

DISCUSSION PAPER SERIES

IZA DP No. 18180

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A Socioeconomic Analysis of Stress-Related
Demands and Resources During Two Different
Stages of the COVID-19 Pandemic**

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ABSTRACT

Stress Perception of Higher Education Students: A Socioeconomic Analysis of Stress-Related Demands and Resources During Two Different Stages of the COVID-19 Pandemic*

The number of students experiencing mental health problems has risen across Europe in recent years. Besides a detrimental effect on study success, there may be lasting negative consequences. Because mental health problems can arise due to chronic perceived stress, we focus on students' stress perceptions. Based on two large-scale student surveys in Germany, we investigate stress perceptions during two phases of the COVID-19 pandemic (2020 and 2021), when different restrictions were in place. The empirical results—obtained by estimation of structural equation models—show that academic workload was constantly the main stress factor for students in both years. Financial stress was especially significant during the economic restrictions in 2020, accounting for more than one-third of the impact of academic workload. In addition to personal resources, social contact proved to be a buffer against perceived stress. During the social restrictions in 2020, increased social contact—when possible—significantly reduced perceived stress, lowering it by one-quarter relative to academic stress. The results also show an association between perceived stress, decreased life satisfaction, and a higher risk of dropping out of higher education.

JEL Classification: I14, I23, I24

Keywords: higher education, mental health, perceived stress, COVID-19

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1 Introduction

In recent years, an increasing share of higher education students in Europe—up to 19%—have reported health restrictions that limited their studies at least slightly (Hauschildt et al., 2021, 2024), with the rate reaching 16% among students in Germany in 2021 (Kroher et al., 2023; Steinkühler et al., 2023). The most common of these restrictions are mental health problems or illnesses¹, such as depression and eating disorders², reported by 65% of students with study-impairing conditions (Kroher et al., 2023; Steinkühler et al., 2023). This share has risen by approximately 20 percentage points in a decade (Steinkühler et al., 2023). In 2021, the proportion of students with mental health problems in Germany was comparable to the European average (13%), although the rates varied widely, from 3% in Romania to 29% in Sweden (Hauschildt et al., 2024).

The sharp increase in self-reported mental health problems among higher education students—and the large differences between countries—may stem from two factors: First, an increase or differences in the actual (diagnosed) prevalence, and second, greater or different openness to verbalization due to increasing social awareness and acceptance (Cuppen et al., 2024; Steinkühler et al., 2023). Unfortunately, it is not possible to distinguish between these two possibilities in surveys, because diagnoses are not available.

Based on this limitation and the fact that the majority (77%) of mental health problems occur before enrollment in higher education (Steinkühler et al., 2023), it is therefore important to consider other, study-specific mental health indicators. Since emotional distress—such as depression or anxiety—can be a psychosocial consequence of chronic perceived stress³ (see, e.g., Cohen et al., 1983; Levenstein et al., 1993; Bergdahl & Bergdahl, 2002; Bovier et al., 2004)⁴, we focus on students' stress perceptions.

¹ While mental health refers to effective functioning in routine productive activities (e.g., work, school), social activities (healthy relationships), or adaptability, mental illness encompasses all diagnosable mental disorders with significant changes in thinking, feeling, and behavior that can lead to impairment and problems in routine activities (APA, 2022). Diagnosable mental disorders are described in detail in the ICD-11 of the WHO (2022) and include, for example, anxiety disorders, depression, bipolar disorder, post-traumatic stress disorder, eating disorders, among others.

² In a European comparison, even the specific types of mental health problems can be shown as shares of students with mental health problems: depression (71%), anxiety disorder (71%), ADHD (25%), eating disorder (20%), personality disorder (11%), addictions disorder (8%) and psychosis (4%) (Cuppen et al., 2024).

³ Stress is defined as a severe strain on an organism caused by internal or external stimuli (stressors) that upset the organism's internal balance and require an adaptive response from the organism (Ernst et al., 2022).

⁴ In addition to mental illnesses, persistent or frequently recurring stress reactions can also promote other stress-related illnesses and disorders, such as cardiovascular diseases (e.g., high blood pressure), metabolic diseases (e.g., type 2 diabetes), headaches and back pain or disorders of the sensory organs (e.g., sudden hearing loss) (Ernst et al., 2022).

Even before the COVID-19 pandemic, students in Germany generally reported high levels of stress. Because of varying conceptualizations, measurement methods, and target student groups, the reported share of students with high stress levels ranged from 25% in 2017 to 47% in 2018 and 53% in 2016 (Herbst et al., 2016; Grützmacher et al., 2018; Sendatzki & Rathmann, 2022). In the summer of 2020, during the COVID-19 pandemic, the proportion of students across Germany who felt (very) stressed was 69% (Zimmer et al., 2021),⁵ which fell to 64% one year later (Kroher et al., 2023). Comparing data from 2015 and 2023, the percentage of students who felt frequently stressed nearly doubled, from 23% to 44%, while those who reported being exhausted by stress in the previous 12 months increased from 44% to 68%, which the authors (in part) attributed to the pandemic (Meyer et al., 2023).

In 2020, in almost all countries, the COVID-19 pandemic led to educational, social, and economic restrictions, which were largely lifted in Germany by the summer of 2021.⁶ First, the closure of universities in many countries (Crawford et al., 2020), which precipitated a shift to online learning, led to negative effects on the quality of teaching, the motivation to persist in studies, preparation for and taking exams, and changes in study workload (see, e.g., Lörz et al., 2020a; Doolan et al., 2021; Haugas & Kendrali, 2024). Second, the restrictions on social contact had a negative impact on students' support networks and contact with fellow students (see, e.g., Doolan et al., 2021; Multrus et al., 2023; Haugas & Kendrali, 2024). Third, locking down the economy resulted in the loss of many student jobs and the deterioration of parents' incomes, and thus financial problems (see, e.g., Aristovnik et al., 2020; Doolan et al., 2021; Meier et al., 2024; Haugas & Kendrali, 2024).

These restrictions contributed to a wide range of mental health problems among higher education students worldwide, including elevated stress levels, more pronounced depressive symptoms, and heightened anxiety (see, e.g., Hasan & Bao, 2020; Mheidly et al., 2020; Wang & Zhao, 2020; Browning et al., 2021; Deng et al., 2021; Hamza et al., 2021; Hoyt et al., 2021; Rutkowska et al., 2021, 2022; Chen & Lucock, 2022; Bohman et al., 2023; Okado et al., 2023).⁷ Compared with pre-pandemic cohorts, higher education students in the pandemic cohort reported higher perceived stress levels (Elmer et al., 2020; Charles et al., 2021; Broks et al.,

⁵ In an international comparison, Germany ranks first with the highest proportion of students with a high perceived stress score (prevalence: 73%), followed by Poland (71%), Turkey (70%), Russia (67%), Israel (65%), Colombia (60%), Slovenia (55%), Ukraine (52%) and the Czech Republic (39%) (Ochnik et al., 2021).

⁶ For a description of the temporal phases of the pandemic and the educational, social and economic restrictions in Germany, see Meier et al. (2022).

⁷ These negative effects may—at least to a certain extent—persist into the future. For example, 44% of students expect the negative impact of the pandemic on their mental health situation to continue into the future (Haugas & Kendrali, 2024).

2022; Auerswald et al., 2024). However, these levels varied during the pandemic and were higher in spring 2020 than in the fall (Charles et al., 2021).

This paper aims to improve our understanding of which risk factors during the COVID-19 pandemic were the main cause of the high stress perceptions among higher education students. We conduct a theoretically grounded quantitative empirical analysis based on comprehensive and detailed survey data of on-campus higher education students in Germany. Similar to Slimmen et al. (2022), we calculate perceived stress in relation to three external study-related demands/resources that changed during the course of the pandemic: *Academic requirements*, *social integration*, and *financial stressors*. To assess the impact of the pandemic, we quantify the association with each risk factor during two periods of restrictions with differing intensities. By differentiating between the summer semesters of 2020 and 2021, we offer valuable insights into how stress behavior evolves in response to different risk factors.

In contrast to previous studies, we focus on various student groups to quantify differences in the prevalence and importance of risk factors. Since various groups of students perceive stress differently due to differences in resource endowment, we expect heterogeneous relationships between student-related demands/resources and stress perception. We perform subgroup analyses on vulnerable groups of students (derived from the literature, see Section 2.5)—such as students with impairments, those with children, those from no-academic backgrounds, international students, and students with a migration background—to reveal socioeconomic heterogeneities. Furthermore, we measure the extent to which perceived stress is related to life satisfaction and the progression of studies (intention to drop out). These insights are important for providing targeted support to at-risk students, improving their stress levels, and ensuring their successful graduation in the long term.

To consider demanding environmental conditions (risk factors) in a common model, we develop a modified environment-oriented stress model based primarily on the transactional stress model (TSM) of Lazarus and Folkman (1984) and the systemic demands–resource (SDR) model of Becker et al. (1994).⁸ These models emphasize the interplay between personal resources—such as coping styles and stress resistance—and external environmental demands and resources, including workload, social support, and material resources, in the occurrence of stress. Therefore, they provide a suitable theoretical basis for explaining stress reactions during

⁸ Psychological theory helps us to take a social science perspective on the individual risk factors that may be present in students' academic and social contexts. According to Kriwy and Jungbauer-Gans (2020), social science approaches complement medical and psychological approaches because social contexts often interact with biomedical processes in disease development, resilience, and recovery.

pandemic restrictions. Psychological research emphasizes resource-based theoretical approaches, highlighting that external demands and resources—alongside personal resources—play a crucial role in how individuals perceive stress when assessing and coping with situations or conditions (see, e.g., Kocalevent et al., 2007, 2013; Heinen et al., 2017; Slimmen et al., 2022; Dickhäuser et al., 2024). Empirically, we estimate the relationship and interaction between personal resources and academic requirements, social integration, and financial stressors using a linear structural equation model (SEM).⁹

Since our modified environment-oriented stress model relies on personal resources, academic requirements, social integration, and financial stressors, comprehensive data are necessary for the empirical analysis. The data from “*Studieren in Zeiten der Corona-Pandemie*” (2020) (“*Studying in Corona Times*”; ~28,600 students; Lörz et al., 2020b) and “*Die Studierendenbefragung in Deutschland (2021)*” (“*The Student Survey in Germany*”; ~188,000 students; Becker et al., 2024) provide such a unique database. These two surveys cover a wide range of information, measuring personal resources such as self-efficacy, resilience, and personality traits in the form of proven psychological instruments (short scales) while also containing detailed information on academic, social, and financial demands/resources. In addition, sociodemographic data such as gender, age, socioeconomic background, migration background, parenthood, impairment, employment, housing situation, and study-related characteristics such as degree, semester, and major are collected. The analyses are limited to about 16,400 students in 2020 and about 22,600 students in 2021, because all observations without information on the relevant characteristics are excluded.

Following previous research, mental health disorders such as depression and anxiety can lead to poorer academic performance and an increased probability of dropping out of higher education (Eisenberg et al., 2009; Hjorth et al., 2016; Zajac et al., 2024). High levels of perceived stress can lead to poorer academic performance among higher education students (Pritchard & Wilson, 2003; Varghese et al., 2015; Kötter et al., 2017). In their review, Pascoe et al. (2019) highlighted the negative impacts of persistent academic-related stress on educational achievement, such as lower academic performance, reduced learning capacity, and higher chances of dropout; students’ mental health, such as lower well-being and higher

⁹ Multivariate statistical analysis methods such as linear SEM merge the methodological sub-areas of econometrics and psychometrics (Aichholzer, 2017).

prevalence of depression, anxiety, and substance use and abuse; poor sleep quality and quantity; and physical health. All of these factors may affect entry into the labor market.¹⁰

Unlike most research on pandemic-related stress in higher education, our study focuses not only on academic and social stressors but also on financial stressors. Higher education students in Germany face a number of financial challenges, which have been exacerbated by the pandemic and inflation. During the pandemic (2020–2021), many students lost their jobs, leading to a drastic fall in income, and socially disadvantaged groups became more reliant on loans (Meier et al., 2024).¹¹ Furthermore, the cost of living has increased tremendously due to inflation in the aftermath of the pandemic (2022–2023), hitting students harder than the general population (Meier et al., 2023).

Given the substantial number of students affected, the increases in the perception of stress, and the fact that mental health problems have an impact not only on academic success but also on the rest of one's life, it is important to investigate and understand the underlying factors contributing to higher stress levels. Investigating the relationship between external resources and stress is of vital importance, as it provides a fundamental starting point for social policies and prevention strategies.

Compared to the psychological literature, we are able to identify risk factors for different groups of students and have additional information on study-related characteristics (e.g., intention to drop out) to highlight the negative consequences of stress for students in addition to its impact on mental health. We do not aim to contribute to psychological stress research, as the instruments available in the surveys to operationalize individual coping resources (internal resources) are not sufficient for this purpose. Our paper aims to provide researchers and decision-makers in the higher education sector with insights into which risk factors contribute most to the perception of stress and which student groups are particularly at risk for experiencing high stress levels. At the same time, our aim is to motivate the implementation of external demands/resources for future (psychological) stress research.

The remainder of the paper is structured as follows: The derivation of our theoretical stress model based on psychological theory and current literature is presented in Section 2. Section 3 contains the data description, the operationalization of the variables of interest, and the resulting data restrictions. Section 4 presents the descriptive and estimation results as well as the

¹⁰ In economic terms, mental health problems can lead to lower labor productivity, working less, consuming less or investing less (Bubonya et al., 2017; Abramson et al., 2024).

¹¹ Higher student loans and other forms of debt can cause higher levels of stress (Danahy et al., 2024) and have a negative impact on the mental health of students (Carney et al., 2005; Sheldon et al., 2021).

heterogeneity analyses of the considered student groups and the consequences of perceived stress for life satisfaction and studies. Section 5 concludes the paper.

2 Theoretical Considerations and the Literature

2.1 Theoretical Psychological Stress Models

According to Ernst et al. (2022), stress research can be divided into biological, psychological, and sociological approaches: While the biological approach describes the physiological reactions to stressors outside the body, the psychological approach describes the effect (perception, appraisal) of stressors depending on the coping options available. Both can be complemented by sociological approaches to consider stress in a social context (Ernst et al., 2022).

In the widely used and frequently adapted TSM of Lazarus and Folkman (1984), the separate elements of person and environment are integrated into a dynamic reciprocal relationship within a two-stage cognitive appraisal of situations (Lazarus & Folkman, 1984, p. 294). In this process, a primary appraisal determines whether a situation is “*irrelevant*”, “*benign-positive*” or “*stressful*”, while a secondary appraisal indicates “*which coping options are available*” (Lazarus & Folkman, 1984, pp. 32, 35). Stress occurs when an individual evaluates a situation as stressful while also believing that they do not have sufficient coping skills to deal with the threat.

In contrast to traditional static models¹², the TSM is change oriented: The interplay between personal and environmental factors is a “*process*”, since the relationship is constantly changing, and an effect may later become a cause (Lazarus & Folkman, 1984, p. 295). Personal variables include “*value commitments*”, “*belief assumptions (e.g., personal control)*”, and “*cognitive coping styles*”, while environmental (situational) variables include “*(situational) demands, constraints*” or “*social and material resources*” (e.g., “*social network*”) (Lazarus & Folkman, 1984, pp. 305, 308). However, their appraisal depends not only on the person or their environment but on the integration of both factors in a particular transaction (Lazarus & Folkman, 1984).

Hobfoll (1989) criticized stress research for being too vague and difficult to test empirically, instead presenting a resource-oriented stress model, the conservation of resources (COR) model, as an alternative. This model integrates both objective and subjective components of

¹² Lazarus and Folkman (1984) describe the antecedent-consequent or stimulus-response model as traditionally static models that view the relationships between the person and the environment as linear, unidirectional and static.

resources and assumes that people seek to conserve, protect, and increase their resources, with the potential or actual loss of these resources constituting the primary source of stress. These resources include “*objective resources*” (e.g., status values), “*conditions*” (e.g., social relationship, living with someone, marital status, profession), “*personal characteristics*” (e.g., stress resistance) and “*energies*” (e.g., time, money, knowledge), with “*social support*” is considered a special type of resource that can occur in all four categories (Hobfoll, 1989, p. 517).

