What is the Relation between Stress, Anxiety, and Intolerance of Uncertainty?

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Abstract

Mental health issues among University students pose a prevailing problem in the current educational setting with students regularly reporting high levels of stress and anxiety. University is an uncertain period paired with different stressors and instabilities that not every student is able to properly deal with. Literature suggests that a person's intolerance to uncertainty (IU) affects stress and anxiety. This study investigates the relation between stress, anxiety, and IU in students at the University of Twente. More specifically, it will assess whether stress positively predicts anxiety and if, IU moderates this relationship. Additionally, gender will also be examined in this context due to its link to stress and anxiety. A quantitative cross-sectional online-survey research design (N=1268) was used to collect data from students attending the University of Twente in spring of 2019. To measure stress, anxiety and IU, the Perceived Stress Scale (PSS-14), the Brief Measure for Generalized Anxiety Disorder (GAD-7) and the short version of the Intolerance of Uncertainty Scale (IUS) were used, respectively. Independent sample t-tests and stepwise multiple regression analyses were executed to test the hypotheses. Gender differences were found across stress, anxiety and IU with women reporting higher levels. As hypothesized, stress positively predicted anxiety and IU significantly moderated this relationship. Explorative analyses revealed a moderation effect for men, but not for women. The moderation-effect was small; however, it still shows the need for further research and interventions aimed to improve students' mental well-being. The findings offer directions by showing IU's unique role in the relationship of stress and anxiety. Tackling students' tolerance of uncertainty might improve their coping with anxiety.

Keywords: Stress, Anxiety, Intolerance of Uncertainty, University students, Moderation

Introduction

Mental health problems are a rising concern among University students. Dealing with environmental changes and the pressure of meeting academic demands are just a few of many factors that contribute to students experiencing University as a stressful time. Additionally, the age of onset (i.e. 21 years of age) of common mental disorders, such as anxiety disorders, is the time when students attend University (De Girolamo, Dagani, Purcell, Cocchi, & McGorry, 2012; Lijster et al., 2017). It might, therefore, not be surprising that during the last years, the severity of mental health problems has increased, as well as the number of students seeking help (Hunt & Eisenberg, 2010). Furthermore, young adulthood is a period in which significant personality changes are likely to emerge (Roberts, Walton, & Viechtbauer, 2006). According to the diathesis-stress-model, personality factors play an important role in the occurrence of mental health issues (Chen & Hong, 2010). An important concept that has been researched in adolescents and University students in combination with both stress and anxiety is the intolerance towards uncertainty (IU). During their studies, University students are confronted with many uncertain situations that often determine the course of their life. The degree to which students are able to tolerate this uncertainty possibly affects their mental health. The current study, therefore, aims to investigate the relation between stress, anxiety, and IU in University students.

Multiple studies have shown that stress is a worldwide issue in University students which is supported by prevalence rates of students experiencing severe or extremely severe levels of stress. These numbers range from 5.1% to 30.8% (Bayram & Bilgel, 2008; Beiter et al., 2015; Shamsuddin et al., 2013; Wahed & Hassan, 2017). Stress is referred to as a process in which internal and external demands exceed an individual's ability to cope with them (Amirkhan, Landa, & Huff, 2018; Cohen, Kessler, & Gordon, 1995; Maajida Aafreen, Vishnu Priya, & Gayathri, 2018). This process is influenced by various environmental factors, e.g. the occurrence and frequency of challenging life events (Pearlin, Menaghan, Lieberman, & Mullan, 1981), personal factors, e.g. beliefs about stress or a person's coping style (Cohen et al., 1995; Pearlin et al., 1981) and social factors, such as an existing social support system (DeLongis, Folkman, & Lazarus, 1988; Pearlin et al., 1981).

Students are especially at risk for experiencing high stress because they are confronted with multiple stress-sources simultaneously during a sensitive time in their lives. Environmental sources of stress are e.g. the transition of leaving home and adjusting to a new

life at college or accommodation (Towbes & Cohen, 1996). Studies found that students living off-campus experience more stress due to addressing issues in their housing (Beiter et al., 2015), or if they have a general dissatisfaction with their living conditions (Chow, 2005). Students living in shared housing experience more stress because of increased noise and distractions (Heath & Kenyon, 2001). Moreover, financial concerns pose a persistent stressor for many students, especially for those coming from a low socio-economic background (Andrews & Wilding, 2004; Bayram & Bilgel, 2008). Personal sources of stress include self-esteem (Beiter et al., 2015; DeLongis et al., 1988) and body image (Beiter et al., 2015). A social stressor that many students are faced with is social instability caused by finding new friends or changes in romantic status due to attending University (Auerbach et al., 2018). However, the most prominent causes of stress in University students are academic performance (Beiter et al., 2015; Bertocci, Hirsch, Sommer, & Williams, 1992), the pressure to succeed (Beiter et al., 2015; Hirsch & Ellis, 1996) and post-graduation plans (Beiter et al., 2015). The latter being more relevant for senior students since they are closer to graduation and must prepare to find employment (Beiter et al., 2015).

It is crucial to assess when feelings of stress become unhealthy because dealing with high levels of stress contributes significantly to developing mental disorders (Bystritsky & Kronemyer, 2014; Schneider & Riffle, 2012) and physical illnesses (McEwen, 2008; Schneider & Riffle, 2012). Stress lies on a spectrum (Edwards & Cooper, 1988): one end demonstrates good stress, termed eustress (Selye, 1976), which can have positive outcomes, e.g. on well-being (Quick, Quick, Nelson, & Hurrell Jr, 1997). On the other end of the spectrum lie severe, unhealthy feelings of stress which often result in emotional and mental struggles (Bystritsky & Kronemyer, 2014). Common physiological and psychological symptoms of high stress include gastro-intestinal symptoms (diarrhea or stomach pain), appetite change, weight change, and fatigue (Amirkhan et al., 2018) or mood changes and feelings of nervousness (El Ansari, Oskrochi, & Stock, 2013). High stress can also impair cognitive functions often expressed through concentration problems or forgetfulness (El Ansari et al., 2013).

Another construct closely related to stress is anxiety. Stress is an important factor in the development of anxiety disorders, as well as other common mental disorders such as depression, obsessive compulsive disorder, and post-traumatic stress disorder (Huang, Nigatu, Smail-Crevier, Zhang, & Wang, 2018). University students are at risk for experiencing high levels of stress due to being confronted with multiple stressors over an extended period.

