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The potential of different approaches to reduce stress and enhance well-being in law students undergoing prolonged exam preparation

presented by
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List of Studies Included in This Publication-Based Dissertation

Study 1

Reschke, T., Lobinger, T., & Reschke, K. (2023). The potential of an exam villa as a structural resource during prolonged exam preparation at university. *Frontiers in Education, 8*, 1130648.

Study 2

Reschke, T., Lobinger, T., & Reschke, K. (2024a). Short-term effectiveness of a brief psychological intervention on university students' stress and well-being during prolonged exam preparation: results of a randomized controlled trial. *Cogent Education, 11,* 2354663.

Study 3

Reschke, T., Lobinger, T., & Reschke, K. (2024b). Examining recovery experiences as a mediator between physical activity and study-related stress and well-being during prolonged exam preparation at university. *PLOS ONE, 19,* e0306809.

Summary

Stress can help us achieve our best performance, but can also make us sick, especially if it lasts for a long time and is accompanied by a lack of rest and regeneration. Preserving physical and mental health as well as a high degree of psychological well-being requires effective stress management. In order to cope with high demands over longer periods of time, the availability of individual and structural resources plays an important role. The purpose of this dissertation was to increase the understanding regarding practical ways to stress reduction in higher education settings. The goal was to explore the potential of three different intervention approaches, all innovative in their own way and not previously studied in this way. Specifically, this dissertation used three single studies to examine distinct ways to reduce study-related stress and enhance well-being among advanced law students undergoing prolonged exam preparation.

Study 1 was a cross-sectional study which took a setting-based intervention approach. Based on the Demand-Control Model, this study examined whether using an exam villa as a structural resource would predict study-related stress and satisfaction. It tested perceived decision latitude to be a mediator of the relationship between villa use and both outcomes. The study included $N = 205$ advanced law students that provided self-reports on different variables. Structural equation modeling revealed villa use to predict stress but not satisfaction over and beyond the demand-control dimensions. Mediation analyses showed decision latitude to fully mediate the relationship between villa use and both outcomes. Also, using the exam villa was associated with both less subjective stress and more satisfaction. These findings support the potential of structural resources to reduce stress and increase satisfaction among students who are in prolonged and demanding periods of study. The findings show starting points for how universities can provide structural support to improve study conditions.

Study 2 was a randomized controlled trial that followed an individual-based intervention approach. Based on the Transactional Model of Stress and Coping, this study examined the effectiveness of a brief psychological intervention on study-related stress and well-being. The design included an experimental and an active waitlist control group. The intervention lasted

only three hours and consisted of six modules designed to help students learn to better cope with the specific stressors of their exam preparation. The sample included *N* = 56 advanced law students who provided self-reports at baseline, immediately before and after the intervention, as well as one and two weeks later (post and follow-up). Repeated-measures ANOVAs revealed a significant reduction in stress immediately after the intervention, but no significant improvement in well-being. Post-measurement showed the reverse pattern: the intervention significantly increased students' well-being but did not reduce their stress. The effects of the intervention remained stable at follow-up and the control group also showed benefits. The brief intervention was effective in the short term, particularly for enhancing study-related well-being. There is great potential in providing students with brief and tailored interventions and universities are recommended to implement such psychological support formats within their curricula.

Study 3 was a longitudinal study including three measurement occasions and took an alternative intervention approach. Following Conservation of Resources Theory, this study examined the role of recovery experiences as a mediator of the relationship between physical activity as one particular recovery activity and study-related stress and well-being. A total of *N* = 56 advanced law students gave self-reports on different variables. Results showed a negative trend in time concerning recovery-related variables and the outcomes. Mediation analyses revealed recovery experiences to partially mediate the relationship between physical activity and the outcomes at some measurement occasions. This suggests that the positive effects of recovery experiences related to physical activity become more relevant over time with particular positive effects on well-being. The findings support the importance of recovery during prolonged periods of academic strain and universities are advised to make students aware that recovery is a key mechanism to achieve resource replenishment.

Taken together, the findings of each study in this dissertation demonstrated that there is great potential for providing students with more resources during prolonged study periods such as exam preparation. Study 1 showed that providing students with structural resources such as an exam villa predicted stress, while decision latitude made up an important mediating

mechanism. Study 2 demonstrated that providing students with individual resources such as a brief psychological intervention could reduce stress and enhance well-being in the short term. Study 3 indicated that raising students' awareness of the importance of recovery along with physical activity showed positive effects on stress and well-being. Ultimately, the results of this dissertation have important practical implications for higher education and offer several starting points for reducing stress and improving student well-being.

Keywords: stress, well-being, student, exam preparation, university, intervention, resources

1 Introduction

Difficult roads lead to beautiful destinations. This wise saying seems to relate to academic life at university very well. Whereas there is great heterogeneity among different study programs concerning achievement standards and performance requirements, preparing and taking examinations pose major academic challenges that most students experience as stressful. Stress is defined as an unpleasant experience that results from the perceived discrepancy between certain demands and the individual resources to cope within a given situation. Following this transactional understanding, stress depends upon individual cognitive appraisal and emerges when demands are numerous, prolonged, and coping resources are taxed or even exceeded (Lazarus & Folkman, 1984). Academic examinations such as final examinations in medical school or law school are particularly stressful events as they require students to master extensive learning material. Next to the academic demands, however, the duration that students need to prepare their exams is also relevant to make exam preparation a study phase of prolonged academic stress. In fact, study programs with state examination formats have been found to entail chronic stress characteristics where the time-consuming and academically challenging nature of exam preparation is of particular relevance (Giglberger et al., 2022; Middendorf et al., 2017; Multrus, Majer, Bargel, & Schmidt, 2017).

Among all study programs with state examinations, legal studies can be considered one of the most competitive programs with the most stressful academic exam period in the German university system (Giglberger et al., 2022; Heublein, Hutzsch, Kracke, & Schneider, 2017; Multrus et al., 2017). German law students allocate the final phase of their studies with completing their exam preparation (“Examensvorbereitung”) which can range between eleven months and two years with about 18 months on average (Busch, 1990; Sanders & Dauner-Lieb, 2013). During exam preparation, students put a very strong focus on learning and reviewing their study material and usually cut back on leisure activities, social engagement, and other psychological resources that would be helpful for stress reduction. Many students even withdraw themselves socially and feelings of worry and fear are typical emotional states associated with the psychological demands during exam preparation (Lobinger, 2016;

Heidebach, 2022). Therefore, the psychological demands related to exam preparation put advanced law students at risk of suffering from high levels of stress and low levels of well-being.

To this date, study-related stress and its potential negative effects during prolonged exam periods received very little scientific attention. Many basic research studies have examined academic stress among university students, but most have considered only short-lasting examination periods. Except for one recent study (Giglberger et al., 2022), there is little empirical evidence on the adverse psychological and physical effects of prolonged periods of academic stress lasting for many months. Most importantly, there is a lack of applied research that has focused on law students during exam preparation exploring suitable intervention options for stress reduction. This appears to be of particular relevance in order to help students achieve good academic performance and better cope with academic stressors. Thus, many open questions still remain and this lack of research relates to the potential of different intervention approaches to provide psychological support to those students undergoing prolonged exam preparation.

To close this gap in the literature, this dissertation will address different options and possibilities to both reduce study-related stress and enhance study-related well-being during legal exam preparation. In doing so, it will give answers to the following questions: (1) Is there a way to address the high stress levels of advanced law students with a setting-based initiative? If so, does this structural action show positive effects? (2) Can students' high stress levels be reduced by an individual-based brief psychological intervention? If so, can the positive effects be demonstrated through a genuine experiment? (3) Is it possible to reduce students' high stress levels through an alternative intervention approach that focuses on the interplay of physical activity and recovery? If so, do positive effects emerge over the course of exam preparation?

In the following, stress will be introduced as the central construct of this dissertation. Relevant theoretical approaches and stress models are explained and the empirical background of study-related stress is presented. Then, the construct of well-being is introduced

and the situation of law students during exam preparation is illustrated. Since there are few studies on this topic, especially in the area of applied research, the effectiveness of various intervention options for stress reduction will then be outlined. The research gap is then identified and the objectives of this dissertation are stated. Three studies are then presented as its centerpiece, all of which examined different approaches to stress reduction. Study 1 follows a setting-based intervention approach with the use of an exam villa as a structural resource. Study 2 follows an individual-based intervention approach with a brief psychological intervention for stress management. Study 3 takes an alternative intervention approach with the role of recovery experiences and physical activity. To round out this dissertation, a general discussion follows regarding the possibilities for stress reduction and well-being enhancement. Finally, implications for theory, future research and practice are outlined and a conclusion is drawn.

2 Stress

The concept of stress has a long tradition in psychological research and different theoretical approaches have provided a solid foundation to better understand stress. Contrary to popular belief, stress is not necessarily linked to negative effects, but constitutes a protective human response pattern towards potential environmental threats (Selye, 1974). This pattern activates the physiological stress system that provides the fight-flight(-freeze) response that helps to regulate and adapt to current conditions (Cannon, 1915). Over time, however, the demands that individuals face have changed compared to our ancestors and this also includes different environments in which we operate today. The psychological demands of the modern work environment provide new challenges that has led to the definition of psychological stress. Researchers agree that psychological stress is a state (response) that can result from external or internal demands (stressors) and arises from a reciprocal relationship (interaction) between an individual and its environment in which cognitive aspects (appraisal) play an important role (Lazarus & Folkman, 1984). Recent literature reviews suggest that stress refers to a condition where stressors are numerous, prolonged, and include unpredictability and uncontrollability, which exceed an individual's natural ability to self-regulate (Agorastos & Chrousos, 2021; Koolhaas et al., 2011).

There are two major types of stress that are commonly differentiated in the literature: acute and chronic stress (Agorastos & Chrousos, 2021; McEwen, 1998). Acute stress is experienced when stressors are moderate and/or transient. This type of stress is short-termed and perceived as manageable by the individual. Importantly, the activation of the stress system is limited in time and stress hormones such as cortisol soon return to normal levels. Chronic stress refers to prolonged or frequently recurring strains. In this case, an individual is repeatedly exposed to one or more different stressors (e.g., high demands at work) which impairs its ability to adapt in a functional way. Chronic stress usually develops slowly and without a clear beginning and might last indefinitely. Expecting strains and constant worrying contribute to chronic stress which can also be reinforced by relevant needs not being met (e.g., need for recovery) or anticipated events not occurring in everyday routines (e.g., positive

feedback). Chronic stress results in a prolonged or recurrent activation of the stress system what is likely to have long-term negative effects on psychological and physical health (Agorastos & Chrousos, 2021; McEwen, 1998; Turner et al., 2020). See Figure 1 for a visual representation of acute and chronic stress and its trajectories as a function of stress system activation and time.

In order to measure stress, research generally distinguishes between qualitative methods (e.g., interview) and quantitative methods (e.g., questionnaire) (Heinrichs, Stächele, & Domes, 2015). Since stress can be understood as a subjective phenomenon within an individual that significantly depends on the cognitive evaluation of a stressor and available coping resources, stress is typically operationalized by questionnaires. This dissertation also follows this classical approach of psychological stress research, namely the measurement of stress with standardized questionnaire procedures. Nevertheless, stress can be measured not only on a psychological level, but also on a physiological level (e.g., via cortisol in saliva or hair). The human stress response can be observed directly (e.g., through activation of body muscles) and indirectly (e.g., through activation of the hypothalamus-pituitary-adrenal axis). However, it remains to be noted that the measurement of physiological stress is considered to be very complex and subject to many influencing factors, even though it makes a valuable additional contribution in the context of stress diagnostics (Agorastos & Chrousos, 2021; Heinrichs et al., 2015).

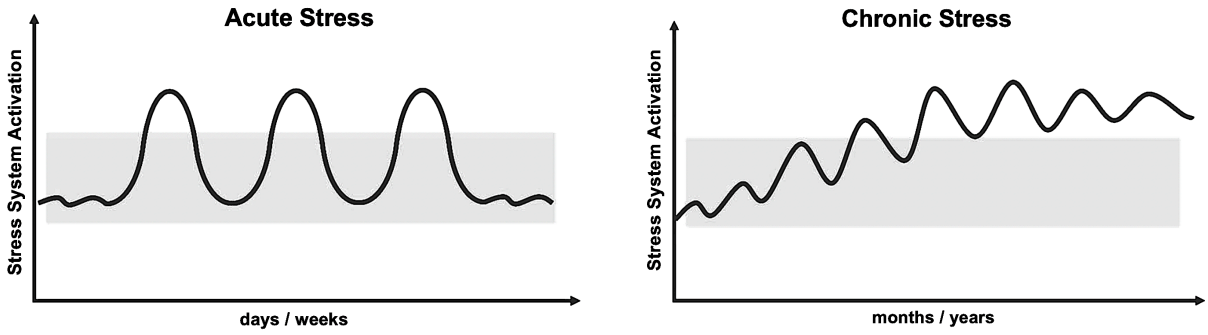

Figure 1. Characteristics of acute and chronic stress and the activation of the stress system over time (cf. Agorastos & Chrousos, 2021).