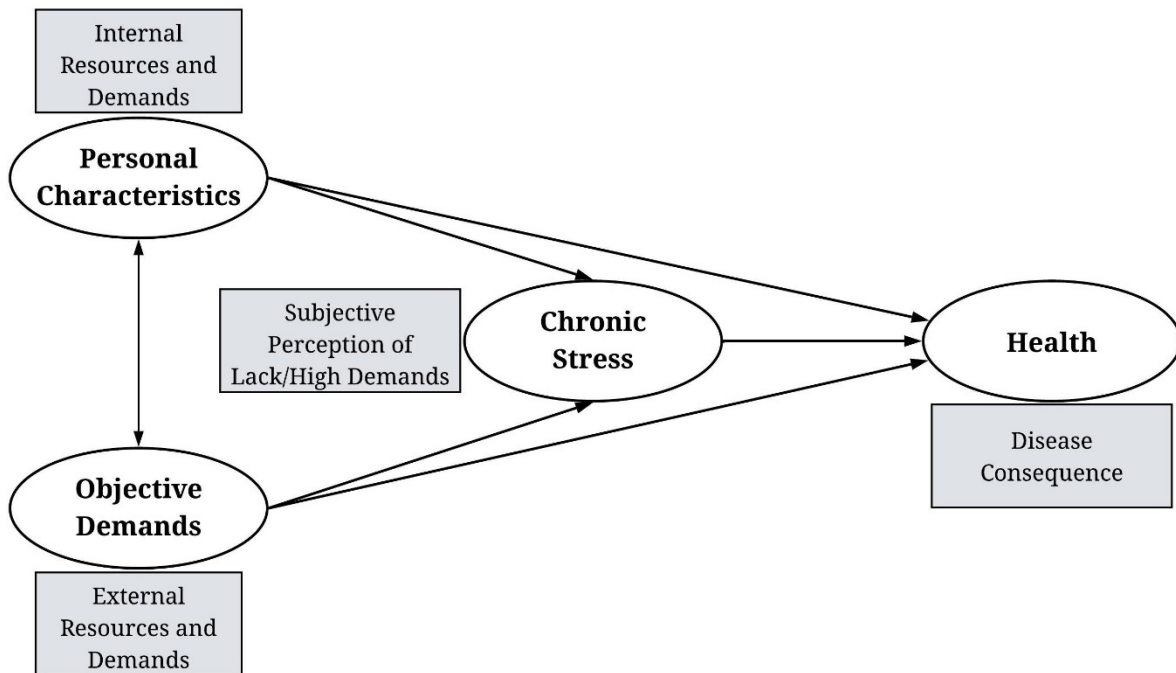


Figure 1: Systemic Demands-Resources Model

Notes: Own illustration based on Becker et al. (2004, p. 14).

The SDR model (Becker et al., 1994) follows Lazarus and Folkman’s (1984) TSM and is related to Hobfoll’s (1989) COR model. Becker et al. (2004) argued that an individual’s state of health depends on how well they can cope with *demands* (conditions that an individual has to deal with) using their *resources* (see Figure 1).¹³ Internal demands arise from the expectations and needs of an individual, in addition to physiological needs, for self-fulfillment, security, commitment, and appreciation (Blümel, 2024). External demands are mainly social and work related, such as a high workload at work or school and pressure to perform (Becker et al., 2004). Individuals draw on internal and external resources to cope with internal and external demands. Internal resources, or personal resources, include mental and physical capacities, such as intelligence, self-efficacy beliefs, problem-solving skills, personality traits,

¹³ In the SDR model, health includes both physical and mental health (Blümel, 2024).

and physical fitness, which is strongly influenced by age (Becker et al., 2004; Blümel, 2024). External resources include social (e.g., social relationships), work related (e.g., working conditions), and material resources (e.g., sufficient income) (Blümel, 2024). Although the SDR model looks at the process from an ecological perspective, it highlights the interactions between internal and external system levels—that is, between internal and external demands and resources.¹⁴

2.2 The Literature on Personal Resources

It is well documented that individuals who are better endowed with personal coping resources—such as self-efficacy, resilience, sense of coherence, optimism, and joy—or personality traits such as neuroticism experience lower levels of chronic perceived stress (see, e.g., Kocalevent et al., 2007, 2013, 2014; Ebstrup et al., 2011; Heinen et al., 2017; Obbarius et al., 2021). Because of their different dimensions, one's overall personal resources are not directly measurable or observable; rather, they are latent variables. Latent variables are operationalized using different measurable indicators (items/manifest variables) to map the relationships between different personal resources and stresses. A variety of psychological concepts are used in the literature to operationalize the personal resources described above in the context of stress research. Heinen et al. (2017) used resilience, self-efficacy, optimism, and joy as dimensions of personal resources in their research on higher education students' perceptions of stress. There is evidence that optimism is related to the *Big Five* personality traits—specifically extraversion and neuroticism (Rey & Extremera, 2014; Busseri & Choma, 2016)—and that these traits are directly related to the perception of stress (Ebstrup et al., 2011). Therefore, in this study, we operationalize personal resources by *resilience*, *self-efficacy*, and *personality traits*. The research discussed in the following section mainly addresses different dimensions of mental health problems, with a focus on students' stress perceptions. However, since we assume a relationship between stress and mental health problems, we also considered these dimensions.

¹⁴ There are also other models linking the relevance of external (job-related) demands and resources to mental health problems (such as psychological strain, burnout, or stress), such as Karasek's (1979) demands-control model and the job demands-resources (JD-R) model by Demerouti et al. (2001), although the internal system level is not considered. These models were subsequently expanded to include personal resources (Xanthopoulou et al., 2007). In our view, these models are only suitable for our research project to a limited extent, as they focus not only on the influence of job demands and resources on mental health but also on the work engagement of employees. However, the extended JD-R model also emphasizes the reciprocal influence of personal resources (e.g., self-efficacy) with (job) resources and mental health (Xanthopoulou et al., 2007). According to the student-related JD-R model by Gusy et al. (2016), Lesener et al. (2020), and Bakker and Mostert (2024), alongside personal resources, study characteristics can be divided into two distinctive categories: Study demands and study resources.

Resilience is closely linked to mental health and perceived stress: “*While resilience has been defined as resistance to illness, adaptation, and thriving, the ability to bounce back or recover from stress is closest to its original meaning*” (Smith et al., 2008, p. 194). Low emotional resilience or low bounce-back resilience are significant risk factors for mental health problems among higher education students (Sheldon et al., 2021). Heinen et al. (2017) and Sahu et al. (2019) show a negative correlation between resilience and perceived stress among higher education students. Resilience is also directly related to stress, as noted by García-León et al. (2019): Participants with low resilience had higher perceived stress scores. According to Tung et al. (2014) and Wu et al. (2020) students with higher levels of resilience generally have lower levels of stress and related symptoms, which is also evident among university students during the COVID-19 pandemic and beyond (Ye et al., 2020; Hu et al., 2023; Litwic-Kaminska et al., 2023; Jozefiaková et al., 2024).

Self-efficacy expectations refer the assessment of one’s own ability to successfully plan and execute actions to achieve the desired goals (Beierlein et al., 2013). Self-efficacy can influence how people deal with stressful and challenging situations by ensuring that personal resources for coping with stressful situations are strengthened (Kocalevent et al., 2007, 2013; Heinen et al., 2017). It has also been shown that higher self-efficacy has a direct negative effect on (students’) perception of stress (Ebstrup et al., 2011; Madson et al., 2022; Dickhäuser et al., 2024). Accordingly, higher levels of self-efficacy (in self-regulation) buffered perceived (study-related) stress during the COVID-19 pandemic (Keyserlingk et al., 2022; Auerswald et al., 2024).

Personality traits can be described in five dimensions using the *Big Five* model: Neuroticism, extraversion, agreeableness, conscientiousness, and openness (see, e.g., Costa & McCrae, 1992).¹⁵ However, although neuroticism is positively related to stress (Ebstrup et al., 2011; Afshar et al., 2015; Luo et al., 2023), the other four dimensions are associated with lower levels of stress and have been collectively described as a protective factor against feelings of stress (Ebstrup et al., 2011; Afshar et al., 2015; Luo et al., 2023). In particular, the first four dimensions are particularly relevant to stress perception (Ebstrup et al., 2011), with neuroticism having the strongest relationship (Luo et al., 2023). Ikizer et al. (2022) and Karing (2021)

¹⁵ According to Rammstedt et al. (2013), *extraversion* includes characteristics such as sociability and assertiveness; *neuroticism* describes a person’s emotional instability and leads to nervousness, anxiety, and depression; *agreeableness* shows altruism, interpersonal trust, cooperation, and forbearance; *conscientiousness* is characterized by determination, persistence, discipline, and reliability; and *openness* is an expression of interest in new experiences and adventures.

showed that neuroticism in particular was a strong predictor of stress during the COVID-19 pandemic.

2.3 The Literature on External Resources and Demands

Studies on the causes of student stress have considered environmental conditions alongside personal characteristics. These sources of stress include traditionally *academic/university-related* and *social/family factors* as well as *financial problems* (see, e.g., Misra et al., 2003; Robotham, 2008; Brougham et al., 2009; Turiak & Krinner, 2014; Adams et al., 2016). Environmental factors are also reflected in the current literature as changes in external resources due to the pandemic (see, e.g., Aristovnik et al., 2020; Slimmen et al., 2022; Cuppen et al., 2024; Zhang et al., 2024).

Academic requirements are considered the main source of stress for students (Barbayannis et al., 2022). Traditionally, perceived stressful study requirements have included a high workload and long working hours related to study (Dickhäuser et al., 2024) as well as exams (Herbst et al., 2016). The pandemic led to the closure of universities in many countries and a fundamental transition to online learning (Crawford et al., 2020), which had far-reaching consequences for students. Many reported an increase in their university workload as a result of the pandemic, accompanied by a switch to online teaching methods, examinations, and assessment which caused additional stress (Elsalem et al., 2020; Abdulghani et al., 2020; Matos Fialho et al., 2021; O'Byrne et al., 2021). Additional perceived academic stressors during the pandemic were increased study demands, difficulties with self-organized learning, and the housing situation (Auerswald et al., 2024), as well as increased concerns about academic performance, problems with concentration (Son et al., 2020), and general learning difficulties (Hu et al., 2023).

Social integration, or social support, is positively related to mental health, buffering the negative effects of stress on mental well-being (Bovier et al., 2004). Therefore, a low level of social support worsens the relationship between stress and the mental health of students (Chao, 2012; Sendatzki & Rathmann, 2022). Lockdowns, stay-at-home orders, and contact restrictions, as well as the switch to online learning, led to less contact with family, friends, and fellow students as well as social isolation (Son et al., 2020; Werner et al., 2021; Haugas & Kendrali, 2024). Social stress—such as reduced perceived social support and less social contact due to the pandemic—has been associated with increasing general stress (Ye et al., 2020; Li et al., 2021; Broks et al., 2022; Litwic-Kaminska et al., 2023), loneliness (Werner et al., 2021), as well as anxiety and depression (Cao et al., 2020; Ma et al., 2020; Li et al., 2021; Kohls et al., 2021; Giesselbach et al., 2023; Jozefiaková et al., 2024). Several stressors have been identified

as contributing to these mental health problems among students (Son et al., 2020): Isolation in social networks, lack of interaction and emotional support, physical isolation (Elmer et al., 2021), isolation from friends and acquaintances (Rutkowska et al., 2021, 2022), and decreased social interactions due to physical distance (Son et al., 2020).

Financial stressors, such as monetary concerns, burdens, and difficulties, can lead to mental health problems for students (Eisenberg et al., 2013; Bøe et al., 2021; Charles et al., 2022) and resulting in higher levels of depression and anxiety (Andrews & Wilding, 2004; Shao et al., 2020) or stress (Brougham et al., 2009; Sendatzki & Rathmann, 2022). Moreover, employment—or a heavy workload and working hours—along with full-time education generally has a negative impact on students’ mental health (Roberts et al., 1999, 2000; Carney et al., 2005) and can lead to burnout and higher stress (Herbst et al., 2016; Benner & Curl, 2018). As a result of economic restrictions during the pandemic, many students in Germany lost their part-time jobs, or their parents’ income deteriorated, leading to a worsening of students’ financial situations (Becker & Lörz, 2020; Gewalt et al., 2022; Meier et al., 2024). Monetary stressors during the pandemic—such as financial strain, worsening financial situations, loss of economic resources, reduction in work hours, or worry about financial problems—caused higher prevalence of depressive and anxiety symptoms (Sundarasan et al., 2020; Deng et al., 2021; Negash et al., 2021; Matos Fialho et al., 2021; Tancredi et al., 2022; Buffel et al., 2024) as well as higher levels of stress and distress (Karing, 2021; Chen & Lucock, 2022; Lawley et al., 2025).

2.4 A Modified Environment-Oriented Stress Model

Based on the literature, we suggest a modification of the psychological theories described in Section 2.1 to depict the stress response of higher education students during the COVID-19 pandemic.¹⁶ We focus on the aforementioned resource-based theoretical stress models, which emphasize that—in addition to personal characteristics—external demands and resources play a central role in individuals’ perceptions of stress. The conceptual similarities between the models in explaining stress perceptions in the interplay between personal resources—such as coping styles and stress resistance—and external, environmental demands and resources, including workload, social support, and material resources, provide a suitable theoretical basis for explaining stress reactions during pandemic restrictions, in line with Hobfoll (1989),

¹⁶ According to Gerlinger (2020), the term theory in the sociology of health is generally used pragmatically to provide an analytical framework for traditionally highly empirical research. The question is not which approach is right, but how to empirically test the arising questions and how to combine proven approaches into a more comprehensive model (Kriwy & Jungbauer-Gans, 2020).

because of resource loss. Moreover, as we have shown above, the theoretical approaches are well established in the literature, have been sufficiently operationalized—including for higher education students in Germany—and have been empirically tested.¹⁷ Hence, we are confident that they provide a valid and convincing foundation for our analysis.