Given that severe stress fosters the development of anxiety (Schneider & Riffle, 2012), students are also at a greater risk for experiencing anxiety. This is supported by high prevalence rates: 15% to 29.9% of University students report severe or very severe levels of anxiety (Bayram & Bilgel, 2008; Beiter et al., 2015; Choueiry et al., 2016; Shamsuddin et al., 2013; Wahed & Hassan, 2017). It is crucial to differentiate between problematic feelings of anxiety and benign feelings. Like stress, anxiety lies on a spectrum and its lower end, i.e. mild feelings of anxiety can have positive effects, e.g. sparking motivation, or warning against real danger (Endler & Kocovski, 2001; McNeil et al., 2012). Whereas the higher end represents severe feelings of anxiety, such as anxiety disorders (Endler & Kocovski, 2001). Anxiety disorders are characterized by severe and prolonged feelings of fear and physiological reactions, such as increased heart rate, heart palpitations or sweating (Baxter, Vos, Scott, Ferrari, & Whiteford, 2014; McNeil, Vargovich, Ries, & Turk, 2012; Thayer, Friedman, & Borkovec, 1996). They can cause significant impairment in a person's daily life and prevent them from properly managing daily responsibilities (American Psychological Association, 2013). Furthermore, several studies found that sleeping problems, such as insomnia and the quality of sleep, are related to anxiety (Choueiry et al., 2016; Mason & Harvey, 2014). Anxiety is caused by interpreting certain situations or stimuli as fear-/threat-inducing (Spielberger, 2013). What people find threatening varies depending on personal, social, or cultural factors (McNeil et al., 2012).

University students must regularly deal with high workloads, due to attending multiple courses at the same time, while also meeting deadlines and passing exams. So, if a student assesses the workload of an exam as not manageable in the given time, it will illicit stress because the student cannot cope with the demands. In turn, the upcoming exam will be feared by the student and make him anxious. The relationship between stress and anxiety is supported by literature: high workloads (Maajida Aafreen et al., 2018), academic performance and the pressure to succeed are frequently named as sources for stress and anxiety (Beiter et al., 2015). Moreover, multiple studies confirmed a positive relationship between stress and anxiety (Costantini, Davis, Braun, & Iervolino, 1973; Johnson & Sarason, 1978; Sarason, Johnson, & Siegel, 1978).

A risk factor that is associated with anxiety and stress is gender. Being female makes one more vulnerable to anxiety and stress as females tend to regularly report higher levels of anxiety and stress than males (Matud, 2004; McLean & Anderson, 2009; McNeil et al., 2012). Anxiety disorders and comorbidities seem to be more prevalent among women (McLean,

Asnaani, Litz, & Hofmann, 2011) and girls are more likely to develop an anxiety disorder than boys (McLean & Anderson, 2009). Similarly, stress-related disorders, such as posttraumatic stress disorder, are more prevalent among women (Tolin & Foa, 2008). Studies investigating anxiety and stress among University students support this notion by reporting higher levels of anxiety and stress in females (Bayram & Bilgel, 2008; Beiter et al., 2015; Brougham, Zail, Mendoza, & Miller, 2009).

Although, it has been assessed that stress fosters anxiety (Schneider & Riffle, 2012), the underlying mechanisms and factors that enable the development of anxiety symptoms are still to be explored. One theory that offers an explanation on how stress affects mental health problems, such as anxiety, is the diathesis-stress model. This model suggests that existing personal characteristics (e.g. biological factors, genetic factors, or personality traits) make people more vulnerable to illnesses when facing stress (Schneider & Riffle, 2012). These personal characteristics act as moderators of stress and influence the exposure and appraisal of stress-sources and coping abilities of a person (Schneider & Riffle, 2012).

University students are regularly confronted with uncertain situations and challenges that are characterized by a certain degree of instability. Dealing with academic challenges, e.g. writing exams, social changes, such as finding new friends, and concerns about the future, e.g. finding employment after graduation, are just few of many problems that students must face. Many of them cannot be tackled immediately, but often require students to endure at least some degree of uncertainty before they can be solved. The extent to which students are able to tolerate uncertainty is an important characteristic that affects the experience of mental health problems. Additionally, University students are oftentimes young adults which are in a sensitive period of their life. Most of them must learn how to build a life by themselves without the help of their parents or caretakers. Issues related to studies are paired with personal issues related to learning to become independent. This complex situation makes University students vulnerable to mental health issues and the effects of IU can become especially observable.

IU is known as “a dispositional characteristic that reflects a set of negative beliefs about uncertainty and its implications” (Dugas & Robichaud, 2007, p.24) and represents an underlying fear of the unknown (Carleton, 2016). It consists of two dimensions: prospective IU and inhibitory IU (Carleton, 2012; McEvoy & Mahoney, 2011). Prospective IU refers to making negative cognitive appraisals to future events, e.g. future situations are inevitably

going to turn out bad due to missing information or planning (Carleton, Norton, & Asmundson, 2007). Whereas inhibitory IU refers to the behavioural inhibition that is experienced in relation to uncertainty which means that a person feels paralyzed to act due to the uncertainty of a situation (Carleton et al., 2007). IU also plays a role in the process of worry and its maintenance (Freeston, Rhéaume, Letarte, Dugas, & Ladouceur, 1994; Laugesen, Dugas, & Bukowski, 2003) and it has been shown to impair decision-making processes (Buhr & Dugas, 2002).

Different levels of IU have been shown to affect the experience of stress and anxiety. For example, individuals high in IU tend to rate ambiguous situations as "stressful and upsetting" (Buhr & Dugas, 2006, p.223) compared to low IU individuals. In situations that are moderately stressful, but show explicit uncertainty, high IU individuals show increased anxiety levels and more distress than low IU individuals (Jacoby, Abramowitz, Buck, & Fabricant, 2014; Reuman, Jacoby, Fabricant, Herring, & Abramowitz, 2015). Furthermore, IU impacts a person's ability to effectively cope with stressors. It has been reported that individuals high in IU tend to use more maladaptive coping strategies than low IU individuals (Doruk, Dugenci, Ersöz, & Öznur, 2015) which has been found to increase levels of anxiety (Wongtongkam, 2019). Vice versa, it has been found that low levels of IU are associated with high levels of resilience (Lee, 2019), which buffer against negative effects of stress (Schneider & Riffle, 2012), and could indirectly decrease anxiety. These individual differences in IU might interact with stress and thus, possibly moderate the relationship with anxiety. The moderating effect of IU has been confirmed in other studies before. A study by Chen and Hong (2010) investigated the moderating effect of IU on the relationship between negative life events and anxiety in an undergraduate student sample. Negative life events are considered a significant source of stress due to their irritating and distressing nature (Chen & Hong, 2010). The researchers confirmed that negative life events increased anxiety symptoms among high IU individuals, but not among low IU individuals. Another study by Zlomke and Jeter (2013) investigated the moderating effect of IU on the relationship between daily stress and worry. Worry is a significant part of anxiety (McNeil et al., 2012) and regularly reported in anxiety disorders (American Psychological Association, 2013). They found that high levels of IU interact with stress and significantly predicted worry (Zlomke & Jeter, 2013).

