Perceived Stress, Depression and Anxiety in University Students: The Role of Resilience

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PERCEIVED STRESS, DEPRESSION AND ANXIETY IN UNIVERSITY STUDENTS: THE ROLE OF RESILIENCE

Abstract

Objective: An increase in student's mental health problems and a respective increase in students' levels of perceived stress becomes more apparent in recent literature. In previous research, resilience has demonstrated to serve as a preventative measure that protects students from stress and mental health issues. The objective of this research is to examine whether resilience has a preventative function of stress, depression, and anxiety in a student sample.
Method: The study was a cross-sectional study that examined levels of perceived stress and resilience and symptoms of depression and anxiety in a student sample of the University of Twente (N=1246). In this study, correlation analyses between resilience, perceived stress, depression, and anxiety were examined.
Results: Consistent with previous research, the results of this research showed that resilience was significantly negatively correlated with the level of perceived stress and the tested psychopathological symptoms ($p < .01$). Due to the significant correlations, it was assumed that resilience has a moderating and a mediating effect on the relationship between perceived stress and depression, and anxiety. The findings show that resilience has no mediating effect but a significant moderating effect on the investigated relationship.
Conclusion: Despite the disapproval of the expectation that resilience has a mediating effect and that the findings show that resilience has no meaningful moderating effect in this sample, this study, nevertheless, provides considerable insight into the advantages of resilience. The benefits of using this study as a longitudinal study and designing a possible intervention that strengthens student's resilience are discussed.

Keywords
Resilience, Perceived Stress, Depression, Anxiety, University students

Introduction

The life and the time at university can offer a range of opportunities but it can also be a stressful and exhausting period for students. Not all students are immune to this stressful time which can go along with health problems and mental illnesses which appear to have increased in recent years (Hunt & Eisenberg, 2010). Recent reports from Counselling Institutions at Universities support this finding of an increase in students and further inform about an increase in the severity of symptoms of mental health problems (Xiao et al., 2017). Depression and anxiety are the mental health problems that have been reported most in university students and that depression as well as anxiety appear to have increased in the last years (Mahmoud, Staten, Hall, & Lennie, 2012).

The American College Health Association (ACHA) found an increase of 5% in students diagnosed with depression for the time span between 2000 and 2006 (American College Health Association, 2009). The ACHA conducted a large data acquisition of university students in the year 2006 and emphasizes that 17.8% of the students indicated symptoms of depression and 12.4% symptoms of anxiety which constitute a relatively large proportion in relation to the general population. Referring to the World Health Organization (WHO) and other scientific work, university students can be at risk for suicidal ideation when they experience increasing symptoms of anxiety and depression (Arria et al., 2009; World Health Organization [WHO], n.d.). In order to counter possible consequences such as suicide that can be caused by mental health problems more in-depth research is necessary to understand the underlying factors that are related to mental health problems in the population of university students.

One of the possible reasons that can cause mental health problems are an increase in stress in the life of a student. Stress can result when the amount of perceived internal and external pressures seem unfeasible for a person to cope with which can overstrain one's capacities and can consequently lead a person to experience the situation as threatening and, thus, as stressful (Maajida Aafreen, Vishnu Priya, & Gayathri, 2018). The ACHA examined that about a third of the student population reported stress to be the most frequent factor that impedes their academic performance and their mental health (American College Health Association, 2009). Previous scientific work supports the findings and emphasizes that an increase of stressors experienced at University can even cause mental health problems (Beiter et al., 2015). Symptoms

of depression and anxiety can, thus, be possible consequences of students who are not able to cope effectively with the stressors exposed to at university. The study of Pierceall & Keim (2007) support this finding and emphasizes that important indicators of possible mental health problems can be psychological stressors at University like the fear of academic failure, the management of financial shortcomings and problems with interpersonal relationships. In particular, the feeling of being unable to cope with academic stressors such as studying for exams or acquiring a large content of study materials in a comparatively short period of time has been found to increase stress in students (Kumaraswamy, 2013). Moreover, academically related stressors were found to be the pressure to succeed, pressure regarding academic performance and the conflict of which professional career to choose after graduation (Beiter et al., 2015).

Attending University can be a stressful time for students because they are facing these significant stressors for a long period of time which in turn can cause social, occupational and cognitive impairments and negatively impact the academic progress (Hunt & Eisenberg, 2010; Huang et al., 2018). When stress is present over a long period of time it can become chronic which in turn can cause cognitive impairments that negatively affect a student's memory and learning capacity and can further impact a student's mental health (Maajida et al., 2018). The consequences of an inability to cope with stress can go along with a lack of attention, concentration and can cause vulnerability regarding anxiety and depression (Alexander & Harrison, 2013). The negative consequences that can arise from an inability to cope with stress and especially with chronic stress emphasize the importance of effective coping abilities.

Effective coping abilities regarding stressors experienced at university vary among university students. Some seem to cope better with stress than others. One important factor why some students are able to cope with stressors better might be resilience (Hartley, 2011). Resilience concerns the ability to deal effectively with difficulties and setbacks in one's life and further to effectively cope with stress (Dias, 2015; Connor & Davidson, 2003). These findings are supported by Connor and Davidson (2003) who emphasize that resilience can be evaluated as not only having the ability to bounce back from stressors but also as possessing the capacity to cope effectively with stress. It can, thus, also be considered as a coping strategy. Further research suggests that resilience can influence how fast and especially how effectively an individual can return to a state of stability after a stressful event or a series of those events (Oken, Chamine, & Wakeland, 2015).

Furthermore, Abiola and Udofia (2011) present an understanding of resilience being an inner strength that consists of various components such as the ability to face challenges and stressful events with optimism and flexibility. To the researcher's knowledge, scientific work that examines the role of resilience in university students has a scarcity in research. However, a study conducted by García-León, Pérez-Mármol, Gonzalez-Perez, del Carmen García-Ríos, & Peralta-Ramírez (2019) observed university student's level of stress, resilience and psychopathological symptoms and other constructs (such as social stress) over a three months' time span that preceded the exam period. The study found that students low in resilience showed increasing levels of psychopathological symptoms in the month that was closest to the exam period. High resilient students, on the other hand, displayed less psychopathological symptoms (García-León et al., 2019). Additional research supports the preventative function of resilience in a way that people who are high in resilience are likely to experience lower levels of depression (Dias et al., 2015). These findings show that resilience could act as a buffer between the level of perceived stress and the experience of symptoms of depression and other psychopathological symptoms such as anxiety.

Besides the possibility of having a buffering effect, resilience has another strength that lies in the composition of the construct itself. Research on resilience shows that it can be considered as a versatile and multifaceted construct. Some studies focus on resilience as a fixed trait which is stable over time that remains unaffected by environmental change (Laird, Krause, Funes, & Lavretsky, 2019). This view on resilience resembles the idea of having the general ability to bounce back quickly after a stressful event in one's life that has previously been described. Other studies provide an understanding of resilience as a state which is dynamic and leads an individual to be adaptive towards changes in the surrounding environment (Luthar, Cicchetti, & Becker, 2000). Resilience is also viewed as a state which is changeable over time and can allow for personal growth (Luthar, et al., 2000). The ability of personal growth which goes along with an increase in resilience over time has been evaluated as a protector against mental health problems such as depression and anxiety (Lee, Nam, Kim, Kim, Lee, & Lee, 2013; Tusaie & Dyer, 2004). Further research highlights the preventative and protective effect of resilience on symptoms of depression and anxiety (Steinhardt, & Dolbier, 2008).