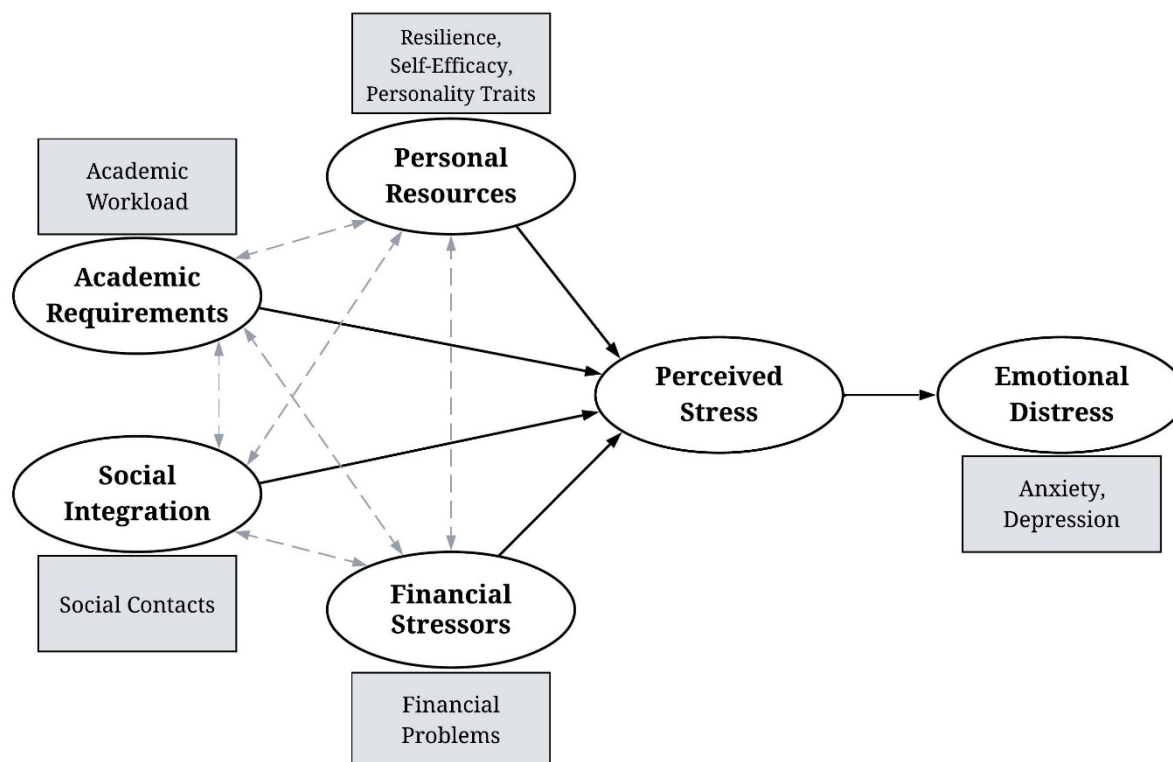


Figure 2: Modified Environment-Oriented Stress Model

Notes: Own representation based on Becker et al. (2004), Ebstrup et al. (2011), Kocalevent et al. (2007, 2013, 2014), and Heinen et al. (2017).

A student's stress response—as well as its impact on emotional distress—that results from the interaction of personal resources and external stressors can be represented by a modified environment-oriented stress model based on the considerations described in the previous sections (Figure 2). Following Becker et al.'s (2004) theoretical conception of the relationship between personal and external resources, we consider the psychological indicators of personal resources established by Ebstrup et al. (2011), Heinen et al. (2017), and Kocalevent et al. (2007, 2013, 2014) to be relevant for our case in terms of resilience, self-efficacy, and personality traits. We supplement these with external student stressors, such as academic requirements (e.g., high workload), social integration (e.g., limited social contact), and financial stressors

¹⁷ For an overview of studies on the TSM see e.g., Obbarius et al. (2021), for the COR model see Halbesleben et al. (2014), and for the SDR model see Becker et al. (2004). For example, Heinen et al. (2017) and Dickhäuser et al. (2022) used the TSM for higher education students to describe the relationship between different resources and perceived stress. Wade-Bohleber et al. (2020) applied the relationship between social and psychological resources and stress with the SDR model for adolescents.

(e.g., current financial problems), which seem particularly relevant given the restrictions imposed by the pandemic.

Perceived stress refers to the subjective experience of stress, or the extent to which one perceives demands as stressful. External demands have a direct impact on perceived stress levels. We expect that high academic requirements, financial problems, and a lack of social integration¹⁸ will lead to a higher perception of stress. Personal resources may have a direct impact on stress perception, or act as a buffer influencing the response to a stressor (Kocalevent et al., 2013). In other words, the more resources one possesses, the lower one's perception of stress will be for the same amount of strain.

In addition to the direct effects of personal (coping) resources, academic requirements, social integration, and financial stressors on students' stress perceptions, it is important to emphasize the interactions between personal and external resources. The dotted lines show indirect or moderating effects. Personal resources directly influence the perception of stress and can also affect demands. In the context of TSM, the individual's cognitive appraisal is decisive in determining what causes a stress reaction. Only the individuals themselves can determine what is perceived as stressful. Therefore, we emphasize the interactions between the individual and external demands, even if we cannot explicitly map the evaluation process (in the transactional sense) with cross-sectional data. For example, there are interactions between academic stress and social integration and resilience (Wilks & Spivey, 2009). It is therefore important to consider the interaction between personal characteristics and environmental factors, especially when (as in our case) working with self-assessments of the students' environment. However, there may also be interactions between external demands and resources in the individual's environment (Blümel, 2024).

Thus, the model integrates the cognitive evaluation process (Lazarus & Folkman, 1984), the significance of resource loss in stress perception (Hobfoll, 1989), and differentiation between internal and external demands and resources (Becker et al., 1994). We assume that the perception of stress will differ across student groups due to differences in resource endowment. Several characteristics associated with student stress can be derived from the literature and are presented in Section 2.5.

¹⁸ From a health sociological perspective, social relationships (social networks, support and capital) act as a buffer (social relationships buffer the negative effects of stressors on health) and as a main effect (social relationships with a positive effect on health) in relation to health (Vonneilich & von dem Knesebeck, 2020).

2.5 Differences in Perceptions of Stress among various Groups of Students

A variety of research has been conducted on stress perception among higher education students. Here, we describe student groups/characteristics that are considered particularly vulnerable, as found in the literature. These can be distinguished by sociodemographics, private situations, and academic situations.

Gender is an important variable in every stress-related research. Overall, female students on average report higher levels of stress than male students (Day & Livingstone, 2003; Dahlin et al., 2005; Bayram & Bilgel, 2008; Brougham et al., 2009; Varghese et al., 2015; Herbst et al., 2016; Grützmacher et al., 2018; Graves et al., 2021; Dickhäuser et al., 2022). This was also evident during the pandemic (Abdulghani et al., 2020; Aslan et al., 2020; Elmer et al., 2020; Browning et al., 2021; Graves et al., 2021; Barbayannis et al., 2022; Kroher et al., 2023), as the pandemic had a more pronounced negative impact on academics and social isolation of female students compared to their male counterparts (Prowse et al., 2021; Rutkowska et al., 2021). Females also reported higher levels of anxiety and depression symptoms than males during the pandemic (Deng et al., 2021; Chen & Lucock, 2022).

Regarding *age*, perceived stress in general (in Germany) does not differ between students of different age groups following Sendatzki and Rathmann (2022), which is also reflected in a Germany-wide survey in 2021 (Kroher et al., 2023). During the pandemic, other studies showed that younger age (18-24 years) was a risk factor for higher psychological effects among students (Browning et al., 2021), and higher age was associated with lower stress levels at the beginning of the pandemic in Germany (Karing, 2021).

Concerning the *educational background*, there are social status-related differences in the perception of stress in Germany: The higher level of stress experienced by those with a low socioeconomic status can be explained by a lower sense of self-worth and perceived opportunities for control (Sendatzki & Rathmann, 2022). International pandemic-related literature also suggested that students with higher SES experienced lower levels of psychological impact (Browning et al., 2021), that living within a stable family income was a protective factor against anxiety (Cao et al., 2020), and that students with low SES or with parents without higher education had more depressive symptoms (due to economic stressors) (Buffel et al., 2024).

A *migration background* is associated with higher levels of stress in Germany, e.g., due to language challenges during studies or experiences of discrimination and stigmatization by other students (Sendatzki & Rathmann, 2022). In addition, students who study in a country other than the one in which they were born (*international students*) experience different stressors and

sometimes more pronounced stress (Robotham, 2008). During the pandemic, students without a migration background experienced lower levels of psychological impact (Browning et al., 2021), and international students had higher perceived stress and more depressive symptoms due to lower perceived social support and resilience (Prado et al., 2024).

Students with children were, at the beginning of the pandemic (summer 2020), more stressed than the overall group of students due to their living situation (e.g., closed schools, daycare centers) in Germany (Zimmer et al., 2020). One year later (summer 2021), however, they felt less stressed than students without children, presumably because schools and daycare centers had reopened, children were regularly cared for, and more time was available for studying (Kroher et al., 2023).

A (*study-affecting*) *impairment* is related to stress: Students with chronic illnesses have higher stress levels on average in Germany (Sendatzki & Rathmann, 2022), which was also evident during the pandemic: Students with (study-affecting) impairments were significantly more stressed during the pandemic in 2020 and 2021 compared to students without study-affecting impairments (Zimmer et al., 2020; Kroher et al., 2023). International evidence also showed that experiencing poor/fair general health was a risk factor for higher levels of psychological impact during the pandemic among students (Browning et al., 2021).

Students' stress levels may also be impacted by financial characteristics, such as *employment status* or *receiving BAfoeG*. Alongside financial support from family, income from employment besides studies (59% of students) and payments from the BAfoeG¹⁹ (10% of students) are among the main sources of students' funding in Germany (Kroher et al., 2023). As already described, different levels of financial resources can also have an impact on the perception of stress. For example, a very high level of part-time employment (Herbst et al., 2016) or debt (Danahy et al., 2024) can cause a high level of perceived stress (even though in the tuition-free higher education system in Germany, the debt due to the BAfoeG is comparatively low, e.g., compared to the USA). During the pandemic, the reduction in working hours was positively related to depressive symptoms (Buffel et al., 2024) and material or financial aid had a buffering effect on the level of stress (Litwic-Kaminska et al., 2023).

Research on the *living situation* of students shows that the type of housing can have an impact on the perception of stress: For example, students living off campus have higher stress scores than students living in dorms (Beiter et al., 2015), and distress due to housing issues

¹⁹ The BAfoeG (Federal Training Assistance Act for students) is a German legislation that establishes the framework for federal student grants and loans.

during the pandemic led to higher stress levels (Auerswald et al., 2024). While living alone was associated with a greater prevalence for depression and anxiety (Sundarassen et al., 2020; Deng et al., 2021), living with parents was protective factors against anxiety (Cao et al., 2020; Matos Fialho et al., 2021).

Regarding the *semester and the desired degree* students' perceptions of stress vary at different points in their academic careers, though the differences are not clear-cut. Sometimes, higher stress scores are found among first- and second-year students (Bayram & Bilgel, 2008), while at other times, higher stress scores are found among juniors and seniors compared to freshmen (Beiter et al., 2015). In Germany, Bachelor's students experience greater stress than Master's or state examination students during their studies (Herbst et al., 2016). During the pandemic, there were also differences: The "COVID-19 cohort" in Sweden reported higher levels of academic stress than the most senior students (three years or more) (Bohman et al., 2023), and third- and fourth-year students and seniors experienced more stress in China and the USA (Li et al., 2021; Herres et al., 2025). Advanced students in Germany experienced higher stress levels during the pandemic than first-year students; this may have been due to increased performance requirements, uncertainty about their professional future, or the need to adapt their study organization due to the pandemic (Kroher et al., 2023).

Finally, the *major of study* is a crucial factor for stress. In Germany, students of veterinary medicine, agriculture, forestry and nutrition, and computer science have the highest stress levels, while students of linguistic and cultural studies, humanities, education, and sports science have the lowest stress levels (Herbst et al., 2016). Special attention had traditionally been paid to medical students, who were particularly affected by higher stress levels before and during the pandemic (Heinen et al., 2017; Abdulghani et al., 2020; O'Byrne et al., 2021; Broks et al., 2022). This is not the case in Germany in 2021: Students in linguistics, law, and the arts reported high levels of stress (Kroher et al., 2023).

3 Data and Operationalization

3.1 Datasets

Our analysis is based on two cross-sectional datasets²⁰ from Germany-wide student surveys conducted online in 2020 and 2021 (see Table 1). In 2020, a special survey was carried out on the situation at universities during the pandemic. The data collection took place between June

²⁰ In order to record changes in the sense of a TSM according to Lazarus and Folkman (1984), panel data are required. As we do not have a panel dataset, but two cross-sectional datasets for 2020 and 2021, we cannot capture this transactional dimension.

and August, representing the relaxation phase of the COVID-19 pandemic between the first (March–May 2020) and second (November 2020–May 2021) lockdown in Germany, when students attended online classes. The main survey took place on a much larger scale in 2021. Data were also collected during the summer semester, but from May to September—when some students had returned to university and their financial situation had eased compared to the economic restrictions during the lockdowns in Germany (Meier et al., 2022). The data thus provide unique insights into students’ experiences of stress during two stages of pandemic restrictions.

Table 1: Datasets

	2020	2021
Original title	Studieren in Zeiten der Corona-Pandemie	Die Studierendenbefragung in Deutschland (2021)
English title	Studying in Corona Times	The Student Survey in Germany (2021)
Survey period	June 15 to August 10	May 4 to September 19
Observations	28,623 students	187,935 students
Sample split	No (all students received all questions)	Yes (not all students received all questions); see Beuße et al. (2022)
HEIs contacted	23 public higher education institutions*	250 public, church and private higher education institutions
Institutions covered	Universities, universities of applied sciences	Universities, universities of applied sciences, distance learning universities, dual universities
Further information	Lörz et al. (2020a)	Beuße et al. (2022) and Kroher et al. (2023)
Data source	Lörz et al. (2020b)	Becker et al. (2024)
FDZ-DZHW	10.21249/DZHW:sitco2020:1.0.0	10.21249/DZHW:sid2021:1.0.1

Notes: Own representation. *To be as representative as possible of the heterogeneous student population, the universities were selected using theoretical sampling: The size, type and range of majors offered by the universities were all taken into account (Lörz et al., 2020a).

Both surveys stemmed from the “*German Student Social Survey*”, a long-term study of the economic and social situation of students that has been conducted every 4–5 years since 1951. For this reason, most of the variables are included in both datasets. The great advantage of the data lies in the provision of information on perceptions of stress during the four weeks prior to answering the questionnaire. In addition, further study-affecting health impairments are covered. Extensive sociodemographic and socioeconomic data (e.g., gender, age, academic background, migration background, parenthood) and student characteristics (e.g., type of study, major, course of study) are also provided. Another focus is on student financing and the economic situation of students (e.g., questions about current financial problems). Additionally, the dataset contains information on students’ everyday lives between studying and working, including weekly time budgets, employment in addition to studies, and contact with family and friends.

However, the two surveys differed in terms of content and technical aspects (see Table 1). The much shorter 2020 survey focused on the situation during the pandemic. It asked how students were coping with the switch to digital teaching, and how their study, funding, housing, and weekly time budgets had changed. In contrast, the 2021 survey no longer focused on pandemic-related changes, allowing for the collection of a wide range of information not possible in 2020.

The two surveys also differed technically in the number of participating universities and students reached, as well as in the modularized, split survey design in which not all students were asked all questions (see Beuße et al., 2022).²¹ A basic module, which includes central key variables (e.g., sociodemographic and study characteristics), is available for the entire sample. The survey includes detailed information on gender and diversity (50% of the sample) and cultural framework conditions (50% of the sample). Additionally, two-thirds of the students are randomly selected to provide in-depth information on each of the following key set of characteristics (modules): 1) individual characteristics and educational history, 2) study situation and study conditions, and 3) employment, housing, and financial situation.

3.2 Analysis Dataset: Sample Restrictions

Because complete information was not available for all students surveyed—due to early interview termination, missing data, and the sample-split design—data restrictions applied. Appendix Table A.1 provides a detailed breakdown of how the number of observations was reduced because of missing values for the relevant variables (e.g., perceived stress, personal characteristics, academic workload, social contact, and financial problems), as well as for the relevant sociodemographic, socioeconomic, and study-related characteristics.²²

Additionally, doctoral students, students on leave of absence, and students studying abroad were excluded, as their studies and financial situations were likely to have differed from those of other students. As the 2021 data included both state and private—that is, distance or dual—universities, the two datasets would not be comparable, given that private universities tend to have a higher proportion of distance learning and part-time students. To avoid biased results—

²¹ The split design, combined with a common set of questions, enables the investigation of a wide range of topics with the data (Beuße et al., 2022).