This study aims to contribute to the knowledge gap surrounding the relation between stress, anxiety, and IU. Therefore, the following research question is proposed:

What is the relation between stress, anxiety, and intolerance of uncertainty in University students?

As suggested in the literature above, there is evidence to assume that there is a relationship between stress and anxiety in University students. This target group is of particular interest for this research question due to its unique life situation. University students are confronted with multiple sources of stress, reaching from academic to personal challenges, which make them vulnerable to mental health problems, such as anxiety. This notion is confirmed by high stress and high anxiety prevalence rates among University students. Moreover, multiple sources found that stress contributes significantly to anxiety symptoms. Hence, the following hypothesis is proposed:

H 1: Stress positively predicts anxiety.

In line with the diathesis-stress model, individual differences of IU could act as a moderator in the relationship between stress and anxiety. Thus, at the same level of stress, high IU individuals experience more anxiety compared to low IU individuals. More specifically, the following hypothesis is proposed:

H 2: IU positively moderates the relationship between stress and anxiety.

As discussed above, gender is related to stress and anxiety and it will, therefore, also be examined in the context of this study.

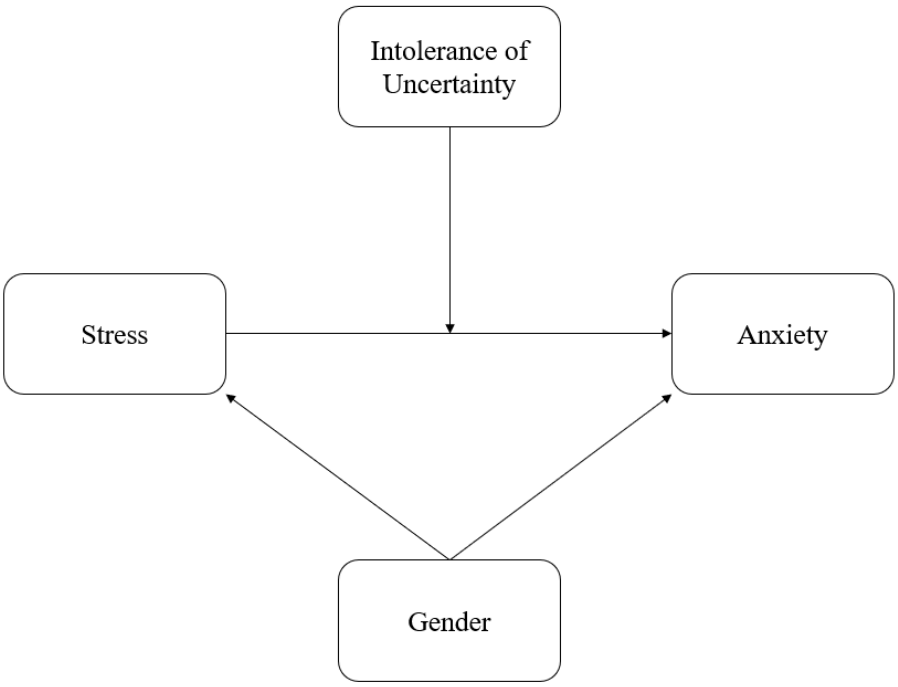

Figure 1. Hypothesized model for the relations among gender, stress, anxiety, and intolerance of uncertainty.

Methods

Design

The study uses a quantitative cross-sectional online-survey research design. The variables being researched are stress, anxiety, and intolerance of uncertainty.

Participants

To recruit participants a convenience sampling method was used. Invitations to participate in the study were sent out via e-mail to all registered students at the University of Twente and gathered 2057 responses. The inclusion criteria of this study included that participants had to be older than 18 years. Participants were excluded if they did not fill out all the required questionnaires measuring stress, anxiety, and IU. Based on this exclusion-criterion, a large part of responses (*N*= 788) had to be removed from the sample. One participant was deemed not credible by indicating the age of 99 because there is no 99-year old student at the UT and was therefore excluded from the sample. No noteworthy outliers had been detected. Thus, 1268 participants remained for analysis. The sample consisted of slightly more men (53.3%) than women, and the dominant nationality was Dutch (71.1%). The participants' ages ranged from 18 to 77 (*M*= 22.2, *SD*= 3.43). Table 1 gives a more detailed overview of the sample.

Table 1

General Demographic Characteristics of the Sample (N= 1268)

Item	**Category**	**Frequency**	**%**
Gender	Male	676	53.3
	Female	583	46.0
	Diverse	9	0.7
Age (years)	18 – 21	577	45.5
	22 – 25	546	43.1
	26 – 77	145	11.4
Nationality	Dutch	901	71.0
	German	142	11.2
	Other EEA	76	6.0
	Other Non-EEA	149	11.8

Note. EEA-countries include all 28 members of the European Union and Liechtenstein, Norway, and Iceland.

Out of 788 removed responses, only 427 filled in the first three demographic questions. As described in table 2, this sample was predominantly male (54.9%) and most participants were of Dutch Nationality (75.5%). The mean age was 22 (*SD*= 2.75) and ranged from 18 to 42. There were no significant systematic differences detected for gender (X^2(2, 1695)= .53, $p > .05$), nationality (X^2(73, 1695)= 79.96, $p > .05$) and age (t(906, 98)= -1.47, $p > .05$) between these groups.