2.1 Stress Theories and Models

There are several theoretical approaches that have tried to conceptualize and explain stress. While some theories have focused on the physiological stress response others have concentrated on understanding psychological stress. The subsequent sections present a selection of three stress models that allow to explain psychological stress and identify factors that promote stress but also show direct ways to reduce stress as well as indirect ways to enhance well-being. These single stress models are the following: (1) Demand-Control Model (Karasek, 1979), (2) Transactional Model of Stress and Coping (Lazarus & Folkman, 1984), and (3) Conservation of Resources Theory (Hobfoll, 1989).

2.1.1 Demand-Control Model

Even though stress is an internal process, perceptions are also substantially influenced by external factors such as poor working or study conditions. The Demand-Control Model (*DCM*; Karasek, 1979) is one of the predominant models for explaining stress in work-related contexts. The DCM focuses on objective structural aspects of the work environment to explain work-related stress and postulates two dimensions: perceived psychosocial demands and perceived decision latitude (control). Demands refer to physical, psychological, social, or structural conditions that require an individual to invest effort in order to complete certain tasks (e.g., work load, time pressure). Control refers to physical, psychological, social, or structural resources that provide an individual with opportunities to make use of different inherent skills in order to complete a task and decide which task to give attention to under what circumstances.

The DCM distinguishes four types of work activities: passive, active, low-strain, and high-strain work activities that are all characterized by scoring either low or high on the demand-control dimensions that can lead to development of stress and health-related problems (see Figure 2 for an overview). High-strain work activities are existing when an individual perceives high work-related demands and low decision latitude at the same time and the model assumes such a constellation to be associated with elevated stress as well as risks

to physical and mental health (Karasek, 1979; Karasek & Theorell, 1990). A more positive constellation results from an active work activity where an individual experiences high work-related demands combined with high decision latitude. The theory was later extended by the dimension of social support as an additional resource within work environments (Johnson & Hall, 1988; Johnson, Hall, & Theorell, 1989).

There is a considerable body of research showing the empirical validity of the DCM in both cross-sectional and longitudinal studies. For example, demands positively predicted various health-related outcomes such as stress experience, depressive symptoms, dissatisfaction, as well as cardiovascular disease (De Jonge & Kompier, 1997; De Lange, Taris, Kompier, Houtman, & Bongers, 2003; Häusser, Mojzisch, Niesel, & Schulz-Hardt, 2010; Terry & Jimmieson, 1999; van der Doef & Maes, 1999). Furthermore, two systematic reviews showed control to be a positive predictor of general psychological well-being when work activities provide both high demands and decision latitude (Häusser et al., 2010; van der Doef & Maes, 1999).

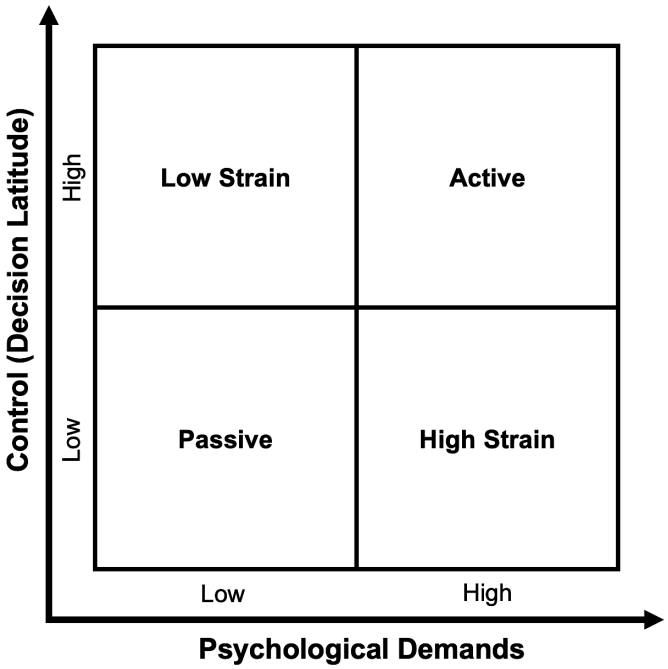

Figure 2. Adapted version of the Demand-Control Model showing its two dimensions and four quadrants (cf. Karasek, 1979).

2.1.2 Transactional Model of Stress and Coping

How individuals respond to challenges from their environment can be understood as a result of internal factors such as perceptions and psychological stress results from a subjective process that happens with in a person. The Transactional Model of Stress and Coping (*TSC;* Lazarus, 1966; Lazarus, 2006; Lazarus & Folkman, 1984) is one of the most accepted theoretical approaches to explain stress in psychological research The TSC postulates that stress is caused by an imbalance or discrepancy between demands and resources and underlines the relationship (transaction) between person and environment to be crucial. Psychological stress results from a cognitive evaluation in which an individual relates an event to be personally relevant to his or her well-being and health. The associated demands of this event may then surpass individual resources to deal with them effectively. Whether an actual event is experienced as stressful thus depends upon cognitive evaluation which is also called appraisal. Individuals actively relate to the possible stressor by using appraisal and do so based on their personal needs, values, and experiences.

The TSC distinguishes between two types of appraisals (Lazarus, 1966, Lazarus & Folkman, 1984). Both primary and secondary appraisal determine the experience of stress (see Figure 3 for an overview). While primary appraisal deals with the potential stressor to be evaluated based on personal needs and values, secondary appraisal looks at personal resources that are available to counter the stressor. Depending on whether an individual assesses his or her own resources as sufficient to cope with an event (stressor), this results in an irrelevant, positive, or stress-related evaluation. The experience of stress results when a stressor taxes or exceeds the available resources of an individual to cope with it (Lazarus & Folkman, 1984).

As a comprehensive model, the TSC incorporates the concept of coping as a way to change the stress response once it has been triggered which includes problem- and emotion-focused coping (Lazarus, 1966; Lazarus & Folkman, 1984). While problem-focused coping aims to bring about a change in the causes of stress or the situation, emotion-focused coping aims to change the emotional state and reduce unpleasant feelings. According to the TSC,

coping attempts are also evaluated by the individual in terms of their effectiveness in altering the stress response. This leads to reappraisal of the stressor and the resources which may reduce experienced stress.

There is a substantial amount of cross-sectional and longitudinal studies that confirmed the TSC empirically for various populations and contexts such as employees in the workforce, patients in the medical field, and students in higher education settings (Dewe, 1991; González-Ramírez, García-Campayo, & Landero-Hernández, 2011; Heinen, Bullinger, & Kocalevent, 2017; Jerusalem, 1993; Laugaa, Rascle, & Bruchon-Schweitzer, 2008; Obbarius, Fischer, Liegl, Obbarius, & Rose, 2021; Paek, Ip, Levine, & Avis, 2016; Zureck, Altstötter-Gleich, Gerstenberg, & Schmitt, 2015).

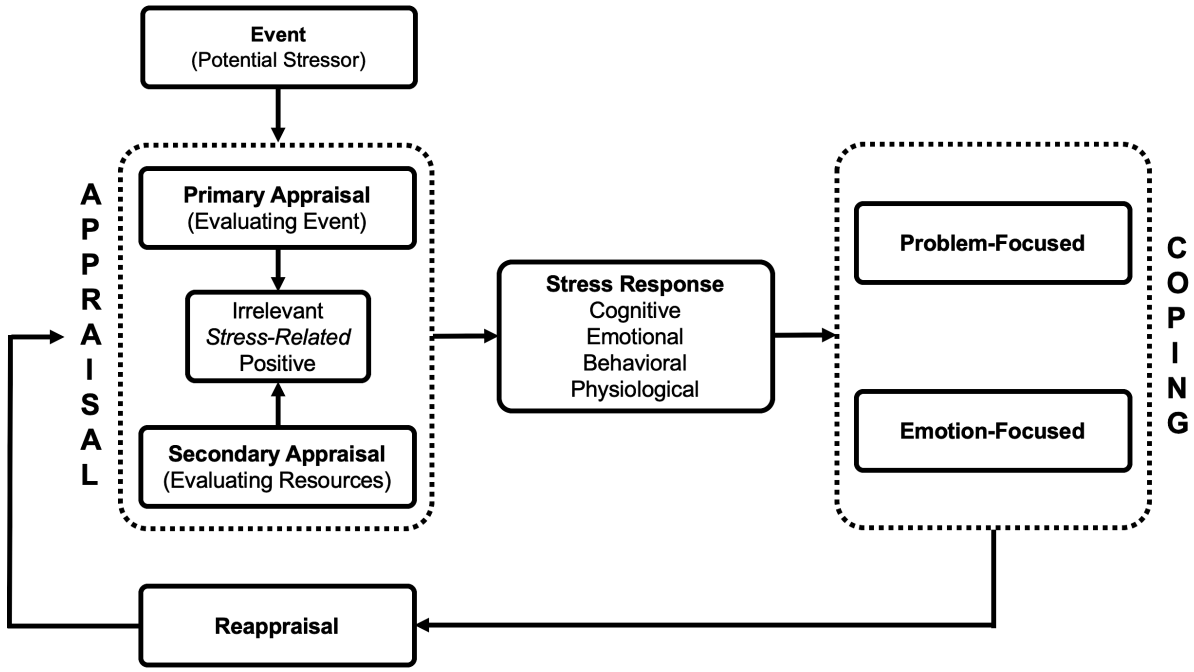

Figure 3. Adapted version of the Transactional Model of Stress and Coping with the different appraisal processes and forms of coping that occur within an individual in a given environment (cf. Lazarus & Folkman, 1984).

2.1.3 Conservation of Resources Theory

Resources play a central role in the development and management of long-lasting stress. One of the predominant theoretical approaches to understand chronic stress is the Conservation of Resources Theory (*COR*; Hobfoll, 1989). The COR theory postulates that individuals are motivated by the need to protect, conserve, and encourage acquisition of valued resources. Resources can roughly be divided into primary resources that are necessary for survival (e.g., food, health), secondary resources being closely related to primary resources (e.g., social support, employment), and tertiary resources that provide access to the aforementioned (e.g., social status) (Hobfoll & Lilly, 1993). Stress occurs as a result of any set of circumstances that threaten or deplete resources and actual loss of resources is considered to have significant psychological impact. According to COR theory, individuals must invest resources to protect against resource loss, recover from losses, and gain resources (Hobfoll, 1998). This principle becomes evident in health behaviors such as taking time for doing sports. For example, an individual could invest resources to recover from health-related resource loss by engaging in physical activity, for instance. This person invests additional resources (i.e., time and effort) to gain further health-related resources which results in positive outcomes (i.e., improving cardiovascular and psychological health). A visual representation of this idea of resource investment is depicted in Figure 4.

COR theory states that resource loss is crucial for the development of stress. To get to this stage, an individual first evaluates an event based on personally available resources to counter the potential stressor. The individual then decides upon the specific type of resource investment along with its motivation to either engage in favorable (e.g., resource-providing) or unfavorable (e.g., resource-consuming) activities. Following this dichotomy, resources can be both gained, which is linked to positive psychological outcomes such as well-being, and lost, which is associated with negative psychological outcomes such as stress. These experiences circle back to the pool of available resources that the individual uses to assess ongoing stressors. People differ in how many resources they have available to cope with stressors. Those who have fewer resources are more susceptible to further resource loss and also less

likely to acquire new resources. A loss cycle can develop where initial losses make the individual even more vulnerable. Those individuals who have more resources, however, are less susceptible to the negative effects of ongoing demands and may enter a gain cycle.

Over the years, COR theory has received extensive empirical support from a wide range of study topics and methodologies and has been shown to be especially useful in understanding the links between stress and physical health (Dirik & Karanci, 2010; Kessler, Turner, & House, 1988). For example, it provides insights that have helped researchers to develop interventions for coping with chronic stress or trauma (e.g., Cook, Aten, Moore, Hook, & Davis, 2013; Freedy, Saladin, Kilpatrick, Resnick, & Saunders, 1994) and long-term effects of burnout in occupational settings (Gorgievski & Hobfoll, 2008; Halbesleben, 2006; Toker, Melamed, Berliner, Zeltser, & Shapira, 2012).