²² Due to the randomized split-sample design of the survey of 2021 (see Section 3.1), not all of the original 187,935 students in the core module dataset could be included in the analysis. Since the variables we needed to operationalize our model were spread across two of the three key sets (modules) (questions on perceived stress, resilience and financial stressors were included in module 3) and the questions on social integration and academic requirements were included in module 2)), and each student received questions on two key sets (modules), the number of observations was automatically reduced to one-third (61,521) of the observations in the original dataset.

for example, because of lower time budgets, higher workloads, or less social contact—when comparing the two years, only on-campus students were considered. Students at on-campus universities show significantly higher levels of stress than students at distance learning universities in Germany (Turiax & Krinner, 2014). This was also evident during the pandemic: On-campus students were the most stressed, which is likely due to the fact that on-campus students faced significantly more changes and adjustments due to the pandemic (e.g., switching to online teaching) than students in other study formats (Kroher et al., 2023).²³

Table 2: Comparison of the Initial Datasets with the Analysis Samples

	2020			2021			Diff. (5)-(2)
	Initial Dataset	Analysis Sample	Diff. (2)-(1)	Initial Dataset	Analysis Sample	Diff. (5)-(4)	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Women	0.606	0.617	0.011*	0.606	0.610	0.004	−0.007
Age	24.736	24.023	−0.713***	24.447	23.765	−0.682***	−0.258***
Academic background	0.551	0.562	0.011*	0.560	0.579	0.019***	0.017***
Migration background	0.187	0.176	−0.011**	0.198	0.166	−0.032***	−0.010**
International students	0.075	0.050	−0.025***	0.068	0.033	−0.035***	−0.017***
With children	0.069	0.044	−0.025***	0.055	0.030	−0.025***	−0.014***
With study affecting impairment	0.147	0.158	0.011**	0.166	0.177	0.011***	0.019***
Employment besides studies	0.480	0.466	−0.014**	0.629	0.634	0.005+	0.168***
BAfoeG recipient	0.178	0.193	0.014***	0.147	0.167	0.020***	−0.026***
Living with parents/family	0.313	0.334	0.021***	0.300	0.298	−0.001	−0.036***
First-year student	0.227	0.214	−0.014***	0.205	0.184	−0.021***	−0.030***
<i>Desired degree</i>							
Bachelor	0.574	0.583	0.008*	0.624	0.597	−0.027***	0.014**
Master	0.254	0.260	0.006+	0.243	0.258	0.015***	0.002
State examination	0.139	0.158	0.019***	0.119	0.129	0.010***	0.029***
<i>Major group</i>							
Humanities	0.165	0.171	0.006+	0.106	0.124	0.017***	−0.047***
Sports	0.010	0.010	−0.000	0.010	0.010	0.000	0.001
Law, economics, social sci.	0.369	0.365	−0.003	0.409	0.376	−0.033***	0.011+
Mathematics, natural sciences	0.120	0.136	0.015***	0.113	0.138	0.025***	0.002
Human medicine, health sci.	0.041	0.043	0.003+	0.076	0.072	−0.004*	0.028***
Agricultural, forestry, etc.	0.022	0.024	0.001	0.026	0.030	0.004***	0.006***
Engineering sciences	0.242	0.226	−0.016***	0.228	0.221	−0.008**	−0.005
Arts	0.029	0.025	−0.004**	0.030	0.030	−0.000	−0.005**
N	28,623	16,413		187,935	22,602		

Notes: Own calculations. The observations in the initial dataset vary due to missing data; the maximum observations (N) are shown. The significance of the differences is based on a two-sample t test with equal variances. + $p < 0.10$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

²³ To achieve greater consistency between the student samples from 2020 and 2021, we were only able to compare students enrolled at universities that participated in both years. However, due to the sample split design, this would have drastically reduced the number of observations from 22,602, so we refrained from doing so.

The final datasets for 2020 and 2021 included 16,413 and 22,602 students, respectively, with full information. For both datasets, we tested whether the sample restrictions resulted in systematic differences in the composition of the analysis sample compared to the initial dataset (see Table 2, columns 3 and 6). No, or only minor, deviations for relevant individual—such as gender, educational background—and study-related characteristics, including majors, were found. Expected differences were reflected in a lower age—and thus in housing situation and parenthood—and a lower proportion of international students and students with migration backgrounds. Overall, we assumed that our analytic samples for 2020 and 2021 were not biased by systematic nonresponses, such as interview dropouts or missing data.

In terms of the differences between the two analytic samples from 2020 and 2021 (see Table 2, column 7), there were no, or only minor, differences regarding gender, desired degree, and major. This suggests that the datasets were generally comparable. However, as expected, there were deviations presumably related to the pandemic. In 2020, there was a lower share of students in employment in addition to their studies and more students funded by BAfoeG. At the same time, a higher share of students lived with their parents than in 2021, when some restrictions had been lifted. A comparison of the datasets also showed an increase in the share of students with impairments who restricted their studies, as mentioned earlier.

3.3 Method and Operationalization

Our modified environment-oriented stress model described in Section 2.4 illustrates the relationship between variables that are not directly observable or measurable—so-called latent variables. To estimate the relationship between the latent variables of perceived stress and personal, academic, social, and financial demands/resources, we implemented the theoretical model using a linear SEM. The first step is to create a measurement model allowing the estimation of the latent variables using observable indicators/items. Each item serves as a proxy for the underlying latent variable, and it is possible to estimate the latent variable itself by analyzing the correlations between the items. In the next step the structure of the model will be analyzed, also known as the structural or path model. Here, the latent variables and their relationships are examined to understand the overall context.

In this model, we estimated the direct effects of personal resources, academic requirements, social integration, and financial stressors as independent variables on students' stress perceptions, as the dependent variable. The model also examines how these factors interact (covariances) so that the path coefficients can be isolated and meaningfully interpreted—that

is, the extent to which they affect the perception of stress.²⁴ Thus, a structural model makes it possible to show the sign and strength of the relationship of external resources and demands on the perception of stress. This allowed us to test whether the relationships between our latent variables were consistent with theoretical expectations and to form statements about how much each external factor influenced students' perceptions of stress.

To measure these relationships, we operationalized the latent variables using measurable survey items. In addition to traditional psychological research, survey instruments are also used in the social, economic and health sciences to measure psychological characteristics of individuals in order to better describe and predict social processes (Rammstedt et al., 2012).²⁵ The 2020 and 2021 student surveys used several standardized instruments (short scales) developed by psychologists to measure perceived stress and various personality dimensions. For our model, we used the scales of *resilience*, *self-efficacy*, and *personality traits* for the latent variables of personal resources. The questionnaires also provided measurable and comparable items for external environmental factors over the two years.

When selecting items from a wide range of surveyed variables, we considered two aspects. First, we ensured that the variables were suitable for the model requirements regarding personal characteristics (see Section 2.2) and external resources/requirements (see Section 2.3). Second, we ensured that the variables were surveyed in the same form in both 2020 and 2021. In terms of comparability, the split-sample design limited personal resources. Although self-efficacy and personality traits were surveyed in both years, the 2021 sample split meant that they could not be analyzed alongside stress and the three external resources/challenges (see Section 3.2). Therefore, in 2021, only resilience was available for personal resources in a joint model that was not surveyed in 2020. However, our focus was on external factors, and we primarily considered personal resources as a covariate, which should not have imposed a significant limitation.

Students' perceived stress in 2020 and 2021 was measured using the following question: “How have you generally felt over the last four weeks?” Students could respond to “stressed” and “overburdened” on a five-point scale ranging from 1 (*not at all/never*) to 5 (*very much/very*

²⁴ The coefficients of the measurement models contain the correlations of the indicators with the corresponding latent variables and describe how well the indicators measure the latent variables.

²⁵ For a review of the increasing use of personality trait measures in the economic literature, see, e.g., Thiel and Thomsen (2013).

often) (DZHW, 2020, 2024) (see Appendix Table A.2 for descriptive results).²⁶ Following Kroher et al. (2023) this measurement was based on a modified version of the *Perceived Stress Questionnaire (PSQ)* developed by Levenstein et al. (1993) and further adapted for German-speaking countries by Fliege et al. (2001).²⁷ The original PSQ by Levenstein et al. (1993), consisting of 30 questions, and the German modification by Fliege et al. (2001, 2005), consisting of 20 questions, allow the construction of a psychosomatic index for the current subjective experience of stress.²⁸ With a Cronbach's α for internal consistency of 0.84 (see Table 3), the items had good reliability and formed a suitable scale for current perceptions of stress, as the values were comparable to those reported by Ebstrup et al. (2011) or Slimmen et al. (2022).

Table 3: Available Items/Instruments from the 2020 and 2021 Surveys

Latent Variable	Survey	Instrument	Items	Cronbach's α
Perceived Stress	2020	PSQ-2 (modified)	2	0.844
	2021	PSQ-2 (modified)	2	0.842
Personal Resources	2020	ASKU	3	0.820
	2020	BFI-Neuroticism	2	0.647
	2020	BFI-Extraversion	2	0.832
	2020	BFI-Agreeableness	2	0.228
	2020	BFI-Conscientiousness	2	0.569
	2020	BFI-Openness	2	0.667
	2021	BRS (modified)	4	0.773
Academic Requirements	2020	Academic Workload	2	0.246
	2021	Academic Workload	2	0.093
Social Integration	2020	Social Contacts	6	0.543
	2021	Social Contacts	6	0.588
Financial Stressors	2020	Financial Problems	4	0.842
	2021	Financial Problems	4	0.796

Notes: Own calculations. The values for 2020 and 2021 are based on 16,413 and 22,602 observations, respectively.

Questions about *resilience* were included in the 2021 questionnaire as an adaptation of the *Brief Resilience Scale (BRS)* by Smith et al. (2008) or its German translation by Chmitorz et al. (2018). Of the six items of the original BRS, four were surveyed in the present questionnaire. One example is: “*I don't need much time to recuperate from stressful experiences.*” The (other)

²⁶ In 2021, two additional items (“*happy*” and “*sad*”) were introduced. These were posed differently in 2020: “*How do you generally feel?*”; with the response items “*I am happy*” and “*I feel melancholic*” (DZHW, 2020, 2024). Due to the different (time-related) question, and to increase the consistency of the models, only the two comparable items were used.

²⁷ Additionally, Kroher et al. (2023) adapted the scale from the “Pairfam” relationship and family panel (see, e.g., Walper, 2021).

²⁸ The PSQ-30 score is considered in the literature to be a valid instrument for measuring subjective perceptions of stress within the framework of a transactional view of stress (Kocalevent et al., 2007).

questions and the corresponding descriptive statistics are presented in Appendix Table A.2. Students answered each of the four questions on a five-point scale ranging from 1 (“*do not agree at all*”) to 5 (“*totally agree*”) (DZHW, 2024). With a Cronbach’s α of 0.77 (see Table 3), the BRS is considered sufficiently valid and reliable, as it is comparable to—or significantly higher than—the values found in the psychological literature (see, e.g., Kocalevent et al., 2014; Heinen et al., 2017).

We measured *students’ self-efficacy* in 2020 using the *German short scale for measuring general self-efficacy beliefs (ASKU)* developed by Beierlein et al. (2013). The short scale is based on three items surveyed in the student survey, such as “*In difficult situations, I can rely upon my abilities*” (see Appendix Table A.2). Students answered each of the three items on a five-point scale ranging from 1 (“*not at all*”) to 5 (“*totally*”) (DZHW, 2020). This psychological scale also showed good internal consistency ($\alpha = 0.82$; see Table 3) and had comparable values to Kocalevent et al. (2013, 2014) and Heinen et al. (2017).

The procedure for assessing the five dimensions of *personality traits* originated from individual personality-psychological diagnostics; however, there were also shorter survey instruments that allowed the dimensions to be used outside psychology, for example, in large-scale social or economic research (Rammstedt et al., 2013).²⁹ In the 2020 student surveys, five personality traits (neuroticism, extraversion, agreeableness, conscientiousness, and openness) were recorded using 10 questions (BFI-10) based on the *Big Five* inventory by Rammstedt and John (2007).³⁰ Of these, two questions addressed each of the five personality traits, one positive and the other negative, to cover as wide a range of dimension as possible (Rammstedt et al., 2013). For neuroticism, for example, the following items were included: “*I’m relaxed and don’t let stress upset me*”, and “*I easily get nervous and anxious*” (DZHW, 2020). Students answered each of the 10 questions on a five-point scale (see Appendix Table A.2). The five personality traits scales showed clear differences in internal consistency with Cronbach’s α values between 0.23 and 0.83 (see Table 3). Ebstrup et al. (2011) and Slimmen et al. (2022) showed that such differences are to be expected, although not on the same scale. Therefore, the agreeableness and conscientiousness scales, with values below 0.6, were disregarded.

Unlike scales adapted or modified from the psychological literature to measure stress perception and personal resources, the student surveys did not include psychological

²⁹ The use of short scales to measure personality traits is common in the literature, e.g., for (educational) economic questions (see e.g., John and Thomsen (2014) or Thiel et al. (2014)).

³⁰ An international counterpart is the “Ten-Item Personality Inventory” (TIPI) by Gosling et al. (2003).

adaptations to stress-related external resources or demands.³¹ For this reason, we independently selected suitable survey items. Given that the datasets for 2020 and 2021 (in their long tradition, see Section 3.1) contain extensive information about the study, social, and financial situations of the time, we could identify appropriate items to proxy academic, social, and financial demands/resources. We focused on items asked in 2020 and 2021 to maximize consistency between the two models.

For the operationalization of *academic requirements*, we included questions about *academic workload* in our model. In 2020 and 2021, students provided information on their weekly workloads (in hours) while attending courses and independent study (see Appendix Table A.2). Thus, we followed Dickhäuser et al. (2024), who used the average study-related workload of students when examining different stressors for academic (objective) demands. However, since study-related workload can vary depending on the university and major, a high correlation between the two items of workload was not expected, as reflected in the low internal consistency (see Table 3). However, our intention was not to measure the same item with two variables but rather to combine the variables to depict high academic stress. For this reason, unlike with the psychological scales, we did not set a limit on internal consistency for the external requirements/resources.

For students' *social integration*, we used their self-assessment of how often they had *contact*—ranging from 1 (*never*) to 5 (*very often*) on a five-point scale—in person, by phone, or in writing, outside lectures with fellow students, students in other majors, acquaintances outside the university, lecturers, university administration staff, and family, including parents and siblings (see Appendix Table A.2). This approach is comparable to Slimmen et al.'s (2022) “loneliness” approach to integrate social relationships and integration into the model. This six-item scale had moderate internal consistency (2020: $\alpha = 0.54$, 2021: $\alpha = 0.59$; see Table 2) and was therefore comparable to the results on social support reported by Dickhäuser et al. (2024).

We considered information from four questions on *financial situation* to measure *financial problems*. Two questions related directly to current financial problems, including those due to the pandemic, and two questions related to how well students managed their money. Because of the opposing connotations of the questions, we reversed the polarity of the two positive items to obtain a meaningful interpretation of financial problems (see Appendix Table A.2). With

³¹ There are instruments that address different dimensions of stressors, such as the “*Perception of Academic Stress Scale*” by Bedewy and Gabriel (2015) for academic stressors or the “*Adolescent Stress Questionnaire*” by Byrne et al. (2007) for social or financial stressors, both of which are used by Slimmen et al. (2022).

Cronbach's α values of 0.84 in 2020 and 0.80 in 2021 (see Table 3), the scale had high reliability, comparable to Byrne (2007) and Slimmen et al. (2022).

4 Results

4.1 Descriptive Results

For an initial descriptive overview of the development over time of students' stress perception, academic workload, social contact, and financial problems, it was necessary to create instruments based on the individual surveyed items. Following Fliege et al. (2001, 2009) we formed a sum score from the raw scale values and linearly transformed it into values between 0 and 1,³² with a high total PSQ score representing a high level of experienced stress (Fliege et al., 2001). In addition, the mean values were calculated as sum scores from the two items on study-related workload, the six items on social contact and the four items on financial problems. The total score thus allowed for a comparison of the results.³³

Table 4: Descriptive Results of the Instruments

	Mean (SD) 2020 (1)	Mean (SD) 2021 (2)	Diff. (2)–(1) (3)
PSQ-2	0.672 (0.261)	0.639 (0.267)	–0.032***
Academic Workload	28.241 (19.555)	35.104 (15.814)	6.862***
Social Contacts	2.613 (0.565)	2.667 (0.575)	0.054***
Financial Problems	1.780 (0.933)	1.609 (0.789)	–0.171***

Notes: Own calculations. The values for 2020 and 2021 are based on 16,413 and 22,602 observations, respectively. The significance of the differences in the means is based on a two-sample t-test with equal variances. *** $p < 0.001$.

