examine the total effect of stress on mental well-being.

Afterwards, a mediation analysis was performed, whereby stress was set as the independent variable, mental well-being as the dependent variable, and ASE as the mediator variable. This analysis was performed using PROCESS version 4.3.1 written by Andrew F. Heyes, which operates based on bootstrapping. By default, 5,000 bootstrap samples were derived from the original data. The output was interpreted regarding whether the conditions for a significant mediation analysis were met. These conditions include (1) that the effect of the independent variable on the mediator variable is significant, (2) that the effect of the mediator variable on the dependent variable is significant when controlling for the independent variable, (3) that the direct effect of the independent variable on the dependent variable while controlling for the mediator variable is reduced compared to the total effect of the independent variable on the dependent variable without controlling for the mediator variable, and (4) that the indirect effect of the independent variable on the dependent variable through the mediator variable is

significant. An indirect effect is considered statistically significant if its bootstrap confidence interval does not include zero.

In the mediation analysis, the first step was a linear regression analysis which indicated whether the effect of stress on ASE was significant. The second step was a multiple regression analysis with stress and ASE as independent variables and mental well-being as dependent variable. This showed whether the effect of ASE on mental well-being was significant when controlling for stress. In the third step the direct effect of stress on mental well-being when controlling for ASE was calculated. By comparing it to the results of the simple linear regression for the total effect of stress and mental well-being without controlling for ASE, it could be examined whether the direct effect was reduced compared to the total effect. As the fourth step, the bootstrap confidence interval of the indirect effect of stress on mental well-being through ASE was calculated.

Results

Preliminary Analysis

At first, the assumptions were tested for all three relationships (Appendix D). The assumptions of linearity, independence, and normality were met for all relationships. However, results from the Breusch-Pagan for the assumption of equal variance, indicated that this assumption was not met for the relationship between stress and ASE only.

Descriptive Analysis

In order to gain insight into the main characteristics of the data, descriptive statistics were calculated (Table 2). Examining the means, no floor or ceiling effects could be detected. Additionally, the standard deviations for all three variables were relatively low compared to the scale ranges of the respective measures, indicating that there was little variability in the sample. The relationships between the variables as indicated by the Pearson Correlation Coefficients are reported in the context of the main analysis.

Table 2

Table of Means, Standard Deviations, and Pearson Correlation Coefficients

Variables	*M*	*SD*	Stress	Mental Well-Being	ASE
Stress	2.50	0.44	-	-.41***	-.45***
Faculty Shortcoming	2.87	0.47	-	-.41***	-.31***
Worries about Future	2.60	0.78	-	-.22*	-.20*
Unsupportive Climate	1.90	0.60	-	-.25**	-.18
High Workload	2.44	0.80	-	-.23*	-.47***
Low Commitment	2.70	0.67	-	-.32***	-.32***
Mental Well-Being	2.81	0.85	-.41***	-	.38***
Emotional Well-Being	3.23	1.02	-.34***	-	.36***
Social Well-Being	2.23	1.02	-.33***	-	.20*
Psychological Well-Being	3.08	0.94	-.39***	-	.43***
ASE	3.95	0.69	-.45***	.38***	-

Note. Sample size: 118; SLC scale: 1-4; MHC-SF scale: 0-5; GASE scale: 1-5; *=p≤.05; **=p≤.01; ***=p≤.001

Main Analysis

Average Levels of Stress and Mental Well-Being

To answer RQ1, i.e. *"What are the average levels of stress and mental well-being among university students?"*, the mean scores of the SLC and MHC-SF were examined and compared to norm groups (Table 3). The mean stress level of the sample was 2.50. Looking at the subscale means, the means of the subscales faculty shortcoming and low commitment were slightly above the means of the norm group, the means of the subscales unsupportive climate and high workload were slightly below the means of the norm group, and the mean for the subscale worries about future was equal to the mean of the norm group. As some subscale means were below and some were above those of the norm group and these differences are subtle, it can be assumed that the overall levels of stress were similar in the norm group and in this sample. For

mental well-being, a mean of 2.81 for the current sample was slightly below the mean of the norm group (*M* = 2.98). The same held for the mean comparison of the subscales, namely emotional well-being, psychological well-being, and social well-being. As expected, this indicated that this sample of university students experienced slightly lower levels of well-being compared to the average population.