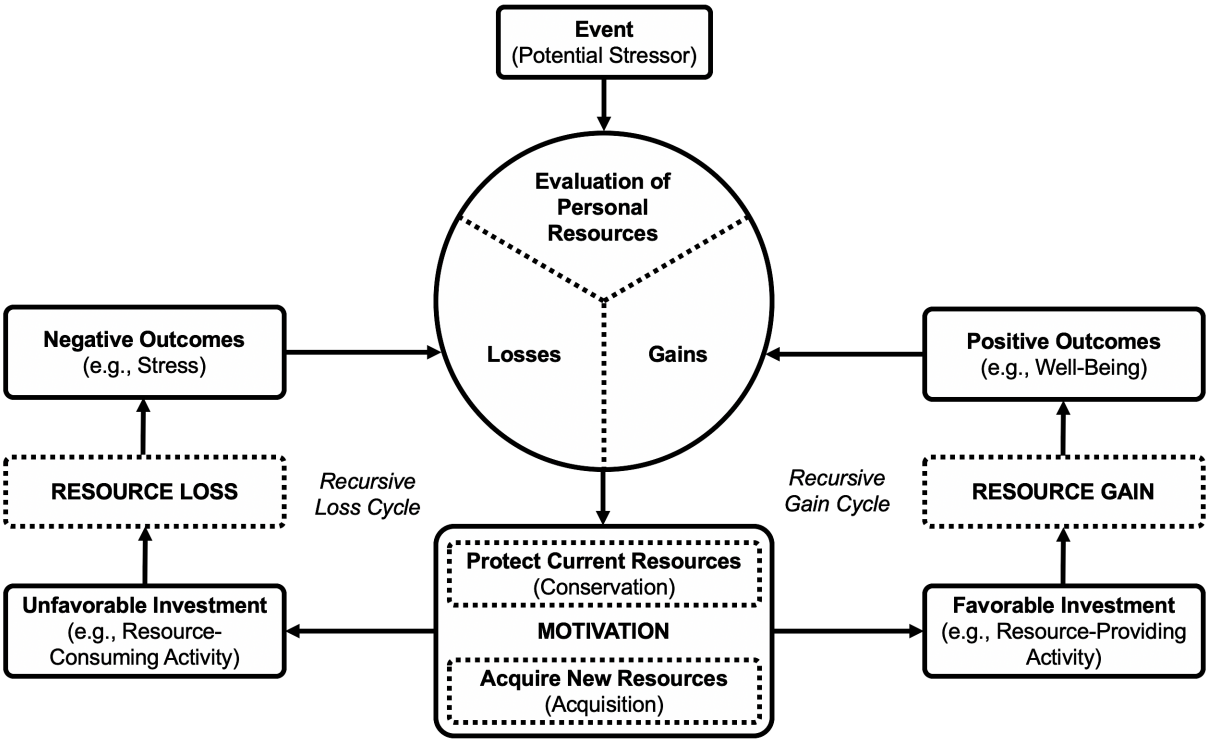

Figure 4. Adapted version of the Conservation of Resources Theory showing the importance of resource management for explaining stress and well-being. Increasing resources leads to reduced levels of stress and enhanced levels of well-being (cf. Buchwald & Hobfoll, 2004).

2.2 Study-Related Stress

Studying in the pursuit of a higher education degree goes along with numerous academic pressures and university level education confronts students with particular demands. As supported by a growing body of evidence, many students report to feel overwhelmed at university with academic stressors to be one of the most prevalent sources of stress (Bedewy & Gabriel, 2015; Misra & Castillo, 2004; Karyotaki et al., 2020; Pascoe, Hetrick, & Parker, 2020; Reddy, Menon, & Thattil, 2018; Robotham & Julian, 2006). For instance, one study surveyed college students across the United States found that up to 87% of all students consider their studies a significant source of stress (American Psychological Association, 2020). Among these findings, it is not surprising that preparing for and passing exams has been repeatedly demonstrated to be one of the greatest stressors for students (Abouserie, 1994; Beiter et al., 2015; Duan et al., 2013; Pascoe et al., 2020).

Academic stress can not only impair motivation and hinder academic achievement but also lead to mental health problems that are likely to lead to further impairment of overall functioning (Cotton, Dollard, & de Jonge, 2002; Eisenberg, Golberstein, & Hunt, 2009; Pascoe et al., 2020; Stallman, 2010). Symptoms of anxiety, burnout and depression are frequently reported and discussed as negative emotional responses to academic stress (Gusy, Wörfel, & Lohmann, 2016; Macaskill, 2013; Robins, Roberts, & Sarris, 2015; Wynaden, Wichmann, & Murray, 2013). More recent research even suggests increasing mental health challenges for higher education institutions and universities in face of the consequences of the COVID-19 pandemic (American Psychological Association, 2020; Lederer, Hoban, Lipson, Zhou, & Eisenberg, 2021; Lipson et al., 2022). The COVID-19 pandemic has had a significant impact on college students' daily lives, causing considerable stress and deteriorations in their mental and physical health (e.g., Clabaugh, Duque, & Fields, 2021; Husky, Kovess-Masfety, & Swendsen, 2020; Patsali et al., 2020).

Whereas there is great heterogeneity among different study programs concerning achievement standards and performance requirements, preparing and taking examinations pose important academic challenges that most students experience as stressful. For instance,

major academic examinations such as final examinations in medical school or law school have frequently been studied as models for acute stress (Stowell, 2003). Researchers have acknowledged academic examination stress to have both acute (i.e., stress directly before and during an exam) and prolonged characteristics (i.e., stress during preparation or review period for an exam) (e.g., Maydych et al., 2017). Next to the academic demands, it is mainly about the duration that students need to prepare their exams that is decisive to make exam preparation a prolonged and chronic stress experience. There is ample evidence that study programs with state examination formats have chronic stress characteristics (e.g., Middendorf et al., 2017; Multrus et al., 2017). Many studies have linked academic examination stress with specific health problems such as symptoms of somatization and insomnia (Preuß, Schoofs, Schlotz, & Wolf, 2010; Weik & Deinzer, 2014; Zunhammer, Eberle, Eichhammer, & Busch, 2013; Zunhammer, Eichhammer, & Busch, 2014). However, few studies examined positive mental health including psychological well-being among students that would both contribute to a more complete picture of mental health and may offer pathways for stress reduction (e.g., positive psychological interventions).

3 Well-Being

The concept of well-being is a wide notion that has been commonly known as happiness in psychology research. There are many terms for happiness which are often not clearly separated in theory and practice (e.g., quality of life or psychological well-being). Two overarching perspectives on well-being have been distinguished in the literature: hedonic and eudaimonic well-being. From the hedonistic perspective, an individual is considered happy when he or she experiences pleasure and joy (i.e., frequent positive affect or feelings and less frequent negative affect or feelings) and high life satisfaction. This way of looking at well-being has also been termed as subjective well-being in psychological science (Diener, 1984). From the eudaimonic point of view, an individual is considered happy if he or she strives for a successful life that includes human virtues and strengths (Eid & Larsen, 2008). Accordingly, when both perspectives are considered together, happiness consists of the components of pleasant life (hedonic focus) as well as good life and meaningful life (eudaimonic focus) (Seligman, 2002).

Various theories have been proposed in the context of (subjective) well-being, but to date there is no theory that can provide satisfactory explanations and predictions for a wide range of findings, nor is there a theory that is accepted by the majority of scholars. Research has been devoted to better understanding the components and determinants of well-being as well as examining individual and cultural factors that underlie well-being. Likewise, various interventions to enhance well-being have been developed and studied in different settings. From this plethora of research, the following sections focus on subjective well-being, which is based on individuals' cognitive and affective (and thus easily measurable) evaluations. The following sections also address university and higher education as a setting to reflect the situation of students.

3.1 The Concept of Subjective Well-Being

Subjective well-being (SWB) relates to how people evaluate their lives and can be understood as a general state of subjective wellness (Diener, 1984). Researchers often distinguish cognitive and affective facet of SWB (Diener, 2000; Diener, Suh, Lucas, & Smith, 1999). The cognitive facet entails life satisfaction (i.e., global judgments of one's life) and satisfaction with important life domains (e.g., satisfaction with health, relationship, or work). Both are considered cognitive components since they depend on evaluative beliefs (attitudes) about one's life. People who are satisfied with their lives usually feel good and vice versa. This is why life satisfaction and domain satisfaction are highly correlated even after controlling for potential bias such as personality (Schimmack, 2008). The affective facet includes positive affect (presence of pleasant emotions and moods) and low levels of negative affect (relative absence of unpleasant emotions and moods). For example, people feel good when they are involved in exciting activities and experience joy and pride along with little fear and sadness. Empirical studies largely indicate that positive and negative affect are independent components of the affective facet of SWB. This means that a person with high positive affect typically (but not necessarily) experiences low negative affect and vice versa (Schimmack, 2008).

To briefly summarize, the components of SWB can roughly be divided into cognitive components (life satisfaction and domain satisfaction) and affective components (positive affect and negative affect). See Figure 5 for a visual representation. In order to measure SWB, it is important to consider all components and to measure them with one or more measurement instruments. This approach was also considered in the context of this dissertation. Since SWB is characterized by the personal evaluation of one’s well-being, the measurement of SWB follows a long tradition of self-reports. While early research typically relied on single-item measures for each component of SWB (e.g., “All things considered, how satisfied are you with your life?” for measuring life satisfaction), recent measures include several items for each component. For instance, the Satisfaction with Life Scale (*SWLS*; Diener, Emmons, Larson, & Griffin, 1985) assesses general life satisfaction with five items (e.g., “In most ways my life is

close to my ideal") on a 7-point response scale ranging from 1 (*strongly disagree*) to 7 (*strongly agree*). To measure the affective component of SWB using several items, the Positive and Negative Affect Scale (*PANAS*; Watson, Clark, & Tellegen, 1988) constitutes a classic tool to measure both positive and negative affect. Although researchers have begun to utilize new methods to get a better understanding of how people are feeling over longer periods of time (e.g., naturalistic experience sampling measures), the measurement of SWB through questionnaires remains a much more economical option that has prevailed in measuring psychological constructs.

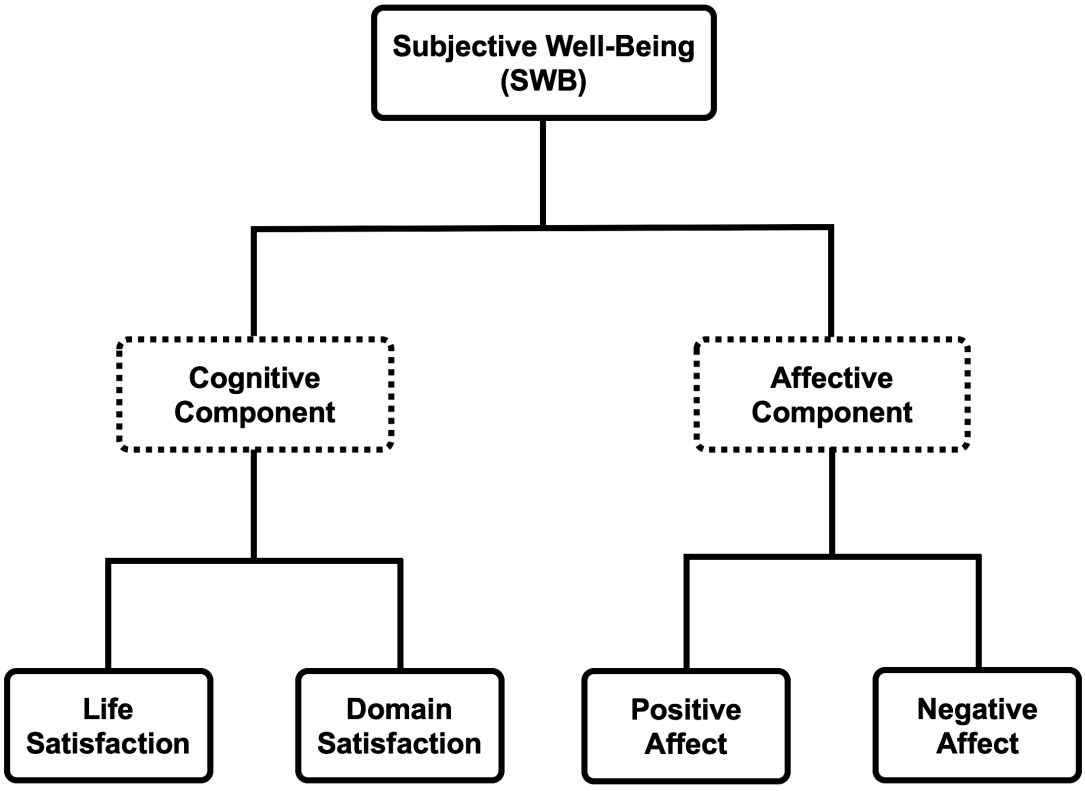

Figure 5. Taxonomy of subjective well-being (SWB) representing its single components (cf. Diener, 2000).

3.2 Study-Related Well-Being

There are many academic demands that come along with studying for a higher education degree and these challenges can have a significant impact on students' mental health and overall well-being. Study-related stress associated with assessments such as exam has been shown to be a strong predictor of student well-being (e.g., Denovan & Macaskill, 2017; McIntyre, Worsley, Corcoran, Harrison Woods, & Bentall, 2018). According to recent research, there has been a rise in the number and severity of mental health problems and help-seeking behaviors among university students worldwide (Auerbach et al., 2018; Hunt & Eisenberg, 2010; Lipson et al., 2022). Evidence suggests that most mental illnesses develop in adolescence and peak by 25 years of age which makes university students vulnerable to develop mental health problems (Kessler et al., 2007). Moreover, students' mental health has recently been strained by the COVID-19 pandemic as shown by many studies (Bennett, Heron, Gunnell, Purdy, & Linton, 2022; Donald & Jackson, 2022; Martínez, Valencia, & Trofimoff, 2020; Reis et al., 2021). As a result, scholarly interest in student well-being continues to grow and researchers are looking for strategies to assist students maintain their well-being in the face of personal and academic stressors.

It is important to capture SWB in students and to connect it to their study and living situation for several reasons. First, SWB is an important construct that complements mental health problems and pathology which allows to obtain a more comprehensive picture of students' mental state while studying. This provides a better understanding of study-related experiences including negative experiences (i.e., study-related stress) and deficits as well as positive experiences (i.e., study-related well-being) and resources. For this reason, the term study-related well-being can be seen in close relation to SWB, because the items used in the questionnaire measurements are intended to specifically capture SWB of students. Coming from the Positive Psychology school of thought, the focus can thus be broadened to include positive attributes such as psychological assets and strengths that enhance well-being (Kobau et al., 2011). This perspective also makes it possible to derive specific interventions to support students in their (internal) competencies or otherwise provided with (external) resources.