Table 4 shows the scores for the relevant variables of interest—here, as instruments. In 2020, during the pandemic, the average PSQ score was 0.67—0.03 points higher than one year later, when some of the pandemic restrictions had been lifted.³⁴ These results are consistent with those of Charles et al. (2021) and Malinauskas and Saulius (2022). In 2020, because of the change in study conditions—namely, the switch to online teaching—the workload for higher education students in Europe was greater than it had been before on-site classes were canceled (Doolan et al., 2021). The available data indicated a smaller academic workload in 2020, at 6.9

³² Using the following equation: $PSQ - Score = (((\text{feelstress} + \text{feellover})/2) - 1)/4$. The linear transformation is based on the formation of the PSQ index by Levenstein et al. (1993, p. 32).

³³ For the academic workload, the sum of the time spent on courses and self-study was calculated, and then the mean was determined. For social contacts and financial problems, the mean values were calculated from six and four items, respectively (see Appendix Table A.2). These mean values from ordinal-scale variables are only used for comparison between 2020 and 2021, so the limitations are disregarded.

³⁴ The differences in stress levels become even clearer when looking at the distribution. The distribution of stress levels among students in 2020 was significantly more left-skewed (skewness: -0.644) than in 2021 (skewness: -0.402), i.e. stress levels were higher. This is consistent with previous findings that stress levels were higher at the beginning of the pandemic than at a later point in time (albeit in 2020) (Charles et al., 2021).

hours per week lower than in 2021. This may be because the standard length of many degree programs increased and fewer exams were taken in 2020. Stronger restrictions on social contact in 2020 were reflected in the lower average social contact of students compared with 2021. Consistent with the findings of Meier et al. (2024), students reported significantly higher financial difficulties in 2020 than they did one year later, after most economic restrictions had been lifted. This may have been due to job losses and/or inadequate financial support.

To analyze and quantify the possible correlation between the three pandemic-related stressors, it was necessary to control for students' personal risk characteristics. To justify the selection of relevant (personal) instruments for further analysis, the correlation matrices for the years 2020 and 2021 are presented in Table 5 (as, e.g., in Kocalevent et al., 2007; Ebstrup et al., 2011; Heinen et al., 2017; Slimmen et al., 2022; Dickhäuser et al., 2024).³⁵

The bivariate correlations for 2020 showed a significant negative correlation ($r = -0.16$) between perceived stress (PSQ-2) and self-efficacy (ASKU) (see Table 5), in line with the existing literature (e.g., Kocalevent et al., 2007; Ebstrup et al., 2011; Heinen et al., 2017). There were differences in the individual dimensions of personality traits, with neuroticism showing the strongest correlation with perceived stress ($r = 0.32$), which is consistent with the findings of Ebstrup et al. (2011). Our results, however, showed no significant correlation with agreeableness. Slightly positive correlations were found for extraversion, conscientiousness, and openness, although negative correlations would have been expected here.

The variables of interest each demonstrated significant correlations with perceived stress, as expected (see Section 2.3). Social contact had a negative correlation, while financial problems and study-related workload showed positive correlations. These results are consistent with the studies of Dickhäuser et al. (2024) and Slimmen et al. (2022).

Table 5 also shows the bivariate correlations for 2021. There was a negative, although very low, correlation between PSQ and resilience (BRS) ($r = -0.03$), consistent with the results of Heinen et al. (2017). As in the previous year, there were larger correlations between stress and the variables of interest, which were comparable in direction and magnitude to the correlations for 2020.

³⁵ For this purpose, the negatively connoted characteristics were inverted, following Rammstedt et al. (2012, p. 32), to calculate mean values and thus form the five personality traits. To obtain a scale value for individual self-efficacy and resilience, the mean value of the answers to the three questions is calculated, following Beierlein et al. (2012, p. 24) and Chmitorz et al. (2018).

Table 5: Pearson's Correlation Coefficients r of all Instruments (Bivariate)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
2020										
(1) PSQ-2	1.000									
(2) ASKU	-0.157***	1.000								
(3) BFI-Extraversion	0.017*	0.189***	1.000							
(4) BFI-Neuroticism	0.324***	-0.394***	-0.189***	1.000						
(5) BFI-Agreeableness	-0.006	-0.001	0.151***	-0.019*	1.000					
(6) BFI-Conscientiousness	0.027***	0.268***	0.100***	0.002	0.072***	1.000				
(7) BFI-Openness	0.069***	0.039***	0.100***	0.086***	0.096***	0.054***	1.000			
(8) Academic Workload	0.201***	0.040***	0.026***	0.029***	-0.012	0.179***	0.007	1.000		
(9) Social Contacts	-0.137***	0.120***	0.132***	-0.066***	0.039***	0.058***	0.027***	-0.023**	1.000	
(10) Financial Problems	0.192***	-0.106***	0.052***	0.054***	-0.014 ⁺	-0.072***	0.075***	0.025**	-0.119***	1.000
2021										
(1) PSQ-2	1.000									
(2) BRS	-0.031***	1.000								
(3) Academic Workload	0.174***	-0.015*	1.000							
(4) Social Contacts	-0.092***	0.032***	-0.009	1.000						
(5) Financial Problems	0.191***	-0.006	0.038***	-0.149***	1.000					

Notes: Own calculations. The values for 2020 and 2021 are based on 16,413 and 22,602 observations, respectively. ⁺ $p < 0.10$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

4.2 Results of the Modified Environment-Oriented Stress Model for 2020 and 2021

To analyze and quantify external demands and resources in relation to students' stress perceptions, we considered the relevant personal resources of the students—at least as control variables—in our model. In addition to self-efficacy, we controlled for the personality dimension of neuroticism in the model for 2020.⁴⁰ Neuroticism has been shown to have a very high correlation with perceived stress (see Section 4.1), acceptable internal consistency (see Section 3.2), and relevance (see Section 2.2). To ensure acceptable reliability and relevance of the psychological items, we did not include the personality dimensions agreeableness and conscientiousness in the model (due to low internal consistency). We further did not implement extraversion (due to low correlation with stress perception, despite high internal consistency) and openness (due to lack of relevance in the stress research literature).

We estimated the theoretical model as a SEM using the maximum likelihood method with robust standard errors and the Satorra–Bentler estimator.⁴¹ Figure 3 depicts the results of the measurement and structural models. The standardized coefficients allowed for a direct comparison of the relative strength of the relationship between the relevant variables and the perception of stress. With a coefficient of -0.182 ($SE = 0.011$), personal resources showed a negative influence on stress levels; that is, higher self-efficacy and lower neurotic traits were associated with lower levels of stress. The standardized coefficients can be interpreted as changes in standard deviations. If personal resources increased by one standard deviation, perceived stress decreased by 0.182 standard deviations. Social resources also had a negative relationship with stress levels (-0.114 , $SE = 0.013$). This indicates that more frequent social contact was associated with a significant reduction in perceived stress. Academic workload had a positive influence on stress levels (0.414 , $SE = 0.019$); that is, a higher academic workload correlated with a significant increase in the perception of stress. Financial problems also had a positive effect on stress levels (0.164 , $SE = 0.010$).

Thus, academic workload had the strongest positive influence (standardized partial regression coefficient) on the perception of stress, at around two and a half times stronger than

⁴⁰ Because of the inverse correlations between self-efficacy and neuroticism, we inverted the neuroticism scores. This was done to scale both variables in the same direction and thus allow for a coherent interpretation of the influence of personality on stress perception.

⁴¹ The standard assumption for linear SEM and ML estimation is the (multivariate) normal distribution of the data. A Shapiro-Francia test and a Doornik-Hansen test were performed to test this. The null hypothesis of a univariate and multivariate normal distribution of the data used must be rejected in this case for 2020 and 2021. Therefore, the Satorra-Bentler estimator was used, as it is robust to non-normally distributed variables in ML estimation (Aichholzer, 2017).

financial problems. On the other hand, social factors strongly mitigated stress perception.⁴² These results suggest that academic workload and financial problems were the main sources of perceived stress, while social support played a protective role. However, this protective function accounted for only approximately one-quarter of the negative academic workload; it was also weaker than financial problems. The model can explain more than a quarter of the variation in students' perceptions of stress ($R^2 = 0.263$).⁴³

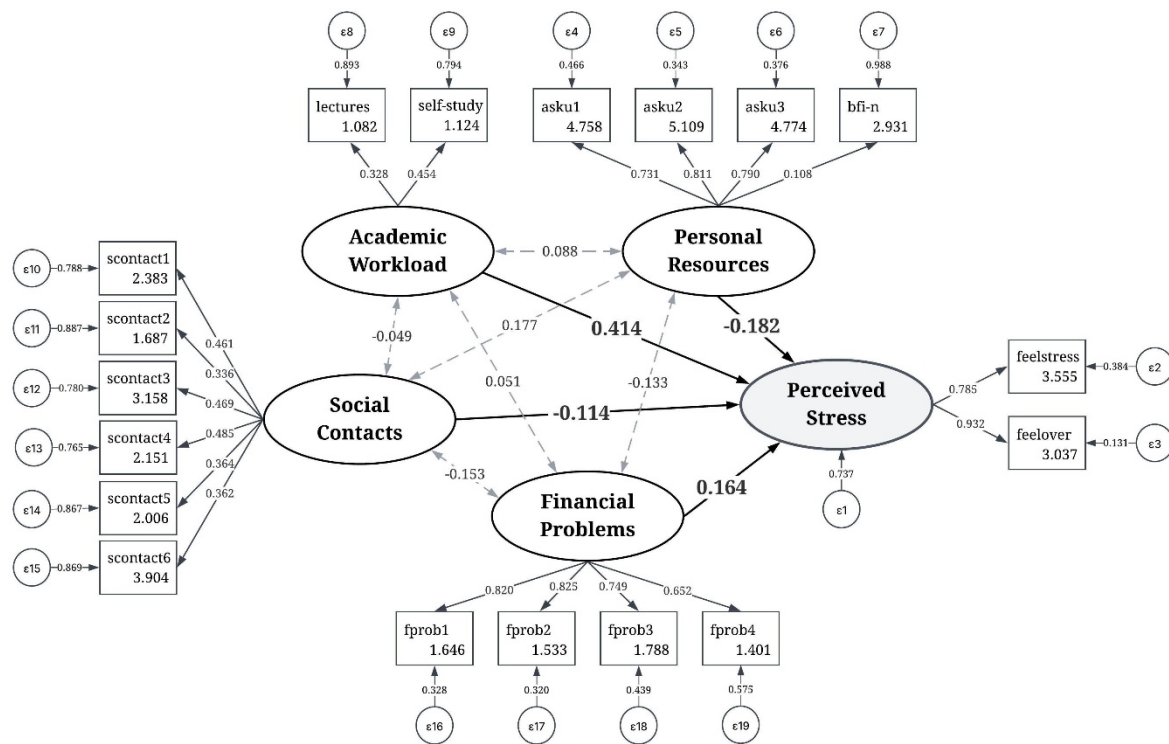


Figure 3: SEM Results of the Modified Environment-Oriented Stress Model (2020).

Notes: Own calculations. Values are based on 16,413 students. Ovals, unobserved latent variables; rectangles, observed indicator variables (items); circles, observed residual variables; numbers on lines with arrows at one end are standardized regression coefficients; numbers on lines with arrows at each end are correlation coefficients. A legend for the items can be found in Appendix Table A.3. No constraint parameters. All regression coefficients shown are statistically significant ($p < 0.001$). Santorra–Bentler estimator results. Fit indices: $\chi^2/df = 4801.150/125$, $p < 0.000$; normed $\chi^2 = 38.409$; TLI = 0.913; CFI = 0.929; SRMR = 0.040; RMSEA = 0.048.

Figure 4 shows the results of our 2021 model, which was estimated in the same way as the 2020 model. As mentioned earlier, only the personal resource items differed. Instead of self-efficacy and personality trait neuroticism, the 2021 model uses resilience to represent personal resources. From the 2021 data, personal resources also showed a negative relationship with

⁴² The results are consistent with those of Slimmen et al. (2022), who in separate models showed a stronger role for academic pressure on stress perceptions than for financial or family pressure, with the contributions of the latter two at similar levels.

⁴³ Despite the high chi-square value, the overall model fit is within an acceptable range. Since the chi-square value as an absolute fit indicator increases with increasing sample size and leads to significant results (Aichholzer, 2017)—and we have a significantly higher number of observations in our study than is common in the psychological literature—it is important to also look at the relative quality measures. The values of the relative fit indices TLI (> 0.90) and CFI (> 0.90) as well as the absolute fit indices SRMR (< 0.05) and RMSEA (< 0.05) indicate that the model has an acceptable fit despite the high chi-square value (see Aichholzer, 2007, for a compilation of standard values).

stress (-0.435 , $SE = 0.011$), although this relationship seemed to be significantly stronger. Due to the different operationalization of personal resources, the comparison was limited, but there was at least an indication that resilience made a greater contribution to buffering the perception of stress than, for example, self-efficacy. There was also a negative relationship between social contact and stress (-0.047 , $SE = 0.013$), which was lower than in 2020. There was a comparable positive association of 0.481 ($SE = 0.042$) for academic workload. The positive correlation for financial problems was also significant, at 0.096 ($SE = 0.013$), but lower than in 2020.⁴⁴ Due to the lower partial relationships between social contact and financial problems, academic workload was relatively more important for stress in 2021 than in 2020. Its contribution to perceived stress was five times greater than financial stress and ten times greater than the buffering effect of social contact. The relative contribution of financial problems and social contact remained at a level similar to 2020.

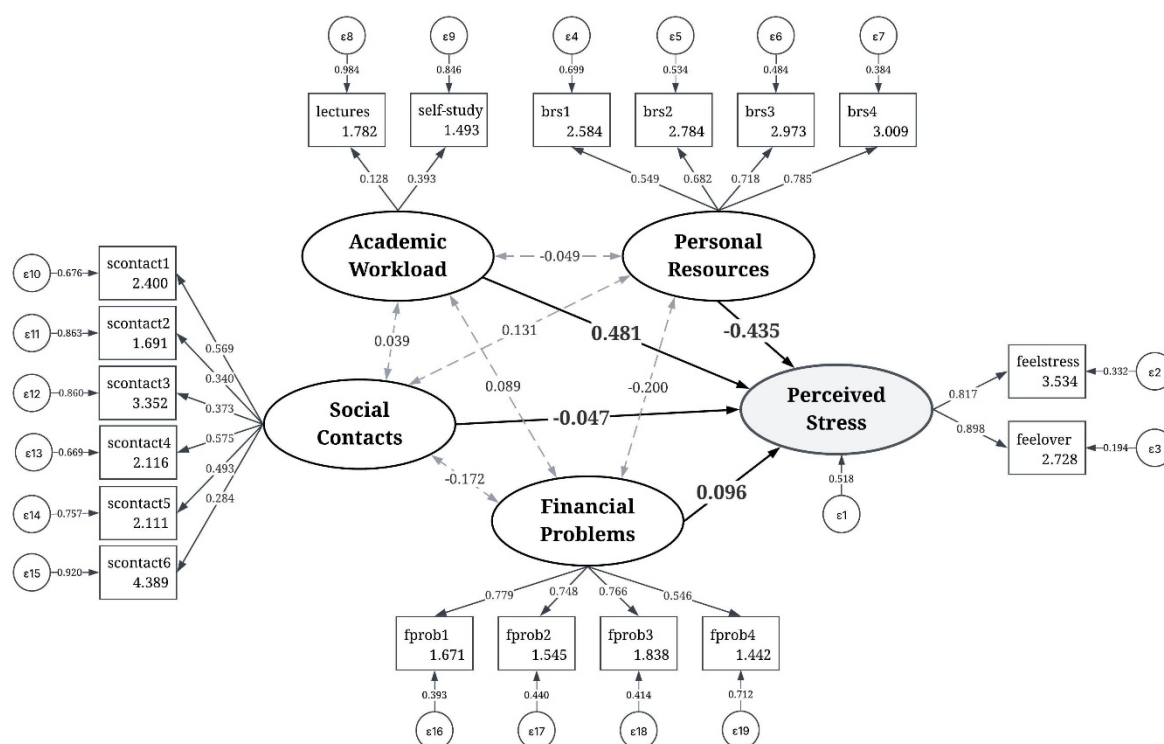


Figure 4: SEM Results of the Modified Environment-Oriented Stress Model (2021).