In current times this understanding of resilience seems to be of great importance because mental health issues seem to increase among university students who lie within the age group in

which most mental health problems are reaching its climax (Huang, Nigatu, Smail-Crevier, Zhang, & Wang, 2018). This finding emphasizes that action is needed to counteract the increase in mental health problems in order to achieve an increase in public health. Previous research shows that resilience can have a preventative aspect that can help to tackle stressors and also mental health problems of anxiety and depression. Obtaining an insight into the mentioned aspects of resilience might lead to a better understanding of why some students seem to be more stress-resistant and more resistant to mental health problems than others.

It is crucial that possible constructs that effectively tackle mental health problems among students receive more attention in order to counter the increase in depression and anxiety. It is important for our society to understand the underlying phenomena of stressors among our young generation before these problems are rising any further. Furthermore, it is expected that this research provides a better insight into the current status of students' mental health and which factors might influence the level of perceived stress. A detailed understanding about what might influence the stressors in a student's life and how depression and anxiety in students can be decreased can guide the development of interventions at student campuses to support students in need (Liu et al., 2019). The focus of this research, therefore, is to evaluate the relationship between perceived stress, resilience, and mental health and to evaluate whether resilience has an important role within these relationships and if it is of such importance that it should be implemented into planned interventions of the University of Twente.

Due to the scarcity mentioned earlier that resilience has not been researched in-depth in a student sample the role of resilience is not certain whether resilience. It is uncertain whether resilience might have a mediating or moderating effect on the relationship between stress and mental health symptoms under inspection. MacKinnon (2011) emphasizes that moderation analyses are conducted when the variable is a stable aspect of an individual which would plead for treating resilience as a trait in a moderation analysis. It is coherent to conduct a mediation analysis that entails resilience as a changing construct and, thus, as a state (MacKinnon, 2011). The mediation analysis is conducted to test whether the relationship of stress on depression and anxiety respectively can best be explained using resilience as a mediator. Testing whether resilience has an effect on the relationship between stress and depression and anxiety presupposes that there is actually a relationship between stress and the analyzed mental health

symptoms. Therefore, the relationship between stress and the investigated mental health problems is also tested.

Regarding the aspects mentioned it is expected that resilience is an important factor that influences how students deal with stressors at university and that decreases the likelihood for students to suffer from depression and anxiety. It is further expected that resilience has a moderating and mediating impact on the level of stress perceived by students and the probability of suffering from depression or anxiety (see Figure 1 and 2). Due to the above-mentioned facts the following research questions and hypotheses emerge:

RQ1: How much stress, resilience and symptoms of depression, and anxiety are students experiencing?

RQ2: Is there a relationship between stress and the symptoms of depression and anxiety?

H1: Stress is positively correlated with symptoms of depression and symptoms of anxiety.

RQ3: Is there a relationship between resilience and symptoms of depression and symptoms of anxiety?

H2: Resilience is negatively correlated with symptoms of depression and anxiety.

RQ4: Is there a relationship between stress and resilience?

H3: There is a negative correlation between stress and resilience.

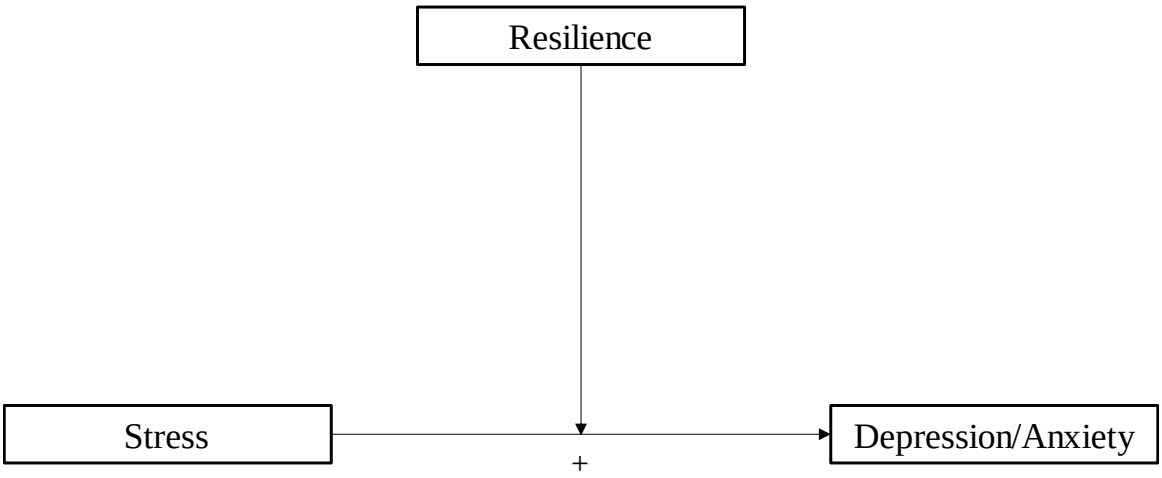
RQ5: Does resilience have an effect on the relationship between stress and depression and/or anxiety?

H4: Resilience acts as a moderator between the level of stress perceived by college students and their symptoms of anxiety and depression.

H5: Resilience acts as a mediator between the level of stress perceived by college students and their symptoms of anxiety and depression.

Figure 1

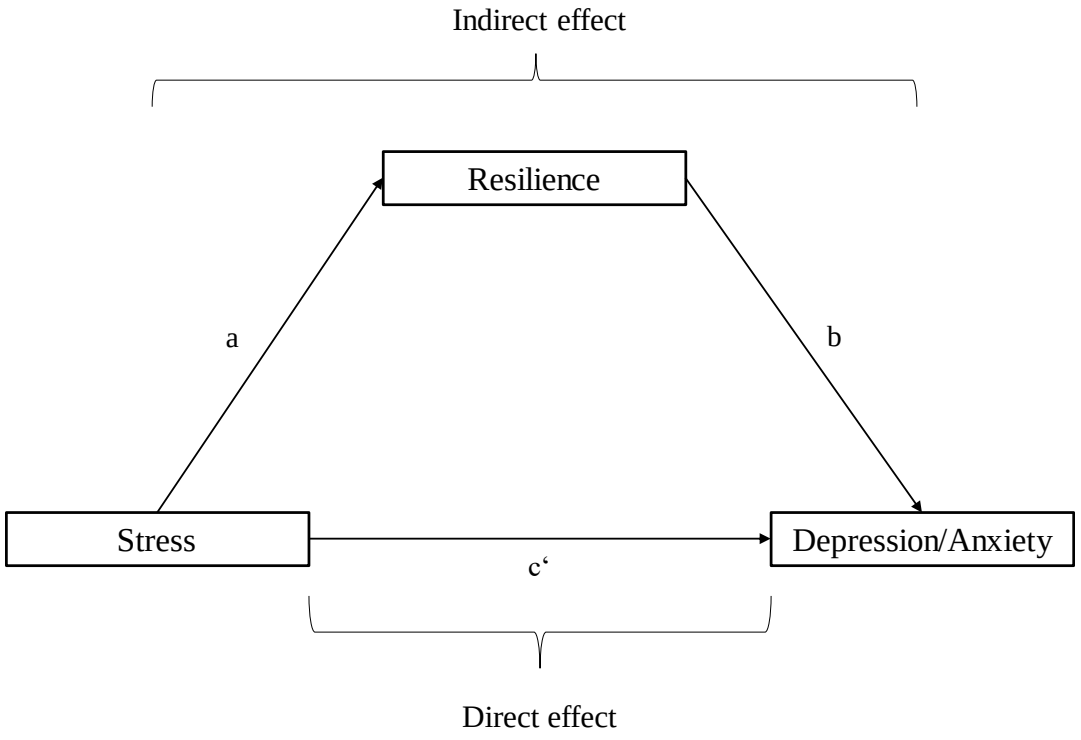
A visual explanation of the positive relationship between the independent variable, the assumed moderator and the dependent variable.