Table 3

Means and Standard Deviations of the Current Sample and the Norm Groups

Variables	*M**	*SD**	*M***	*SD***
Stress	2.50	0.44	-	-
Faculty Shortcoming	2.87	0.47	2.5	0.4
Worries about Future	2.60	0.78	2.6	0.8
Unsupportive Climate	1.90	0.60	2.1	0.6
High Workload	2.44	0.80	2.9	0.7
Low Commitment	2.70	0.67	1.7	0.7
Mental Well-Being	2.81	0.85	2.98	0.85
Emotional Well-Being	3.23	1.02	3.66	0.96
Social Well-Being	2.23	1.02	2.32	1.01
Psychological Well-Being	3.08	0.94	3.18	1.00

Note. Sample size: 118; SLC scale: 1-4; MHC-SF scale: 0-5;

*Current sample; **Norm Groups (De Beurs et al., 2022; Porru et al., 2022)

The Relationships between Stress, Mental Well-Being, and Academic Self-Efficacy

The Pearson correlation coefficient for the relationships between stress, mental well-being and ASE (Table 2) were used to answer RQ2, i.e. *"How are stress, mental well-being and ASE related among university students?"*. The Pearson correlation coefficients (Table 2) indicated a moderate negative relationship between stress and mental well-being (*r* = -.41). The subscales of the SLC had either weak or moderate negative relationships with mental well-

being. The subscales of the MHC-SF all demonstrated moderate negative relationships with stress. Regarding ASE, results indicated a moderate negative relationship with stress ($r = -.45$), as well as either weak or moderate relationships with the subscales of the SLC. The relationship between ASE and mental well-being was shown to be moderate and positive ($r = .38$). The relationships between ASE and the subscales of the MHC-SF were either weak or moderate positive relationships. Generally, all relationships were statistically significant, except for the relationship between the SLC subscale unsupportive climate and mental well-being. To conclude, in line with expectations results indicated a negative relationship between stress and mental well-being, a negative relationship between stress and ASE and a positive relationship between ASE and mental well-being.

The Mediating Effect of ASE on the Relationship between Stress and Mental Well-Being

To investigate RQ3, i.e. *"Does ASE mediate the relationship between stress and mental well-being among university students?"*, the first step was to conduct a simple linear regression analysis (Table 4) with stress as independent variable and mental well-being as dependent variable. It was shown that the total effect of stress on mental well-being was statistically significant. Furthermore, results indicated that stress negatively predicted mental well-being. For every unit that stress increased, mental well-being decreased by 0.79 units. This effect is illustrated in Figure 2.

Table 4

Output Simple Linear Regression Analysis for Stress and Mental Well-Being

	B	SE	t	p	95% CI
Intercept	4.79	0.41	11.61	<.001	[3.97, 5.60]
Stress	-0.79	0.16	-4.87	<.001	[-1.11, -0.47]

Note. $R^2 = 0.17$; $R^2_{adj} = 0.16$; $F(1,116) = 23.67$; $p < .001$

Figure 2

The Total Effect of Stress on Mental Well-Being

To examine, whether ASE mediates the negative relationship between stress as independent variable and mental well-being as dependent variable, as suspected based on previous research findings, a mediation analysis (Table 5) was conducted and the conditions for a significant mediation were evaluated. Step 1 indicated that the effect of stress on ASE was statistically significant. This showed that stress negatively predicted ASE, whereby ASE decreased by 0.70 units for every one-unit increase in stress. Approximately 20% of the variance in ASE was explained by stress. Furthermore, results of step 2 in the mediation model showed that ASE positively predicted mental well-being when controlling for stress. For every unit that ASE increased, mental well-being increased by 0.30 units. Moreover, results showed that the direct effect of the independent variable on the dependent variable was reduced when controlling for the mediator variable. In step 3, the direct effect of stress on mental well-being, whilst controlling for ASE, was $B = -0.58$ [95% CI (-0.93, -0.23)], indicating that mental well-being decreased by 0.58 units for every one unit increase in stress. This effect was lowered compared to the total effect of stress on well-being found in the regression analysis ($B = -0.79$), though still significant ($p = .002$). Lastly, in step 4 it was shown that the indirect effect of stress on well-being through ASE was significant, as the Bootstrap Confidence Interval [-0.38, -0.06] did not include zero. As all conditions for a significant mediation were met, it was concluded that ASE partially mediated the negative relationship between the independent variable stress and the dependent variable mental well-being, which was consistent with expectations. The paths between these constructs and the corresponding coefficients are visualized in Figure 3.