Table 2

General Demographic Characteristics of the Removed Responses Sample (N=427)

Item	**Category**	**Frequency**	**%**
Gender	Male	234	54.8
	Female	191	44.7
	Diverse	2	0.5
Age (years)	18 – 21	200	46.8
	22 – 25	188	44.0
	26 – 42	39	9.1
Nationality	Dutch	322	75.4
	German	33	7.7
	Other EEA	20	4.7
	Other Non-EEA	52	12.2

Note. EEA-countries include all 28 members of the European Union and Liechtenstein, Norway and Iceland.

Procedure

This study was created via Qualtrics by psychology students of the University of Twente in 2019 for their Bachelor thesis. Other variables assessed in this study were burnout, depression, wellbeing, heavy drinking, drug-use, internet use, resilience, stress mindset, fear of missing out (FOMO), loneliness, and sense of belonging. The study was approved by the Ethical Committee of the faculty of Behavioural, Management and Social Sciences (BMS) of the University of Twente. The data collection started on April 5th, 2019 and ended on May 13th, 2019. The survey was distributed two ways. First, a mass e-mail invitation signed by the board of the University with the link to the survey was sent to all registered students via their student e-mail address. Second, the involved researchers continued to distribute the survey-link among their fellow students.

Via the hyperlink, the participants were directed to the first page of the survey. This was a welcoming page summarising necessary information with regards to the topic, the

background of the study and the confidentiality, anonymization, and handling of the participants' data. The information was provided for the participants to make an informed choice about whether they wanted to participate in the study. Additionally, participants had been informed about their involvement being voluntarily, and their right to withdraw from the study at any given moment. Once the participants gave their consent, they were able to start the survey. The participants had to fill out multiple questionnaires for multiple variables. The order of the questionnaires was randomized, and it took approximately 20 – 25 minutes to complete. At the end, participants were thanked for their participation and given the opportunity to register themselves to receive a summary of the results and/or to participate in a student panel.

Measuring Instruments

Demographic variables. The demographic variables were assessed by asking general questions about the participants' age, gender, whether they identify as LGBT (lesbian, gay, bisexual, and/or transgender), nationality and their religious beliefs. Furthermore, study-related questions were added, such as in which study program they were enrolled, their year of study, whether they studied full-time or part-time and how much time they spent with sleeping and private activities.

Stress. The Perceived Stress Scale (PSS-14) by Cohen, Kamarck, and Mermelstein (1983) was used to measure how much stress the participants experienced. The PSS-14 is a quantitative self-report measure with 14 items rated on a 5-point Likert scale ranging from 0 ("*never*") to 4 ("*very often*"). The questionnaire uses items, such as "*In the last month, how often have you felt nervous and "stressed"?*" or "*In the last month, how often have you found that you could not cope with all the things that you had to do?*", to assess different factors contributing to feelings of stress. The overall score is obtained by adding all scores together. Hereby, items 4, 5, 6, 7, 9, 10, and 13 must be scored in reverse. The higher the sum score, the higher or more intense stress the participants experience. The lowest score obtainable is 0 and the highest score is 56. In several studies a cut-off score of 28 was used differentiating between low and high levels of stress (Brahmbhatt, Nadeera, Prasanna, & Jayram, 2013; Shah, Hasan, Malik, & Sreeramareddy, 2010; Walvekar, Ambekar, & Devaranavadagi, 2015). The overall psychometric properties of the PSS-14 have been found to be acceptable (Lee, 2012; Leung, Lam, & Chan, 2010). In this study, the reliability of the PSS-14 is $\alpha = .86$ which

is acceptable. The PSS has also been found to be well validated for college students (Lee, 2012).

Anxiety. The Brief Measure for Generalized Anxiety Disorder (GAD-7) by Spitzer, Kroenke, Williams and Löwe (2006) was used to assess the degree of anxiety the participants experienced. This questionnaire consists of 7 items rated on a 4-point Likert scale ranging from 0 ("*not at all*") to 3 ("*nearly every day*"). While filling out the scale, the participants must indicate the frequency of anxiety-related symptoms they experienced over the last two weeks. Those symptoms include "*feeling nervous, anxious, or on edge*" or "*worrying too much about different things*". The sum of scores makes up the overall score which is then divided into four categories: minimal anxiety (0 – 4), mild anxiety (5 – 9), moderate (10 – 14), and severe anxiety (15 – 21). The reliability of the GAD-7 was found to be acceptable with a Cronbach's Alpha of .89 and overall performs as a good measure for general anxiety (Beard & Björgvinsson, 2014; Naeinian, Shairi, Sharifi, & Hadian, 2011; Spitzer et al., 2006).

Intolerance of uncertainty. Intolerance of uncertainty was measured by using the short version of the Intolerance of Uncertainty Scale (IUS) by Carleton et al. (2007). The scale consists of 12 items, such as "*unforeseen events upset me greatly*" or "*uncertainty keeps me from living a full life*", with two subscales, namely prospective IU and inhibitory IU. The items are rated on a 5-point Likert scale ranging from 1 ("*not at all characteristic of me*") – 5 ("*entirely characteristic of me*"). The sum score of all items represents the overall score of the scale. The higher the sum score, the higher is the level of intolerance of uncertainty the participant experiences. The reliability of the IUS is acceptable ($\alpha = .90$). The IUS has been found to be a good measure for intolerance of uncertainty, reflecting excellent internal consistency and good test-retest reliability (Buhr & Dugas, 2002; Carleton et al., 2007).

Data Analysis

The statistical analyses were conducted using the software SPSS v25 (IBM, 2017) and the PROCESS macro for SPSS (Hayes, 2018). The PROCESS macro was specifically used to aid with moderation analyses. Prior to analyses, participants were excluded from the sample who did not fill in all required questionnaires. Subsequently, boxplots were visualized to check for outliers. Descriptive statistics were calculated for all the variables (stress, anxiety, IU), assessing the mean scores and standard deviations. Before, the items 4, 5, 6, 7, 9, 10, and 13 of the PSS-14 had been reversed. Additionally, in order to check whether the variables were normally distributed, Skewness and Kurtosis were calculated. As an appropriate cut-off

threshold concerning the Skewness and Kurtosis values, scores were set at +1 and -1. The reliability of all scales was checked using Cronbach's Alpha. A value of $\alpha > .70$ was considered acceptable (Tavakol & Dennick, 2011). After that, the relationship between the different variables was investigated by assessing their Pearson correlation coefficients. Values of .30 were considered medium effect size and values of .50 were considered large effect size (Cohen, 1992). The statistical significance was set at $p < .05$. An independent sample t-test was used to test whether there were significant gender differences across stress and anxiety. Prior to this analysis, participants who identified as "diverse" were removed from the sample because only male and female participants were relevant for this test. Stepwise multiple regression analyses were used to test for two models. Model 1 was used to test whether stress positively predicts anxiety. During the next step, an interaction term (stress x IU) was computed. In model 2, the interaction term was added, and it was assessed whether stress x IU had an impact on anxiety by examining a significant change in the effect size compared to the first model.