Note. The '+' indicates the positive relationship between the variables.

Figure 2

A visual explanation of the assumed mediating relationship between stress and the dependent variable(s).



Method

Overview and Design

To examine the role of stress, depression, anxiety, and resilience in students of the University of Twente (UT), a questionnaire has been distributed online. Stress is the independent variable used in this research, depression and anxiety the dependent variables and resilience the expected moderating or mediating variable. As this study was part of a research conducted by multiple other researchers, other dependent, as well as independent variables, were also included in the online survey. The survey was a cross-sectional study that analyzed data at a specific point in time (April-May 2019) from the student population of the UT.

Participants

Recruitment of the students was conducted by sending a welcoming email with the hyperlink of the survey to all students enrolled at any program of the University of Twente (UT). The survey was filled out by 2057 participants. Due to exclusion criteria, 1246 participants (60.57% of the initial population) remained for further analysis. The age of these 1246 participants ranged from 18 to 48 years (M = 22.2, SD = 3.06, Median=22.0). 659 of the participants were male (52.9%) and 578 female (46.4%) and 9 other (0.7%). Students from 63 Nationalities participated in this study. The proportion of responses varied between the different Nationalities and included 888 participants from the Netherlands (71%), 141 from Germany (11%), 52 from India (4%), and further 165 responses (13.2%) from remaining 60 countries.

Materials

The questionnaire started with the welcoming mail and continued with some questions about the participant's demographics. The participants were encouraged to indicate their age, gender, nationality, religious orientation, and study program. Additional questions were asked about daily sleep duration, the number of hours spent on classes at the university such as lectures and tutorials, as well as the hours spent on studying, working and personal care. These data enable the researchers to identify whether certain demographics of the participants have a possible impact on the outcome of the study. The order of the following questionnaires was

randomly distributed. Four questionnaires have been used to address the research questions and the relating hypotheses.

Resilience. To assess resilience the Brief Resilience Scale has been used and six items such as "I tend to bounce back quickly after hard times" and "I usually come through difficult times with little trouble" have been administered. The items were answered on a five-point Likert scale ranging from strongly disagree (1) to strongly agree (5). Positively worded items were rated from 1 to 5 and negatively worded items were reverse scored so they could also be rated from 1 to 5. The resulting scale scores for each participant is the sum of the individual item scores. A higher total score is in accordance with more resilience than a lower score (Leontjevas, de Beek, Lataster, & Jacobs, 2014). The questionnaire demonstrated high validity in previous research with a Cronbach's alpha ranging from .80-.91 (Smith, Dalen, Wiggins, Tooley, Christopher, Bernard, 2008). In this study, the Brief Resilience Scale demonstrated good internal consistency ($\alpha = .81$).

Stress. To assess the level of participant's perceived stress, the validated questionnaire of the Perceived Stress Scale (PSS-14) with its 14 items was used. Items such as "In the last month how often have you felt you were unable to control important things in your life?", "In the last month how often have you been able to control irritations in your life" and "In the last month how often have you felt difficulties were piling up so high that you could not overcome them?" were used. The scoring for the questionnaire theoretically ranges from 0-56 because all items in this questionnaire were rated from 0 to 4, meaning that the higher the total scale score the higher the level of perceived stress (Katsarou et al., 2012). As the PSS-14 is not a diagnostic tool, there are no cut-off scores (Remor, 2006). An operational cut off value of 28 has been selected for this study. This value has been used in similar studies on students and a sample mean on the PSS-14 of 28 and above would indicate a high level of perceived stress (Amr, El Gilany, & El-Hawary, 2008; Shah, Hasan, Malik, & Sreeramareddy, 2010). The study of Shah et al. (2010) reported a mean of the total sum scores of 30.84 within their sample of students. The questionnaire demonstrated good internal consistency ($\alpha = .81$) and adequate concurrent validity in previous studies (Remor, 2006). In this study, the questionnaire demonstrated good internal consistency ($\alpha=.86$).

Anxiety. Furthermore, the dependent variable of anxiety was measured by using the Generalized Anxiety Disorder Scale (GAD -7). The participant's anxiety was assessed by rating

questions on a 4-point Likert type scale such as “Over the last two weeks, how often have you been bothered by the following problems?” of “Feeling nervous, anxious or on edge” and “Being so restless that it is hard to sit still”. Answer options ranged from not at all (0) to nearly every day (3) and the total possible scale scores, thus, range from 0 to 21 (Parkerson, Thibodeau, Brandt, Zvolensky, & Asmundson, 2015). A higher total scale score would indicate more symptoms of anxiety. The cut-off values of 5, 10, and 15 can be interpreted as representing mild, moderate, and severe levels of anxiety (Spitzer, Kroenke, Williams, & Löwe, 2006). The scale has demonstrated good test-retest reliability and internal consistency resulting in a Cronbach’s alpha of α =.92 in previous studies (Spitzer, Kroenke, Williams, & Löwe, 2006). The GAD-7 demonstrated almost excellent internal consistency in this study (α = .89).

Depression. The Patient Health Questionnaire Mood Scale (PHQ-9) was used to measure participant’s level of depression. Participants were pleased to answer nine questions regarding how often they have been bothered by problems over the last two weeks. Problems ranged from “how often have you been bothered by trouble falling asleep, staying asleep, or sleeping too much?” to “how often have you been bothered by feeling down, depressed or hopeless?”. The four answer options ranged from not at all (0) to nearly everyday (3) with a total score ranging from 0 to 27 (Zhang et al., 2015). A higher total score would be an indication for more symptoms of depression. Regarding (Kroenke, Spitzer, & Williams, 2001) scores of 5, 10, 15, and 20 on the PHQ-9 represent mild, moderate, moderately severe, and severe depression, respectively. Based on the PHQ-9 algorithm a cut off value of 10 is detecting students who are positively screening for depression (Manea, Gilbody, & McMillan, 2015). The PHQ-9 is a questionnaire with established acceptable psychometric properties. In previous literature the PHQ-9 demonstrated a reliability ranging from .83 to .92 (Cameron, Crawford, Lawton & Reid, 2008). The questionnaire demonstrated good internal consistency in this study (α=.84).

Procedure

Once the study was approved by the Ethical Committee of the University of Twente a supervisor from the faculty of Behavioral, Management and Social Sciences sent a welcoming mail with the hyperlink of the study to all registered students of the University of Twente (UT). Subsequently, the researchers proceeded with the recruitment of participants via distributing the

hyperlink of the Research & Experience software Qualtrics. The survey was online for six weeks during April and May in the spring semester of 2019.