Table 5

*Output Mediation Analysis for Mediation of ASE between Stress and Mental Well-Being*

	B	SE	t	p	95% CI	R^2	F	p***
Step 1						0.20	(1, 116)	<.001
							29.55	
Constant	5.71	0.33	17.39	<.001	[5.06, 6.36]			
Stress	-0.70	0.13	-5.44	<.001	[-0.96, -0.45]			
Step 2						0.22	(2, 115)	<.001
							16.01	
Constant	3.06	0.76	4.00	<.001	[1.54, 4.57]			
Stress	-0.58	0.18	-3.26	.002	[-0.93, -0.23]			
ASE	0.30	0.11	2.67	.01	[0.08, 0.53]			
Step 3								
	-0.58	0.18	-3.26	.002	[-0.93, -0.23]			
Step 4								
Stress	-0.21	0.08*			[-0.38, -0.06]**			

Note. Step 1 = regression analysis for stress (IV) and ASE (DV); Step 2 = regression analysis for stress (IV), ASE (IV) and mental well-being (DV); Step 3 = Direct effect of stress on mental well-being; Step 4 = Indirect effect of stress on well-being, mediated by ASE; *Bootstrap Std. Error; ** Bootstrap Confidence Interval; *** *p*-value of the *F*-test

Figure 3

The Effect Sizes and Directions between the Variables
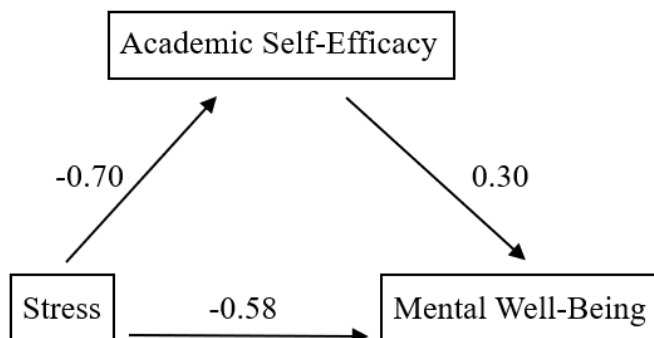
Discussion

The current study aimed to investigate the relationship between stress, mental well-being and ASE in university students, specifically whether ASE mediates the relationship between stress and mental well-being. Results suggested average stress levels in the current sample compared to other university students and below-average levels of mental well-being compared to the average Dutch population. Furthermore, moderate negative relationships between stress and mental well-being and between stress and ASE were found, and a moderate positive relationship between ASE and mental well-being could be established. Additionally, results indicated a partial mediation through ASE for the relationship between stress and mental well-being.

Interpretation of the Findings

Average Levels of Stress and Mental Well-Being

Regarding RQ1, the average stress level in this study was similar to that found in a sample of Italian university students, suggesting that university students experience comparable levels of stress across different countries (Porru et al., 2022). These results were expected as elevated stress levels among university students compared to the average population have been measured in various countries, indicating that the experience of increased stress among university students is universal (Denovan & Macaskill, 2016; Schlarb et al., 2017).

Furthermore, the level of mental well-being was lower compared to the Dutch population (De Beurs et al., 2022). Previous research indicated that stress levels among university students tend to be higher compared to the average population (Denovan & Macaskill, 2016). Based on the moderate negative relationship between stress and mental well-being found

in this study, the lower levels of mental well-being in this sample might be attributable to elevated levels of stress among university students.

Even though results showed that lower levels of mental well-being were at least partly attributable to stress, another reason for elevated stress levels might have been a majority of participants were female. Data from the norm group suggested that women exhibit lower levels of well-being compared to men (De Beurs et al., 2022). This is in line with research which found that women report higher levels of mental distress than men (Gamma & Angst, 2001; Hintikka et al., 2000). Thus, the higher proportion of female participants could have been a significant factor contributing to the lower scores for mental well-being.

The Relationships between Stress, Mental Well-Being, and Academic Self-Efficacy

In investigating RQ2, a moderate negative relationship between stress and mental well-being was found, which was in line with what was expected based on previous research (Denovan & Macaskill, 2016; Extremera & Rey, 2015; Malik et al., 2020). Hence, it was concluded that university students who experience higher levels of stress are more likely to experience lower levels of mental well-being. A possible explanation is that stress might elicit negative emotions which can reduce mental well-being (Extremera & Rey, 2015).