Results

As shown in table 3, the mean-score for stress was $M = 27.29$ ($SD = 8.47$). The lowest score obtained was 4 and the highest 52. In this sample, 49.7% of participants experienced high stress levels as indicated by a score above the cut-off of 28 (Brahmbhatt et al., 2013; Walvekar et al., 2015). Concerning anxiety, the scores ranged from 0 to 21 with a mean score of $M = 7.94$ ($SD = 5.40$). In this sample, 21.7% of participants experienced moderate levels of anxiety and 13.9% experienced severe levels of anxiety. Concerning IU, the mean-score was $M = 32.97$ ($SD = 9.67$), the lowest score obtained was 12 and the highest 60.

The distribution of the data across the variables was estimated by using Skewness and Kurtosis. Stress and IU were normally distributed. Concerning anxiety, the data were positively, moderately skewed and had a slightly flat distribution but still fall within the appropriate cut-off points (table 3). The reliability was assessed using Cronbach's Alpha and indicated that all scales are reliable (table 3).

Following descriptive statistics, Pearson correlations among stress, anxiety and IU were calculated. A significant, strong positive correlation had been assessed among stress and anxiety ($r = .75$, $p < .05$). Correspondingly, the correlation shows a strong effect size ($r^2 = .56$). Significant positive, but rather moderate correlations had also been found among stress and

IU (r= .46, p < .05, r^2 = .21), as well as anxiety and IU (r= .48, p < .05, r^2 = .23). These correlations showed a small effect size.

Table 3

Descriptive Statistics and Correlations of the Sample (N= 1268)

Scale	*M (SD)*	*α*	*Skewness*	*Kurtosis*	*Stress*	*Anxiety*	*IU*
Stress	27.29 (8.47)	.86	-.04	-.40	1	-	-
Anxiety	7.94 (5.4)	.89	.52	-.54	.75*	1	-
IU	32.97 (9.67)	.90	.20	-.32	.46*	.48*	1

Note. *p < .05.

To test whether there were existing gender differences across stress and anxiety, an independent two sample t-test was executed. Concerning stress, it was found that females obtained significantly higher scores (M= 28.94, SD= 8.3) than males (M= 25.89, SD= 8.37) (t(1257)= -6.48, p < .05). Similarly, females also scored significantly higher on anxiety (M= 8.99, SD= 5.32) than males (M= 7.06, SD= 5.33) (t(1257)= -6.42, p < .05). Additionally, the t-test revealed that females also had significantly higher scores on IU (M= 34.12, SD= 9.67) than males (M= 31.99, SD= 9.58) (t(1257)= -3.92, p < .05).

Table 4

Differences of the Assessed Variables across Gender

Variable	*Female (N= 583) M (SD)*	*Male (N= 676) M (SD)*	*t(df)*	*p*
Stress	28.94 (8.3)	25.89 (8.37)	-6.48 (1257)	.000
Anxiety	8.99 (5.32)	7.06 (5.33)	-6.42 (1257)	.000
IU	34.12 (9.67)	31.99 (9.58)	-3.92 (1257)	.000

To test the first hypothesis whether stress positively predicts anxiety, a linear regression model was used. The model showed that stress explains 55.5% of variance of

anxiety (R^2= .555, F(1, 1266) = 1578.95, p < .001) and stress was found to significantly predict anxiety (β= .75, t(1266) = 39.74, p < .001).

To test the second hypothesis whether IU moderates the relation between stress and anxiety, an interaction-term of stress and IU (stress x IU) was added to a second model. The second model also explained a significant amount of variance in anxiety (R^2= .583, F(2, 1265)= 883.90, p < .001). Both models were compared to check whether the second model explained significantly more variance than the first one. This could be supported (R^2-change = .028, p < .001) and indicated that there was a present moderation effect. These results overlined with the moderation analysis done with PROCESS by showing that the interaction-term was a significant predictor of anxiety (Table 5). The corresponding regression lines are presented in figure 2. Given that a moderation effect occurred, the third hypothesis could be supported.

Table 5

Moderation Analysis of Stress, Anxiety, and IU

Model	*Standardized β*	*SD*	*t*	*p*
(Constant)	7.83	.11	70.55	.00
Stress	.43	.01	32.83	.00
IU	.09	.01	6.85	.00
Stress*IU	.003	.001	2.87	.004

Note. Dependent variable: anxiety.