Once the participants followed the hyperlink that was sent via email to all students of the University of Twente, they found the welcoming email on the first page of the questionnaire to make sure that they were provided with all the necessary information about the research. In the welcoming mail, it was stated that the UT is concerned about the student's wellbeing and would like to improve in terms of creating an action plan that is based on the results obtained from the questionnaire. The students were, thus, informed that they could actively contribute to making the UT a better place. It was further indicated that it would take 20 minutes to fill out the complete questionnaire and that the data was treated confidentially. As an additional motivation to fill out the survey ten gift vouchers were distributed among respondents. The welcoming email was signed by the Rector Magnificus of the University of Twente.

To arrive on to the next page, the participant had to click on the arrow that was located at the lower right corner. An informed consent was provided to each participant (Appendix 1) on this page which assured that it can be withdrawn from the study at any time. Furthermore, the participants were informed about the anonymization and the confidential treatment of their personal data. In order to agree with the informed consent, it was asked to select the option "I agree to participate". Without this agreement of the informed consent, the participants would not be able to continue the questionnaire.

Questions about the participant's demographics followed the informed consent. The four questionnaires about the participant's perceived stress, resilience, and psychosomatic symptoms such as anxiety and depression were found on the following pages. The various question blocks that have been embedded in the survey were randomly distributed with the help of a randomizer to make sure that the questionnaires appearing at the end of the survey are also answered. Finally, the participants were thanked for their cooperation and once again were provided with the contact details of one of the researchers who could be contacted in case of any doubts or remaining questions and the study ended.

Data Analysis

Once the data collection of this cross-sectional study finished, the raw data has been retrieved via the Research & Experience Software 'Qualtrics'. Analysis has been conducted

using the Statistical Package for Social Sciences (IBM SPSS Statistics 25). In order to comply with the confidentiality of the data the variable that contains the email addresses of the respondents who wished to get informed about the results of the study were deleted. The particular items in the Brief Resilience Scale and the Perceived Stress Scale were reversed and the scoring for all questionnaires was adapted. The descriptive statistics of the data was calculated. Furthermore, the data was screened in order to determine a final dataset.

This study comprised a convenience sample of 2057 of undergraduate and graduate students. For the descriptive statistics and correlations between the variables, three exclusion criteria were used. First, participants above the age of 77 were excluded. The cut off value of 77 has been chosen because it is known that there is a student at the age of 77 studying at the UT. One participant who indicated the age of 99 was excluded because the credibility of this participant in other parts of the survey was questioned.

This led to a data set of 2056. Furthermore, participants who filled in the questionnaire in less than 600 seconds (which resemble ten minutes) were excluded because more time is needed to fill in the questionnaire conscientiously. Nine participants were excluded because they filled in the whole survey in less than ten minutes. Further, all participants who did not fill in all four questionnaires needed for further analyses were excluded which resulted in a final data set of 1246 participants. Boxplots have been created to detect any possible outliers. No noteworthy outliers have been detected in this data set. A uniform sample size provided more transparency for comparisons of the data. Furthermore, the exclusion of participants was necessary in order to conduct the moderation and mediation analyses that provide answers to the research questions and the relating hypotheses.

Proceeding with the analysis the reliability of the measurement data was determined. Cronbach's alpha has been determined to see whether the scales have internal consistency. To evaluate the total variance of this data set from its mean the sum scores have been calculated. In order to conduct correlations and to interpret the descriptive statistics, values of skewness and kurtosis have been considered. A skewness value above 2 and/or a kurtosis value larger than 7 may indicate a non-normally distribution of a sample larger than $N > 300$ (Kim, 2013). The skewness and kurtosis values in this sample were between ± 1 and, thus, offered an indication of a normal distribution of the population. Because of this parametric distribution, Pearson R was

used. The mean scores and standard deviations have been computed for all variables to see how the participants scored on the respective scales.

A correlation matrix has been created to test the possible relationship between the independent and dependent variables. For these analyses a significance level of $p < .05$ would be estimated as significant. To test the third hypothesis, if resilience moderates the relationship between stress and depression/anxiety the PROCESS Add-on developed by Hayes was used (Hayes, 2017). PROCESS has been chosen because it standardizes all variables and also computes the interaction term automatically (Hayes, 2017). This favors the interpretation of the results and provides a uniform overview of the results. The independent variable for these hierarchical multiple regressions is stress, the moderator resilience and in one moderator analysis, the dependent variable is depression and in the other anxiety.

To test for moderation, it is analyzed whether there is an interaction effect between stress and resilience and whether such an effect is significant in predicting depression or anxiety. To avoid potentially multicollinearity with the interaction term of resilience, the variables stress and resilience were centered and an interaction term between these two variables was created. If the effect is significant ($p < .05$) it is determined whether the effect is enhancing the effect of stress on depression/anxiety, whether it is buffering in which resilience would decrease the effect of stress on the respective DV or whether it is antagonistic in which resilience would reverse the effect of stress on depression/anxiety.

Finally, two mediation analyses have been conducted with the additional use of the PROCESS Add-on to see whether stress is having an effect on resilience and resilience having an effect one of the respective DVs of depression and anxiety. An effect would be accepted at a significance level of .05. Four steps must be considered in these mediation analyses. First, the relationship between the IV and the particular DV has to be significant. Then, the significance of the relationship stress and resilience must be confirmed and proceeding the significance of the relationship between resilience and the DV in the presence of stress ($M|X \rightarrow Y$) must be confirmed. At last, the insignificance of the relationship between stress and the DV in the presence of resilience must be confirmed. An online Sobel test has been conducted to test whether there is a significant mediation effect. For the mediation analyses, a significance level of $p < .05$ has been used.

Results

Table 3 presents an overview of the descriptive statistics and the correlations between the variables depression, anxiety, resilience, and perceived stress. The overview includes the mean, standard deviation, the range, minimum and maximum, the sum statistic and the Pearson correlation.

Table 1

Descriptive statistics and Correlations

	M	SD	Min	Max	1	2	3	4
1.Depression	8.74	5.49	0	27	1			
2. Anxiety	7.96	5.40	0	21	.73**	1		
3. Resilience	19.03	4.39	6	30	-.46**	-.50**	1	
4. Stress	27.31	8.49	4	52	.71**	.75**	-.60**	1

Note. **. Correlation is significant at the 0.01 level (2-tailed). M = Mean, SD = Standard deviation. Stress means perceived stress. The sample for these analyses was N = 1246.

The mean scores from the sum scores of each variable were inspected. The dependent variable depression has a mean of 8.74 (SD=5.49) which indicates that the sample achieved mild scores with a tendency to moderate scores on the extent to which one experiences depressive symptoms. In this sample, the average of participants perceives moderate symptoms of depression. 25.4% of the sample fall within the category that does not indicate any symptoms of depression. Most participants (36.6%) display symptoms of mild depression. 21.2% of the sample fall into the category of moderate depression, 12.7% into the category of moderately severe depression and 4.1% into the category of severe depression.

The second dependent variable of anxiety, has a mean score of 7.96 (SD=5.40), indicating a moderate score with a tendency towards a moderate level of anxiety. 30.1% fell into the category that experiences no symptoms of anxiety. 34.2% fell within the category that shows mild symptoms of anxiety, 21.9% moderate and 13.8% severe symptoms.