It is also important to capture SWB in students because a variety of studies have shown that more satisfied people were more physically active, liked themselves and others more, and even had stronger immune systems (Larsen & Eid, 2008). Also, in a higher education context, students with higher levels of SWB showed more academic engagement and also better academic performance (Chambel & Curral, 2005; Cotton et al., 2002; Nickerson, Diener, & Schwarz, 2011; Tuominen-Soini, Salmela-Aro, & Niemivirta, 2011). Moreover, SWB and academic achievement have been shown to be central indicators of positive psychological functioning for young adults (e.g., Bücker et al., 2018; Suldo, Riley, & Shaffner, 2006). While these are largely correlative findings and therefore causality cannot be assumed (i.e., SWB in students leads to better outcomes), it can be concluded that the promotion of SWB is very likely to lead to positive effects. In fact, promoting SWB in students itself can be seen as an important outcome and universities should consider this in an appropriate way. For example, it could be a good starting point if students experience their current study situation as satisfactory as well as their study conditions as conducive and if this is supported by the universities.

4 The Situation of Law Students During Exam Preparation

Among all study programs with state examinations, legal studies can be considered one of the most competitive programs (Heublein et al., 2017; Multrus et al., 2017). Academic demands are set very high to become a fully qualified lawyer which makes study-related stress a common phenomenon at law school. Different factors have been discussed that are thought to be responsible for stress during law school such as high demands and the study conditions at law school (Heublein et al., 2017; Rabkow et al., 2020). Also, final examinations have been discussed that are typically organized as collective exam campaigns that require several months of preparation for both the written and the oral part.

The German system of legal education requires law students to prepare and pass two state examinations where the actual performance plays an essential role. At the end of their formal studies at university, German law students take their first state examination that is considered to be one of the most psychological demanding final examinations in (German) academia (Lobinger, 2016). Law students are required to master the complexity of the entire learning material of their study subject starting from the beginning of the first semester. Specifically, the successful completion of the first state exam requires students to pass five to eight written exams of five hours duration each usually in a two-week time period (with the actual number depending on the federal state) as well as an oral examination of about 90 minutes which takes place a couple of months later. Passing each written exam is considered very demanding since students need to solve a complex legal case within one topical area of law. It is important to note that the exam performance achieved makes up 70% of the final grade of students' entire law studies and that failure rates are at 25-30% what constitutes an additional psychological burden. Even though students get a second attempt if they failed the first time, there is a considerable risk of dropping out empty-handed without a law degree (Heublein et al., 2017). Furthermore, the final grade achieved within the first state exam has substantial impact on future occupation chances and career options (Towfigh, Traxler, & Glöckner, 2018; Rabkow et al., 2020).

While the exam poses a major stressful event in itself, the road leading there is considered at least as demanding. German law students allocate the final phase of their studies with completing their exam preparation which can range between eleven months and two years with about 18 months on average (Busch, 1990; Sanders & Dauner-Lieb, 2013). During exam preparation, students put a very strong focus on learning and reviewing their study material which makes it necessary to cut back on leisure activities, social engagement, and other psychological resources that would be helpful for stress reduction. Many students even withdraw themselves socially and feelings of worry and fear are typical emotional states associated with the psychological demands during exam preparation (Lobinger, 2016; Heidebach, 2022). Another challenge is the writing of mock exams that are taken by most students to train solving legal cases in order to prepare for their first state exam. This is where universities as well as a number of private coaching services offer special one-year courses to support students. Taking mock exams poses not only a psychological but also a physical stressor because successful passing requires many pages to be written by hand in five hours working time. One study found that students take about 24 mock exams on average over a time period of 43 weeks (Glöckner, Towfigh, & Traxler, 2013). It is likely that the continuing psychological burden associated with the long-lasting exam preparation has negative effects on students' study-related stress and satisfaction. In fact, many of the exam-related demands mentioned above put advanced law students at risk of suffering from chronic stress during exam preparation.

One recent work by Giglberger and colleagues (2022) conducted a multi-method longitudinal study in Germany and followed 452 advanced law students over a 13-months period of their exam preparation. This exam group was studied along with a control group of students that did not start with their exam preparation. Over time, there was a significant difference of perceived stress levels between both groups with exam students showing a continuous increase until the exam whereas controls were stable in their stress levels. For exam students, this pattern could also be observed for symptoms of anxiety and depression as well as several facets of perceived chronic stress. It is concerning to note that at several

measurement time periods, students' anxiety and depression scores were well above clinically relevant thresholds for mental illness. These stress-related psychological changes were paralleled by results from psychobiological measures that revealed a blunted cortisol awakening response (CAR) in exam students compared to baseline and to the control group over time. Giglberger et al. (2022) argued these blunted cortisol patterns upon awakening to show a down-regulation of the hypothalamic-pituitary-adrenocortical axis indicating hypocortisolism due to chronic stress during exam preparation. Interestingly, subjective stress and the CAR both reverted to baseline levels following the exam period which indicated fast recovery for most students. For some students, however, stress levels did not return to baseline and it can be assumed that the stressor of exam preparation has negative after-effects for those students that persist for many months after the actual exam period (e.g., mental illnesses such as burnout and depression). This is particularly relevant because it has been shown that prolonged hypoactivation of the stress system is linked to adverse effects for both psychological and physical health (Agorastos & Chrousos, 2021).

The study concluded that exam preparation poses a significant source of stress for advanced law students both on a psychological and physiological level but remained unrevealing with regard to practical implications (Giglberger et al., 2022). However, when looking at the practical significance of such research, chronically elevated stress levels and deterioration of overall functioning in students should encourage thinking further than just describing stress and its trajectories. Therefore, to prevent serious health problems in advanced law students, applied research should explore different pathways to reduce stress during exam preparation by developing specific interventions and testing their effectiveness.

5 Approaches to Reduce Stress and Enhance Well-Being in Students

Efforts to reduce stress and enhance well-being become particularly important when there is a prolonged discrepancy between high demands and individual resources to cope with stressors of a particular situation. As described earlier, this applies to the situation of advanced law students going through exam preparation. Researchers in the fields of health psychology as well as industrial and organizational psychology distinguish two major approaches to health promotion that also apply to stress reduction: individual-based interventions and setting-based intervention. The individual-based approach focuses on individual or behavioral possibilities and resources. Individual-based interventions aim to reduce stress by acting on psychological and behavioral factors such as teaching coping skills. In contrast, the setting-based approach focuses on environmental or structural possibilities and resources. Setting-based interventions aim to reduce stress by acting on structural factors such as making curricular changes. Moreover, there are alternative interventions to support stress reduction that can be located somewhere between individual-based and setting-based interventions. All these approaches to reducing stress and increasing student well-being are described in more detail in the following sections.

5.1 Individual-Based Interventions

Recent research on study-related stress and well-being has repeatedly been emphasizing the importance of providing distressed students with suitable interventions to reduce stress and prevent mental health problems (Auerbach et al., 2016; Amanvermez et al., 2023; Breedvelt et al., 2019; Harrer et al., 2018; Karyotaki et al., 2020). Many stressors that students have to deal with can be attributed to individual factors regarding the development and maintenance of stress such as low academic achievement, anxiety, and depression (e.g., Andrews & Wilding, 2004; Ebert et al., 2018; Eisenberg et al., 2009). For this reason, individual-based interventions follow a long and promising tradition to address these stressors and provide students with skills to better manage themselves while navigating though university.

Amanvermez and colleagues (2023) provided a meta-analysis of high methodological quality that reviewed a wide range of stress management interventions for students with high stress levels and an unselected student sample. This meta-analysis included studies that followed an individual-based approach providing specific stress interventions with stress, anxiety, and depression as the outcomes of interest. For highly stressed students, findings revealed a moderate overall effectiveness of stress interventions on all outcomes with a moderate-to-large effect size for stress (g = 0.61). Interventions that had a cognitive-behavioral therapy (CBT) background were most effective when compared to other intervention types. Findings were similarly promising for the unselected student group, but generally less pronounced. In these students, intervention types that based on CBT, mindfulness-based stress reduction, and mind-body concepts showed higher effects than programs that focused on skills training with no significant difference regarding intervention length. The authors concluded that stress management interventions have the potential to both reduce stress and prevent mental health problems in the higher education context (Amanvermez et al., 2023).

Apart from targeting study-related stress, individual-based interventions have also been shown to be effective in enhancing students' mental health and well-being and there is meta-analytic evidence to support this (e.g., Halladay et al., 2019; Howell & Passmore, 2019; Winzer, Lindberg, Guldbrandsson, & Sidorchuk, 2018). One recent review has synthesized all review-level evidence currently available and found that specific intervention types were effective in reducing common mental health problems students when compared to passive controls (Worsley, Pennington, & Corcoran, 2022). Interventions that based on CBT, mindfulness, and also technology-delivered interventions were particularly helpful with many reviews suggesting that the effects of CBT are more sustainable over time. Moreover, interventions delivered via technology (i.e., internet-based interventions) were found to be more effective for mental health problems when CBT components were at their heart even though conventional treatment including direct human interaction produced better results. Eventually, psychoeducation was suggested to be a less effective intervention strategy without long-lasting benefits (Worsley et al., 2022).

5.2 Setting-Based Interventions

Whereas a great amount of research has focused on individual-based interventions for stress reduction, far less high-quality research was conducted that examined setting-based approaches (Upsher, Nobili, Hughes, & Byrom, 2022). Setting-based interventions follow a rather new approach to promote health and are concerned with changing structural and organizational aspects that play a role for health and well-being (Dooris, 2009). In doing so, they include methodological strategies such as policies, environmental modification, social marketing, as well as academic- and curriculum-embedded strategies to protect and promote health and well-being. For example, modifying the grading system to a binary pass/fail or making curricular changes that tailor students' needs would pose strategies that can have rather direct impact on students' experiences of stress while studying.

Most setting-based interventions that were shown effective to reduce stress among students addressed medical students by introducing changes like pass/fail grading systems. Such changes to the curriculum were related with enhanced student well-being and reduced symptoms of stress and anxiety in the short-term and appeared to have no adverse effects on students' academic outcomes (Spring, Robillard, Gehlbach, & Moore Simas, 2011). Another review found that curricula enriched with mandatory stress reduction programs that teach mindfulness to medical and dental students show reductions in psychological distress and enhancements in quality of life (Dobkin & Hutchinson, 2013). A more recent and influential review found that academic-based interventions that enhance learning and teaching significantly improved psychological well-being (Fernandez et al., 2016). Many interventions implement strategies that are directly related to changes within the curriculum such as including mandatory mental health courses, assessing students' performance differently, and making curricular changes and thus follow a combined approach that offer both individual and structural resources to students. Even though the review was the first comprehensive work to compile evidence on different setting-based initiatives, the majority of reported studies included health-related disciplines such as medicine (Fernandez et al., 2016).

Taken together, setting-based interventions bring with them great potential to both reduce stress and enhance well-being in students, but care needs to be taken concerning what interventions are implemented. When looking at the effectiveness of curriculum-embedded interventions, robust evidence is still lacking at this time with more studies are needed to fill this gap (Upsher et al., 2022; Worsley et al., 2022). Evidence is inconclusive whether such interventions have a positive influence on mental health as well as study-related stress and well-being which provides a promising avenue for future research (Upsher et al., 2022). As for findings related to the positive effects of specific learning environments, there are no studies to date that have examined study-related stress.

5.3 Physical Activity as an Alternative Intervention Approach

While individual-based interventions and setting-based interventions are the two overarching approaches in the literature, there are also alternative interventions to reduce stress and enhance well-being among students. Physical activity, for example, represents an interesting alternative for students to cope with experienced stress. Engaging in self-initiated physical activity represents an individual strategy for regulating stress that has a positive impact on one's well-being at the same time. In this context, physical activity can be differentiated from individual-based interventions because it does not act on the individual from the outside (i.e., there is no external party inviting the individual to take part in any kind of initiative). Rather, physical activity represents a self-regulated behavior which can be seen as a restorative counterweight to students' everyday learning routines that facilitates stress recovery. In fact, physical activity constitutes a resource-providing recovery activity in itself and has repeatedly been shown to promote individual feelings of recovery (Sonnentag, Cheng, & Parker, 2022).

Physical activity has continuously been shown to help reduce stress and enhance well-being in adults (Calderwood et al., 2021; Hamer, 2012; Reed & Ones, 2006). For the situation of university students, meta-analytic evidence suggests that interventions including exercise are effective in reducing stress as well as symptoms of anxiety and depression (Guo, Liu,

Shen, Wei, & Yang, 2020; Litwiller, White, Hamilton-Hinch, & Gilbert, 2018; Huang, Nigatu, Smail-Crevier, Zhang, & Wang, 2018). However, in many studies, physical activity was not clearly differentiated from other movement-related interventions such as tai chi, yoga, or mindfulness. This makes it unclear whether its positive effects are due to physical exercise (i.e. endurance or strength training) or other factors. However, recent review-level evidence that has taken this particularity into account points into a similar direction in that physical activity can buffer perceived stress and mental health problems as well as strengthen subjective well-being among university students (Abrantes et al., 2022; Herbert, 2022; Wunsch, Fiedler, Bachert, & Woll, 2021).