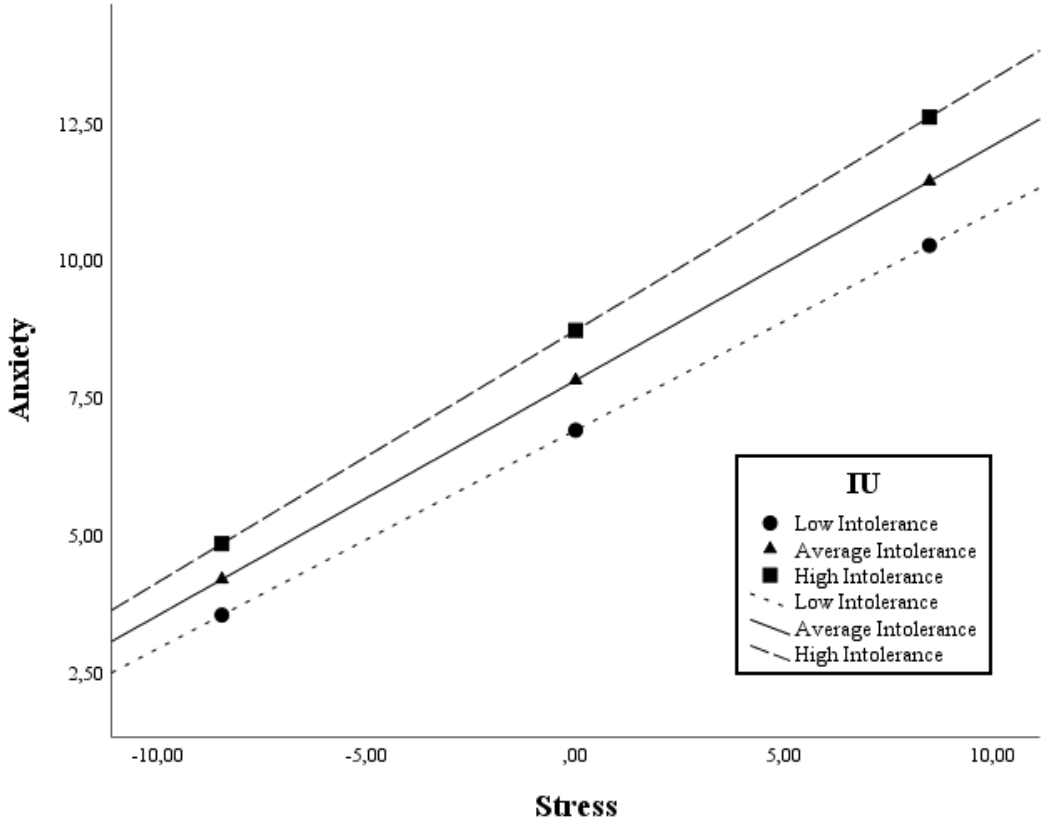

Figure 2. Illustration of the regression lines of low IU, average IU, and high IU.

For explorative reasons and based on the gender differences assessed above, it was further tested whether there is an existing moderation effect for the male and female sample, respectively. Two moderation analyses were conducted with PROCESS to check whether the interaction-terms (stress x IU) were significant predictors of anxiety. Concerning the male sample, the results revealed that a moderation effect occurred (Appendix A, table 6). The moderation analysis of the female sample showed that the interaction-term does not significantly predict anxiety and thus, does not moderate the relationship between stress and anxiety (Appendix A, table 7). Further illustrations of the results can be found in appendix B.

Discussion

This study aimed to examine gender differences related to stress and anxiety and the relation between stress, anxiety, and IU. The results showed that there were apparent gender differences between stress, anxiety, and IU scores. Women experienced more of stress, anxiety, and IU than men. Furthermore, the results supported for first hypothesis that stress positively predicts anxiety. In other words, participants that experience stress also experience anxiety. The second hypothesis, that IU acts as a positive moderator in the relationship between stress and anxiety, could also be supported. This means that people who are highly

intolerant towards uncertainty tend to experience more anxiety in stressful and uncertain situations.

The findings of this study are in line with existing literature that also reported higher anxiety levels for female University students (Bayram & Bilgel, 2008; Beiter et al., 2015; Ibrahim & Abdelreheem, 2015; Milić, Škrlec, Milić Vranješ, Podgornjak, & Heffer, 2019; Miranda-Mendizabal et al., 2019; Saleh, Camart, & Romo, 2017). However, there is also one study that did not find any gender differences in anxiety (Lun et al., 2018) and a study conducted with adolescents (16-19) that found higher anxiety scores in males (Barahmand, 2008). The contradicting results that males scored higher on anxiety could be due to cultural differences. The study by Barahmand (2008) was conducted in Iran where boys experience more societal pressure to succeed in school and university than girls. It would therefore not be surprising that they are more anxious about whether they meet those expectations. On the contrary, the current study has been conducted in the Netherlands, Europe with the majority of participants being European. Both genders must attend school here and there is not more societal expectation on either of the genders to be successful in school. Differing anxiety levels for men and women could also be explained by a wide range of factors (genetic, biological, personal, and environmental) that contribute to differences and often make women more vulnerable to anxiety (McLean & Anderson, 2009). For example, self-efficacy is a personality factor that affects the ability to cope with potential threat. Women frequently report low levels of self-efficacy and may therefore react more anxious (McLean & Anderson, 2009). However, the most important factor that seems to be responsible for differing experiences of anxiety is the unique combination of genetic predispositions, environmental factors and the distinctive socialization processes of men and women (McLean & Anderson, 2009). Men and women are met with different expectations due to their gender and their imminent role from an early age on (McLean & Anderson, 2009; McNeil et al., 2012). For example, it was found that parents find anxiety-related behaviour, such as withdrawal and inhibition, more acceptable for girls, but not for boys (McLean & Anderson, 2009). There is also consistent evidence that as men get older, they are less likely to report anxiety because it is seen as feminine (McLean & Anderson, 2009; McNeil et al., 2012).

The findings concerning gender differences in stress are also in line with current literature with women reporting higher stress levels for men. These differences have not only been found in college students (Bayram & Bilgel, 2008; Brougham et al., 2009; Shamsuddin et al., 2013; Wahed & Hassan, 2017), but also in groups with varying (socio)demographic

characteristics (Gentry et al., 2007; Matud, 2004). One explanation for these gender differences might be that women tend to use more maladaptive coping strategies than men. These coping strategies, such as avoidance or rumination, are less effective in reducing stress (Matud, 2004; McLean & Anderson, 2009) and have also been linked to other mental health issues, such as depression (Thompson et al., 2010).

Concerning the gender differences in IU, mixed results were found. The current study found higher IU scores in females. Yet there were studies that reported opposite results, namely higher IU scores for males (Barahmand, 2008; Olson, Rosso, Demers, Divatia, & Killgore, 2016) and studies that found no differences (Carleton et al., 2007; Carleton et al., 2012). As already mentioned above in the context of anxiety, cultural differences could also explain the differing IU scores for males. Due to societal expectations in Iran, boys feel more pressure to succeed in the academic context and have more trouble dealing with uncertainty than girls (Barahmand, 2008). However, in the societal context of the current study, no such expectations are reflected on either of the genders. A reason why female University students show higher levels of IU could be that IU, similar to anxiety, is influenced by socialization processes. Women may have experienced a weaker sense of personal control during their socialization which might have made them feel less able to effectively cope with their environment (McLean & Anderson, 2009). In addition to that, women also report lower levels of self-efficacy which negatively affects their ability to cope with stressors (McLean & Anderson, 2009). This could ultimately result in a greater intolerance towards uncertainty since in this context unknown or unpredictable stressors could pose an even bigger challenge to deal with.

