

**Student Well-being During the COVID-19 Pandemic: The Role of Primary and
Secondary Stressors**

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Abstract

The COVID-19 pandemic and the resulting changes in university regulations and restrictions significantly impacted university students' mental well-being and stress levels. However, little is known about the types of stressors that affect well-being and stress the most. This study therefore investigates the effects of primary and secondary stressors on students' stress and well-being during the COVID-19 pandemic. The more direct and short-term primary stressors used in this study included worries about getting infected with COVID-19 and the worry about close friends and families getting the virus. The more indirect long-term secondary stressors entailed concerns about falling behind in university, the diploma's worth, finding a job after university, study enjoyment and worries about the financial situation. A cross-sectional online survey was performed among a Dutch participant sample ($n = 455$). It was collected in November 2020 from two technical universities in the Netherlands. The data was analysed using a series of linear regression models and a mediational analysis, exploring the relationship between the stressors as well as their impact on student stress and well-being during the COVID-19 pandemic. The results indicated that both primary and secondary stressors significantly affected student stress ($b = -.02$ to $.15$) and well-being ($b = .06$ to $-.70$), with secondary stressors explaining more variability in well-being ($R^2 = .14$ compared to $R^2 = .01$) and stress ($R^2 = .23$ compared to $R^2 = .04$), possibly due to their longer-lasting and diverse effects on the students' lives. In addition, secondary stressors did not mediate the relationship between the primary stressors, well-being and stress. These findings are of importance for preparing for future pandemics and how to deal with them or for understanding the constructs of primary and secondary stressors and how they interplayed during the COVID-19 pandemic. In addition, the findings can be used for creating interventions targeting student stressors that could improve student well-being and stress after the COVID-19 pandemic.

Keywords: COVID-19, Students, Well-being, Stress, Primary Stressors, Secondary Stressors

Student Well-being During the COVID-19 Pandemic: The Role of Primary and Secondary Stressors

The mental health and well-being of university students have been topics of concern for some time. In general, the student population is increasingly acknowledged as vulnerable (Burns et al., 2020; Kools et al., 2020; Zurlo et al., 2020). On the one hand student life can be exciting, but it can also bring a lot of stress, pressure, competition, academic overload and life changes with little leisure time, less time for friends and family and many worries about the future (Burns et al., 2020; Kools et al., 2020; Zurlo et al., 2020). Between 1993 and 2014 the number of students and young adults in the United Kingdom with mental health problems increased from 15% to 19% (McManus et al., 2016), while at the beginning of 2019 already 20.4% of students in the Netherlands suffered from depression or anxiety (Flink, 2020).

Since the start of the COVID-19 outbreak in 2019 and its later classification as a pandemic, the well-being of students has further decreased drastically to 25.5% of students with depression and anxiety in the Netherlands (Flink, 2020). During the COVID-19 pandemic, poor well-being was reported by 66.3% of students (Liu et al., 2021) along with increased levels of depression, anxiety, stress and uncertainty (Lanza et al., 2022; Naser et al., 2021; Nochaiwong et al., 2021; Paton et al., 2023; Schwartz et al., 2021; Yang et al., 2022; Yim et al., 2022; Zhai & Du, 2020; Zurlo et al., 2020). Nonetheless, some studies did not only find negative effects of the COVID-19 pandemic on students' well-being. A study conducted by Paton et al. (2023) for example, reported that 4% of the 825 students investigated in northern England showed improvement in well-being measures during the COVID-19 pandemic. Nonetheless, improvements in well-being during the COVID-19 pandemic were seen as exceptions as they only represent a small part of the sample (Paton et al., 2023).

Around 90% of students worldwide had to experience the effects of the COVID-19 pandemic on different parts of their lives (Paton et al., 2023; Yim et al., 2022). It disrupted the students' lives, influencing nearly every aspect of it, including the living situation, the learning environment, the grading system and the social setting (Burns et al., 2020; Lanza et al., 2022, Liu et al., 2021). New measures by the government and universities to stop the virus from spreading, like the lockdowns, resulted in a complete reorganisation of society and education with new demands, routines, schedules and structures (Van de Velde et al., 2021; Von Keyserlingk et al., 2021). Social activities got cancelled, new responsibilities and challenges evolved, and many students needed to move back home to their parents and lost their jobs forcing them to adapt their daily life (Van de Velde et al., 2021; Von Keyserlingk et al., 2021; Zurlo et al., 2020). The closing of campuses and the switch to online education disrupted the

acquisition of new knowledge leading to stress, uncertainty and increased study pressure, while social support decreased (Van de Velde et al., 2021; Yang et al., 2022; Yim et al., 2022), highly impacting their well-being and mental health (See e.g. Burns et al., 2020; Gündoğan, 2022; Kools et al., 2020; Lanza et al., 2022; The Heathy Minds Network & American College Health Association, 2020; Von Keyserlingk et al., 2021; Yim et al., 2022; Zhai & Du, 2020; Zurlo et al., 2020). The impact of the COVID-19 pandemic and online education on university students put students at an elevated risk for mental health issues that may not easily be reversed (Liu et al., 2021; Yim et al., 2022).

All these factors that may have caused students distress and impacted their well-being are called stressors (Moran, 2024). These stressors can be categorised as either primary stressors, which directly relate to a disaster (Williams et al., 2021) or secondary stressors which are more indirectly related long-term effects of it (Williams et al., 2021). In the context of the COVID-19 pandemic getting infected or exposed to the virus would be seen as primary stressors, while job loss and financial or other worries would be seen as secondary stressors, both potentially impacting well-being and stress (Zaken et al., 2021). While many different studies have already explored different stressors related to disasters like floodings or earthquakes and their impact on students' well-being (e.g. Basit, 2011; Felix et al., 2020; Gerstner et al., 2020; Trip et al., 2018), little is known about stressors during pandemics in general or the recent COVID-19 pandemic in specific. Some studies were investigating different stressors on their own, but there is a lack of literature on the more overarching constructs of primary and secondary stressors (Evans et al., 2021; Hollister et al., 2022; Kara & Karaaslan, 2022; Tinsley, 2020), their differing effect on students' well-being and stress and on the connection between the two categories. Therefore, this research will focus on the extent to which primary and secondary stressors impacted university students' well-being and stress during the recent COVID-19 pandemic and if there is a mediational effect between the two stressor categories, stress and well-being.