The third variable of resilience has a mean of 19.03 (SD=4.39). As mentioned beforehand a higher score is in accordance with more resilience. The scores ranged from 6-30 in this sample. A mean of 19.03 indicates a value of average resilience of the participants. The variable stress has a mean of 27.31 (SD=8.49) which indicates moderately high levels of perceived stress in participants. In this sample, the minimum was at 4 and the maximum at 52. 50.3% of the sample scored below the chosen cut-off score of 28. This indicates that the majority has values that do not indicate high levels. 49.7% of the sample scored above the cut-off score, showing high levels of stress.

Regarding the tested psychopathological symptoms of depression and anxiety, significant correlations with the remaining two variables of perceived stress and resilience were found. Stress correlated significantly with depression ($r=.71$, $p<.01$) resulting in participants who perceive a high level of stress also indicated more symptoms of depression. The correlation of stress and anxiety was also positive ($r=.75$, $p<.01$) and significant, indicating that when participants perceive higher levels of stress they also experienced more symptoms of anxiety.

Based on these Pearson correlations the first hypothesis that levels of stress are positively correlated with symptoms of depression and anxiety is accepted. Stress, depression, and anxiety correlated negatively with the variable of resilience. The Pearson correlation of resilience to depression has a value of -.46 and indicates that there is a moderate to high correlation between resilience and depression. Participants scoring high in resilience scored low in depression in this sample. The Pearson correlation of resilience to the dependent variable of anxiety is significant ($r=-.50$, $p<.01$) which indicates that participants scoring high in levels of anxiety scored low in resilience. The second hypothesis can also be accepted. The correlation of stress and resilience was also significant ($r=-.60$, $p<.01$) indicating that participants perceiving high levels of stress are low in resilience. This negative correlation confirms the third hypothesis. Finally, Pearson's r test revealed a statistically significant correlation between the two dependent variables of depression and anxiety ($r= .73$, $p < .01$).

Moderation analysis of resilience and stress on depression

Based on the correlations found between the variables, a moderation analysis has been conducted to test whether resilience has the assumed moderating effect on the relationship between the

independent variable of perceived stress and the dependent variable of depression. Table 2 displays the multiple regression analysis with and without the interaction.

Table 2

Multiple regression analysis for stress, resilience and the interaction term on depression

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	R Square Change	F Change	df1	df2	Sig.
1	.71[a]	.51	.51	3.85	.509	1287.12	1	1244	.000
2	.72[b]	.51	.51	3.83	.01	15.17	1	1243	.000

a.Predictors: (Constant), Stress

b. Predictors: (Constant), Stress, Stress_Resilience

The multiple regression analysis (see Table 5) shows that Model 1 (without the interaction term) is significant because $F(1, 1244) = 1287.12$, $p < .001$. Model 2 (with the interaction term) is also significant because $F(1, 1243) = 646.77$, $p < .001$. It is then examined if the amount of variance accounted for in Model 2 is significantly more than in Model 1. Model 2 with the interaction between stress and resilience accounted for significantly more variance than just stress and depression by themselves, R^2 change= .01, $p < .001$ (see Table 5). Indicating that there is a potentially significant moderation between stress and resilience on depression.

Since there is a potentially significant moderation effect between stress and resilience on depression, the magnitude of the moderation is tested. A regression was run on the centered terms to examine the effect. The following values were drawn from the PROCESS Add-on. For low resilience, stress b= .51, t(1242)=25.73, p<.001 meaning that for low resilience, there is a relationship between stress and depression. An increase in stress leads to a .51 increase in depression when resilience is low. For average resilience, stress b=.45, t(1242)=27.94, p<.001 meaning that for average resilience, an increase in stress leads to a .45 increase in depression. For high resilience, stress b=.38, t(1242)=19.70, p<.001 meaning that for high resilience, an

increase in stress leads to a .38 increase in depression. These results show that when resilience has increased, the effect of stress on depression is decreased.

To test the hypothesis that there is a relationship between stress and depression, and more specifically whether resilience moderates the relationship between stress and depression, a multiple regression analysis has been conducted. In the first step, the variable stress was included. This variable accounted for a significant amount of variance in depression, $R^2 = .71$, $F(1, 1244) = 1287.12$, $p < .001$. The interaction term between stress and resilience was added to the regression model, which accounted for a significant proportion of the variance in depression, $\Delta R^2 = .01$, $\Delta F(1, 1243) = 15.17$, $p < .001$, b = -.015, t(1242) = -5.65, p < .001. The analyses show that there is a moderation effect of resilience. The predictor and the moderator are significant with the interaction term added, showing that moderation has occurred, however, the main effects are also significant.

Moderation analysis for stress and resilience on anxiety

In the second moderation analysis it is tested whether resilience has a moderating effect on the relationship between stress and anxiety. Table 3 displays the multiple regression analysis with and without the interaction of stress and resilience.

Table 3

Multiple Regression Analysis for anxiety as the DV and stress as the IV

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	R Square Change	F Change	df1	df2	Sig. F Change
1	.75[a]	.56	.56	3.55	.56	1590.86	1	1244	.000
2	.75[b]	.57	.57	3.53	.01	17.87	1	1243	.000

a. Predictors: (Constant), Stress

b. Predictors: (Constant), Stress, Stress_Resilience

The multiple regression analysis shows that Model 1 (without the interaction term) is significant because $F(1, 1244) = 1590.88$, $p < .001$. Model 2 (with the interaction term) is also significant because $F(2, 1243) = 806.67$, $p < .001$. Model 2 with the interaction between stress and resilience accounted for significantly more variance than just stress and anxiety by themselves, R^2 change= .01, $p< .001$, indicating that there is potentially significant moderation between stress and resilience on anxiety.

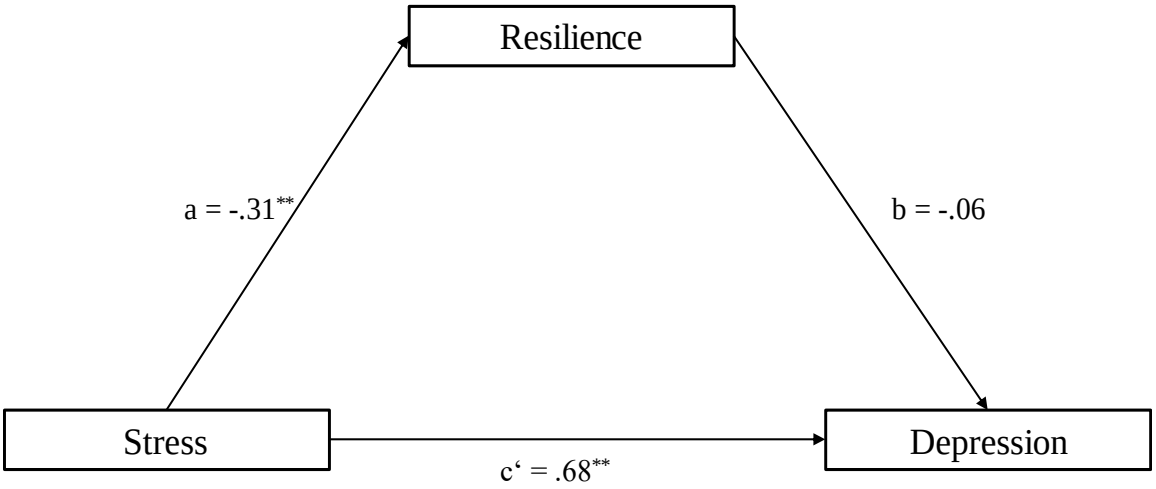
The Moderation analysis that tested for the magnitude of the moderation was conducted with the PROCESS Add-on used for SPSS. The analyses showed that resilience has a moderating effect on stress and anxiety. For low resilience, stress b= .48, t(1242)=29.02, p<.001 meaning that for low resilience, there is a relationship between stress and anxiety. An increase in stress leads to a .48 increase in anxiety when resilience is low. For average resilience, stress b=.45, t(1242)=31.03, p<.001 meaning that for average resilience, an increase in stress leads to a .45 increase in anxiety. For high resilience, stress b=.41, t(1242)=23.26, p<.001 meaning that for high resilience, an increase in stress leads to a .41 increase in anxiety.