Beyond the negative relationship between stress and mental well-being, some stressors were found to have a stronger relationship with mental well-being than others. For instance, the relationship was particularly strong for the SLC subscale faculty shortcoming. This suggests that specifically university students who experience stress due to factors like the use of passive rather than active learning methods, a lack of preparation for the future profession, or a lack of encouragement for personal development tend to show decreased mental well-being (Porru et al., 2022). Accordingly, previous research revealed that the two most profound stressors among university students were the primary use of passive learning strategies rather than active learning and gaining knowledge relevant to their future careers (Porru et al., 2022). Hence, the suspected negative relationship between stress and mental well-being could be confirmed in this sample and beyond that it was found that stressors related to faculty shortcoming are particularly relevant in relation to mental well-being.

Furthermore, a moderate negative relationship between stress and ASE was found, indicating that university students with higher stress levels tend to have less confidence in their academic abilities compared to university students with lower stress levels. This finding was coherent with what was expected based on previous research findings (Denovan & Macaskill, 2016). A reason for such a relationship could be that university students high in ASE cope more

effectively and are more likely to perceive stressors as challenges than threats, thereby lowering stress (Denovan & Macaskill, 2016).

Similar to the relationship with mental well-being, the relationships with the different SLC subscales varied in strength, with high workload having the strongest relationship with ASE. This suggests that especially students who are stressed by the workload required for their study tend to doubt their academic skills. High workload includes factors such as an imbalance of work and free time and too high study pace (Porru et al., 2022). Contrary to these results, a previous study by Jungert and Rosander (2010) found no relationship between ASE and high workload. However, they argued that this might be explained by the fact that it depends on whether a high workload is evaluated as a threat or challenge. In the current study, results indicate that a high workload elicited stress and was therefore likely perceived as a threat by participants, who were mostly psychology students. As the study by Jungert and Rosander (2010) examined university students from engineering programmes, it could be argued that the difference in results might be caused by different appraisals of high workload, dependent on the study programme. Conclusively, the expectation that stress and ASE are negatively related was met in this study, and this relationship was found to be particularly strong with high workload.

Furthermore, in coherence with previous research higher levels of ASE were associated with higher levels of mental well-being (Denovan & Macaskill, 2016). These findings indicate that university students who believe that they possess the capabilities to reach their academic goals have higher levels of mental well-being. Furthermore, this relationship was particularly strong with psychological well-being. Thus, students with high ASE tend to thrive through self-actualization. Similar to the relationship between stress and ASE, the relationship between mental well-being and ASE can be explained through the tendency of highly self-efficacious students to use problem-focused coping, which increases mental well-being (Denovan & Macaskill, 2016). To conclude, the relationship between ASE and mental well-being was positive in this study, as was expected, and it was shown that psychological well-being is more strongly related with ASE than emotional and social well-being.

The Mediating Effect of ASE on the Relationship between Stress and Mental Well-Being

Regarding RQ3, the expectation that ASE mediates the negative relationship between stress as independent variable and mental well-being as dependent variable could be confirmed. More specifically, a partial mediation was found, meaning that the negative relationship between stress and mental well-being is partly attributable to ASE. Thus, stress and mental well-being are directly related and indirectly related through ASE. The indirect negative effect

through ASE is the result of a negative relationship between stress and ASE and a positive relationship between ASE and mental well-being. These findings suggest that university students with high levels of stress are more likely to exhibit low levels of mental well-being and that they are additionally more likely to have low levels of ASE which further increases the probability of having low levels of mental well-being.

The mediating effect found in this study was similar to that found in a study conducted prior to the COVID-19 pandemic (Denovan & Macaskill, 2016). Thus, even though stress levels have increased and levels of mental well-being have decreased among university students due to the pandemic, there were no substantial changes in the relationships between these constructs and their relationship with ASE (Son et al., 2020; Xiong et al., 2020)

Limitations and Strengths

The main limitation of this study was that the relationships between the constructs could only be tested for association and not for causality, due to the cross-sectional study design. This must be considered in the interpretation of the results, as regression and mediation analyses assume causality. In this study, causality between the construct was assumed based on previous research. However, it could be ruled out that the causality is reversed or that the variables are related through a third unknown variable (Asamoah, 2014).