Positive Approach to Well-being and Stress

According to Jarden & Roache (2023), one of the most widely used definitions of well-being is the definition of Michaelson et al. (2012). They describe that “well-being can be understood as how people feel and how they function, both on a personal and a social level, and how they evaluate their lives as a whole.” (Michaelson et al., 2012, p. 6). This definition describes well-being as consisting of elements of emotion, behaviour, cognition and relationships (Jarden & Roache, 2023). This view is a more positive approach to well-being compared to the often and more usual approach of looking at the absence of problems and

dysfunction (Lamers et al., 2010; Magalhães, 2024). Often, studies involved with the mental health of students, especially during the COVID-19 pandemic, investigate their mental health in the form of depression or anxiety scores, focusing only on the symptomatic dimension (Magalhães, 2024). Still, according to for example Huppert and Whittington (2003) or Magalhães (2024), mental health and well-being are more than not experiencing psychological symptoms, making it essential to also look at the other, more positive side of mental health. Instead of focusing on the pathology of an individual, their social, emotional and psychological well-being can be evaluated, using constructs such as life satisfaction, social integration, self-acceptance and environmental mastery. This can enable clearer and more diverse insights into stressors and how they affect individuals during their daily lives (Lamers et al., 2010).

Irrespective of their well-being, however, stress can also play an important role in the mental health of students. Stress can be defined as feeling emotional, physical or psychological strain and pressure (Psychology Today, n.d.; Scott, 2022). It is a state of mental tension and worry caused by for example a difficult situation (WHO, 2022). Stress is a natural human response that helps in challenging threats and problems in everyday life, but stress can become chronic, making it unhealthy and heavily impacting mental health (APA, n.d.; Scott, 2022; WHO, 2022). As stress is closely related to the perception, interpretation and resulting reaction to a situation, it can provide important additional insights for a better understanding of stressors and how they affect an individual (Cohen et al., 1995).

By taking a more positive and complete approach to mental health through exploring both a positively based well-being and stress measure, the current, symptom and problem-oriented research field can be extended to provide a more balanced and insightful overview on student mental health (Magalhães, 2024).

Primary and Secondary Stressors

The psychological effects of extreme events like the COVID-19 pandemic are commonly viewed as resulting from a complex array of primary and secondary stressors. Stressors are defined as “the problematic or troublesome events, experiences, or perceptions that cause us distress and threaten our well-being” (Moran, 2024; p.1). Williams et al. (2021) further added that circumstances, attitudes, and responses can also be stressors. Primary stressors are part of or are directly connected to the disaster (Lock et al., 2012, Ntontis et al., 2023; Tempest et al., 2017; Williams et al., 2021), they are consequent on people's involvement in a disaster such as watching someone being killed, or fearing for one's life and the safety of others (Lock et al., 2012). This can, for example, include viruses that make people fear for their lives, floodwaters, earthquakes and fires that destroy, injure and kill people or mass

displacement that triggers the fear for one's own or other's safety and life (Ntontis et al., 2023; Tempest et al., 2017). In the context of the COVID-19 pandemic, this involves stressors directly connected to the virus itself. The students or their social environment getting infected with the COVID-19 virus or the students getting exposed to it in other forms, like the fear that themselves, friends or family get infected with it are, for example, seen as primary stressors (Zaken et al., 2021).

Secondary stressors on the other hand are indirectly related to disaster (Lock et al., 2012; Tempest et al., 2017; Williams et al., 2021). They are circumstances, events and policies, usually present longer than the disaster itself (Lock et al., 2012), people's conditions, social or societal factors before the disaster (e.g., work circumstances, bureaucracy) or problematic and inefficient responses to the disaster itself (Ntontis et al., 2023; Williams et al., 2021). This includes lack of governmental or general support, the breakdown of relationships, inappropriate leadership and financial or personal loss. Additional work pressure as well as problems in returning to normality and fixing problems or specific plans made before the disaster can also be seen as secondary stressors (Lock et al., 2012; Tempest et al., 2017; Williams et al., 2021). In the context of the COVID-19 pandemic, this involves issues like losing one's job resulting from the COVID-19 pandemics influences or financial or other worries and struggles that are indirectly caused by the COVID-19 pandemic but impact the student in one or another way during or even after the COVID-19 pandemic (Zaken et al., 2021).

In the literature, both primary stressors and secondary stressors have been shown to contribute to a decrease in well-being and an increase in mental health problems (Zaken et al., 2021). Primary and secondary stressors are major predictors of distress, disorder and mental health (Moran, 2014; Tempest et al., 2017; Williams et al., 2021; Zaken et al., 2021). Moran (2014) suggested that secondary stressors may develop as a consequence of primary stressors. As primary stressors are directly related to the disaster, they initiate the stress process while secondary stressors develop from the resulting stress levels, opening the possibility for a mediating role of secondary stressors (Moran, 2014). Still, there only is limited research about the role of primary and secondary stressors together or which ones are of higher importance for well-being and stress during a crisis. In a study by Alfadhil & Drury (2018), Jordanian refugees reported more issues with variables categorised as secondary stressors than from variables categorised as primary stressors, suggesting that secondary stressors might be of higher importance for well-being than primary stressors. However, the relative influence of primary and secondary stressors may depend on the context of the disaster and region.

The Role of Primary and Secondary Stressors on Student Stress and Well-being During the COVID-19 Pandemic

During the COVID-19 pandemic, pandemic-related study stressors seemed to have a very high impact on university students' well-being and mental health (Li et al., 2022). First of all, many students worried about falling behind in university as a result of the COVID-19 pandemic, increasing their pessimism and reducing their mental health due to academic frustration and study problems (De Boer, 2020; Li et al., 2022; Tasso et al., 2021; Yim et al., 2022). Students also worried about the worth of their diplomas which led to insecurity about their future perspectives and increased their negative thoughts, depression and stress levels (Ad Valvas, 2023; Klebs et al. 2021). In addition, finding a job after university was also found to be a topic of great concern to students as this worry was found to increase anxiety, negative thoughts and stress levels (Al-Ansi, 2021; Aslan, 202; Aucejo et al., 2020; Kara & Karaaslan, 2022). Furthermore, university students worried that they would have a less enjoyable study period, reducing their well-being due to big changes in teaching strategies, low engagement during classes and less contact with peers (De Boer, 2020; Hollister et al., 2022; Okada, 2022; Okada & Sheehy 2020). Next, students also worried about their financial situation. This stressor was found to be associated with more stress and worse mental health (Caring Universities, 2022; Montacute & Holt-White 2020; The Healthy Minds Network & American College Health Association, 2020; Van de Velde et al., 2021; Zhai & Du, 2020). Lastly, multiple studies emphasised that university students worry about getting infected or that their social environment might get infected. This worry then led to higher distress, stress and reduced well-being in addition to higher anxiety levels and general poor mental health (Burns et al., 2020; Sebri et al., 202; The Healthy Minds Network & American College Health Association, 2020; Zhai & Du, 2020; Zhou & Guo, 2021).