Taken together, however, there is only little systematic research about the efficacy of physical activity and exercise interventions within higher education settings. Particularly, there is a lack of studies that examined study periods with high academic demands such as preparing and passing exams. For example, it would be interesting to better understand whether students are able to cope better with long-lasting periods of study-related stress if they themselves engage in resource-providing activities such as physical activity that helps with stress recovery. Future work should therefore look at the potential that lies within PA as a means of stress reduction because it is both cost-effective and supports physical and psychological health.

5.4 Preliminary Conclusion

Studying for a higher education degree comes with multiple challenges and high academic demands are one of the most common sources of stress among students. As supported by a huge body of research in the higher education context, these challenges can have a significant impact on students' mental health and overall well-being. Continuous and prolonged exposure to stressors makes students vulnerable to experience chronic stress and develop physical and mental health problems that can further aggravate over time. Study programs with state examinations hold prolonged periods of intensive studying that students have to go through in order to pass their final exams and successfully graduate. Of these

demanding study programs, legal studies can be considered one of the most competitive programs. Advanced law students endure a long-lasting study period of exam preparation of about 18 months in which they not only face the complexity a huge body of study material but also face the necessity to solve legal cases in form of mock exams to develop legal expertise.

Recent research indicates that most law students undergoing exam preparation are indeed chronically stressed and at risk for developing psychopathology (Giglberger et al., 2022). Exam preparation poses major stressor that significantly impacts students' overall functioning. Because chronic stress is a significant risk factor developing an array of serious physical and mental health problems, it is worth thinking about ways to counteract negative trajectories and intervene. Fortunately, the psychological literature offers an array of different interventions that are suitable to address academic stress. Examples include mindfulness-based interventions, psychological interventions, psychoeducation interventions, recreation programs, relaxation interventions, setting-based interventions, and stress management or stress reduction interventions.

Of all these different types of interventions, research has continuously put emphasis on individual-based interventions and setting-based interventions as two major approaches to reduce stress in students. To reduce stress and prevent mental health problems, recent evidence indicates that stress management interventions are an effective means to reduce stress as well as symptoms of anxiety and depression among student. Next to CBT, mindfulness- and mind-body-oriented interventions were shown to be most effective especially when programs lasted over several weeks. To promote mental health and enhance well-being, current evidence suggests that CBT, mindfulness, and technology-delivered interventions are most effective. Evidence on setting-based interventions appears to be limited at this time and more research is needed to gain a clearer picture of the potential of interventions that provide students with structural resources. Eventually, research on alternative interventions such as physical activity is growing and has continuously been showing positive effects for reducing stress and enhancing well-being among students.

6 Specification of This Dissertation Project

The upcoming sections make up the core of this dissertation. Based on the previously described theoretical models and empirical findings, open research questions are formulated. Subsequently, the objectives of this dissertation are specified. Finally, a brief overview of the three single studies is given, all of which have examined different approaches to reduce stress and enhance well-being among students undergoing prolonged exam preparation.

6.1 Open Research Questions

Study-related stress and well-being as well as intervention approaches have been studied by many researchers in recent years. Despite the progress that has been made, open questions remain. To date, researchers have primarily examined groups of students facing moderate academic demands. Students with high levels of stress (i.e., students that prepare or undergo their final exams) have received less scientific attention. This is particularly the case for students who prepare for an exam over a long period of time (i.e., several months up to one year and more). For advanced law students, prolonged exam preparation carries an enormous potential to experience chronic stress. Although there are initial empirical works that have been able to validate chronic stress and related health problems in students undergoing exam preparation, there is a lack of studies that examined starting points for reducing stress in those students. We know little about the effectiveness and practical utility of alternative initiatives to reduce stress and enhance well-being that do not follow traditional formats. Individual-based interventions have typically been studied, but these require a high level of effort for students to participate (e.g., attending a stress management course that lasts over several weeks). As mentioned earlier, however, exam preparation represents a study period that leaves little room for additional time commitment. It is unclear whether other intervention strategies tailored to law students would be effective in reducing study-related stress and enhancing study-related well-being. For example, it has not yet been examined whether a structural initiative specifically designed for students undergoing exam preparation shows positive effects. Similarly, targeted individual interventions for coping with stress have received little scientific vigor. It is therefore

unclear whether tailored and time-constrained psychological interventions are suitable and effective for students in exam. Similarly, there are few studies that have investigated starting points for reducing stress that entail self-initiated and self-sustained behavior of students. For instance, the role of engaging in physical activity to recover from exam-related stress has not yet been studied. The next sections explain which objectives were prioritized in filling in these gaps in the literature.

6.2 Objectives of This Dissertation

The overarching objective of this dissertation was to expand the knowledge about feasible approaches to reduce stress in higher education settings. This work has set itself the goal of examining the potential of both innovative and alternative interventions that have not been studied in this way before. In doing so, it focused on three different approaches to act on study-related stress and well-being. It needs to be emphasized that this dissertation focused on the situation of advanced law students at Heidelberg University. All students were within exam preparation which constitutes a study period of long-lasting academic stress that students must endure in order to graduate. While exam preparation has always been considered a very stressful time for law students, the adverse physical and psychological effects linked to chronic stress have only recently been addressed by research (Giglberger et al., 2022).

It is important to note that no empirically robust approaches have yet been explored to address the high stress levels of advanced law students during exam preparation. To meet the need for stress reduction, this dissertation employed three studies that were designed to examine the positive effects of different interventions to both reduce stress and enhance well-being among students undergoing exam preparation. To date, there is a lack of empirical research that looked at resourceful influential factors to support students that experience prolonged academic stress.

The first specific objective of this dissertation was to examine whether using an exam villa as a supportive learning environment would act as a structural resource during exam preparation. By looking at a setting-based approach, this was to finding out whether using the villa would lead to an increase in students' perceived decision latitude which unfolds positive effects on stress and satisfaction as outcomes. The purpose was to determine whether villa use predicted stress and satisfaction and whether decision latitude mediated the relationship between villa use and both outcomes.

The second specific objective of this dissertation was to examine the positive effects of a brief and tailor-made psychological intervention for students undergoing exam preparation. By following an individual-based approach and using a randomized controlled trial, this was to determine whether taking in the intervention reduced levels of stress and enhanced levels of well-being for students. Up until now, the effects of brief and tailored interventions that target students within specific study periods of prolonged academic stress have received no scientific attention.

The third specific objective of this dissertation was to examine whether physical activity as one specific recovery activity is beneficial to help students better cope with academic strains during exam preparation. By taking an alternative intervention approach, this was to finding out whether spending time on recovery activities with physical activity in particular results in reduced study-related stress levels and increased levels of well-being. The purpose also was to determine the extent to which recovery experiences mediate the relationship between physical activity and both outcomes.

The upcoming section gives an overview of the three studies included in this dissertation and briefly describes the research questions, the methodological approaches, and how each study contributes to the literature. Table 1 provides an overview of all three studies and important characteristics.

6.3 Overview of the Studies

Study 1 (“The potential of an exam villa as a structural resource during prolonged exam preparation at university”) is a cross-sectional study that followed a setting-based intervention approach. Based on the Demand-Control Model (Karasek, 1979), this study examined whether using an exam villa as a structural resource would predict study-related stress and satisfaction. Moreover, it tested perceived decision latitude to be a mediator of the relationship between villa use and both outcomes. The study included *N* = 205 advanced law students that were all within exam preparation. Students provided self-reports on the respective variables. Structural equation modeling and mediation analyses were applied to test the hypotheses. It is worth noting that this study goes beyond previous research, as no empirical studies could be found that have examined whether such a structural initiative turns out to be an effective means of reducing stress among students. Furthermore, little is known about resourceful influential factors during prolonged academic stress in higher education contexts. The study points at innovative structural opportunities to reduce stress among students that go beyond classic individual-based approaches.

Study 2 (“Short-term effects of a brief psychological intervention on stress and well-being among university students undergoing prolonged exam preparation”) is a randomized controlled trial which took an individual-based intervention approach. Based on the Transactional Model of Stress and Coping (Lazarus & Folkman, 1984), it examined the effectiveness of a brief psychological intervention on study-related stress and well-being using an experimental and an active waitlist control group. The intervention took only three hours to complete and comprised six modules that taught students different strategies to reduce stress during exam preparation. The sample comprised *N* = 56 advanced law students that provided self-reports at baseline, right before and after the intervention, as well as one and two weeks later (post and follow-up). To test intervention effects, repeated-measures ANOVAs were used. In applying this methodology, this study contributes to the literature by examining the potential of a brief and tailored intervention that targeted students’ needs during stressful study periods. Since no other empirical studies could be located that had already examined this issue, this

was the first study to examine the causal effects of a brief psychological intervention. Again, it focused on exam preparation, which is a study phase with a prolonged period of academic stress for students.

Study 3 (“Examining recovery experiences as a mediator between physical activity and study-related stress and well-being during prolonged exam preparation at university”) is a longitudinal study using three measurement occasions which followed an alternative intervention approach. Based on Conservation of Resources Theory (Hobfoll, 1989), this study examined the role of recovery experiences as a mediator of the relationship between physical activity and study-related stress and well-being during exam preparation. The study included N = 56 advanced law students that gave self-reports on the respective variables. Mediation analyses were performed to test the hypotheses. This study contributes to the literature because there is a lack of longitudinal findings which examined the role of recovery activities and experiences over longer periods of time (i.e., several months). The purpose of this study was to provide deeper insights into what might help students to reduce stress and enhance well-being over the course of exam preparation. Physical activity represents a self-regulated recovery activity that allows for a time-saving way to help students experience recovery. Physical activity can therefore be seen as a promising alternative intervention that students can make use of.

Table 1

Overview of the three studies within this dissertation and their characteristics

Study	Theoretical model	Intervention type	Design	Independent variables	Dependent variables	Statistical analysis
1	Demand-Control Model	Setting-based	Cross-sectional	Demands, decision latitude, villa use	Study-related stress and satisfaction	SEM, Mediation
2	Transactional Model of Stress and Coping	Individual-based	Randomized controlled trial (pre, post, and follow-up)	Experimental and control group	Study-related stress and well-being	RM-ANOVAs
3	Conservation of Resources Theory	Alternative	Longitudinal (three measure-ment occasions)	Physical activity as specific recovery activity and recovery experiences	Study-related stress and well-being	Mediation

Notes. SEM = structural equation modeling; RM-ANOVAs = repeated measures analysis of variance.

7 Empirical Research

7.1 Study 1: The potential of an exam villa as a structural resource during prolonged exam preparation at university

Note: The following manuscript is the final version that was published in Frontiers in Education. However, it is neither supposed to be a copy of the original article nor is it a suitable citation.

Reschke, T., Lobinger, T., & Reschke, K. (2023). The potential of an exam villa as a structural resource during prolonged exam preparation at university. *Frontiers in Education, 8*, 1130648.

Abstract

Drawing on the Demand-Control Model, this study examined whether using an exam villa as a supportive learning environment provides a structural resource for law students during exam preparation. First, we hypothesized that villa students show higher decision latitude and satisfaction and less stress compared to non-villa students. Second, we expected villa use to predict stress and satisfaction over and beyond the demand-control dimensions. Third, decision latitude was tested to mediate of the relationship between villa use and both outcomes. Our cross-sectional study included $N = 205$ advanced law students that gave self-reports on their stress and satisfaction, villa use, their perceived demands and decision latitude along with some control variables. All students were within a period of long-lasting exam preparation stretching over 12 to 18 months whereas $n = 41$ students used the villa. Using the exam villa was associated with both less subjective stress and more satisfaction. SEMs revealed villa use to predict stress but not satisfaction over and beyond the demand-control dimensions with 73% of overall explained variance in stress and 62% of variance in satisfaction. Decision latitude mediated the relationship between villa use and both outcomes. The findings support the potential of structural resources in reducing stress among students undergoing prolonged academic stress.

Keywords: academic stress, satisfaction, university students, decision latitude (DL), structural resource, setting-based approaches

1 Introduction

High-stress levels and growing mental health problems have been shown to challenge university students (Robotham & Julian, 2006; Beiter et al., 2015; Ribeiro et al., 2018; Rabkow et al., 2020), while exam periods appear to be particularly stressful (Zunhammer et al., 2013; Lyndon et al., 2014; Campbell et al., 2018). Stress is defined as an unpleasant experience that results from the perceived discrepancy between certain demands and the individual resources to cope within a given situation. Therefore, stress depends upon individual cognitive appraisal and emerges when demands are numerous and prolonged, and coping resources are taxed or even exceeded (Lazarus & Folkman, 1984). There is ample evidence that study programs with state examination formats such as in medical and law school have characteristics of prolonged academic stress given the time-consuming and academically challenging nature of exam preparation (e.g., Duan et al., 2013; Multrus et al., 2017; Giglberger et al., 2022). Studies have found prolonged academic examination stress to be not only related to high-stress levels but also to potential health problems such as symptoms of anxiety, depression, or somatization (Weik & Deinzer, 2010; Zunhammer et al., 2013; Giglberger et al., 2022).