The variable of stress accounted for a significant amount of variance in anxiety, R= .75, $F(1, 1244) = 1590.87$, $p < .001$. As in the previous moderation analysis, the variables stress and resilience were centered, and an interaction term was created. Next, the interaction term between stress and resilience was added to the regression model, which accounted for a significant proportion of the variance in anxiety, $\Delta R^2 = .01$, $\Delta F(1, 1243) = 17.87$, $p < .001$, b = -.008, t(1242) = -3.73, p < .001. The moderation analysis shows that resilience has a moderating effect on the relationship between stress and anxiety.

Mediation analyses

Figure 3

Mediating effect of resilience on the dependent variable of depression

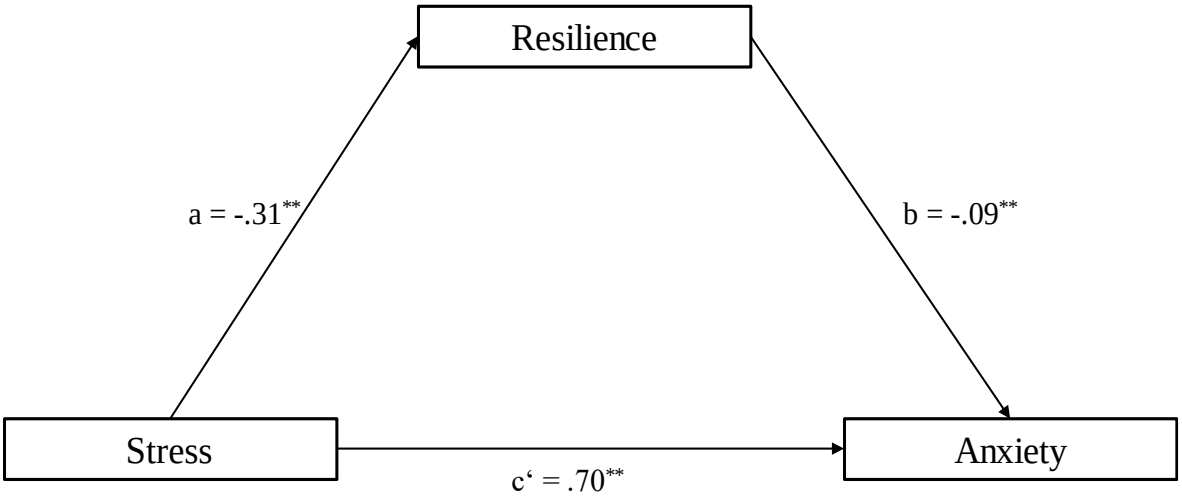


Note. **. Correlation is significant at the 0.01 level (2-tailed). The values for path a, b and c’ are derived from the regression analyses conducted with the PROCESS Add-on.

In Step 1 of the mediation model, the regression of stress on depression, ignoring the possible mediator of resilience, was significant, b = .46, t(1244) = 36.51, p = <.001. Step 2 showed that the regression of stress on the mediator, resilience, was also significant, b = -.31, t(1244) = -26.49, p = <.001. Step 3 of the mediation process showed that the mediator (resilience), controlling for stress, was non-significant, b = -.06, t(1244) = -1.77, p = .08. Step 4 of the analyses revealed that, controlling for the mediator (resilience), stress was a significant predictor of depression, b = .44, t(1244) = 27.64, p < .001. It was found that resilience does not mediate the relationship between stress and depression because stress is significant in the presence of resilience and this rejects the mediation effect.

Figure 4

Mediating effect of resilience on the dependent variable of anxiety



Note. **. Correlation is significant at the 0.01 level (2-tailed). The values for path a, b and c’ are derived from the regression analyses conducted with the PROCESS Add-on.

In Step 1 of the mediation model, the regression of stress on anxiety, ignoring the possible mediator of resilience, was significant, b = .47, t(1244) = 44.20, p = <.001. As in the previous conducted mediation analysis, the regression of stress on the mediator resilience, was also significant, b = -.31, t(1244) = -26.49, p = <.001. Step 3 of the mediation process showed that the mediator (resilience), controlling for stress, was significant, b = -.09, t(1243) = -2.99, p =.003. Step 4 of the analyses revealed that, controlling for the mediator (resilience), stress was also a significant predictor of anxiety, b = .44, t(1243) = 30.69, p < .001. There is no mediation effect because there is no meaningful reduction in the effect of the relationship between the initial independent variable of stress and the dependent variable of anxiety in the presence of the predicted mediator resilience. The last hypothesis is rejected.

The conducted analyses show that resilience is negatively correlating with stress, depression, and anxiety and that stress, in turn, is positively correlated with anxiety and depression. Resilience has a significant moderating effect on the relationship between stress and depression as well as stress and anxiety. However, resilience has not been found to be a mediator.

Discussion

The purpose of the study was to provide an insight into the mental health, the level of perceived stress and the level of resilience of students enrolled at the University of Twente. To the researcher's knowledge, this is the first study assessing the constructs under investigation in this constellation. This research is, thus, providing an important addition to the literature especially because the focus is on resilience in a student sample that has not gained much attention in previous literature. In this study, it was further attempted to examine the relationship between the variables of perceived stress, resilience, depression, and anxiety to examine to what extent they are influencing each other.

Principal discussion

With regard to the first research question regarding how much stress, resilience and symptoms of depression and anxiety students are experiencing, the findings show that the majority of students experience mild symptoms of depression as well as mild symptoms of anxiety. Prevalence rates from students studying at a German university show that 14.1% showed symptoms of depression (Bailer, Schwarz, Witthöft, Stübinger & Rist, 2008). Comparing the values found in this research which also uses the Patient Health Questionnaire it becomes apparent that a relatively high proportion of UT students display symptoms of depression. This concerning result goes along with the results that about a third of students indicate moderate, moderately severe and severe symptoms of depression. The third of the students that do not indicate any symptoms of depression is recognizable but still less than the proportion of symptom-free students in the study of Bailer et al. (2008).

Regarding anxiety, the majority of the students fall within the category of mild anxiety. The prevalence rates in previous studies show a value of 8.4% for anxiety and show a lower score than in the student sample of the UT (Vázquez, Torres, Otero & Díaz, 2011). Another study indicates a prevalence rate of 11.6% for anxiety but this value is also lower than the value of students studying at the University of Twente (Verger, Guagliardo, Gilbert, Rouillon, & Kovess-Masfety, 2010). It must be noted that this study reported only symptoms of depression and/or anxiety, which do not correspond to a diagnosis of a disorder. When comparing the symptoms of depression and anxiety to the diagnosis it becomes apparent that the symptoms are rather high.