In a previous study by Aarntzen et al. (2023), these academic COVID-19 stressors were investigated under the context of academic well-being, which consisted of elements such as academic satisfaction, academic belonging, academic efficacy, persistence intentions and dropout intentions. Aarntzen et al. (2023) found that especially the worry about study progress (worry about falling behind) and the worry about study enjoyment were related to the decrease in academic well-being of university students in the Netherlands during the COVID-19 pandemic.

Nonetheless, the research on these stressors is mostly focused on the dysfunctional approach to mental health or specific forms of well-being, like academic well-being in the Aarntzen et al. (2023) paper. Therefore, although all these stressors seemed to have influenced

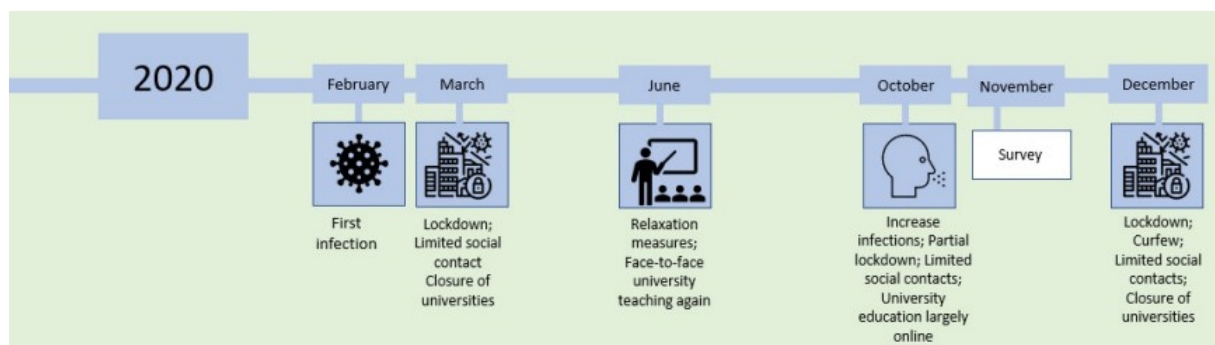
student's mental health, further investigation of the effects of academic stressors on a positive and more general approach to students' well-being and stress in the context of the COVID-19 pandemic is needed. This would give a clearer and more elaborate overview of the importance of academic stressors during a pandemic, and provide extra insights into the importance of them for well-being and stress interventions to increase and support students' mental health.

The Dutch Context During the COVID-19 Pandemic

One last part that should be considered when investigating the effects of the COVID-19 pandemic is the context and timeframe investigated. Depending on the country and timeframe during the COVID-19 pandemic, different governmental regulations were in place and influenced university students differently (WHO, n.d.). The sample of this study was collected in the Netherlands in the fall of 2020, which was the second semester of COVID-19-influenced education. Although in the summer of 2020, some restrictions in, for example, social contact and events were partially released, an increase in COVID-19 infections led to an increase in anti-COVID measures in fall 2020 when the data was collected (De Boer, 2020). Dutch university students therefore mostly participated in online classes, spending most of their time at home in front of their computers (De Boer, 2020). Due to the governmental restrictions, they were not able to have as many social interactions as they were used to before and were therefore often alone (De Boer, 2020). These regulations in the Netherlands therefore influenced the university students' well-being and stress differently than in other countries as the regulations there might have been different. (See Figure 1 for an overview of the Dutch context and timeframe of the data collection).

Figure 1

Overview of the Dutch context and regulations during the COVID-19 pandemic



Note. This overview was retrieved from the article of Aantzen et al., (2023).

The Current Research

As students appeared to be especially vulnerable during the COVID-19 pandemic and as their well-being is already concerningly low, this research aims to gather additional insights into university students' stressors during the pandemic and their connection to well-being and stress. In a previous study by Aarntzen et al. (2023) on STEM students in the Netherlands, the effects of COVID-related study stressors and the buffering effects of social support systems from universities on academic well-being were already investigated, but the current study will not only investigate STEM students but also social science students while also focusing on a more positive and general form of mental well-being instead of academic well-being. In addition, the role of different stressors will not only be investigated individually but also under the categories of primary and secondary stressors. Specifically, the following research question will be answered: To what extent were primary and secondary stressors associated with student well-being and stress during the COVID-19 pandemic? It was planned to fill knowledge gaps both in research about student well-being as more insights into important COVID-19-related stressors and their influence on well-being and stress were needed and also in research about primary and secondary stressors as little research about primary and secondary stressors during pandemics and the connection between the different stressors was conducted.

Therefore, the university students' worry about getting COVID-19 and their social environment getting COVID-19 (primary stressors) and their worries about falling behind, diploma worth, finding a job, study enjoyment and finances (secondary stressors) were analysed to see their effects on well-being, stress and their interaction. Based on the current literature about academic stressors, it was hypothesised that (1.) the primary stressors and secondary stressors were positively related to stress and negatively related to the well-being of students during the COVID-19 pandemic. As Alfadhil & Drury (2018) found, people might suffer more from secondary than from primary stressors, it was also hypothesised that (2.) secondary stressors were more strongly related to student well-being and stress during the COVID-19 pandemic than primary stressors. Finally, as Moran (2014) suggests that secondary stressors might develop resulting from primary stressors, it was lastly hypothesised that (3.) secondary stressors mediated the relationship of primary stressors on student well-being and stress during the COVID-19 pandemic.