Notes: Own calculations. Values are based on 22,602 students. Ovals, unobserved latent variables; rectangles, observed indicator variables (items); circles, observed residual variables; numbers on lines with arrows at one end are standardized regression coefficients; numbers on lines with arrows at each end are correlation coefficients. A legend for the items can be found in Appendix Table A.3. No constraint parameters. All regression coefficients shown are statistically significant ($p < 0.001$). Santorra–Bentler estimator results. Fit indices: $\chi^2/df = 7682.618/125$, $p < 0.000$; normed $\chi^2 = 61.461$; TLI = 0.895; CFI = 0.914; SRMR = 0.043; RMSEA = 0.052.

With the model and our variables for 2021, we can explain a significantly larger proportion of the variation in perceived stress—with an R^2 of 0.482—than for 2020. This may indicate that

⁴⁴ When comparing the coefficients, it should be noted that we could not perform significance tests due to the differentiated model specification (personal characteristics).

more variance can be explained by personal resources or that the 2020 model contains more unobserved variation due to the pandemic, which we were unable to model.⁴⁵

4.3 Heterogeneity Analyses by Various Student Groups

As described in Section 2.5, differences in students' perceptions of stress were to be expected. The data allowed us to compare different groups of students. We included gender, age, educational background, migration background, parenthood, study-affecting impairment, employment, BAfoeG support, type of housing, semester, desired degree and major group in the analyses. In this way, we were able to provide a differentiated insight into student stress research that goes beyond many psychological studies.⁴⁶ In order to investigate the extent to which specific groups of students differed in their perception of stress, we conducted heterogeneity analyses. We differentiated between two dimensions of inequality: Firstly, differences in the relative frequency of stress occurrence and external demands/resources (see Section 4.3.1). Secondly, in the comparison of the reaction of demands and resources to the stress perception of the respective groups (see Section 4.3.2).

4.3.1 Differences in Perception of Stress and Presence of Stressors

For the heterogeneity analyses, we adapted our model from Section 4.2, and added a binary variable to the structural model of the SEM (for both years) describing group affiliation (e.g., "women").⁴⁷ On the basis of this variable, we measured the path coefficients in the direction towards personal resources, academic workload, social contacts, financial problems and perceived stress. This approach allowed us to determine which groups of students reported particularly high levels of stress (while controlling for the implemented variables), but were also more susceptible to high or low (study-related) resources or demands. By doing so, we were able to identify groups particularly vulnerable to risk factors. The estimation results for the path coefficients of the binary variables are shown in Table 6 for 2020 and 2021.

The general patterns of reported group differences in stress levels and external demands and resources are comparable, with a few exceptions, in significance and sign in both years. Consistent with previous studies, women reported higher levels of stress than men in both years. There were lower levels of personal resources for women (although these are only comparable

⁴⁵ The quality measures of our model for 2021 are comparable, although slightly worse than those for 2020. Nevertheless, the model has an acceptable overall fit.

⁴⁶ For example, the studies by Heinen et al. (2017), Slimmen et al. (2022), or Dickhäuser et al. (2024) are based on observations at one university and therefore do not allow for in-depth and representative heterogeneity analyses (e.g., if only one major group is surveyed, as in the case of Heinen et al. 2017).

⁴⁷ This study is limited to the genders female and male as reported by the students. Gender is binary due to a lack of cases for other genders.

to a limited extent due to the different instruments for resilience in relation to self-efficacy and neuroticism and are not the focus of this study). Women indicated a higher academic workload and more social contacts, while there are only minor differences in terms of financial problems.

Contrary to expectations, older students (those over 23 years old) reported higher stress levels (especially in 2021) despite having a lower academic workload, possibly due to more frequent financial problems than their younger counterparts. Students with an academic background (students who have at least one parent with an academic degree) had fewer financial problems than those without an academic background. The expected lower stress levels for students with an academic background did not become apparent. In line with previous research, students with a migration background had slightly higher stress levels, lower levels of social integration, and more financial problems. Financial problems and fewer social contacts (in 2020) were also particularly evident among the group of international students—with similar stress levels to the domestic students. As expected, students with children and students with a study-affecting impairment experienced higher levels of stress in both pandemic years. Both groups had fewer social contacts and (clearly) greater financial difficulties than their counterparts. As expected, students in employment were more stressed while spending less time on their studies than students without employment. Despite BAfoeG support, sponsored students had greater financial problems and less social contacts that did not manifest as higher stress levels. In line with previous studies, students who lived with their parents and/or other family members reported fewer financial problems, higher levels of social integration and lower stress levels.

As expected, first-year students experienced lower stress levels during the pandemic than their more experienced counterparts, despite having a heavier academic workload and lower levels of social integration. Similar results are shown when students are compared by degree: Students on Master's degree courses were found to have a higher level of stress than those on state examination courses. The latter group had a higher academic workload and fewer financial difficulties (this may have been due to social background, as students from academic families tend to be overrepresented in degree programs that require state examinations, see Kroher et al., 2023). The differences between the major groups (which were taken by most students, see Table 2) show that students in the humanities and law, economics and social sciences had higher stress levels and lower academic workloads, while the other major groups reported lower financial problems. Students of mathematics and human medicine had a higher academic workload than students of other majors.

Table 6: Path Coefficients of the Binary Group Variable on Stressors, Resources and Demands

		Perceived Stress	Personal Resources	Academic Workload	Social Contacts	Financial Problems
Path Direction		BGV → PSQ	BGV → PR	BGV → AW	BGV → SC	BGV → FP
Binary Group Variable (BGV)	Year	(1)	(2)	(3)	(4)	(5)
Women	2020	0.125 (0.009)***	−0.095 (0.008)***	0.045 (0.015)**	0.126 (0.010)***	−0.015 (0.008) ⁺
	2021	0.066 (0.012)***	−0.256 (0.007)***	0.103 (0.018)***	0.140 (0.008)***	−0.018 (0.007)*
Age (older than 23 years)	2020	0.041 (0.011)***	0.060 (0.008)***	−0.135 (0.015)***	−0.053 (0.010)***	0.240 (0.008)***
	2021	0.113 (0.024)***	−0.013 (0.007) ⁺	−0.187 (0.023)***	0.002 (0.008)	0.220 (0.007)***
Academic background	2020	−0.006 (0.009)	0.041 (0.009)***	0.001 (0.015)	0.014 (0.010)	−0.143 (0.008)***
	2021	−0.015 (0.011)	0.048 (0.007)***	0.045 (0.016)**	0.043 (0.008)***	−0.193 (0.007)***
Migration background	2020	0.023 (0.010)*	−0.046 (0.009)***	−0.033 (0.016)*	−0.041 (0.011)***	0.155 (0.009)***
	2021	0.027 (0.010)**	−0.046 (0.008)***	0.012 (0.018)	−0.044 (0.009)***	0.121 (0.008)***
International students	2020	0.001 (0.010)	−0.010 (0.009)	−0.017 (0.015)	−0.033 (0.012)**	0.160 (0.010)***
	2021	−0.021 (0.010)*	0.006 (0.008)	0.046 (0.017)**	0.008 (0.010)	0.114 (0.009)***
With children	2020	0.090 (0.009)***	0.058 (0.008)***	−0.032 (0.014)*	−0.047 (0.011)***	0.065 (0.009)***
	2021	0.091 (0.014)***	0.039 (0.007)***	−0.106 (0.018)***	−0.007 (0.009)	0.050 (0.008)***
With study-affecting impairment	2020	0.096 (0.009)***	−0.227 (0.009)***	0.015 (0.015)	−0.115 (0.011)***	0.166 (0.009)***
	2021	0.064 (0.011)***	−0.350 (0.007)***	0.042 (0.017)*	−0.098 (0.008)***	0.189 (0.008)***
Employment besides studies	2020	0.098 (0.011)***	0.104 (0.008)***	−0.157 (0.015)***	0.066 (0.010)***	−0.029 (0.008)***
	2021	0.187 (0.033)***	0.058 (0.007)***	−0.284 (0.027)***	0.102 (0.008)***	0.079 (0.007)***
BAfoeG recipient	2020	0.020 (0.009)*	−0.023 (0.009)**	0.057 (0.015)***	−0.045 (0.010)***	0.062 (0.008)***
	2021	−0.003 (0.009)	−0.049 (0.007)***	0.026 (0.016)	−0.050 (0.008)***	0.107 (0.007)***
Living with parents/family	2020	−0.033 (0.011)**	−0.057 (0.008)***	0.054 (0.015)***	0.451 (0.009)***	−0.118 (0.008)***
	2021	−0.008 (0.009)	−0.008 (0.007)	−0.050 (0.015)**	0.015 (0.008) ⁺	−0.084 (0.007)***
First-year students	2020	−0.033 (0.010)**	−0.071 (0.008)***	0.153 (0.016)***	−0.052 (0.010)***	−0.037 (0.008)***
	2021	−0.064 (0.013)***	0.014 (0.007) ⁺	0.087 (0.018)***	−0.151 (0.008)***	0.009 (0.007)
<i>Desired degree</i>						
Bachelor	2020	0.023 (0.009)*	−0.122 (0.008)***	−0.079 (0.015)***	−0.017 (0.010)	0.026 (0.008)**
	2021	0.039 (0.013)**	−0.068 (0.007)***	−0.124 (0.018)***	−0.063 (0.008)***	0.051 (0.007)***
Master	2020	0.041 (0.010)***	0.096 (0.008)***	−0.115 (0.014)***	0.026 (0.011)*	0.025 (0.008)**
	2021	0.111 (0.023)***	0.032 (0.007)***	−0.208 (0.023)***	0.087 (0.008)***	−0.021 (0.007)**
State examination	2020	−0.072 (0.012)***	0.050 (0.008)***	0.222 (0.017)***	−0.007 (0.010)	−0.066 (0.008)***
	2021	−0.259 (0.061)***	0.051 (0.007)***	0.439 (0.037)***	−0.021 (0.008)**	−0.046 (0.007)***
<i>Major groups</i>						
Humanities	2020	0.075 (0.009)***	−0.047 (0.009)***	−0.055 (0.014)***	0.013 (0.011)	0.067 (0.008)***
	2021	0.068 (0.015)***	−0.102 (0.007)***	−0.110 (0.019)***	0.033 (0.009)***	0.070 (0.008)***
Law, economics, social sciences	2020	0.084 (0.010)***	0.013 (0.008)	−0.118 (0.015)***	0.053 (0.010)***	0.022 (0.008)**
	2021	0.146 (0.023)***	−0.029 (0.007)***	−0.218 (0.024)***	0.032 (0.008)***	0.011 (0.007)
Mathematics, natural sciences	2020	−0.044 (0.010)***	−0.027 (0.009)**	0.105 (0.016)***	−0.027 (0.010)**	−0.078 (0.008)***
	2021	−0.114 (0.022)***	−0.009 (0.007)	0.208 (0.024)***	−0.028 (0.008)**	−0.066 (0.007)***
Human medicine, health sciences	2020	−0.105 (0.012)***	0.071 (0.008)***	0.173 (0.018)***	0.014 (0.011)	−0.059 (0.007)***
	2021	−0.153 (0.032)***	0.071 (0.007)***	0.289 (0.029)***	0.025 (0.008)**	−0.042 (0.006)***
Engineering sciences	2020	−0.068 (0.009)***	0.026 (0.008)**	0.049 (0.015)**	−0.045 (0.010)***	−0.016 (0.008) ⁺
	2021	−0.034 (0.009)***	0.080 (0.007)***	0.003 (0.016)	−0.064 (0.008)***	−0.003 (0.007)

Notes: Own calculations. The values for 2020 and 2021 are based on 16,413 and 22,602 observations, respectively. The results of the path coefficients of the binary variables on the latent variables in the structural model were estimated by maximum likelihood estimation using the Satorra-Bentler estimation method. Only standardized coefficients of the structural model are presented. ⁺ $p < 0.10$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

Table 7: Multi-Group-Estimates: Differences Between Student Groups (2020)

	N	Personal Resources	Academic Workload	Social Contacts	Financial Problems
Path Direction		PR → PSQ	AW → PSQ	SC → PSQ	FP → PSQ
<i>Gender</i>					
Women	10,119	−0.248 (0.022)***	0.634 (0.035)***	−0.052 (0.025)*	0.105 (0.021)***
Men	6,294	−0.174 (0.017)***	0.410 (0.028)***	−0.133 (0.020)***	0.203 (0.016)***
Sig.	-	*	***	**	***
<i>Age</i>					
Up to 23 years	9,184	−0.205 (0.015)***	0.450 (0.024)***	−0.116 (0.018)***	0.168 (0.014)***
Older than 23 years	7,229	−0.146 (0.015)***	0.347 (0.022)***	−0.115 (0.017)***	0.155 (0.014)***
Sig.	-	**	*	n.s.	*
<i>Educational background</i>					
Non-academic background	7,194	−0.191 (0.015)***	0.373 (0.023)***	−0.116 (0.018)***	0.148 (0.014)***
Academic background	9,219	−0.175 (0.016)***	0.458 (0.027)***	−0.118 (0.018)***	0.175 (0.014)***
Sig.	-	n.s.	***	n.s.	*
<i>Migration background</i>					
Without migration background	12,852	−0.191 (0.013)***	0.458 (0.022)***	−0.103 (0.015)***	0.158 (0.012)***
With a migration background	2,743	−0.173 (0.023)***	0.331 (0.032)***	−0.139 (0.028)***	0.160 (0.021)***
International students	818	−0.101 (0.042)*	0.208 (0.064)**	−0.145 (0.049)**	0.165 (0.034)***
Sig.	-	*	***	n.s.	n.s.
<i>With children</i>					
No	15,691	−0.189 (0.011)***	0.427 (0.018)***	−0.108 (0.013)***	0.157 (0.010)***
Yes	722	0.137 (0.133)	−0.240 (0.339)***	0.100 (0.220)	0.587 (0.169)**
Sig.	-	n.c.	***	n.s.	n.c.
<i>With study-affecting impairment</i>					
No	13,817	−0.159 (0.012)***	0.442 (0.020)***	−0.102 (0.014)***	0.156 (0.011)***
Yes	2,596	−0.538 (0.112)***	0.884 (0.128)***	−0.193 (0.109) ⁺	0.095 (0.087)
Sig.	-	***	***	n.s.	n.s.
<i>Employment besides studies</i>					
No	8,772	−0.198 (0.014)***	0.403 (0.024)***	−0.105 (0.017)***	0.179 (0.013)***
Yes	7,641	−0.141 (0.015)***	0.351 (0.023)***	−0.128 (0.017)***	0.156 (0.014)***
Sig.	-	*	n.s.	n.s.	n.s.
<i>Living with parents/family</i>					
No	10,923	−0.204 (0.013)***	0.426 (0.023)***	−0.017 (0.013)	0.167 (0.013)***
Yes	5,490	−0.196 (0.018)***	0.410 (0.027)***	−0.052 (0.010)***	0.173 (0.017)***
Sig.	-	n.s.	n.s.	***	n.s.
<i>First-year students</i>					
No	12,904	−0.179 (0.013)***	0.445 (0.021)***	−0.114 (0.015)***	0.166 (0.012)***
Yes	3,509	−0.191 (0.021)***	0.325 (0.030)***	−0.116 (0.026)***	0.145 (0.020)***
Sig.	-	n.s.	***	n.s.	n.s.
<i>Desired degree</i>					
Bachelor	9,561	−0.178 (0.014)***	0.402 (0.020)***	−0.113 (0.016)***	0.154 (0.013)***
Master	4,262	−0.137 (0.022)***	0.463 (0.043)***	−0.098 (0.027)***	0.161 (0.023)***
State examination	2,590	−0.227 (0.024)***	0.266 (0.033)***	−0.155 (0.029)***	0.193 (0.023)***
Sig.	-	*	***	n.s.	⁺