The first hypothesis that stress positively predicts anxiety could be supported based on the results of this study. This offers support for stress as a significant contributor to anxiety as reported in other studies (Costantini et al., 1973; Huang et al., 2018; Johnson & Sarason, 1978; Sarason et al., 1978; Schneider & Riffle, 2012). What should be noted is that in this study, stress was assessed using a self-report questionnaire that measured perceived stress. Thus, this is a participant's subjective experience of stress which could be affected by different cognitive biases. Negative attentional bias and absolutist thinking are two biases that have been found to elevate psychological distress (Morrison & O'Connor, 2008; Ostell & Oakland, 1999). Negative attentional bias is the tendency to primarily focus attention on negative events (Morrison & O'Connor, 2008). Absolutist thinking is a cognitive bias which focuses on the belief of the "rightness" or certain values, behaviors, and ideas (Ostell &

Oakland, 1999). In other words, there is only one "right" of thinking for the absolutist person and everyone should adhere to this way. If this conformity is not met by others or the person themselves, then it will cause significant distress (Ostell & Oakland, 1999).

The results of the second hypothesis that IU moderates the relationship between stress and anxiety offer support for the diathesis-stress model, which assumes that individual differences have a moderating effect on the relationship between stress and (mental) illnesses (Schneider & Riffle, 2012). This effect could be explained by IU impairing an individual to effectively cope with stressors (Doruk et al., 2015) and in turn fostering anxiety. The moderating effect of IU has also been established in other studies with related concepts. For example, a study by Chen and Hong (2010) researched IU's role in the relationship between negative life events and anxiety. What is striking, however, is that in the explorative analyses, a moderation effect for IU was only found in the male sample. Here, the moderation effect was stronger than in the mixed gender analyses. Although, women overall show higher IU levels in this sample, high IU women do not tend to experience noticeable increased levels of anxiety in the face of stressful and uncertain situations. On the other hand, it shows that high IU men are much more affected by stress and experience increased levels of anxiety. Men are thus more anxious if faced with uncertain situations compared to women. Until now, no studies have been found that researched the moderation effect of IU separately for men and women.

Future research should aim to further explore the moderation-effect of IU, possibly in different target groups. The moderation-effect in the current sample was rather small. Nonetheless, it shows us that this direction should be further explored. It would be valuable to replicate this study with more diverse target groups with people from different ages, and different socio-economic backgrounds to see if the findings hold up. Since a moderation effect in the male sample has been established, it would be interesting to see whether this is specific to this particular target group (i.e. University students) or if these gender differences can also be found across different societal groups, especially in male participants. If the differences remain, it would be interesting to dive deeper into the underlying mechanisms and factors as to why higher IU increases mental health problems in men, but not in women. It would also be interesting to research the effects of IU in relation to mental health issues in fields of work, where employees are confronted with a lot of uncertainty that could ultimately result into life-threatening situations, e.g. doctors, nurses, firefighters or police officers, to explore how they handle uncertainty. Comparing the differences (or similarities) could give

researchers valuable information to design interventions on how to improve one's tolerance to uncertainty to weaken the effects of mental health issues.

Acknowledging IU's role in relation to stress and anxiety offers valuable insight into reducing anxiety in University students. IU has been established as a transdiagnostic concept which can be found among other emotional disorders (Obsessive-Compulsive Disorder, Social Anxiety Disorder, Panic Disorders, Health anxiety and Posttraumatic Stress Disorder) (Shihata, McEvoy, Mullan, & Carleton, 2016). It has been acknowledged as a valuable factor in the treatment for anxiety. For example, in the treatment of Generalized Anxiety Disorder (GAD), reducing patients' IU has been shown to be associated with a reduction in anxiety symptoms (Dugas & Ladouceur, 2000). A study investigating IU in relation to treatment outcome in emotional disorders found that IU has significantly decreased after treatment and was a significant predictor of the treatment outcome (Boswell, Thompson-Hollands, Farchione, & Barlow, 2013). Interventions that improve students' IU to ultimately weaken the relationship between stress and anxiety could be designed and applied in a University context. Moreover, research on gender differences of IU can be used to design interventions that effectively improve IU in men and women.

Limitations and strengths

One limitation of this study was its cross-sectional research design. Although, these research designs offer benefits in terms of time-efficiency and applicability to various target-groups (Levin, 2006), they cannot assess causality between variables. That means that the relations assessed in this study are associations. Hence, it cannot be assessed which variable caused the other. It can merely be indicated which direction the causation goes. It could therefore be valuable to set the study up with a research design that can assess causality of variables, e.g. a longitudinal research design. The second limitation of this study was that due to the convenience sampling method used, the risk of representation-bias increases. The survey's aim was to investigate the state of mental well-being of students at the University of Twente. Even though all students were encouraged to participate in the survey, it could be that students who did not experience any mental health complaints did not fill the survey in because they simply did not feel addressed. Therefore, participants with mental health complaints might be overrepresented in this study.

The most significant strength of this study was the large sample size. A total of 2057 responses were gathered. Although, a significant part of the sample had to be removed from

analyses due to not filling in all the required questionnaires, a stable sample of 1268 participants remained. However, a recommendation for future research would be to reduce the length of the survey. Many participants stopped filling in the survey after a few questionnaires or right after the demographic variables. Considering that the survey took roughly 20 – 25 minutes to fill in, the survey could have been too long for many participants to complete. By reducing the overall length of the survey, missing data from participants could be prevented.

Concluding, this study offers valuable insight into the relation between stress, anxiety and IU and the effect of gender. It offers support for IU's moderating effect on the relation between stress and anxiety and gender differences across stress and anxiety. The study also revealed gender differences across IU. In the future, more research is needed to explore these gender differences and their possible explanations. The insights gained from this study can be used to develop and improve interventions aimed at reducing stress and anxiety by offering a new starting point, namely tackling IU.

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Appendix A

Results of the Moderation Analyses of the Male and Female Sample

Table 6

Moderation Analysis of Stress, Anxiety, and IU in the Male Sample

Model	*Standardized β*	*SD*	*t*	*p*
(Constant)	6.91	.15	44.78	.00
Stress	.42	.02	21.61	.00
IU	.09	.02	4.76	.00
Stress*IU	.004	.002	2.63	.01

Note. Dependent variable: anxiety.

Table 7

Moderation Analysis of Stress, Anxiety, and IU in the Female Sample

Model	*Standardized β*	*SD*	*t*	*p*
(Constant)	8.92	.16	55.59	.00
Stress	.43	.02	23.73	.00
IU	.09	.02	4.73	.00
Stress*IU	.002	.002	1.16	.25

Note. Dependent variable: anxiety.