We based our study on the Demand-Control Model (DCM; Karasek, 1979) which is one of the predominant models for explaining stress in work-related contexts. The DCM makes predictions about stressful work environments by postulating two important dimensions: psychosocial demands and control (decision latitude) within a given work situation. Demands refer to physical, psychological, social, or structural conditions that require an individual to invest effort to complete certain tasks (e.g., workload and time pressure). Control refers to physical, psychological, social, or structural resources that provide an individual with opportunities to make use of different inherent skills in order to complete a task as well as decide to which task attention is allocated under which circumstances. The DCM distinguishes four types of work activities: passive, active, low-strain, and high-strain work activities, which are all characterized by scoring either low or high on the demand-control dimensions that can lead to the development of stress and health-related problems. High-strain work activities are existing when an individual perceives high work-related demands and low decision latitude at

the same time and the model assumes such a constellation to be associated with elevated stress as well as risks to physical and mental health (Karasek, 1979; Karasek & Theorell, 1990). A more positive constellation results from an active work activity where an individual experiences high work-related demands combined with high decision latitude. Research that applied the DCM in the university context found empirical support that perceiving high demands and low decision latitude were associated with more stress and less satisfaction as well as symptoms of depression and anxiety (Karasek, 1979; Karasek & Theorell, 1990; Cotton et al., 2002; Chambel & Curral, 2005). More recent research demonstrated that high demands were associated with high levels of study-related stress and decision latitude could positively predict study-related satisfaction (Sieverding et al., 2013; Schmidt et al., 2015).

In this framework, past studies have not only explored explaining factors of study-related stress but also pointed to setting-based initiatives (i.e., utilizing structural opportunities and resources) to reduce stress in university students (Fernandez et al., 2016; Upsher et al., 2022). The other major direction of research focused on individual-based initiatives (i.e., utilizing individual opportunities and resources) to explain and reduce stress among students. Recent evidence suggests that stress management interventions are an effective means to reduce stress as well as symptoms of anxiety and depression among students (e.g., for a recent review and meta-analysis by Amanvermez et al., 2023). Cognitive-behavioral therapy, and mindfulness- and mind-body-oriented programs have continuously been reported to be most effective especially when lasting over several weeks (Worsley et al., 2022). While many of those programs are effective at building and improving students' individual resources, few interventions aim at the potential of structural resources. In fact, focusing on setting-based initiatives would be promising because it could act on the potential sources of stress. For the situation of students, this could translate into curriculum-embedded strategies that reduce academic demands and enhance decision latitude, for instance. Setting-based initiatives such as creating specific learning environments may even help to prevent the need for individual intervention efforts. More research in this direction would lead to a better understanding of the effectiveness of setting-based initiatives (Fernandez et al., 2016; Upsher et al., 2022).

The law faculty of one large German university established an innovative structural approach to address students' needs during prolonged and stressful exam preparation for their first state examination (Lobinger, 2016). This offered support is an exclusive villa that is open to advanced law students to use while preparing their final examinations. Students apply for one out of 50 personal workspaces to use up to 12 months. Selection is not based on previous grades but determined based on the highest need and most expected benefit for the individual student. Students are invited to use their fixed personal workspaces on a 24/7 basis which helps them avoid crowded libraries and study at their own pace. The villa provides a conducive learning environment including rooms for group learning, a small law-specific library, and a kitchen where students of the same field of study can meet and exchange ideas. Given such amenities, it appears worthwhile to examine the role of such an exam villa as a structural resource for study-related stress and satisfaction. The exam villa provides a systematic means of empowering students to arrange and organize their current study situation (e.g., deciding over individual study hours and separating work from leisure). It provides a special work environment that helps students to perceive more individual control over their exam preparation.

The present study aimed at exploring the potential of the exam villa as a setting-based initiative to reduce stress in university students. The DCM states decision latitude to be a central factor that is directly associated with positive effects. Therefore, we assume that using the villa would lead to an increase in decision latitude which can in turn reduce study-related stress and enhance satisfaction. To our knowledge, no empirical studies have examined whether such a structural initiative to reduce stress among students turns out to be an effective means. In addition, little is known about resourceful influential factors during prolonged academic examination stress in higher education contexts. Accordingly, we derived the following research hypotheses:

Hypothesis 1a. Villa students perceive significantly higher levels of decision latitude compared to non-villa students with no between-group differences on demands.

Hypothesis 1b. Villa students report both significantly lower levels of stress and higher levels of satisfaction compared to non-villa students.

Hypothesis 2a. Villa use significantly predicts stress even when important predictors such as the demand-control dimensions and other control variables are considered.

Hypothesis 2b. Villa use significantly predicts satisfaction even when important predictors such as the demand-control dimensions and other control variables are considered.

Hypothesis 3a. Decision latitude significantly mediates the relationship between villa use and stress.

Hypothesis 3b. Decision latitude significantly mediates the relationship between villa use and satisfaction.

2 Method

2.1 Sample and procedure

Our study consisted of N = 205 students (65% female) from one large German university. All of them were advanced law students enrolled for at least six semesters (M = 9.21, SD = 1.64). To participate in the study, students had to meet the inclusion criterion of being in the midst of their exam preparation to pursue their first law degree. At the time of data collection, there was a total number of N = 393 students in exam preparation. There were no exclusion criteria other than that. Students varied in time spent for their exam preparation which ranged from 12 to 24 months. An amount of n = 41 students used a personal workspace in the exam villa (“villa students”). Since there are only 50 spaces available in the exam villa, we reached 82% of all villa students which can be interpreted as a representative subsample. All other students did not use a workspace in the villa (“non-villa students”). The mean age

was 24.22 years (*SD* = 2.19). Data were collected cross-sectionally in early 2017 using economic self-report measures. Paper-and-pencil questionnaires were handed out in exam-relevant seminars and in the exam villa itself. We also informed students about the study on the faculty's website. To obtain a representative sample, we also contacted various cohorts of students who were in the process of preparing for their examinations via an internal faculty email distribution list. Identical online questionnaires were made available by sending students emails that included a questionnaire link. This made it possible to reach more participants because the majority of students no longer attend regular courses during exam preparation. Each questionnaire took about 20 min to complete, and informed consent was obtained. Students completed the questionnaires mostly at their homes or at the exam villa if they owned a personal workspace. The paper questionnaires could be anonymously dropped into a designated ballot box. Students received no financial compensation for their participation. The entire study got supervised and approved by the local ethics committee.

2.2 Measures

2.2.1 Demands and decision latitude

We measured perceived study demands and decision latitude using the questionnaire on structural conditions (*StrukStud*; Schmidt et al., 2018). The questionnaire stems from research based on the DCM and its corresponding Job Content Questionnaire (Karasek, 1979, 1985; Karasek et al., 1998) that received further refinement and adaptation to fit the situation of university students (Schmidt et al., 2018). We focused on the two core dimensions, namely study demands and decision latitude. Decision latitude includes the subdimensions skill discretion and decision authority to assess structural study conditions during exam preparation. Students were asked to answer demands with seven items [e.g., “In my studies, I have to work hard” and “In my studies, I have enough time to get tasks done (reverse coded)”] and decision latitude with eight items (e.g., “In my studies, I develop my own special abilities” and “My studies allow me to make my own decisions”). The answer format was a rating scale ranging from 1 (*strongly disagree*) to 4 (*strongly agree*). We decided to remove one demand

item and three decision latitude items due to better fit to the situation of advanced law students as well as to insufficient singular factor loadings of these items within the structural equation models. Internal consistencies were $\alpha = 0.76$ for demands and $\alpha = 0.69$ for decision latitude.

2.2.2 Study-related stress

We assessed students' stress with the Leipzig Short Questionnaire on Chronic Stress (*LKCS*; Reschke & Schröder, 2016; Reschke & Mätzchen, 2020). This measure was developed as a screening tool in the realm of a stress management training program targeting adults in their working contexts (Reschke & Schröder, 2010). We applied it to the situation of advanced law students and considered prolonged exam preparation to be the students' working context. The brief questionnaire contains seven items that intend to measure seven different domains of chronic stress: (1) loss of control (“I have the feeling of being rushed, trapped or cornered”), (2) loss of meaning (“I sometimes ask myself if all the effort is actually worth it”), (3) negative emotions (“Dissatisfaction and frustration are parts of my everyday life”), (4) early psychosomatic symptoms/sleep disorder (“I wake up regularly during the night or long before I have to get up”), (5) inability to rest (“Even after days off and hours of rest, I feel drained and lethargic”), (6) burden of critical life event (“There are sensitive aspects of my life that upset me when I merely think of them”), and (7) lack of social support (“When I want to talk about my problems, it is hard to find someone who will listen and understand”). Students answered all items on a rating scale ranging from 1 (*strongly disagree*) to 4 (*strongly agree*). We excluded the single item on social support from our analyses due to the assumed confounding effect of other people. The internal consistency was $\alpha = 0.79$.

2.2.3 Study-related satisfaction

We measured satisfaction with the Satisfaction with Life and Studies Scale (*LSZ*; Holm-Hadulla & Hofmann, 2007). This questionnaire builds on the Satisfaction With Life Scale (Diener et al., 1985) and concentrates on the satisfaction component of subjective wellbeing and its cognitive evaluation. The scale we used contained seven items and was tailored to

higher education research by including study satisfaction as a subdomain of life satisfaction. We assumed both life and study satisfaction to be mutually important during exam preparation, and previous studies report all items to load on a single factor with α = 0.79 (Holm-Hadulla, Hofmann, Sperth, & Funke, 2009; Schmidt et al., 2018). The life satisfaction domain included four items that measured students' satisfaction with their personal life situation in terms of their perceived performance and functioning as well as overall life satisfaction (“How healthy and productive do you currently feel?” “How well do you currently manage yourself?” “How well do you currently get along with others?” and “How satisfied are you with your current life?”). The study satisfaction subdomain contained three items that focused on performance and situational aspects of studying (“How satisfied are you with your current academic achievements?” “How satisfied are you with your current study situation?” and “How satisfied are you with your current general study conditions?”). Students were asked to refer back to the last 7 days and answer all items on a rating scale ranging from 1 (*not at all)* to 5 (*very much*). We excluded one life satisfaction item from our analyses because we assumed a confounding effect of other people (“How well do you currently get along with others?”). The internal consistency was α = 0.83.

2.2.4 Use of exam villa

We also wanted to know whether students used a personal workspace in the exam villa during exam preparation. Compared to students that did not use the villa, villa students could benefit from an exclusive learning environment with rooms for group learning and other amenities. Students could use their workspaces day and night including weekends for up to 12 months and reported their frequency of use on a brief rating scale with 0 (*never*), 1 (*sometimes*), and 2 (*often*).

2.2.5 Control variables

We added three more variables to control for potential confounding effects. First, we included workload to assess the overall study effort that students would dedicate to their exam preparation in terms of hours spent per week ("How much time per week do you usually spend on your studies?"). Second, we considered time to examination as we expected this variable to influence subjective stress and satisfaction levels. Studies have shown increased subjective stress levels during examination periods when compared to pre-examination periods (e.g., Lyndon et al., 2014; Giglberger et al., 2022). Students got to choose their temporal distance to their planned exam campaign (*March 2017, September 2017, March 2018, and September 2018*). Third, we also included a brief measure to assess students' personality traits because neuroticism is known to serve as a potential negativity bias in studies with subjective stress ratings (Schmidt et al., 2015). We applied the Big Five Inventory-10 to measure important personality dimensions with 10 items (*BFI-10*; Rammstedt & John, 2007). To account for negative affectivity, we focused on the neuroticism subscale that contained two items ("I see myself as someone who is relaxed, handles stress well (reverse coded)" and "I see myself as someone who gets nervous easily"). Students rated both items on a rating scale ranging from 1 (*disagree strongly*) to 5 (*agree strongly*).

2.3 Statistical analyses

2.3.1 *t*-tests for independent samples

We applied a set of *t*-tests for independent samples to examine the role of villa use on the demand-control dimensions between villa students and non-villa students (Hypothesis 1a). We also wanted to know whether both groups differed on study-related stress and satisfaction (Hypothesis 1b). For interpreting the magnitude of the mean differences, we calculated effect sizes (Cohen's *d*).

2.3.2 Structural equation models

We used structural equation modeling (SEM) to predict study-related stress and satisfaction during exam preparation. Specifically, we wanted to know whether villa use would serve as a significant predictor of both outcomes over and beyond the demand-control dimensions as well as relevant control variables. Based on the findings of previous research, we modeled the data with a hierarchical approach and included the variables in three subsequent steps depending on their presumed importance and novelty (Sieverding et al., 2013; Schmidt et al., 2015). Therefore, we specified three models for each outcome that would each take more variables into consideration. In the first step, we set up a baseline model that included sex, age, time to examination, workload, and neuroticism as relevant control variables. In this first model, all predictor variables were assessed with one item and thus modeled as manifest variables except for neuroticism. In the second step, we added demands and decision latitude as further predictor variables. Both dimensions were specified as latent variables with about five indicators each. The third and last step introduced villa use as our central between-subject variable to examine whether it would still make a relevant contribution toward explaining both outcomes. Villa use was assessed with one item and thus specified as a manifest variable. Both study-related stress and satisfaction were modeled as latent variables with six indicators each. All SEMs were computed using Mplus 7.11 (Muthén & Muthén, 2013).

2.3.3 Mediation

We also used SEM to analyze the role of the demand-control dimensions and whether decision latitude in particular would mediate the relationship between villa use and study-related stress and satisfaction (Hypothesis 3a+b). We computed the indirect effects of villa use over the demand-control dimensions on both outcomes. Therefore, we first specified a basic model with villa use as a predictor for each outcome. We then computed two mediation models and specified the demand-control dimensions as mediators of the relationship between villa use and both outcomes.