The results of the psychopathological symptoms are in keeping with further existing research in which also about a third of the student sample, which is also applicable in this student sample, displayed mental health problems of depression and anxiety (Zivin, Eisenberg, Gollust, & Golberstein, 2009). Zivin et al. (2009) evaluate the amount of students with mental health problems as rather alarming and high. Even though most students in this study fall within the category of scoring mild in depression as well as anxiety there is a recognizable proportion of students who indicate higher scores which emphasizes the need for this university to address the mental health issues of their students. That the majority of students displayed mild symptoms of depression and anxiety might also be associated with the relatively high levels of resilience in this sample which might have had a preventative effect on possible symptoms of mental health.

The findings concerning the level of perceived stress in this sample are also a matter of concern. In this sample, most students scored only slightly below the chosen cut-off value that was used as an indication for high levels of perceived stress. The results show that the majority of the sample is very close to perceiving high levels of stress and more important that about one half is scoring above the cut-off score set. When these findings are compared to previous research, it becomes apparent that there are samples who experience even higher levels of stress (Shah et al., 2010). One explanation for these high scores might be that the compared student sample are medical students who are known to experience higher levels of stress than other students due to their intense study program (Sherina, Rampal, & Kaneson, 2004). The stress level in this student sample can, nevertheless, be interpreted as respectively high. Another explanation that the majority is just slightly below the chosen cut-off score is that the students in this sample show relatively high levels of resilience that might have had a preventative function in this sample. These findings and suggestions are in accordance with the third hypothesis that there is a negative correlation between stress and resilience and provide an answer to the fourth research question.

There is a relationship between stress and resilience in such that when levels of resilience are high, the levels of perceived stress are low. The results that the university students in this study perceived more stress the less resilient they were is in congruence with the literature introduced in previous parts of this report. In previous research, higher resilient student showed lower scores of perceived stress (Garcìa-León et al., 2019; Southwick, Vythilingam, & Charney,

2005). Consequently, it can be suggested that the high scores in stress might have influenced the relatively high scores in resilience and vice versa.

The third research question supports that resilience does not solely have an effect on stress but also on symptoms of depression and anxiety. In this study, higher levels of resilience were accompanied by fewer symptoms of the measured psychopathological symptoms. The findings of this study are in keeping with previously introduced research. Smith et al. (2008) found that an increase in resilience went along with a decrease in symptoms of depression and anxiety in a sample of university students. Based on these results, it can be assumed that resilience has a preventative effect on the mental health of students.

Referring to the second research question, a relationship has been found between perceived stress and the symptoms of depression as well as anxiety. Similar to other published literature, it was found that the stress students perceive is related directly to increased levels of depressive symptoms. In previous scientific work, it was examined what factors in a student's life might be sources of concern that cause an increase in perceived stress in university students. In this study, it was found that stress caused by the pressure to succeed at University caused an increase in depression and anxiety (Beiter et al., 2015). The relationship of perceived stress and the psychopathological symptoms also support the findings of García-León et al. (2019) that were introduced at the beginning of this report. High levels of stress are associated with higher levels of depression and anxiety in a student sample (García-León, 2019).

The findings that resilience has a moderating effect on the relationship between stress and depression/anxiety are in keeping with the last research question. A moderating effect has been found but the effect is, however, rather small and presumably not meaningful. The moderating variable of resilience is only slightly buffering the effect of stress on depression as well as anxiety. Literature shows that in different samples resilience can have a meaningful moderating effect on stress, anxiety, and depression (Bitsika, Sharpley, & Bell, 2013; Catalano, Chan, Wilson, Chiu, & Muller, 2011). The studies that found a moderating effect of resilience on depression, anxiety, and stress used different questionnaires which might give an indication of why a strong moderation was missing in this student sample. Furthermore, the context of the studies that found a meaningful moderation differed from the student sample. The research conducted by Bitsika et al. (2013) measured the objective level of stress adults experience when they are parenting a child with autism. Stress played an important role regarding the extent to

which resilience had a buffering effect in their study. The more stressed parents were, the more resilience was buffering the relationship between stress and mental health in this sample of parents. Previous scientific work is in keeping with the finding that the level of objective and not perceived stress influences the level of how to better cope with stress (Sawatzky et al., 2012).

It might be suggested that the level of perceived stress measured in this sample did not resemble the level of objective stress which in the end led to the finding of a moderating effect. If resilience truly has a moderating effect on the relationship between stress and depression/anxiety in this study the level of stress should have had an impact on the relationship as in previously conducted research. As the level of stress was already relatively high in this student set the level of stress is likely not to have introduced a moderating effect. This suggestion might cease doubts on the measurement of perceived stress and that the measurement of objective stress might lead resilience to have a more meaningful effect on depression and anxiety.

Research by MacKinnon (2011) suggests that moderator variables include characteristics that are stable and that are resistant to changes that occur over time. This fact can lead to the assumption that the moderation analysis in this study was specifically looking at resilience as a stable character trait. It should be discussed whether the Brief Resilience scale is suitable for measuring trait characteristics, as well as, state characteristics of resilience. The questions used in the BRS have been evaluated again and support previous findings of scientific work that the scale is focusing more on the aspects measuring the general resilience that is stable over time (Lai & Yue, 2014). The choice of the scale might give an indication of why resilience had a moderating effect but not a mediating effect. Future research could provide an answer to the most valuable scale measuring resilience in a student sample.

Another explanation of why resilience is a mediator in other studies but not in this one might be that a precise mediation analysis should take time into account because resilience is a dynamic state that is changed over time. As this research was a cross-sectional study that was administered at one point in time no insights could be given if resilience is changing over time. Measurement of resilience at various points in time might lead to different results that show a mediating effect of resilience.

Besides these suggestions that might explain why no meaningful moderating effect was found, it, nevertheless, must be emphasized that there is a possibility that resilience simply does

not have a meaningful moderating or mediating effect in this study. As mentioned previously the high correlations and only the small moderating effect of resilience give an indication that there are effects between the distinctive variables but that these are operating separately. This suggestion would be supported by the previously introduced literature that supports the high correlations between all constructs and shows the respective main effects between them. The existing relationship between resilience, stress, and depression as well as anxiety shows that resilience as a concept has an impact that decreases stress perceived by students and also decreases symptoms of depression and anxiety. The absence of a mediating effect and the absence of a meaningful moderating effect of resilience on the relationship between stress and depression as well as anxiety might give an indication that all variables are separate and independent constructs that are not caused by one another although they are in correlation with each other.

Limitations and strengths of the study

Some limitations become apparent that must be considered when interpreting the results of the study. It should be considered that the data was collected during the exam period of the University of Twente. A lot of deadlines for assignments and exams were pending for many faculties at this time and might have influenced the results of the data due to an increase in academic stressors. Previous research supports the suggestion that an increased level of stress might be assumed in this student sample because it is shown that student's stress level is increasing the closer the exam period is coming (Garcìa-León et al., 2019).