Notes: Own calculations. The results of the path coefficients of the variables on the perceived stress in the structural model were estimated by maximum likelihood estimation method. Only standardized coefficients of the SEM are presented. The multi-group models were not possible in all cases for 2020, as for “BAfoeG recipient”, and “Major groups” convergence was not achieved in the unrestricted model. n.c.: no convergence in the restricted model. n.s.: no significance. ⁺ $p < 0.10$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

Table 8: Multi-Group-Estimates: Differences Between Student Groups (2021)

	N	Personal Resources	Academic Workload	Social Contacts	Financial Problems
Path Direction		PR → PSQ	AW → PSQ	SC → PSQ	FP → PSQ
<i>Gender</i>					
Women	13,781	−0.411 (0.022)***	0.646 (0.045)***	−0.032 (0.025)	0.091 (0.023)***
Men	8,821	−0.442 (0.027)***	0.669 (0.125)***	−0.112 (0.040)**	0.015 (0.059)
Sig.	-	n.c.	n.s.	+	n.s.
<i>Educational Background</i>					
Non-academic background	9,521	−0.439 (0.012)***	0.335 (0.032)***	−0.032 (0.014)*	0.106 (0.014)***
Academic background	13,081	−0.438 (0.018)***	0.598 (0.075)***	−0.069 (0.025)**	0.099 (0.020)***
Sig.	-	n.s.	n.c.	n.s.	n.c.
<i>Migration Background</i>					
Without migration background	18,244	−0.421 (0.016)***	0.572 (0.062)***	−0.059 (0.019)**	0.079 (0.020)***
With a migration background	3,622	−0.463 (0.019)***	0.339 (0.055)***	−0.038 (0.024)	0.129 (0.022)***
International students	736	−0.400 (0.042)***	0.246 (0.071)**	−0.111 (0.048)*	0.126 (0.038)**
Sig.	-	n.s.	**	n.s.	n.s.
<i>With children</i>					
No	21,924	−0.438 (0.012)***	0.542 (0.045)***	−0.050 (0.015)**	0.079 (0.016)***
Yes	678	−0.256 (0.043)***	−0.043 (0.048)	−0.129 (0.049)**	0.194 (0.042)***
Sig.	-	***	n.c.	n.s.	*
<i>With study-affecting impairment</i>					
No	18,603	−0.386 (0.015)***	0.569 (0.056)***	−0.059 (0.018)**	0.775 (0.018)***
Yes	3,999	−0.591 (0.056)***	0.839 (0.112)***	−0.057 (0.078)	0.023 (0.076)
Sig.	-	*	*	n.s.	n.s.
<i>BafoeG recipient</i>					
No	18,828	−0.433 (0.012)***	0.495 (0.042)***	−0.052 (0.015)***	0.102 (0.013)***
Yes	3,774	−0.439 (0.025)***	0.466 (0.086)***	−0.038 (0.028)	0.064 (0.047)
Sig.	-	n.s.	n.s.	n.s.	n.s.
<i>Living with parents/family</i>					
No	15,860	−0.447 (0.012)***	0.463 (0.048)***	0.008 (0.016)	0.113 (0.014)***
Yes	6,742	−0.428 (0.018)***	0.451 (0.051)***	−0.013 (0.011)	0.090 (0.019)***
Sig.		n.s.	n.s.	n.s.	n.c.
<i>First-year students</i>					
No	18,453	−0.432 (0.013)***	0.511 (0.046)***	−0.062 (0.016)***	0.103 (0.015)***
Yes	4,149	−0.457 (0.020)***	0.410 (0.044)***	0.007 (0.020)	0.056 (0.022)*
Sig.		n.s.	+	*	+

Notes: Own calculations. The results of the path coefficients of the variables on the perceived stress in the structural model were estimated by maximum likelihood estimation method. Only standardized coefficients of the SEM are presented. The multi-group models were not possible in all cases for 2021, as for “Age”, “Employment besides studies”, “Desired degree”, and “Major groups” convergence was not achieved in the unrestricted model. n.c.: no convergence in the restricted model. n.s.: no significance. + $p < 0.10$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

4.3.2 Differences in Stress Perception due to Individual Stressors

In order to examine the extent to which academic, social, and financial resources and demands had different effects on the student groups’ perceptions of stress, we applied our original model from Section 4.2 as a multi-group model to the different student groups (Tables 7 and 8 for the years 2020 and 2021). By estimating the multi-group model, we obtained the standardized path

coefficients of personal resources, academic workload, social contacts, and financial problems on perceptions of stress for each student group.

By applying a likelihood ratio test (LR test) to the group models—an unrestricted model and a model restricted to a single path—we can determine whether there were significant differences between the student groups with respect to each path.⁴⁸ As a constraint, we set the path of interest (personal resources, academic workload, social contacts, and financial problems) on stress to be the same for both groups and estimated a separate model. We then compared this with the group model without constraints for significant differences (a similar approach can be found in Kocalevent et al., 2007).⁴⁹

The results of the group estimation show that in 2020 there were only minor differences between women and men in the influence of personal resources on the perception of stress (see Table 7). In 2020, women reacted more strongly to stress from academic workload, while men reacted more strongly to financial problems and had a greater buffer from social contacts (at least for social contacts, a similar pattern was also evident in 2021, see Table 8). Older students (over 23 years old) experienced less academic and financial stress in 2020 than their younger counterparts.

Students without an academic background appeared to be less stressed by academic demands than their peers with an academic background. In terms of academic workload, there were also differences by migration background: National students (without migration background) seemed to be more stressed by study-related demands than those with a migration background and the group of international students in 2020 and 2021. Financial problems seemed to be the main source of stress for students with children, while academic demands were less important in both years. General patterns can also be seen for students with study-affecting impairments in 2020 and 2021: They showed a much stronger stress response due to academic workload compared to students without study-affecting impairment. In 2020, students living with their parents and/or other family members showed a greater buffering effect in terms of stress reduction due to social contacts. First-year students experienced less stress from their academic workload in both of the years examined. There are furthermore significant differences in 2020

⁴⁸ Since Satorra-Bentler estimation with robust standard errors is not allowed for the LR test, we performed the estimations by maximum likelihood for this group comparison. In order to achieve better convergence, we omitted the neuroticism item to operationalize personal resources in the models for 2020, as this had the lowest correlation in the model. This made it possible to reduce the number of parameters to be estimated.

⁴⁹ The multi-group models were not possible in all cases, as in some cases convergence was not achieved (see Tables 7 and 8).

with regard to the degree pursued: Bachelor's and Master's students were more stressed by academic workload, but less stressed by financial problems (see Table 7).

4.4 Perceived Stress and General Life Satisfaction

We consider perceived stress as a predictor of emotional distress (see, e.g., Cohen et al., 1983; Levenstein et al., 1993; Bergdahl & Bergdahl, 2002; Bovier et al., 2004) which is also apparent during the pandemic (Liu et al., 2021), illustrated in our modified environment-oriented stress model (see Figure 2). According to Kocalevent et al. (2007, 2013), Heinen et al. (2017), and Obbarius et al. (2021), it is common practice to estimate the direct impact of stress on emotional distress. The data sets used here contain students' subjective self-assessments of their mental health. Students were able to indicate a "*mental illness (e.g., depression, eating disorders)*" as an answer (DZHW, 2020, 2024). However, since we only have information on stress perception over the last four weeks, we cannot establish a meaningful connection to mental illness. This is because we lack information on the presence and type of disease, as well as whether it can occur in connection with stress. For this reason, we used a more generally valid "*key outcome*" for students, i.e. life satisfaction (Bakker & Mostert, 2024, p. 15).

In the applications of the SDR model by Lesener et al. (2020) and Scheepers et al. (2024), the direct relationship between exhaustion and health is examined, using life satisfaction as a health-related outcome. According to the results, there is a negative association between exhaustion and life satisfaction. Stress research also shows a direct relationship between stress and life satisfaction: Students who experience high levels of stress have low levels of life satisfaction (Matheny et al., 2002; Sendatzki & Rathmann, 2022; Bohman et al., 2023), which we also expect for our analyses. The question used to measure student' general life satisfaction is: "*How satisfied are you currently with your life as a whole / in general?*", which students could answer on a five-point scale ranging from "*not at all satisfied / very dissatisfied*" to "*very satisfied*" (DZHW, 2020, 2024).⁵⁰ We implemented this variable in our models from Section 4.2 and modeled the influence of stress on life satisfaction.⁵¹

The results of the two estimations for 2020 and 2021 are shown in Figure 5. The expected negative relationship between perceived stress and life satisfaction was evident in both years. In 2020 (2021), a one standard deviation increase in perceived stress was associated with a

⁵⁰ The mean score for the life satisfaction variable of 15,808 students in 2020 is 3.637 (SD = 1.007), and in 2021 it is 3.601 (SD = 1.010) of 22,573 students.

⁵¹ Since this is cross-sectional data, no causal direction can be specified. It is unclear whether stress reduces life satisfaction or poor life satisfaction leads to stress. However, since the question asks about perceived stress over the *last four weeks* and *current* life satisfaction, the direction of the effect shown in the model seems reasonable.

0.415 (0.417) standard deviation decrease in reported general life satisfaction. Despite the different effects of the demands/resources in the two years reported, the results thus indicated a general and robustly high influence of stress on life satisfaction.

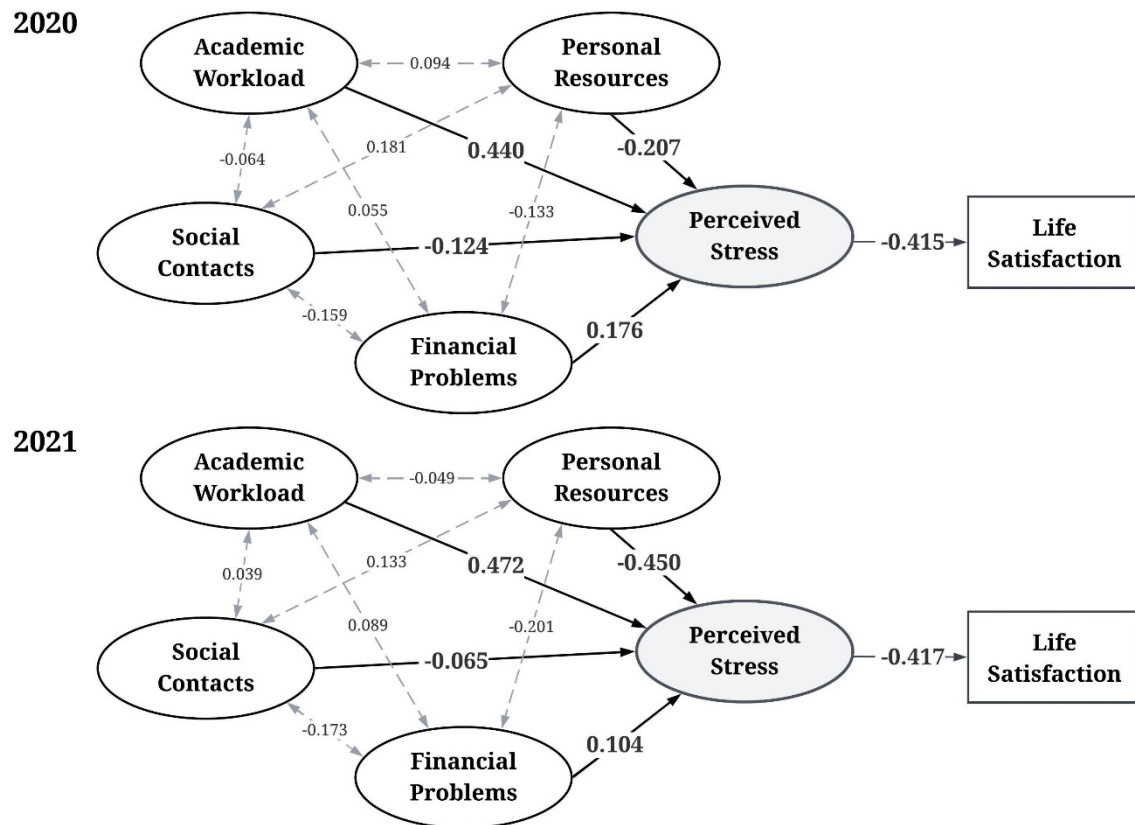


Figure 5: SEM Results with Life Satisfaction 2020 and 2021

Notes: Own calculations. The values for 2020 and 2021 are based on 15,808 and 22,573 observations, respectively. Only the structural model is shown for the sake of clarity. The measurement model is estimated with comparable coefficients as in Figure 3 and 4. Ovals, unobserved latent variables; rectangles, observed indicator variables (items); circles, observed residual variables; numbers at lines with arrows at one end are standardized regression coefficients; numbers at lines with arrows at each end are correlation coefficients. No constraints parameters. All regression coefficients shown are statistically significant ($p < 0.001$). Santorra-Bentler estimator results. Fit Indices: 2020: $\chi^2/df = 6,893.756/142$, $p < 0.000$; normed $\chi^2 = 48.548$; TLI = 0.880; CFI = 0.901; SRMR = 0.054; RMSEA = 0.055; 2021: $\chi^2/df = 10,725.188/142$, $p < 0.000$; normed $\chi^2 = 75.529$; TLI = 0.864; CFI = 0.887; SRMR = 0.054; RMSEA = 0.057.

4.5 Perceived Stress and Study Success (Drop out Intention)

A major advantage of the data is information on students' academic performance and study-related plans, such as their intention to drop out. Dropping out of higher education is usually due to a variety of external and internal factors, including lack of academic prerequisites, lack of motivation to study, financial or personal reasons, which include (mental) health problems (Heublein et al., 2017; Gerdes et al., 2024): Mental health disorders (e.g., depression, anxiety) as well as stress, can lead to poorer academic performance and a greater probability of dropping out of university (Pritchard & Wilson, 2003; Eisenberg et al., 2009; Varghese et al., 2015;

Hjorth et al., 2016; Kötter et al., 2017; Pascoe et al. 2019; Zajac et al., 2024).⁵² During the COVID-19 pandemic, higher education students in Germany were more likely to intend to drop out of university compared to before the pandemic due to a lack of social support or financial concerns (see, e.g., Becker & Lörz, 2020; Koopmann et al., 2023; Meier et al., 2024).