Methods

Research Design

This study is a secondary analysis of the data from a previous study conducted by Aarntzen et al. (2023). To answer the research questions and test the hypotheses, a cross-

sectional research design was used. In this quantitative approach, an online survey was administered with one measurement moment to a sample of university students. Through the correlational between-subjects design, the relationship between the different primary stressors (worry about getting COVID-19, worry about social environment getting COVID-19), secondary stressors (worries about falling behind, diploma worth, finding a job, study enjoyment and finances), well-being and stress was investigated.

Participants

The participants of this study were recruited using convenience and voluntary sampling. The sample was collected during the COVID-19 pandemic in fall 2020 and consisted of second-year STEM and social science students from two technical universities (applied university or research university) in the Netherlands.

In the current study, a total of 455 students participated. Of those, 225 were men (49%), 226 were women (50%), two were another gender and two did not indicate their gender. The participants' ages ranged from 17 to 38 with a mean age of 18.97 (SD = 1.81). Of the 455 participants, the majority came from the Netherlands (N = 315) while the rest came from Germany (N = 40) or other countries (N = 99). At the time the study was conducted 384 of the students lived together with others, 44 alone and 27 did not indicate their living situation. They mostly lived in the Netherlands (N = 423) or Germany (N = 24) (4 in other countries and 4 did not indicate). Of the students participating in this study, most studied technical medicine (N = 58), biomedical technology (N = 43) or mechanical engineering (N = 39) (240 studied in other programs, 75 did not indicate).

Procedure

The participants of the sample were recruited in one of two ways. 1) They were requested to participate in the study via email as part of a follow-up measurement to the study conducted by Aarntzen et al. (2023). 2) They were invited via contact persons in the study programs, for example, an email from the study advisors. All students received personalised feedback on their survey results and could participate in a lottery to win 25 euros if they completed the survey, to further motivate their participation. After the students were invited to participate in the online survey, they could follow a link that was provided to participate. They filled in the online questionnaire with questions about their demographics, academic experiences, well-being and COVID-related questions like questions about worries and stressors.

Materials

All scales used for the current study can be found in Appendix A to Appendix C

Well-being

To measure the well-being of participants, the mental health continuum short form (MHC-SF) (Keyes, 2002) was used. It consists of 14 items that are answered on a 6-point Likert scale (1 = *Never*, 6 = *Every day*) (e.g. “During the past month, how often did you feel happy?”). As the MHC-SF measures emotional, psychological and social well-being, it is commonly applied to assess the well-being and mental health of individuals in a positive, not mainly symptom-based way. The mental health continuum short form has shown high levels of discriminant validity, test-retest reliability as well as internal consistency (Keyes, 2005; Keyes, 2006; Keyes et al., 2008; Lamers et al., 2011; Westerhof & Keyes, 2009). In the current study, the total scale showed good reliability ($\alpha = .89$).

Stress

To measure the stress of participants, the perceived stress scale (PSS) was used (Cohen et al., 1983). It consists of 10 items that are answered on a 5-point Likert scale (1 = *Never*, 5 = *Very often*) (e.g. “In the last month, how often have you been upset because of something that happened unexpectedly?”). The PSS is recommended for both practice and research and is commonly applied to assess to what extent the current life situation is experienced as stressful in adolescents or adults (Cohen et al., 1983; Lee, 2012). In the past, the perceived stress scale showed good internal consistency, satisfactory test-retest validity and good concurrent validity for university students (Lee, 2012). Liu et al. (2020) also found a good convergent validity with stressful life events. The 10-item version of the PSS is also seen as superior to the 14-item version (Lee, 2012). In the current study, it showed excellent reliability ($\alpha = .90$).

Primary and Secondary Stressors

To measure the primary and secondary stressors, seven single-item statements were self-developed. All items are answered using a 7-point Likert Scale (1 = *Not at all*, 7 = *Very much*). To measure the primary stressors the following items were developed: “To what extent are you worried about getting corona (again)?” (Worry about getting COVID-19) and “To what extent are you worried that someone close to you (close friends and family) will get corona?” (Worry about social environment getting COVID-19). To measure the secondary stressors the following items were developed: “Because of the corona crisis, I am concerned that I will fall behind with my studies” (Worry about falling behind), “Because of the corona crisis, I am worried that my diploma is worth less” (Worry about diploma worth), “Because of the corona crisis, I am worried that it will be difficult for me to find a good job after my studies” (Worry about finding job), “Because of the corona crisis, I am worried that I will have a less enjoyable

study period” (Worry about study enjoyment) and “Because of the corona crisis, I am worried about my financial situation” (Worry about finances).

Data Analysis

To analyse the gathered data, Rstudio version 2023.12.1+402 was used. The additional packages “tidyverse”, “car”, “lmtest”, “psych”, “foreign”, “lavaan”, “sandwich” and “boot” were used. In addition, two new variables were created namely “wellbeing”, and “stress” which contain the mean values of the MHC-SF and PSS scale to be able to analyse the data further. To check the linear assumptions, the Rainbow test (Utts, 1982), Shapiro-Wilk test (Shapiro & Wilk, 1965), Breusch-Pagan test (Breusch & Pagan, 1979) and Durbin-Watson test (Durbin & Watson, 1950) were applied. As not all assumptions were met (homoscedasticity and normality), robust standard errors were used for regression analyses to account for these violations and to increase the reliability of the research results. In addition, the descriptives were calculated and a table with Pearson correlations for the variables of interest was created. For that, the categorical variables “gender”, “nation” and “living situation” were recoded into dichotomous variables (See Table 1).

To test the first hypothesis that primary and secondary stressors are positively related to stress and negatively related to well-being, two linear regression models with robust standard errors were used. In the models, either well-being or stress was used as the dependent variable while all the individual primary and secondary stressors were used as independent variables.

To test the second hypothesis that secondary stressors are more strongly related to well-being and stress than primary stressors, R^2 values were calculated for four different linear models. The first model contained the individual primary stressors as independent variables and well-being as the dependent variable, the second model contained the individual primary stressors as the independent and stress as the dependent variable, the third model contained the individual secondary stressors as the independent variables and well-being as the dependent variable and the last model contained the individual secondary stressors as the independent variables and stress as the dependent variable. These R^2 values were then compared to see which models explain the observed data the best. In addition, the 95% confidence intervals for the different models were calculated and checked for overlap to evaluate the difference between the R^2 values.