Additionally, a limitation of this study was the use of convenience sampling, whereby participants are selected based on accessibility (Etikan, 2016). In this case, they were chosen based on social relations through social media and location, i.e. the University of Twente in the Netherlands. This technique was chosen as it is time-efficient and affordable (Etikan, 2016). However, it is likely to introduce sampling bias, as the probability of being included in the sample is higher for some individual from the target population than others, based on their accessibility (Etikan, 2016). Furthermore, when using convenience sampling, the probability of biases to occur is not quantifiable. Therefore, it is unknown how the results might have been influenced and how well the sample represents the population (Etikan, 2016). Due to this sampling technique, the current sample might differ from the target population regarding factors such as gender, nationality or study programme. For instance, the majority of participants were female, German, and/or psychology students. Therefore, the sample might not be representative of the total population of university students, limiting the generalizability of results (Emerson, 2021).

Apart from the limitations, a strength of the study was that validated measures were used to measure the constructs. The scales, namely the SLC, the MHC-SF and the GASE, and the subscales had moderate to high internal reliability in previous studies (Lamers et al., 2010;

Porru et al., 2022; Van Zyl et al., 2022). Furthermore, in the current sample, every scale and subscale had moderate to high internal reliability. This ensured that the variables were accurately measured, which partly enhanced generalizability. Further, this allows for reproducibility of the research and comparison of the scores across different studies.

An additional strength of this study is that its findings fill a gap in previous research by investigating the relationships between stress, mental well-being and ASE after COVID-19. Based on existing studies, it was known that stress levels had increased, and levels of mental well-being decreased among university students due to the pandemic (Son et al., 2020; Xiong et al., 2020). However, the mediating effect of ASE on the relationship between stress and mental well-being had not been investigated after the pandemic occurred.

Conclusion and Future Research

In recent years, the mental health of university students has become an increasing concern, as low levels of mental well-being have become more prevalent and severe (Freire et al., 2020; Slimmen et al., 2022). This, at least in part, is attributable to the impact of the COVID-19 pandemic (Xiong et al., 2020). Thus, there is a need to enhance the understanding of the mental well-being of students (Baik et al., 2019). This study contributed to this understanding by investigating the relationships of mental well-being, stress and ASE after the pandemic. In this study, the relationships between stress and mental well-being and between stress and ASE were negative and the relationship between ASE and mental well-being was positive. Furthermore, a mediating effect of ASE on the relationship between stress and mental well-being was suggested. However, further research is needed to investigate the causality of these relationships, which could reveal reversed causality or confounding variables that cancel out the relationships (Asamoah, 2014). To investigate causality, longitudinal studies are useful, where participants are repeatedly measured over a longer period regarding changes in stress, mental well-being and ASE. Thereby, the sequence of changes in the variables could be observed and causality could be determined. Furthermore, to increase generalizability to the total population of university students, simple random sampling would be advisable. Thereby, imbalances in factors such as gender or study programme as in this study could be avoided.

Conclusively, stress and mental well-being as well as stress and ASE are negatively associated, and ASE and mental well-being are positively associated in university students. Furthermore, a partial mediation through ASE in the relationship between stress and mental well-being can be assumed. These findings were similar to those found before the COVID-19 pandemic. However, further research investigating the causality of these relationships is

required. This is particularly relevant considering the increasing levels of stress and the decreasing levels of mental well-being among university students.

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Appendix A

Survey Items

Demographic Questions

1. Please indicate your age (text entry)

2. Please indicate your nationality (Dutch; German; Other, namely (text entry))

3. Please indicate your gender (Male; Female; Non-binary/third gender; Prefer not to say)

4. In which phase of your study are you right now? (Bachelor year 1; Bachelor year 2; Bachelor year 3; Master year 1; Master year 2; Other (text entry))

5. Which study are you doing? (text entry)

6. In what year did you start your study? (text entry)

7. At which university do you study? (text entry)

Items of the Student Life Challenges

Faculty Shortcomings

1. I feel that my teachers treat me with respect.

2. The teachers often fail to clarify the aims of the activities.

3. The study stimulates my personal development.

4. As a student you are often expected to participate in situations where your role and function is unclear.

5. I am able to influence the studies or curriculum.

6. There is too much focus on passive learning of facts and too little on active seeking of knowledge and time for reflection.