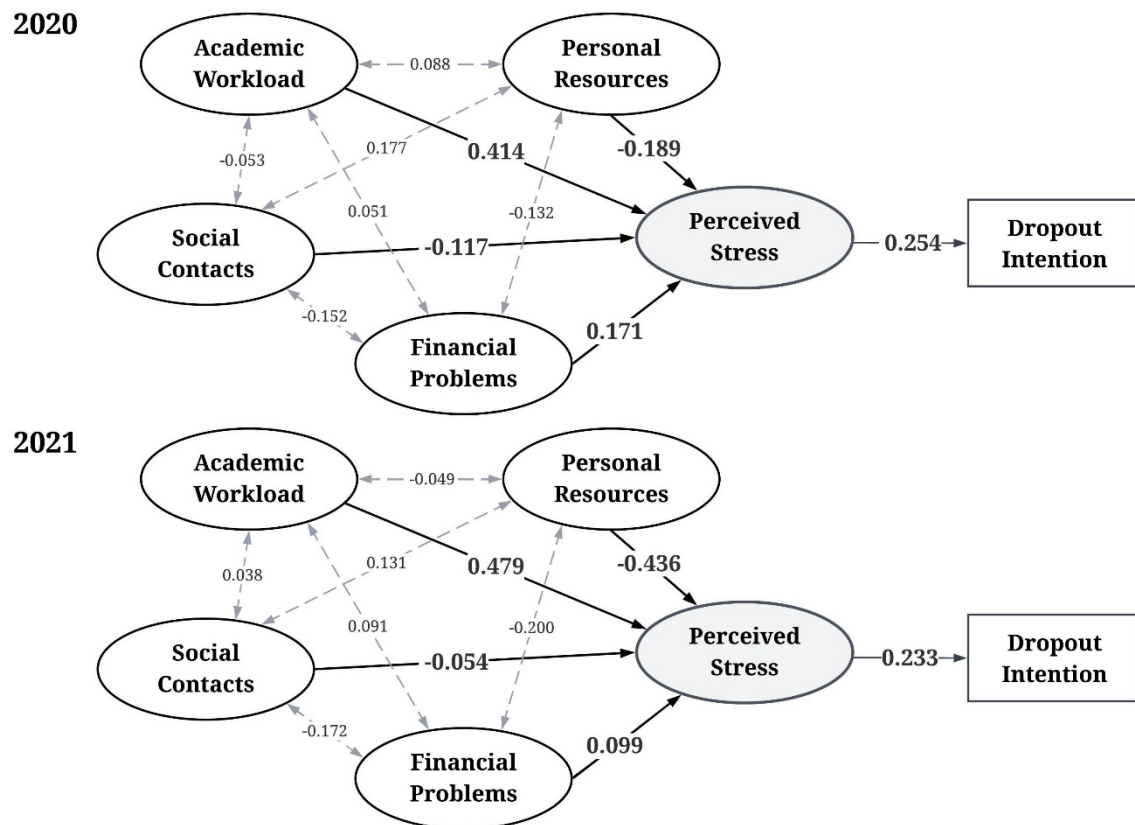


Figure 6: SEM Results with Dropout Intention 2020 and 2021

Notes: Own calculations. The values for 2020 and 2021 are based on 16,373 and 22,583 observations, respectively. Only the structural model is shown for the sake of clarity. The measurement model is estimated with comparable coefficients as in Figure 3 and 4. Ovals, unobserved latent variables; rectangles, observed indicator variables (items); circles, observed residual variables; numbers at lines with arrows at one end are standardized regression coefficients; numbers at lines with arrows at each end are correlation coefficients. No constraints parameters. All regression coefficients shown are statistically significant ($p < 0.001$). Santorra-Bentler estimator results. Fit Indices: 2020: $\chi^2/df = 5,659.523/142$, $p < 0.000$; normed $\chi^2 = 39.856$; TLI = 0.901; CFI = 0.918; SRMR = 0.046; RMSEA = 0.049; 2021: $\chi^2/df = 8,703.314/142$, $p < 0.000$; normed $\chi^2 = 61.291$; TLI = 0.885; CFI = 0.904; SRMR = 0.047; RMSEA = 0.052.

To quantify the relationship between perceived stress and intention to drop out, we adapted our model again. Similar to the SDR framework of Gusy et al. (2016), Lesener et al. (2020), and Bakker and Mostert (2024), our model included a study-related outcome instead of a health-related outcome: We measured the coefficient of perceived stress (in the last four weeks) on the

⁵² We focus here on the drop-out intention, as this is available for 16,373 (2020)/22,583 (2021) students in our sample. The current average grade is also surveyed, but is only available for 9,846 (2020)/19,906 (2021) students. We thus refrain from including it in the analysis.

(current) intention to drop out.⁵³ Figure 6 shows the results of the two estimations for 2020 and 2021. The expected positive relationship between perceived stress and dropout intentions⁵⁴ was apparent in both years. In 2020, a one-standard-deviation increase in perceived stress was associated with a 0.254-standard-deviation increase in dropout intentions, whereas in 2021, it was associated with a 0.233-standard-deviation increase.

5 Discussion

In recent years, student stress levels have remained high, having risen significantly during the COVID-19 pandemic. Although stress levels have decreased slightly since then, they remain a concern. It is well known that stress can negatively impact life satisfaction and jeopardize academic success, which can result in high individual and social costs. To develop targeted support measures for at-risk students, it is crucial to better understand key stress factors, such as academic requirements, social integration, and financial stressors, especially in the wake of the pandemic. However, the scope of these demands/resources extends beyond the effects of the pandemic: Current developments, such as the digitalization of teaching, the challenges posed by artificial intelligence, and a more socially diverse student body—as well as the financial burden of high inflation and rising student rents—are stress factors that exist independently of the pandemic. Therefore, it is important to identify student groups vulnerable to certain stressors to provide them with support and ensure equal opportunities and academic success in the long run.

Using a modified environment-oriented stress model, we examined the relationship between objectively demanding conditions (risk factors) and students' perceptions of stress. From the literature, we derived relevant external demands and resources for higher education students, such as *academic workload*, *social contact*, and *financial problems*, which changed because of the educational, social, and economic restrictions of the pandemic. We provide insights into how these demands differed during two stages of the pandemic (2020 and 2021).

Students experienced higher stress levels during the stricter educational, social, and economic restrictions in 2020 than in 2021. Our results indicate that students' academic

⁵³ Due to the cross-sectional design, no causal direction can be given here, as it is unclear whether stress increases the intention to drop out or whether the consideration of dropping out leads to stress. However, since the perception of stress in the *last four weeks* and the *current* intention to drop out are asked about, the impact direction shown in the model seems plausible.

⁵⁴ The question used to measure dropout intention is: “*To what extent are you currently considering giving up studying altogether / completely abandoning your studies?*”, which students could answer on a five-point scale ranging from “*not at all/never*” to “*very often*” (DZHW, 2020, 2024). The mean score for the intention-to-drop-out variable in 2020 is 1.451 (SD = 1.014), and in 2021 it is 1.382 (SD = 0.880).

workload had the strongest impact on perceived stress in both years. The economic restraints in 2020 led to a deterioration in the financial situations of many students, which is reflected in the greater reported financial problems in 2020 compared to 2021. Financial stress accounted for more than one third of academic stress in 2020, highlighting its significant impact. One year later, when economic restrictions were largely lifted, the relative share was 20%. Despite, or perhaps because of, the restraints on social interactions in 2020, more frequent social contact led to a significant reduction in perceived stress in 2020. The buffer effect accounted for more than one-quarter of academic stress and approximately 70% of financial stress in 2020. One year later, the relative buffering effect of social contact was significantly lower compared to academic stress (10%) and similar to financial stressors in 2021 (50%).

We found heterogeneity in the presence of external demands/resources, as well as the perceived stress caused by these factors. Women reported a higher overall perception of stress; they also had a higher academic workload and perceived it as more stressful than men. Students with children showed a higher perception of stress and more often reported financial problems, which they perceived as highly stressful. In general, students with a study-affecting impairment were more stressed. Despite having nearly the same workload as their peers without an impairment that affected their studies, they perceived this workload as more stressful. In contrast, students living with their parents/families indicated lower levels of stress and better social integration, which provided them with a greater stress buffer. Furthermore, according to our results, perceived stress was directly related to students' life satisfaction and may have also increased the risk of dropping out.

Although we considered the main relevant variables in our model, inferring causal relationships may not be entirely possible because of the additional, undetected influences on stress perception. Nevertheless, our contribution to the existing psychology literature is comprehensive: First, by considering external academic, social, and financial demands and resources we were able to estimate and quantify the effects in a *joint model* over two years. By doing so, we could draw conclusions about the relative associations with perceived stress while controlling for personal resources at two stages of the pandemic. Second, we had detailed information on students' socioeconomic and demographic characteristics, as well as study-related characteristics not included in psychological instruments. This enabled us to apply the model to different student groups to reveal *heterogeneities* (even if the student groups are not distinct and overlap). Third, we were able to quantify the relationship between stress and other *key indicators*, such as life satisfaction and academic progress. However, unfortunately the direction of causality remains unanswered in this study (reverse causality). In our view, it

is important to consider the results of these different dimensions together to get a comprehensive picture of stress development and its consequences among higher education students. Therefore, we recommend to link the personal environment with the study situation, especially with regard to students' academic performance (e.g., grades, length of study, dropout).

According to Levenstein (1993, p. 26) there is “*no gold standard for validating a measure of stress*”. Nevertheless, it is important to emphasize that due to the design of the student survey, our analysis was limited to two stress-related questions. In contrast, in psychological instruments, stress is measured in the form of questionnaires—for example, Levenstein et al. (1993) with 30 questions or Fliege et al. (2001) with 20 questions. Due to technical differences in data collection between 2020 and 2021, the “control variable” of personal (coping) resources was not measured in the same way. In 2020, it was operationalized with self-efficacy and neuroticism, while in 2021, it was operationalized with resilience. Since we do not claim to provide new insights into the impact of personal resources on the perception of stress—as this would have required psychosomatic research and more detailed questionnaires—instead focusing on the external stressors, it was still important to ensure the construct validity (Kocalevent et al., 2007). Therefore, we aimed to maximize the validity of our model and control for these dimensions.

Once the factors describing students' perceptions of stress are identified, policymakers can take appropriate action. As expected, our results indicate that academic stress is the greatest external stressor for higher education students. There exist stress-reducing programs, such as arts-based, psycho-educational, and cognitive/behavioral/mindfulness-based interventions (see Regehr et al., 2013, for an overview) as well as mental health apps and university websites (see Basner et al., 2025, for an overview). Following Cuppen et al. (2024), higher education institutions and policymakers should promote students' mental well-being by providing accessible psychological counseling services and financial support, such as scholarships and emergency funds, to support academic success. Our results show that financial stressors do not appear to have been a major driver of stress perceptions during the pandemic, despite deep economic cuts for students (insofar as students did not drop out of their studies because of this and were no longer in the sample). According to our results, higher social integration can significantly reduce the perception of stress. However, the extent to which higher education institutions and policies can ensure better social integration is central. Further research could relate our findings to evidence on mentoring programs (e.g., Sandner, 2015) for reducing academic stress and increasing social integration. Understanding how far the stressors identified

in our study are reflected in these programs—or not—may help improve their design and targeting, making them more effective and efficient.

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Appendix

Table A.1: Dataset Restrictions

	2020	2021
Initial Dataset	28,623	187,935
<i>Missing information on variables of interest</i>		
– PSQ-2 (modified)	2,247	74,553
– BFI	1,785	-
– ASKU	249	-
– BRS (modified)	-	1,683
– Academic Workload	352	47,546
– Social Contacts	388	33,521
– Financial Problems	2,623	904
<i>Missing information on sociodemographic profile</i>		
– Gender	292	401
– Age	108	108
– Academic background	402	1,392
– Migration background	0	24
– With children	7	11
– With study-affecting impairment	697	401
– BAfoeG recipient	37	39
– Employment besides studies	455	13
– Living with parents/family	266	21
– Semester	337	721
– Desired degree	31	275
– Major group	0	210
<i>Exclusion of students</i>		
– Doctoral students	550	0
– Semester off	151	243
– Non-on-campus students (distance learning, dual and part-time)	1,233	3,267
Analysis Sample	16,413	22,602

Notes: Own calculations. The observations were removed in the order presented.

Table A.2: Descriptive Results

		2020				2021			
		Mean	SD	Min	Max	Mean	SD	Min	Max
Perceived Stress									
Stressed	feelstress	3.829	1.077	1	5	3.782	1.070	1	5
Overburdened	feelovert	3.546	1.168	1	5	3.333	1.222	1	5
Personal Resources									
<i>Resilience</i>									
I don't need much time to recuperate from stressful experiences.	brs1	-	-	-	-	2.980	1.154	1	5
It's difficult for me to go back to normal after something bad happened.	brs2	-	-	-	-	3.106	1.116	1	5
Usually I overcome difficult times without major problems.	brs3	-	-	-	-	3.257	1.095	1	5
I tend to take a long period of time in order to overcome setbacks.	brs4	-	-	-	-	3.276	1.089	1	5
<i>Self-efficacy</i>									
In difficult situations, I can rely upon my abilities.	asku1	3.934	0.827	1	5	-	-	-	-
I can easily handle most problems on my own.	asku2	4.004	0.784	1	5	-	-	-	-
I am generally good at tackling even demanding and complex challenges.	asku3	3.868	0.810	1	5	-	-	-	-
<i>Big Five Inventory</i>									
<i>Extraversion</i>									
I tend to be guarded and reserved. (R)		2.948	1.217	1	5	-	-	-	-
I am sociable and outgoing.		3.217	1.102	1	5	-	-	-	-
<i>Neuroticism</i>									
I'm relaxed and don't let stress upset me. (R)	bfi-n	3.337	1.137	1	5	-	-	-	-
I easily get nervous and anxious.	bfi-n	3.028	1.157	1	5	-	-	-	-
<i>Agreeableness</i>									
I easily trust others and believe in the good in people.		3.328	1.147	1	5	-	-	-	-
I tend to criticise others. (R)		3.078	1.029	1	5	-	-	-	-
<i>Conscientiousness</i>									
I complete tasks thoroughly.		3.997	0.906	1	5	-	-	-	-
I take it easy and tend to be lazy. (R)		3.044	1.172	1	5	-	-	-	-

– Continued on next page –

Table A.2: Descriptive Results

<i>Openness</i>									
I have an active imagination, I'm imaginative.		3.636	1.103	1	5	-	-	-	-
I have very little interest in art. (R)		3.483	1.347	1	5	-	-	-	-
<i>Academic Requirements</i>									
<i>During a typical week, how many hours do you spend on the following activities (during the semesters / study phases)?¹</i>									
Attending classes	lectures	11.422	10.553	0	50 ³	16.926	9.499	0	50 ³
Personal / independent study	self-study	16.82	14.969	0	60 ³	18.178	12.172	0	60 ³
<i>Social Integration</i>									
<i>How often during the current semester have you had contact (directly, by telephone, in writing) with the following persons (outside of classes and lectures)?²</i>									
fellow students	scontact1	2.906	1.219	1	5	2.949	1.229	1	5
students in other disciplines	scontact2	1.848	1.095	1	5	1.822	1.078	1	5
friends and relatives outside the university	scontact3	3.500	1.108	1	5	3.624	1.081	1	5
teachers	scontact4	1.877	0.873	1	5	1.875	0.886	1	5
staff of the higher education institutions' administration	scontact5	1.467	0.731	1	5	1.514	0.717	1	5
family (parents, siblings, etc.)	scontact6	4.082	1.046	1	5	4.216	0.961	1	5
<i>Financial Stressors</i>									
<i>To what extent do the following statements apply to you and your financial situation?</i>									
The financing of my subsistence during my studies is secured. (R)	fprob1	1.847	1.122	1	5	1.692	1.013	1	5
I currently have financial difficulties.	fprob2	2.003	1.307	1	5	1.697	1.099	1	5
I generally manage to get by with the money that I have. (R)	fprob3	1.684	0.942	1	5	1.557	0.847	1	5
Due to the Corona pandemic I cannot proceed with my studies without supplementary financial support.	fprob4	1.585	1.131	1	5	1.490	1.033	1	5

Notes: Own calculations. The values for 2020 are based on 16,413 and for 2021 on 22,602 observations. The questions are taken from the questionnaires from DZHW (2020, 2024). R means reversed coded items.

¹Please round off the amount of time to the nearest full hour and differentiate between the semesters/study phases and the semester breaks/practice-oriented phases. ²I.e. contact of any kind—in person, by telephone, in writing, digitally. ³To exclude implausible values, the top percentile was set to the value of the 99th percentile.