To test the third and last hypothesis that secondary stressors mediate the relationship of primary stressors on student well-being and stress, a mediational analysis using the “lavaan” package in Rstudio was conducted. A parallel mediation model was used with the five individual secondary stressors as the possible mediators for the relationship between the two

primary stressors (independent variables) and the two dependent variables well-being and stress. The significance of the path analysis was established using p-values.

Results

Table 1 contains the descriptives and Pearson correlations of the variables of interest. The table shows that the mean values for the worry of the environment getting COVID-19 (primary stressor) and the worry about the study enjoyment (secondary stressor) are higher than for the other stressors. In addition, the worry about falling behind (secondary stressor) seemed to be moderately correlated with stress, the worry about finances (secondary stressor) seemed to be moderately correlated with the worry about finding a job (secondary stressor) and the two primary stressors worry about the environment getting COVID-19 and the worry about getting COVID-19 also seemed to be moderately correlated. Well-being and stress also seemed to be moderately correlated. Nonetheless, these correlations were only on a moderate level, while all other correlations were weak (See Table 1).

Table 1*Means, Standard Deviations and Correlations Between Variables of Interest*

								Primary Stressors							Secondary Stressors						
	Mean	SD	1	2	3	4	5	6	7	8	9	10	11	12							
1. Gender (0 = men; 1 = women)	-	-	-	-	-	-	-	-	-	-	-	-	-	-							
2. Nation (0 = Dutch/German; 1 = International)	-	-	-.17	-	-	-	-	-	-	-	-	-	-	-							
3. Living situation (0 = alone; 1 = with others)	-	-	-.05	-.24	-	-	-	-	-	-	-	-	-	-							
4. Well-being	2.9	.9	-.02	-.15	.08	-	-	-	-	-	-	-	-	-							
5. Stress	1.9	.8	.12	.20	-.11	-.63	-	-	-	-	-	-	-	-							
6. Worry getting COVID	3.6	1.8	.18	.08	-.05	-.09	.18	-	-	-	-	-	-	-							
7. Worry environment getting COVID	5.0	1.6	.23	.05	-.02	-.02	.11	.56	-	-	-	-	-	-							
8. Worry falling behind	3.9	1.8	-.07	.05	-.04	-.24	.42	.15	.15	-	-	-	-	-							
9. Worry diploma worth	2.9	1.8	-.05	.16	-.10	-.22	.23	.06	.12	.34	-	-	-	-							
10. Worry finding job	3.0	1.8	-.01	.31	-.13	-.16	.25	.09	.11	.24	.55	-	-	-							
11. Worry study enjoyment	5.5	1.5	-.01	.09	-.04	-.21	.22	.08	.19	.36	.22	.22	-	-							
12. Worry finances	3.3	1.9	.05	.25	-.10	-.20	.27	.18	.12	.28	.29	.47	.20	-							

Note. Well-being (MHC-SF) was measured on a 6-point Likert Scale (1 = Never, 6 = Every day), stress (PSS) was measured on a 5-point Likert

Scale (1 = Never, 5 = Very often), the stressors (Custom scale) were measured on a 7-point Likert Scale (1 = Not at all, 7 = Very much).

Hypothesis 1

In line with the first hypothesis, the worry of falling behind, the worry about the diploma worth (secondary stressor), the worry about study enjoyment (secondary stressor) and the worry about finances (secondary stressor) were significantly negatively related to well-being (See Table 2). The worry about finding a job (secondary stressor) and the two primary stressors, worry about getting COVID-19 and worry about the environment getting COVID-19, were not found to be significantly related to well-being (See Table 2).

Table 2

Results of one Regression Model of the Primary and Secondary Stressors on Well-being

	Estimate	Std. Error	t-value	95% CI		p-value
				lower	upper	
Intercept	3.91	.18	21.34	3.55	4.27	<.001***
Worry getting COVID	-.05	.03	-1.85	-.11	.01	.065
Worry environment getting COVID	.06	.03	1.75	-.01	0.12	.082
Worry falling behind	-.70	.02	-2.89	-.12	-.02	.004**
Worry diploma worth	-.07	.03	-2.54	-.12	-.02	.011*
Worry finding job	-.01	.03	-.07	-.06	.06	.944
Worry study enjoyment	-.08	.02	-3.15	-.12	-.03	.002**
Worry finances	-.06	.02	-2.34	-.11	-.01	.020*

Note. Degrees of Freedom = 7, 447. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

Unlike for well-being, the primary stressor worry about getting infected with COVID-19 was significantly positively related to stress (See Table 3). In addition, the worry of falling behind (secondary stressor) and the worry about finances (secondary stressor) were also found to be significantly positively related to stress, while the other secondary stressors like the worry about the diploma worth, the worry of finding a job and the worry about study enjoyment were less important for stress than for well-being as no significant relation to the stress levels were found (See Table 3).

Table 3*Results of one Regression Model of the Primary and Secondary Stressors on Stress*

	Estimate	Std. Error	t-value	95% CI		p-value
				lower	upper	
Intercept	.85	.15	5.46	3.55	4.27	<.001***
Worry getting COVID	.06	.02	2.57	-.11	.01	.011*
Worry environment getting COVID	-.02	.03	-.90	-.01	.12	.367
Worry falling behind	.15	.02	7.32	-.12	-.02	<.001***
Worry diploma worth	.01	.02	.04	-.12	-.02	.671
Worry finding job	.04	.02	1.57	-.06	-.06	.118
Worry study enjoyment	.02	.02	.84	-.12	-.03	.401
Worry finances	.04	.02	2.15	-.11	-.01	.032*

Note. Degrees of Freedom = 7, 447. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

Hypothesis 2

In line with hypothesis two, R^2 values showed that the models that contained the different secondary stressors had higher R^2 values than the models containing the different primary stressors for both well-being and stress (See Table 4). This means that the secondary stressor models explain more variability in well-being and stress than the primary stressor models. In addition, as the 95% confidence intervals of the primary stressor models do not overlap with the 95% confidence intervals of the secondary stressor models, the R^2 values of the models can be seen as significantly different.

Table 4*R² Values of the Different Models*

	Primary Stressors	Secondary Stressors
	[95% CI]	[95% CI]
Well-being	.01 [.01, .04]	.14 [.07, .19]
Stress	.04 [.01, .08]	.23 [.15, .30]

Hypothesis 3

Lastly, the third hypothesis was partly supported, as the analyses revealed one significant indirect effect for well-being and one for stress (See Tables 5, 6). Study enjoyment mediated the relationship between the worry about close friends and family getting COVID-19 and well-being, while the other four secondary stressors did not significantly mediate the relationship between the primary stressors and well-being (See Table 5). In addition, the worry about falling behind in the studies mediated the relationship between the worry of getting COVID-19 and stress, while the other four secondary stressors did not significantly mediate the relationship between the primary stressors and stress (See Table 6).