7. I feel that the training is preparing me well for my future profession.

Worries about Future

8. I am worried that I will not acquire all the knowledge needed for my future profession.

9. The long hours and responsibilities of my future career worry me.

10. The insight I have had into my future profession has made me worried about the stressful workload.

Unsupportive Climate

11. Studying has created a climate of anonymity and isolation among the students.

12. The professional role presented in our course conflicts with my moral viewpoint.

13. There is a competitive attitude among students.

14. I feel that the studies have played a role in creating a cold and impersonal attitude among students.

15. It seems to me to be treated worse on the basis of my sex.

High Workload

16. My study controls my life and I don't have a lot of time for other activities.

17. The literature is too difficult and extensive.

18. The pace of study is too high.

Low Commitment

19. I am satisfied with my choice of career.

20. I am proud of my future profession.

Financial Concerns

21. As a student, my financial situation is worrying.

22. I am worried about my future financial situation and my ability to pay off my student loans.

Note. Items 1, 3, 5, 7, 19, and 20 must be reversed.

Items of the Mental Health Continuum – Short Form

During the past month, how often did you feel…

1. happy
2. interested in life
3. satisfied with life
4. that you had something important to contribute to society
5. that you belonged to a community (like a social group, your school, or your neighbourhood)
6. that our society is a good place, or is becoming a better place, for all people
7. that people are basically good
8. that the way our society works made sense to you
9. that you liked most parts of your personality
10. good at managing the responsibilities of your daily life
11. that you had warm and trusting relationships with others
12. that you had experiences that challenged you to grow and become a better person
13. confident to think or express your own ideas and opinions
14. that your life has a sense of direction or meaning to it

Note. Items 1-3 belong to the subscale Emotional Well-Being, items 4-8 belong to the subscale Social Well-Being and items 9-14 belong to the subscale Psychological Well-Being.

Items of the General Academic Self Efficacy Scale

1. I generally manage to solve difficult academic problems if I try hard enough.
2. I know I can stick to my aims and accomplish my goals in my field of study.
3. I will remain calm in my exam because I know I will have the knowledge to solve the problems.
4. I know I can pass the exam if I put in enough work during the semester.
5. The motto 'if other people can, I can too' applies to me when it comes to my field of study.

Appendix B

Results of the Factor Analysis for the Student Life Challenges Scale

Table 6

Output Kaiser-Meyer-Olkin Test

Scale	MSA*
Overall	0.74
Faculty Shortcomings	0.76
Worries about Future	0.73
Unsupportive Climate	0.75
High Workload	0.71
Low Commitment	0.72
Financial Concerns	0.79

Note. * MSA = Measure of Sampling Adequacy

Table 7

Output Bartlett Test

χ^2	105.36
p	< .001
df	15

Table 8

Eigenvalues Extracted from the Factor Analysis

Factors	Eigenvalues
Factor 1	1.704703051
Factor 2	0.266891589
Factor 3	0.069454746
Factor 4	-0.009779917
Factor 5	-0.133628355
Factor 6	-0.192938014

Figure 4

Scree Plot Based on the Eigenvalues
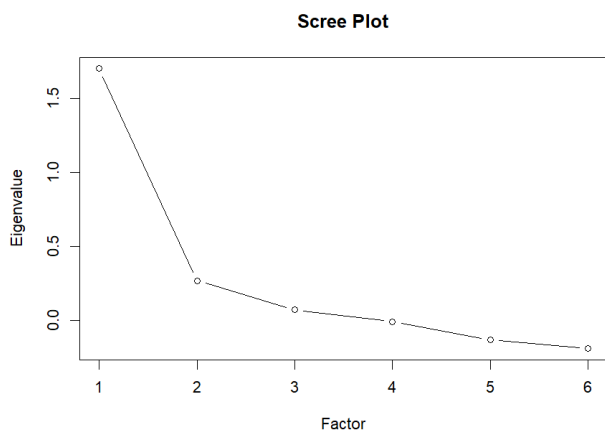
Table 9

Factor Loadings of the Subscales of the Student Life Challenges Scale

Subscale	Factor Loadings
Faculty Shortcomings	0.604
Worries about Future	0.558
Unsupportive Climate	0.664
High Workload	0.500
Low Commitment	0.461
Financial Concerns	0.354

Appendix C

Informed Consent

Clicking "I agree and consent to participate in this study" means:

- you are 18 years of age or older,

- you have carefully and thoroughly read this page (providing information about the
  purpose, procedure, data handling, contacts, participant rights, and participant
  demographics),

- you have been informed about the nature and method of this research in a manner that
  is clear to you,

- and you voluntarily agree to participate in this study.