2.3.4 Evaluation of model fit

To evaluate the model fits of our SEMs, we assessed the χ^2-value with its degrees of freedom, the comparative fit index (CFI), the root mean square error of approximation (RMSEA), and the standardized root mean square residual (SRMR). Due to its dependency on sample size often leading to significant values, we interpreted the χ^2 value with caution (Ullman, 2007). CFI values > 0.95, RMSEA values < 0.06, and SRMR values < 0.08 are considered good model fits (Hu & Bentler, 1999; West et al., 2012). Because the literature remains inconclusive about the final definition of a "good" model, we considered the fit of a model as satisfactory when the majority of the three fit indices (CFI, RMSEA, and SRMR) were within an acceptable range (Lai & Green, 2016).

2.3.5 Missing data

To handle missing data, we used the full information maximum likelihood (FIML) approach within Mplus. This method has the advantage to produce less biased estimates than traditional methods such as listwise or pairwise deletion. FIML estimates the model parameters by taking cases with missing values into consideration while maintaining statistical power (Schafer & Graham, 2002; Enders, 2010).

2.3.6 Confidence intervals

We computed confidence intervals (95%) to examine the significance of an indirect effect within the mediation models. Each mediator was tested using the bootstrap method in Mplus with 10.000 drawn samples. Mediation occurred when indirect effects significantly differed from zero in that the confidence intervals did not include zero.

3 Results

3.1 Descriptive statistics and intercorrelations

Means (*M*), standard deviations (*SD*), and intercorrelations between the examined variables are presented in Table 1 and briefly mentioned in the following. Villa use was related to study-related stress ($r = -0.20$, $p < 0.01$) and satisfaction ($r = 0.15$, $p < 0.05$) as well as to decision latitude ($r = 0.15$, $p < 0.05$) and time to examination ($r = -0.16$, $p < 0.05$). Stress was associated with demands ($r = 0.56$, $p < 0.001$) and decision latitude ($r = -0.39$, $p < 0.001$) as well as neuroticism ($r = 0.44$, $p < 0.001$) and age ($r = 0.16$, $p < 0.05$). Satisfaction was correlated with all variables [e.g., stress ($r = -0.70$, $p < 0.001$), demands ($r = -0.47$, $p < 0.001$), and decision latitude ($r = 0.46$, $p < 0.001$)] except for workload. The demand-control dimensions also correlated with each other ($r = -0.32$, $p < 0.001$). There were also other significant intercorrelations that can be seen in Table 1.

3.2 *t*-tests

With regard to hypothesis 1a, the results of the independent *t*-tests supported that villa students differed on their perceived decision latitude but not on demands. On average, villa students ($M = 2.57$, $SD = 0.47$) perceived significantly higher levels of decision latitude than non-villa students [($M = 2.38$, $SD = 0.53$), $t(198) = -2.06$, $p = 0.041$, $d = 0.36$], although they did not differ on demands [$t(198) = 0.66$, $p = 0.51$]. The effect size of the difference in decision latitude is small to medium and suggests that villa students perceived more control over their study situation during exam preparation than non-villa students.

Turning to hypothesis 1b, the results of independent *t*-tests supported that students who used the exam villa differed in their experienced study-related stress and satisfaction compared to students who did not use it. On average, villa students ($M = 2.34$, $SD = 0.7$) reported significantly lower stress levels than non-villa students [($M = 2.68$, $SD = 0.66$), $t(198) = 2.91$, $p = 0.004$, $d = 0.51$]. In addition, villa students ($M = 2.75$, $SD = 0.70$) reported significantly higher satisfaction levels than non-villa students [($M = 2.49$, $SD = 0.73$), $t(198) = -2.01$, $p = 0.046$, $d = 0.35$]. Both effect sizes are about medium in magnitude and

indicate meaningful differences which provides support that students who used the villa were both less stressed and more satisfied than students that did not use the villa to prepare their exams.

3.3 Structural equation models

The results of confirmatory factor analyses (CFA) for demands, decision latitude, study-related stress, and satisfaction are presented in Table 2. The results of a set of hierarchical SEMs are summarized in Table 3. When turning to the prediction of study-related stress, the first model (M1) including only control variables showed an acceptable fit [$\chi^2_{(43,\ N = 205)} = 99.31$, $p < 0.001$, CFI = 0.896, RMSEA = 0.080, SRMR = 0.053]. We found time to examination ($\beta = -0.15$, $p < 0.05$) and neuroticism ($\beta = 0.64$, $p < 0.001$) to significantly predict stress. Both control variables explained 43% of variance in the outcome. The next model (M2) including the control variables and the demand-control dimensions also fitted the data to an acceptable degree [$\chi^2_{(205,\ N = 205)} = 365.47$, $p < 0.001$, CFI = 0.866, RMSEA = 0.062, SRMR = 0.061]. Demands ($\beta = 0.59$, $p < 0.001$) significantly contributed to the prediction, while decision latitude did not predict stress. The overall explained variance increased to nearly 71%. The third model (M3) including the control variables, the demand-control dimensions, and villa use as predictors showed an acceptable fit as well [$\chi^2_{(220,\ N = 205)} = 395.12$, $p < 0.001$, CFI = 0.856, RMSEA = 0.062, SRMR = 0.060]. We found that using the exam villa ($\beta = -0.13$, $p < 0.05$) significantly predicted the outcome and did so over and beyond the control variables as well as demands and decision latitude. Including the exam villa made up an additional amount of 2% in explained variance. Taken together, all predictors within the third model explained an overall variance of 73% in study-related stress. These results supported hypothesis 2a that using the exam villa significantly predicted study-related stress during exam preparation.

When looking at the prediction of study-related satisfaction, the first model (M1) including only control variables showed a good fit [$\chi^2_{(41,\ N = 205)} = 54.06$, $p = 0.08$, CFI = 0.977, RMSEA = 0.039, SRMR = 0.040]. Time to examination ($\beta = 0.31$, $p < 0.001$) and neuroticism ($\beta = -0.51$, $p < 0.001$) were significant predictors of satisfaction. These variables explained

32% of variance in the outcome. The next model (M2) including the control variables and the demand-control dimensions fitted the data well [$\chi^2_{(202,\ N = 205)}$ = 273.03, p < 0.001, CFI = 0.941, RMSEA = 0.041, SRMR = 0.058]. Demands (β = −0.32, p < 0.01) and decision latitude (β = 0.41, p < 0.001) significantly contributed to the prediction of satisfaction. The overall explained variance increased to nearly 61%. The third model (M3) including the control variables, the demand-control dimensions, and villa use as predictors also showed a good fit [$\chi^2_{(217,\ N = 205)}$ = 314.50, p < 0.001, CFI = 0.922, RMSEA = 0.047, SRMR = 0.059]. We found that villa use (β = 0.06, p = 0.35) did not significantly predict satisfaction. However, including villa use as a predictor made up an additional amount of 1% in explained variance. All in all, the predictors within the third model explained an overall variance of 62% in study-related satisfaction. Contrary to hypothesis 2b, villa use did not significantly predict satisfaction. Even though using the villa did not have a direct effect on satisfaction, it might be possible that villa use exerts an indirect effect. The upcoming section addresses the results of mediational analyses.

3.4 Mediation

With regard to hypotheses 3a and 3b, the results of two mediation models supported decision latitude to fully mediate the relationship between villa use as well as study-related stress and satisfaction. The mediational models and model fit indices are depicted in Figures 1A, B. The model fit indices indicated an acceptable model fit for both mediational models. While villa use significantly predicted study-related stress and satisfaction in the basic models, these effects became non-significant when including demands and decision latitude as joint mediators. We found a significant indirect effect of villa use on stress through decision latitude [β = −0.05, CI (−0.14, −0.01)]. In addition, we found a significant indirect effect of villa use on satisfaction through decision latitude [β = 0.09, CI (0.01, 0.20)]. Demands did not significantly mediate the aforementioned relationships with none of the outcomes.

4 Discussion

This was the first study that examined whether using an exam villa as a supportive learning environment would act as a structural resource for study-related stress during a prolonged exam preparation period.

4.1 Villa as a structural resource

In line with hypothesis 1a, students that used the villa to prepare their final exams perceived more decision latitude (i.e., more control over their study situation) than non-villa students, but there were no differences on demands. Previous studies showed academic demands to play an important role at the university level (Chambel & Curral, 2005; Sieverding et al., 2013; Schmidt et al., 2015). We, therefore, assumed that the academic pressures associated with exam preparation were challenging for all students in our sample. However, villa use did account for differences in decision latitude suggesting that villa students felt more empowered to master academic challenges. In line with the theoretical assumptions of the DCM, the villa appears to be a structural resource that helps students make their own decisions (e.g., starting to study early in the morning when libraries are still closed). This becomes especially important when high demands make students' individual resources such as health-promoting behaviors less likely to be maintained during exam preparation (e.g., sufficient sleeping or regular physical activity) (Lobinger, 2016).

When shifting the focus to hypothesis 1b, villa students did indeed report lower levels of experienced stress and higher levels of satisfaction than non-villa students. These findings suggest that villa students that perceived higher levels of decision latitude also experience less stress. This is in line with previous work where students that reported higher levels of decision latitude (along with lower demands) were also less stressed during an examination period (Schmidt et al., 2015). Moreover, students that took advantage of the villa environment were more satisfied than students that did not use this structural resource. Meeting students' special needs during exam preparation periods could therefore be a promising way for improving both study conditions and students' wellbeing.

In line with our hypothesis 2a, villa use predicted study-related stress and did so over and beyond demands and decision latitude. Consistent with previous studies, demands were the strongest predictor of students' experienced stress (Chambel & Curral, 2005; Sieverding et al., 2013; Schmidt et al., 2015). Therefore, it was not surprising that stress was also strongly predicted by time to examination and neuroticism. The closer students were to the date of their respective exam campaign, the more stressed they felt. Our results point to the stress-reducing potential of the villa as a structural resource. Even though the additional amount of variance in stress explained by villa use was small, the villa had incremental validity. The villa had the power to assert itself as an important variable even over study demands as a strong predictor. Therefore, the villa environment seems to play a role on how students experience the stressors associated with exam preparation. For the situation of advanced law students, this seems to be especially relevant because previous studies indicated students to suffer from high levels of stress during exam preparation (Busch, 1990; Sanders & Dauner-Lieb, 2013; Giglberger et al., 2022). Our results underline the importance of the villa as a structural resource because of its power to predict stress in the face of prolonged and challenging study periods.

When turning to hypothesis 2b, villa use did not make a significant contribution to explaining study-related satisfaction over the demand-control dimensions. Consistent with previous studies, decision latitude was the strongest predictor of students' experienced satisfaction (Chambel & Curral, 2005; Sieverding et al., 2013). Satisfaction was also strongly predicted by time to examination and neuroticism. That means that students felt more satisfied when there was more time left until they had to face the examination. There are two potential reasons why the villa could not significantly predict satisfaction. First, demands and decision latitude were both strong predictors of students' satisfaction in our study. This is why villa use most likely did not make a surmounting contribution to explaining satisfaction. Second, we assumed decision latitude to be a mediator of the relationship between villa use and study-related satisfaction and stress.

4.2 Decision latitude as a mediator

In line with hypothesis 3a, we did indeed find decision latitude to mediate between villa use and stress. We found an indirect effect of villa use on students' stress over decision latitude. This means that decision latitude explains the relationship between villa use and stress. Turning to hypothesis 3b, we did also find decision latitude to be a mediator of the relationship between villa use and satisfaction. Again, we found an indirect effect of villa use on students' satisfaction over decision latitude. These findings support the role of the villa as a structural resource in impacting stress and satisfaction by increasing decision latitude. The villa constitutes a structural resource because of decision latitude being the crucial component by providing students with more control over their study situation. The villa is a supportive environment that offers different learning opportunities. Students become empowered to take an active role in selecting and organizing learning tasks.

We did not find an indirect effect of villa use on stress and satisfaction via demands. Consistent with our expectations, villa use did not have an effect on students' perceived demands. Again, this indicates the villa to be a structural resource that provides a structure in which students can experience more space and freedom in a literal meaning (Lobinger, 2016). Consistent with what is known in stress research, it is not about the demands but rather about the resources that make the difference for successful coping with a given situation. The villa is a structural resource that has positive effects on students' stress and satisfaction mediated by decision latitude. Our findings are in line with research on setting-based initiatives for stress reduction that showed available study resources to have positive effects on various student outcomes (e.g., Robins et al., 2015; Fernandez et al., 2016).