Table 5*Results of the Mediation of Secondary Stressors between the Primary Stressors and Well-being*

	Estimate	Std Error	z-value	P-value
Direct Effects				
Worry getting COVID	-.05	.03	-1.93	.054
Worry environment getting COVID	.06	.03	1.89	.059
Indirect Effects				
Worry getting COVID -> Worry falling behind	-.01	.01	-1.85	.065
Worry environment getting COVID -> Worry falling behind	-.01	.01	-.97	.333
Worry getting COVID -> Worry diploma worth	-.01	.01	-.021	.835
Worry environment getting COVID -> Worry diploma worth	-.01	.01	-1.88	.060
Worry getting COVID -> Worry finding job	-.01	.01	-.10	.924
Worry environment getting COVID -> Worry finding job	-.01	.01	-.10	.924
Worry getting COVID -> Worry study enjoyment	.01	.01	.26	.794
Worry environment getting COVID -> Worry study enjoyment	-.01	.01	-2.16	.031*
Worry getting COVID -> Worry finances	-.01	.01	-1.81	.071

Worry environment getting COVID -> Worry finances	-.01	.01	-.91	.362
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Note. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

Table 6

Results of the Mediation of Secondary Stressors between the Primary Stressors and Stress

	Estimate	Std Error	z-value	P-value
Direct Effects				
Worry getting COVID	.06	.02	2.74	.006**
Worry environment getting COVID	-.02	.02	-1.02	.310
Indirect Effects				
Worry getting COVID -> Worry falling behind	.02	.01	2.18	.029*
Worry environment getting COVID -> Worry falling behind	.01	.01	1.01	.314
Worry getting COVID -> Worry diploma worth	.01	.01	.20	.844
Worry environment getting COVID -> Worry diploma worth	.01	.01	.56	.573
Worry getting COVID -> Worry finding job	.01	.01	.71	.477
Worry environment getting COVID -> Worry finding job	.01	.01	1.55	.122

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Worry getting COVID -> Worry study enjoyment	-.01	.01	-.26	.801
Worry environment getting COVID -> Worry study enjoyment	.01	.01	.89	.374
Worry getting COVID -> Worry finances	.01	.01	1.76	.079
Worry environment getting COVID -> Worry finances	.01	.01	.91	.365

Note. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

Discussion

This research investigated to what extent primary and secondary stressors were associated with university students' well-being and stress during the COVID-19 pandemic in the Netherlands. Furthermore, not just the individual stressors, but also the categories of primary and secondary stressors were considered and the connection between the stressor categories was explored.

The results of the analysis showed that the worry about falling behind during the studies and the worry about the financial situation (secondary stressors) both significantly decreased the well-being and increased the stress of students during the COVID-19 pandemic. These findings are in line with the previous research on the learning and financial situation during the COVID-19 pandemic that already stressed that students in, for example, the United States of America and internationally feared falling behind, as the many changes in the learning environment lead to frustration and academic problems (De Boer, 2020; Hagedorn et al., 2021; Tasso et al., 2021; Yim et al., 2022) as well as the financial difficulties as due to the pandemic in for example China and internationally, students' working possibilities were restricted and many families were not able to support the students as usual (De Boer, 2020; Li et al., 2022; Montacute & Holt-White, 2020). Aarntzen et al. (2023) also already emphasized the importance of the worry about falling behind regarding academic well-being, which also seems to be of similar importance for general, positive well-being and stress levels.

In addition, the students' worry about the diploma's worth after the study and worry about the study enjoyment (secondary stressors) significantly decreased their well-being, but did not increase students' stress levels. The association with well-being is in line with previous research in China, the United Kingdom and the United States, that found these stressors to be impacted by the COVID-19 pandemic. Similar to the worry about falling behind, the changes in the learning environment and the many online classes lead to these stressors decreasing the well-being of students. While for the worry about the diploma's worth, the online classes felt less valuable to the diploma (Klebs et al., 2021, Li et al., 2022), they lead to less social contact and less fun during class activities impacting the worry about the students' study enjoyment (De Boer, 2020; Hollister et al., 2022; Okada & Sheehy, 2020). Nonetheless, these stressors did not independently impact the students' stress levels significantly. One explanation for this could be that the worry about falling behind or the worry about the financial situation are also related to the direct coping of the student with the changed situation (e.g. how to catch up/study differently, how to live with less money). Worrying about the worth of a diploma may not be directly related to a coping action and therefore might not significantly impact stress (Canadian

Mental Health Association & Anxiety Canada, 2016). Besides that, the worry of a different learning environment, online classes and less fun can impact well-being directly, but they do not necessarily mean more stress, as for some students' lower stress levels were measured during online education from home compared to normal in-person classes because they perceive the changes as positive (Jones, 2022). This might also explain why the worry about study enjoyment is not of the same importance for general positive well-being and stress as the worry about falling behind in contrast to the findings of Aarntzen et al (2023) who found both stressors to be of high importance for decreased academic well-being.

Furthermore, the worry of getting infected with COVID-19 (primary stressor) significantly increased the stress levels of the students, while not decreasing their well-being. The association with stress is supported by previous research on the COVID-19 pandemic influences in China, Italy and the United Kingdom, as the students had to adapt to many different regulations in order not to get infected, explaining the effects of this primary stressor (Burns et al., 2020; Sebri et al., 2021; Zhai & Du, 2020; Zhou & Guo, 2021). Still, as students and young adults do not have the same health risk with an infection as older people, the worry of getting COVID-19 might not impact the well-being of the students as much (CDC, 2020), explaining the insignificant effect on well-being in the current study.