Appendix D

Results Assumption Testing

Figure 5

Residuals vs. Fitted Values Plot of the Relationship between Stress and Mental Well-Being
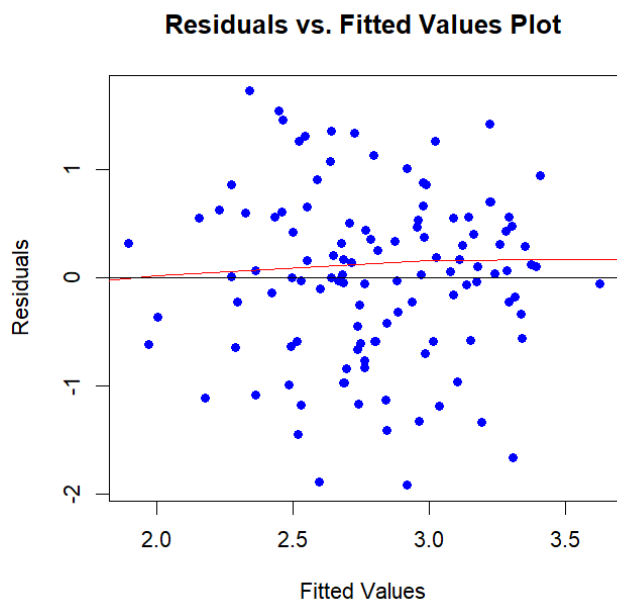
Figure 6

Residuals vs. Fitted Values Plot of the Relationship between Stress and ASE
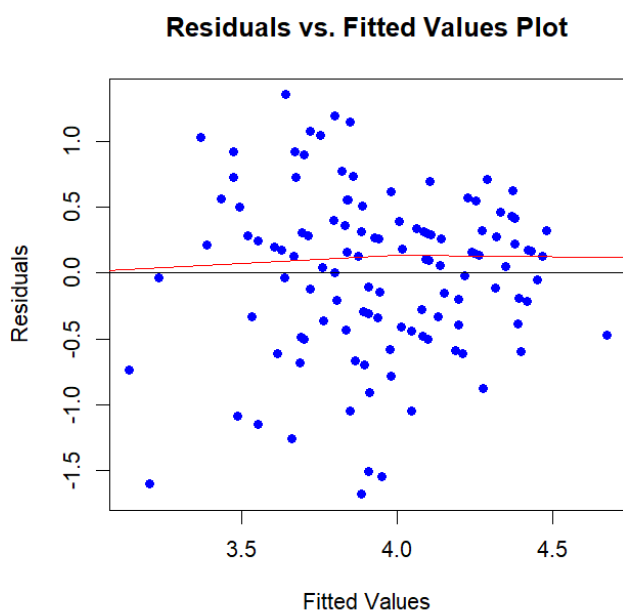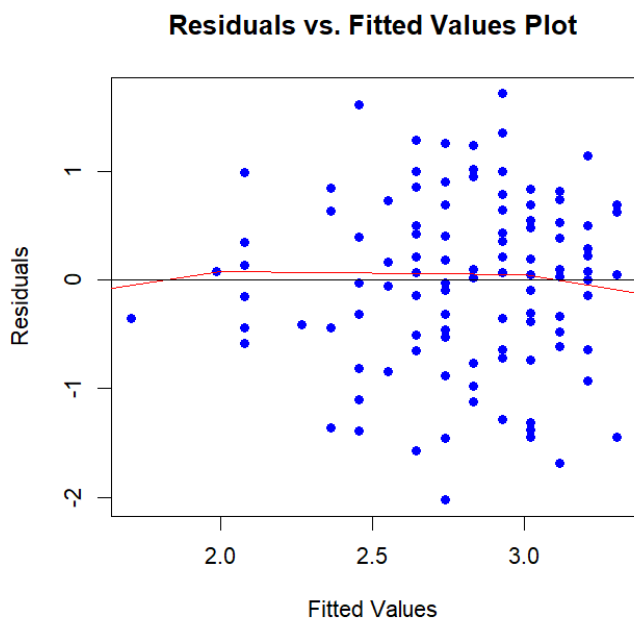
Figure 7