Another limitation might be that not all conditions can be controlled when participants take part in an online survey. It is crucial to consider that the survey took a relatively long time to be filled out because it was also conducted by other researchers who focused on distinctive questionnaires which in turn increased the length of the survey. Due to the high percentage of participants who did not complete the entire survey, it can be assumed that the majority perceived the questionnaire as too lengthy. Research shows that the attention span of adults lies between 10-20 minutes and the time needed to fill out the survey extends this attention span (Wilson & Korn, 2007). This might have had an effect on the concentration of participants and some questionnaires might have not gained as much attention as previous ones. In the future, it

can be suggested to comprise the survey to increase the participant's attention span and to perhaps motivate even more participants to complete the entire questionnaire.

Furthermore, the suitability of some chosen questionnaires regarding the population of university students should be reevaluated. It cannot be said with certainty whether the PSS-14 is measuring what the researchers intended to measure, namely the actual level of stress that students are perceiving at the moment and because of this lack of certainty it can be suggested that more research that gives an indication about the objective levels of stress in students is needed. The standardized questionnaire measuring the perceived stress of students is measuring multiple concepts at the same time and it can be questioned whether it measures the student`s perceived stress in their academic life as it was intended to measure with this questionnaire.

As the PSS-14 is measuring various constructs such as coping abilities, the ability to manage time, the feelings of distress and more, it does not necessarily give an indication about the objective level of stress (Katsarou et al., 2012). A questionnaire measuring the objective and not the perceived level of stress might give results that provide more precise insight into the level of stress in students. The Student Academic Stress Scale (SASS) might be a more suitable measurement because it analyses the level of cognitive, behavioral and affective stress that is common in university students (Pantlin & Woolard, 2014).

Besides these limitations of the study, the high response rate of students should be recognized as a general strength of the study. The questionnaire was sent to all students studying at the University of Twente and besides the chance of winning a voucher, there was no financial or academic reward for students who filled in the survey. It can, thus, be inferred that the questionnaire was filled out voluntarily which supports the truthfulness and sincerity of the answers provided by the participants.

Suggestions for future research

Perhaps the most important implication of this study is the need for the University to implement a method that is repeated continuously to monitor the mental health of the students. A practical recommendation for future research would be to conduct the survey again at a time aside from exam periods to be able to interpret the scoring on each scale used. In order to monitor student's level of stress more precisely, this questionnaire could be administered longitudinally to get a more in-depth insight into the level of student's stress, resilience and

mental health symptoms at different times. The pursuit of conducting this survey longitudinally is also in congruence with existing research that supports monitoring levels of stress over a time span rather than testing it at one point in time (Duan, 2016).

If the study is conducted at various times and over a longer period of time the scores on the questionnaires could be evaluated again and compared to the outcomes of this study. With the help of a longitudinal survey, it could also be better tested whether resilience can be changed and increased with training and is, thus, working as a state or trait. This information would be helpful when it is planned to design an intervention that includes strengthening resilience. When resilience is found to be a state, resilience programs could be used to increase this quality and special focus could be dedicated to students who are possessing resilience as a trait in order to learn about and compare their ways of dealing with academic stressors with the group that is struggling with stress.

The survey was created with the intention to find out student's issues that could be addressed in an intervention program which is planned to be designed. The importance of such a program can be supported by the high level of student's perceived stress and the recognizable proportion of students falling within the categories who experience higher symptoms of depression and anxiety. As previously mentioned, the majority scores slightly below the chosen cut-off value of perceived stress and before this value is rising any further, the University of Twente should take action that decreases student's level of perceived stress.

Perceived stress and especially academic stressors cannot be eliminated completely in a student's life. It would, thus, be less effective to counter the stressors themselves but more effective to tackle the protective influences that help students to deal better with these stressors. Students could benefit from an increase in resilience to enjoy their time at University more stress-free. The University of Twente has a focus on Positive Psychology and Mindfulness which could be used to design the intervention program that includes the quality of resilience.

Previous Mindfulness-Training resulted in an increase in high school student's responses to stress and has increased their inner resilience as well as their stress resilience (Meiklejohn et al., 2012). This training resulted in better working memory, attention, and self-esteem in students. Steinhardt & Dolbier (2008) suggest that a resilience program can be effective regarding student's stress management. A possible design of an intervention program that takes resilience into account supports the suggestion of establishing this survey as a longitudinal study.

The effectiveness of the intervention program could be monitored with the help of a longitudinal questionnaire and to evaluate if there are other demands rising in the student's life. The high response rate that this survey received might suggest how important the topics of mental health are for students and that a conceptual plan on how to decrease psychopathological symptoms and how to increase the ability to better cope with stress is likely to be desired. It can further be suggested that a possible intervention program will be welcomed at this University.

Even though resilience is not a meaningful moderator nor a mediator in the relationship between stress and depression/anxiety its impact should not be underestimated. The conducted research shows that high resilient students perceive less stress than students low in resilience. Additionally, resilient people display fewer symptoms of depression and anxiety. These findings should be addressed in future research with a focus also on student samples to increase the importance of the complex construct of resilience to help students with their time at university. Moreover, resilience should gain more attention in research because it can be used as prevention measures. Plenty of research focuses on the recovery from stressful life hassles but wouldn't it be more beneficial for society if it focuses on preventing people to suffer from these hassles and being better able to cope with these issues in the first place?

Conclusion

This report provides novel empirical evidence on the role of resilience in a student sample of the University Twente. Even though resilience does not have a meaningful moderating nor a mediating effect in this study it, nevertheless, has an impact on stress as well as depression/anxiety. In this study, resilience seems to be determinant in perceived stress and symptoms of depression and anxiety in a way that it decreases symptoms of depression and anxiety in this sample. The findings of this study show that resilience can benefit students to experience less stress and that it has a positive impact on psychopathological symptoms insofar that it decreases symptoms of depression and anxiety. This knowledge should be used for future research because resilience is very much an influencer and has been proven to be a resource against stress and mental health problems. This study, thus, adds evidence that resilience can contribute to a more in-depth understanding of how university students manage an increasingly stressful time at university. Concluding, the knowledge of the separate relations between resilience, perceived stress, depression, and anxiety found in this study could be used to

strengthen student's resilience with the previously suggested resilience programs in order to prepare students for upcoming stressful situations and setbacks in their life at university.

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Appendices

Appendix 1: Informed Consent

Informed consent

Before you proceed in this questionnaire, please read the informed consent information below.

Please be aware that your participation in this study is completely voluntary, and that you can stop taking part at any time. You may also withdraw from this research at any point until one week after submitting the survey. Under no circumstances will your real name or personal information be included in the report of this research. Nobody, except the four researchers and the research supervisor, will have access to the anonymized material. Your data will be treated confidentially, and the research results will be published anonymously. Your personal data will

not be given to third parties without your permission. If you have any question, you may contact Leonie Reh (l.reh@student.utwente.nl).

If you have any complaints about this research, please direct them to the secretary of the Ethics Committee of the Faculty of Behavioural Sciences at the University of Twente, Drs. L. Kamphuis-Blikman P.O. Box 217, 7500 AE Enschede (NL), telephone: +31 (0)53 489 3399; email: l.j.m.blikman@utwente.nl).

If you click on 'proceed', you indicate that you have read and understood the informed consent and have been informed in a manner which is clear to you about the nature and method of the research. By proceeding you agree with participating in this study.