The worry about close friends and family getting infected with COVID-19 (primary stressor) and the worry about finding a job after the studies (secondary stressor) did not significantly impact the well-being nor stress levels of the students. One explanation for the insignificant effect of the worry about close friends and family getting infected with COVID-19 could lie in the wording and specification of the item. As stated before, younger adults have fewer health risks with COVID-19 than elderly people (CDC, 2020). As most friends of the students are likely around their own age and are therefore not at high risk of severe COVID-19 complications, they might experience less impact on well-being and stress. Similarly, with different anti-COVID regulations employed by the government and universities, the students might feel more at ease regarding infecting others, explaining insignificant effects on their stress and well-being levels (De Boer, 2020). In addition, although previous literature points out the worries about finding a job and its impact on mental health (Al-Ansi, 2021; Aslan, 2021; Aucejo et al., 2020; Kara & Karaaslan, 2022), the insignificant effect on well-being and stress in this study could be explained by the study sample. As the sample consists of second-year STEM and social science students, they do not yet have to enter the job market but have at least between one and three years of studying left, depending on if they want to do a Master's degree.

As the step of finding a job is still further away, their well-being and stress levels might be impacted less.

These insights into the effects of the primary and secondary stressors are of high relevance in understanding the effects of the COVID-19 pandemic on students' well-being and stress. They add to the findings of previous research by not only supporting the proposed effects but also by showing them under the Dutch context and regulations. This knowledge could be used to, for example, design interventions to improve student mental health after the pandemic, by targeting stressors that were and may still cause lower well-being or higher stress. In addition, the findings enable the universities and governments to evaluate the regulations employed and how they affected students in higher education in the Netherlands. The insights into the stressors can therefore be used to enhance and balance strategies and prepare in case of future pandemics to decrease the psychological burden on students.

Next, the analysis showed that the secondary stressors were more strongly related to well-being and stress than the primary stressors. The secondary stressors have a bigger impact on the well-being and stress of students during the COVID-19 pandemic than the primary stressors and there seems to be a significant difference between the effects of the secondary and primary stressors. One explanation for this might be due to what the constructs of primary and secondary stressors entail. While the primary stressors are about the direct influences of an extreme events (Lock et al., 2012, Ntontis et al., 2023; Tempest et al., 2017; Williams et al., 2021), so the direct consequences of the COVID-19 infection and the worry about getting infected (Zaken et al., 2021), the field of influence for secondary stressors is bigger. Secondary stressors can entail many different aspects that can also be indirectly related to the COVID-19 pandemic, like the consequences of regulations (Zaken et al., 2021). As secondary stressors also entail the longer-lasting effects of COVID-19 there is more possibility for influencing well-being and stress (Lock et al., 2012; Ntontis et al., 2023; Tempest et al., 2017; Williams et al., 2021). In this case, not just the worry of getting infected plays a role (primary stressor), but also the worry about falling behind, the diploma worth, the study enjoyment and the financial situation (secondary stressors) that can come into play later on. The possible influences of these secondary stressors can have a longer-lasting effect on students education, wealth or other aspects of their future, impacting their well-being and stress even when the direct effects of, for example, worrying about getting affected are already gone (Lock et al., 2012, Ntontis et al., 2023; Tempest et al., 2017; Williams et al., 2021; Zaken et al., 2021). Williams et al. (2021) emphasised that therefore, secondary stressors are beyond the limited scope of direct disaster effects.

Again, this finding is of high importance for understanding how the different stressors affect student well-being and stress. It gives valuable information that can be used to prioritize intervention design or protective measures in case of future pandemics or similar issues. It also adds to the research field of primary and secondary stressors by emphasizing the importance and special role of secondary stressors, in the context of the COVID-19 pandemic. The findings during other disasters, e.g. floodings or earthquakes, are therefore also supported under the context of the COVID-19 pandemic.

Lastly, the analysis showed that the worry about study enjoyment (secondary stressor) mediated the effect of the worry about close friends and family getting COVID-19 (primary stressor) on well-being and that the worry about falling behind during the studies (secondary stressor) mediated the effect of the worry about getting COVID-19 (primary stressor) oneself on stress. This means that the worry about close friends, family and oneself getting COVID-19 came before the worries about falling behind and study enjoyment which then influence well-being and stress. This can be explained as by worrying about others getting infected, the students might have restricted themselves more and avoided contact to not transmit the virus. These restrictions then led to worries about a less enjoyable study period due to increased restrictions and changes from the usual and therefore to lower well-being (De Boer, 2020; Hollister et al., 2022). Similarly, students who worried about getting COVID-19 themselves might have thought that with an infection they would miss out on important courses or that they could not follow the online class properly. They therefore worried more about falling behind and experienced higher levels of stress (De Boer, 2020; Tasso et al., 2021; Yim et al., 2022; Zhou & Guo, 2021).

Still, none of the other secondary stressors mediated the relationship between a primary stressor, stress and well-being. As in the context of the COVID-19 pandemic, the secondary stressors were tightly connected to governmental regulations and societal reactions to the happenings (Lock et al., 2012; Ntontis et al., 2023; Williams et al., 2021; Zaken et al., 2021), the secondary stressors might have also occurred and put a burden on students if the primary stressors, so the worries about friends, family and oneself getting infected with COVID-19 were not or not strongly applicable to the students themselves. Even when not worried about getting infected, students still would have experienced the influence of the regulations and therefore for example the switch to online education, triggering the secondary stressors. During the COVID-19 pandemic, it does not seem like one could clearly connect and relate the effects of primary and secondary stressors to one another.

Through investigating the connection between the primary and secondary stressors, a first step is made in understanding how the stressor categories might interplay in the context of the COVID-19 pandemic, adding to a barely explored field of research. Nonetheless, these insights can be of high importance for understanding primary and secondary stressors and how they might influence each other. Investigating this gives the possibility of understanding the COVID-19 pandemic influences and helps in preparing for future pandemics.

Limitations and Strengths

Some limitations apply to this study. One limitation lies in the cross-sectional nature of the study. As the data was collected on one measurement moment only, it cannot be ascertained how the association between well-being, stress and the stressors looks like in the long run. It would also have been beneficial to investigate these associations through longitudinal methods throughout different phases of the COVID-19 pandemic to gather insights into how well-being and stress levels changed with varying stressor levels. Another limitation lies in the measured stressors themselves. Although the primary and secondary stressors were divided into categories based on their theoretical distinction, it was not tested whether or not there is a distinguishable difference between the stressors and their categories. It would have been beneficial to also explore if the primary and secondary stressors described a different form of impact on the students or if the primary and secondary stressors were too similar.