Residuals vs. Fitted Values Plot of the Relationship between ASE and Mental Well-Being

Figure 8

Histogram of Residuals of the Relationship between Stress and Mental Well-Being
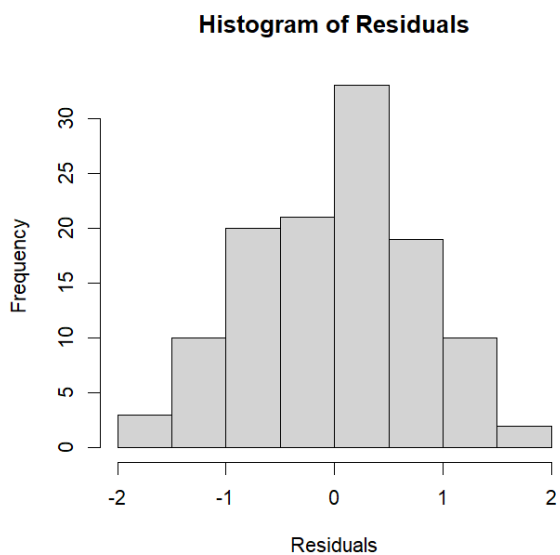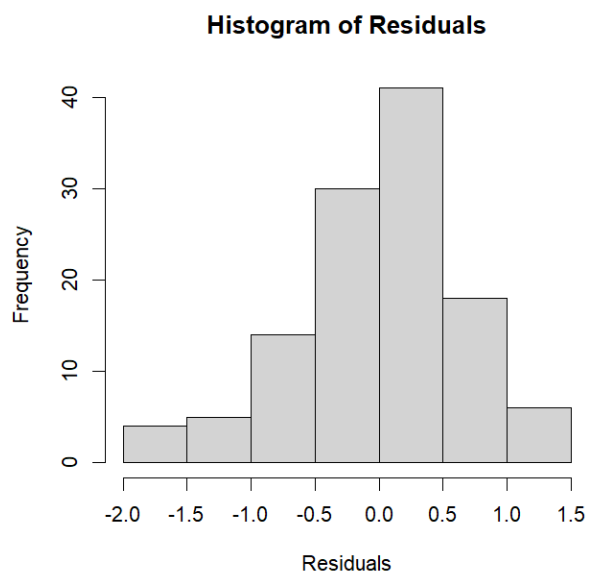
Figure 9

Histogram of Residuals of the Relationship between Stress and ASE

Histogram of Residuals

Figure 10

Histogram of Residuals of the Relationship between ASE and Mental Well-Being
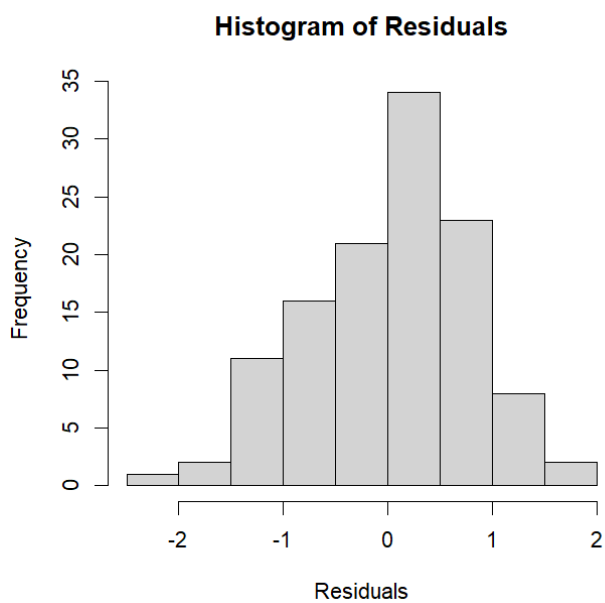

Histogram of Residuals

Table 10

Statistical Test Results of the Assumptions of Equal Variance, Independence, and Normality

Relationship	Breusch-Pagan Test	Durbin-Watson Test	Shapiro-Wilk Test
Stress and Mental Well-Being	BP = 1.65 *p* = .20	DW = 2.19	W = 0.99 *p* = .49
Stress and ASE	BP = 11.94 *p* < .001	DW = 1.91	W = 0.99 *p* = .08
ASE and Mental Well-Being	BP = 0.14 *p* = .71	DW = 2.13	W = 0.99 *p* = .22