Appendix B

Illustrations of the Regression Lines of the Male and Female Sample

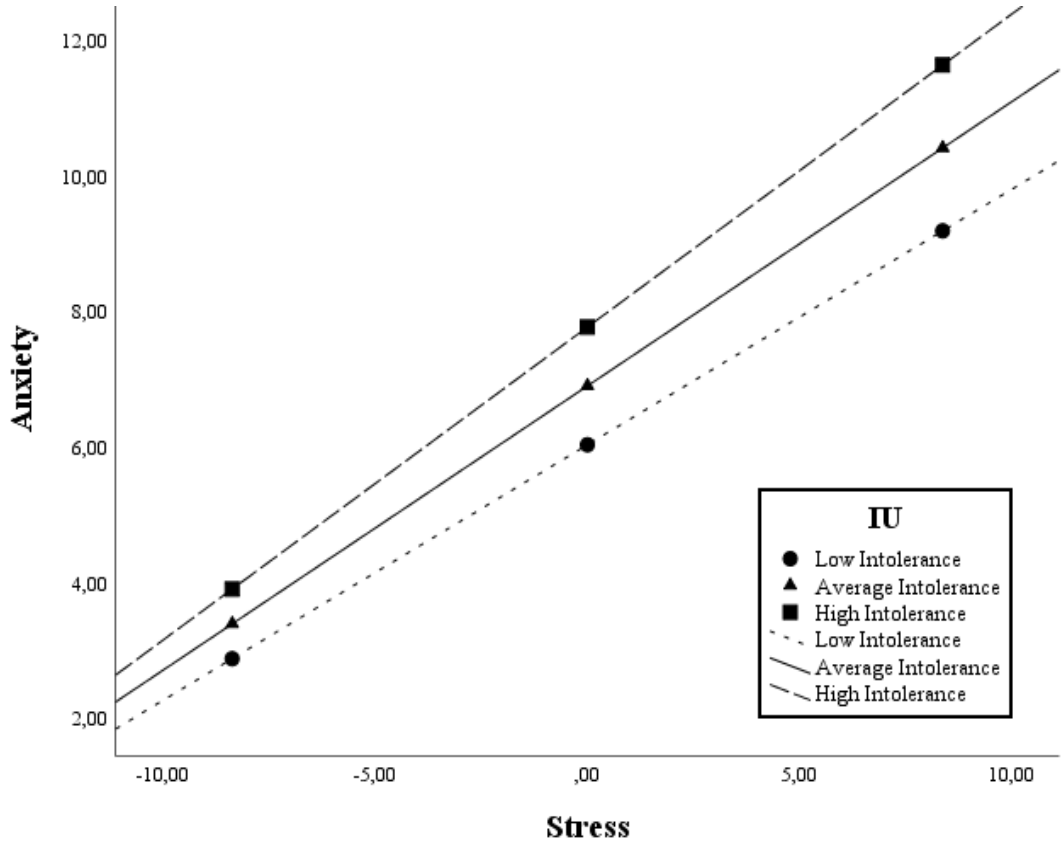

Figure 3. Illustration of the regression lines of low IU, average IU, and high IU in the male sample.

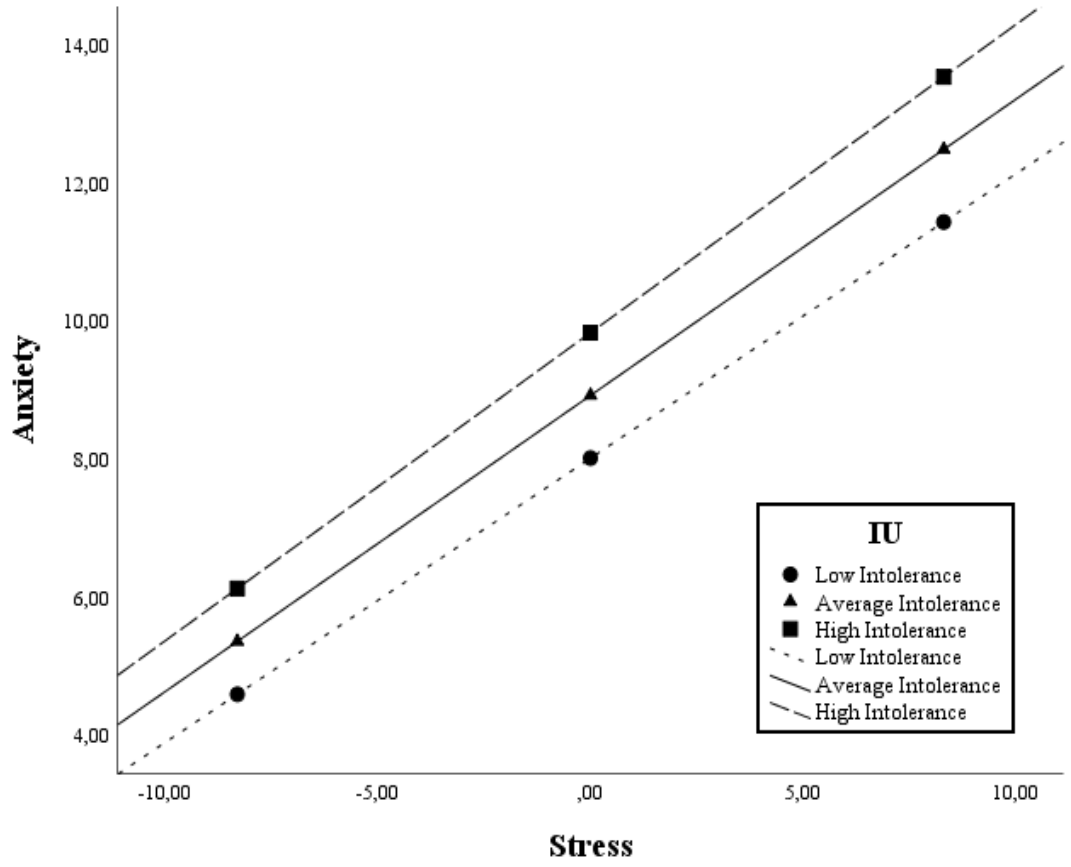

Figure 4. Illustration of the regression lines of low IU, average IU, and high IU in the female sample.