Nonetheless, this research also has strengths. One of these is that this research is one of the few studies that researches the effects of the COVID-19 pandemic on higher education in the Netherlands. The study looks into both primary and secondary stressors, and their effects on both stress and well-being, comparing these effects between the categories and exploring the categories' connection. In comparison to other studies that explore mental health in a more dysfunctional and problem-focused way through, for example, depression or anxiety, this study uses a more positive approach that gives more attention to the extent the students can still function well. For this, the MHC-SF measure of well-being as well as the PSS measure of stress are used to provide a more complete view of student mental health. Lastly, although there is much research about major events like floodings or earthquakes, little is known about the primary and secondary stressors during pandemics. This study does not only divide some possible stressors into these categories and tests them to explore stressors for the COVID-19 pandemic but also focuses on academic stressors, tailoring the study even further to the target group of university students.

Future Directions

As the COVID-19 pandemic has ended, it will not be possible to replicate the study or keep investigating the short-term influences of the pandemic. Nonetheless, the long-term effects of the COVID-19 pandemic and its stressors should be investigated. Students who studied during the pandemic and who were therefore exposed to the different primary and secondary stressors could be observed through longitudinal studies to explore to what extent the COVID-19 stressors impact student well-being and stress even after the pandemic ended. The pandemics and stressors long-term impact could be researched while also being able to investigate whether or not these COVID-19 students became more prone to, for example, academic stressors. In addition, exploring the impact of differences in governmental and university decisions during the pandemic could bring valuable insights for the future handling of pandemics or similar situations that would impact student well-being and stress. The different academic stressors could furthermore be investigated in more detail outside the pandemic and the clear distinction between the two stressor categories could be evaluated, bringing more clarity to the division into the two stressor groups and adding to the list of important academic stressors that is needed when creating interventions. Lastly, it could be of interest to keep investigating the overarching categories of primary and secondary stressors. This could provide additional insights into how they interplay during the different major events, making it easier to create effective and efficient short- and long-term interventions. It should furthermore not be undermined, that the findings might, have been completely different with a sample of, for example, elderly people, as they would fear primary stressors, so the virus and infection consequences more than the more long-term secondary stressors. It could therefore also be of interest to compare the effects of the different stressors between different age groups and generations even after the pandemic.

Conclusion

The results of this research suggest that especially the worry about falling behind in university (secondary stressor) and the worry about the financial situation (secondary stressor) are of high importance for the well-being and stress of university students in the Netherlands during the COVID-19 pandemic. In addition, secondary stressors generally seem to be more strongly related to stress and well-being than the primary stressors, possibly as their effects are usually longer lasting and impact the students in more and different areas of their lives. Future research could continue to investigate different academic stressors and how to divide stressors between the categories of primary and secondary. In addition, investigating the COVID-19 generations through longitudinal research could bring valuable insights into the long-term effects of the pandemic and the different stressors the students were exposed to.

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Appendix A: MHC-SF

Adult MHC-SF (ages 18 or older)

Please answer the following questions are about how you have been feeling during the past month. Place a check mark in the box that best represents how often you have experienced or felt the following:

During the past month, how often did you feel ...	NEVER	ONCE OR TWICE	ABOUT ONCE A WEEK	ABOUT 2 OR 3 TIMES A WEEK	ALMOST EVERY DAY	EVERY DAY
1. happy						
2. interested in life						
3. satisfied with life						
4. that you had something important to contribute to society						
5. that you belonged to a community (like a social group, or your neighborhood)						
SEE BELOW 6. that our society is a good place, or is becoming a better place, for all people						
7. that people are basically good						
8. that the way our society works makes sense to you						
9. that you liked most parts of your personality						
10. good at managing the responsibilities of your daily life						
11. that you had warm and trusting relationships with others						
12. that you had experiences that challenged you to grow and become a better person						
13. confident to think or express your own ideas and opinions						
14. that your life has a sense of direction or meaning to it						

Note: The original wording for item 6 was “that our society is becoming a better place for people like you.” This item does not work in all cultural contexts. However, when validating the MHC-SF, test both versions of item 6 to see which one works best in your context.

Appendix B: PSS

PERCEIVED STRESS SCALE

The questions in this scale ask you about your feelings and thoughts during the last month. In each case, you will be asked to indicate by circling *how often* you felt or thought a certain way.

Name _____ Date _____

Age _____ Gender (Circle): **M** **F** Other _____

0 = Never 1 = Almost Never 2 = Sometimes 3 = Fairly Often 4 = Very Often

- | | |
|--|-------------------|
| 1. In the last month, how often have you been upset because of something that happened unexpectedly? | 0 1 2 3 4 |
| 2. In the last month, how often have you felt that you were unable to control the important things in your life? | 0 1 2 3 4 |
| 3. In the last month, how often have you felt nervous and "stressed"? | 0 1 2 3 4 |
| 4. In the last month, how often have you felt confident about your ability to handle your personal problems? | 0 1 2 3 4 |
| 5. In the last month, how often have you felt that things were going your way? | 0 1 2 3 4 |
| 6. In the last month, how often have you found that you could not cope with all the things that you had to do? | 0 1 2 3 4 |
| 7. In the last month, how often have you been able to control irritations in your life? | 0 1 2 3 4 |
| 8. In the last month, how often have you felt that you were on top of things? | 0 1 2 3 4 |
| 9. In the last month, how often have you been angered because of things that were outside of your control? | 0 1 2 3 4 |
| 10. In the last month, how often have you felt difficulties were piling up so high that you could not overcome them? | 0 1 2 3 4 |

Appendix C: Primary Stressor Items and Secondary Stressor Items

Primary Stressors (1= Not at all, 7=very much):

- “To what extent are you worried about getting corona (again)?” (Worry about getting COVID-19)
- “To what extent are you worried that someone close to you (close friends and family) will get corona?” (Worry about social environment getting COVID-19)

Secondary Stressors (1= Not at all, 7=very much):

- “Because of the corona crisis, I am concerned that I will fall behind with my studies” (Worry about falling behind)
- “Because of the corona crisis, I am worried that my diploma is worth less” (Worry about diploma worth)
- “Because of the corona crisis, I am worried that it will be difficult for me to find a good job after my studies” (Worry about finding job)
- “Because of the corona crisis, I am worried that I will have a less enjoyable study period” (Worry about study enjoyment)
- “Because of the corona crisis, I am worried about my financial situation” (Worry about finances)