4.3 Limitations and implications for future research

The present study has some limitations that need to be mentioned. First, our cross-sectional design limits causal conclusions, and future research should follow students over longer periods of time to examine the positive effects of setting-based initiatives. We gathered data using self-reports which should be accompanied by physiological stress assessments

such as cortisol levels in saliva. Furthermore, the sample consisted of advanced law students only which could make it difficult to generalize the results to other groups of students. We only reached nearly 50% of the total sample of law students in their exam preparation. It is possible that students who took part in the study were more interested in the topic and had higher levels of motivation. However, we tried to avoid bias in the effects on the outcomes by including a set of control variables (e.g., neuroticism). Due to limited workspaces available in the exam villa, there also was a large difference in the number of villa students vs. non-villa students. It is important to note, however, that villa students did not significantly differ on any of the control variables compared to non-villa students. Nonetheless, future studies should use randomization to avoid self-selection biases and allocate students to the villa (experimental group) vs. non-villa (control group). An experimental manipulation should include a pre-post design to examine the causal effects of exam villa use. Yet, this would be challenging because this approach would limit students' freedom to decide how they want to study to prepare for their examinations. In turn, students would likely experience less decision latitude which could make exam preparation more stressful and less satisfying. Future research should also consider assessing the actual time of villa use by asking students how many hours per day/week they use their individual workspace. This approach would also create more variance in the villa variable which is likely to have a positive effect on the relationships with the outcomes. Additionally, we only focused on study-related stress and satisfaction as outcomes. Future work should examine whether villa use and the demand-control dimensions can also predict students' achievement. It would be worthwhile to know whether structural resources such as an exam villa can have positive effects on academic grades both in mock examinations within exam preparation and in the final examinations themselves. In this context, it would also be interesting to examine whether the relationship between villa use and grades is mediated by satisfaction. Finally, even though the data on which the study is based date from 2017, we assume that this does not diminish the significance of the results. The examination structure of law studies in Germany has remained unchanged for centuries (Heidebach, 2022).

4.4 Implications for theory and practice

Our study has important theoretical and practical implications for preventing and intervening efforts in higher education contexts. Our study showed that the DCM (Karasek, 1979) can be applied to university students to predict and explain stress. Going beyond previous studies, we were able to apply the model to the situation of students who were in a study phase of prolonged academic stress. Consistent with the DCM, the use of a structural resource appears to have a positive effect on both students' stress experiences and satisfaction and this effect is due to an increased perception of decision latitude. Law students undergoing exam preparation have to deal with high academic demands, but their perceived capacity to influence decisions that affect their everyday learning seems to be an important resource. Decision latitude is exerting an effect that goes beyond demands. This leads us to assume that high levels of decision latitude are more important than high levels of demands for certain work-related contexts such as in exam preparation. In terms of DCM, it is possible that a work situation with a high demand profile does not require exactly the same level of decision latitude, but rather that its level must exceed demands to be experienced as an active work situation. According to the DCM, students who used the villa can be counted to the active job category. In contrast, students who did not have access to the villa can be counted in the high-strain job category. The findings that villa students had lower stress levels and higher levels of satisfaction compared to non-villa students can be seen as a confirmation of the DCM in the university context. Our study goes beyond prior work because it looked at the demand-control dimensions as potential mediators between work-related initiatives and psychological outcomes.

As practical implications, the results suggest to act on structural conditions by increasing decision latitude. Structural resources that are rooted within the study environment are likely to be more profound and sustainable than common individual-based initiatives such as student counseling or stress management seminars. This is because supportive learning environments help students better cope with academic demands as they occur in everyday study situations. Universities would do well to realize concepts like the exam villa to contribute

to a better learning atmosphere. Such study environments bring with them motivational effects that create a common learning spirit and contribute to facilitating supportive action at universities. Once established, concepts like the villa can make students of different cohorts benefit from the same structure over years. This brings with it an important advantage when compared to individual-based initiatives that are usually finite in time and require staff for maintenance (e.g., student counseling services). Universities are advised to not only create supportive initiatives but also spread the word and actively invite students to take part and benefit.

5 Conclusion

Higher education institutions pose unique environments where the setting has a substantial impact for helping students to pursue their studies successfully (Fernandez et al., 2016). This was the first study to show that using an exam villa poses an innovative structural resource during challenging study periods. As a setting-based initiative, advanced law students that used the villa for preparing their final exams experienced less study-related stress and more satisfaction. Decision latitude played a central role for these positive effects to unfold. Structural initiatives such as the villa make up promising learning environments that contribute to the reduction of stress beyond individual-based initiatives.

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Table 1

Descriptive statistics and intercorrelations among the study variables

Variables	*M*	*SD*	Min	Max	*S*	*K*	2	3	4	5	6	7	8	9
1 Age	24.22	2.19	21	42	3.52	23.30	–.12	.00	.12	.06	–.05	.16*	–.16*	.08
2 Time to examination	1.75	0.83	1	4	0.75	–0.42		–.19**	.19**	.16*	.02	–.06	.18**	–.16*
3 Workload	45.93	12.15	10	80	0.04	0.50			–.03	.19**	.10	.10	–.10	.12
4 Neuroticism	3.25	1.03	1	5	–0.16	–0.89				.30***	–.19**	.44***	–.33***	–.13
5 Study demands	3.35	0.45	1.67	4.00	–0.64	0.12					–.32***	.56***	–.47***	–.05
6 Decision latitude	2.41	0.53	1	3.80	–0.11	–0.19						–.39***	.46***	.15*
7 Stress	2.62	0.69	1.17	4.00	–0.04	–0.62							–.70***	–.20**
8 Satisfaction	2.54	0.74	1	4.50	0.26	–.0.35								.15*
9 Villa use	0.40	0.80	0	1	1.47	0.17								—

Notes. S = skewness, *K* = kurtosis. *p < .05, **p < .01, ***p < .001.

Table 2

Results of confirmatory factor analyses (CFA) for demands, decision latitude, study-related stress and satisfaction

Factor loadings and fit statistics	Demands	Decision latitude	Stress	Satisfaction
	β (SE)	β (SE)	β (SE)	β (SE)
Items				
Item 1	.63 (.06)	.53 (.07)	.75 (.04)	.58 (.06)
Item 2	.53 (.07)	.75 (.07)	.59 (.05)	.71 (.05)
Item 3	.74 (.05)	.54 (.07)	.88 (.03)	.80 (.04)
Item 4	.56 (.06)	.42 (.08)	.34 (.07)	.56 (.06)
Item 5	.47 (.07)	.30 (.08)	.58 (.05)	.75 (.04)
Item 6	.64 (.06)	—	.56 (.06)	.51 (.06)
Model fit				
χ^2	7.08	6.05	12.55	12.48
df	8	4	8	7
CFI	1.00	.99	.99	.99
RMSEA	.00	.05	.05	.06
SRMR	.02	.02	.03	.03

Notes. SE = standard error.

Table 3

Structural equation models predicting study-related stress and satisfaction

Predictor variables, explained variance, and fit statistics	Stress			Satisfaction		
	M1	M2	M3	M1	M2	M3
Control variables						
Sex	–.03	–.03	–.03	.02	.07	.07
Age	.07	.04	.05	–.07	–.06	–.06
Time to examination	–.15*	–.21***	–.23***	.31***	.29***	.30***
Workload	.11	–.02	–.01	–.06	–.06	–.06
Neuroticism	.64***	.34***	.33***	–.51***	–.21*	–.21*
Main variables						
Demands		.59***	.59***		–.32**	–.33***
Decision latitude		–.07	–.06		.41***	.40***
Villa use			–.13*			.06
Explained variance	.43	.71	.73	.32	.61	.62
Model fit						
X^2	99.31	365.47	395.12	54.06	273.03	314.50
df	43	205	220	41	202	217
CFI	.896	.866	.856	.977	.941	.922
RMSEA	.080	.062	.062	.039	.041	.047
SRMR	.053	.061	.060	.040	.058	.059

Notes. M1–M3 = models 1–3. df = degrees of freedom, CFI = comparative fit index, RMSEA = root mean square error of approximation, SRMR = standardized root mean square residual. Sex: 0 = female, 1 = male. *p < .05, ** p < .01, *** p < .001.

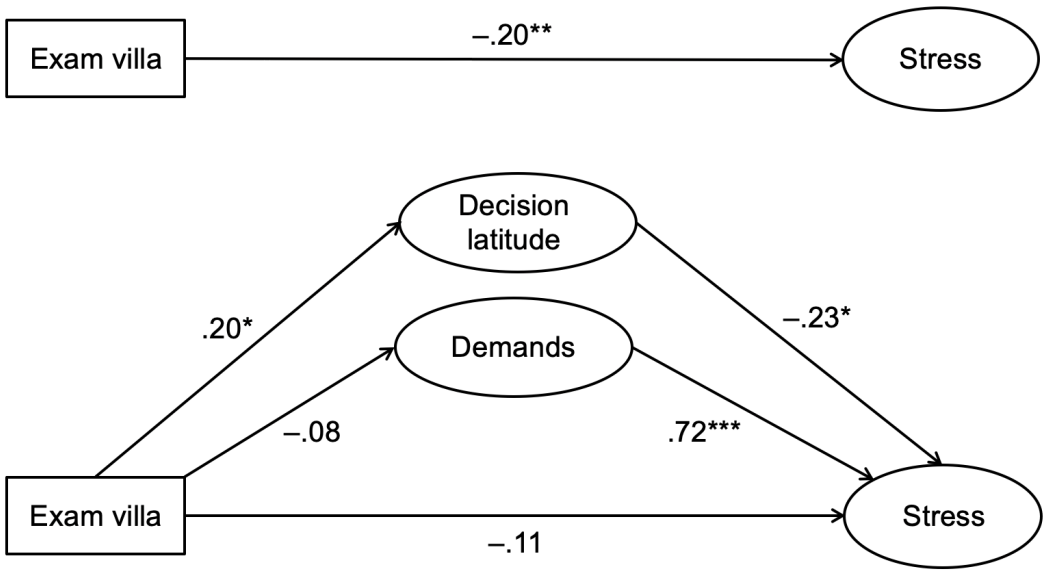

Figure 1A. Basic and mediational model for the relationship between villa use and study-related stress and its direct effects. Demands and decision latitude were included as mediators. Model fit: $\chi^2_{(129,\ N = 205)}$ = 218.68, p < .001, CFI = .911, RMSEA = .058, SRMR = .089.

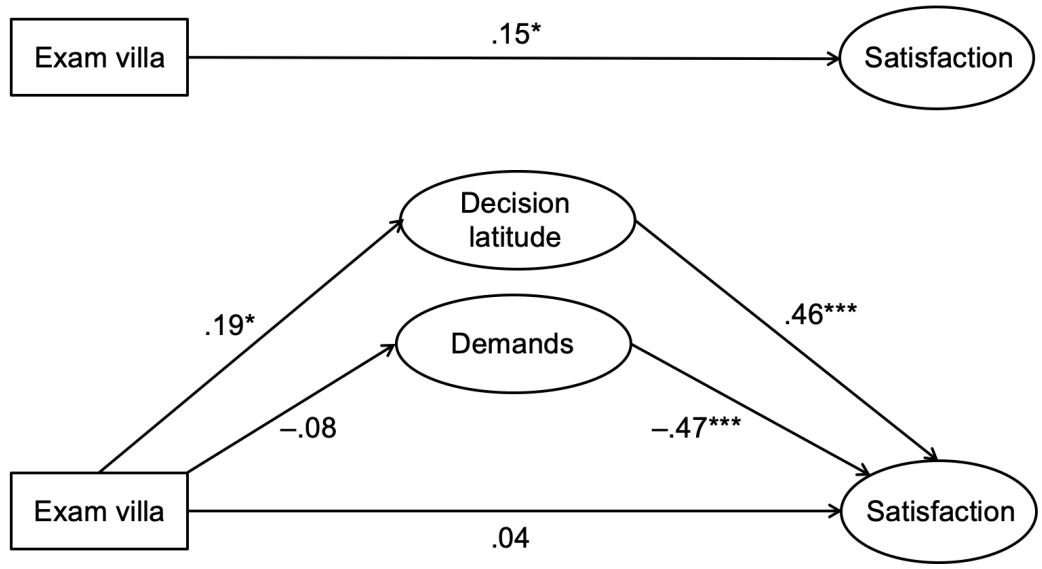

Figure 1B. Basic and mediational model for the relationship between villa use and study-related satisfaction and its direct effects. Demands and decision latitude were included as mediators. Model fit: $\chi^2_{(129,\ N = 205)}$ = 251.38, p < .001, CFI = .884, RMSEA = .068, SRMR = .090.

7.2 Study 2: Short-term effectiveness of a brief psychological intervention on university students' stress and well-being during prolonged exam preparation: results of a randomized controlled trial

Note: The following manuscript is the final version that was published in Cogent Education. However, it is neither supposed to be a copy of the original article nor is it a suitable citation.

Reschke, T., Lobinger, T., & Reschke, K. (2024a). Short-term effectiveness of a brief psychological intervention on university students' stress and well-being during prolonged exam preparation: results of a randomized controlled trial. *Cogent Education, 11,* 2354663.

Abstract

Based on the Transactional Model of Stress and Coping, this study examined the effectiveness of a brief psychological intervention to reduce study-related stress and enhance well-being. Our three-hour intervention taught students psychological strategies to cope with stress specifically tailored to their study situation. Our sample (N = 56) was comprised of advanced law students who were within a 12-to-18-month period of exam preparation. We applied a randomized controlled trial which included an intervention and an active waitlist control group. Students gave self-reports immediately before and after the intervention, as well as at baseline, one, and two weeks later (post and follow-up). Repeated-measure analyses of variance revealed a significant stress reduction right after the intervention but no significant improvement in well-being. Post-measurement showed a reverse pattern in that the intervention significantly enhanced students' well-being but did not reduce their stress. Intervention effects remained stable at follow-up. The waitlist control group also showed lower levels of stress and higher levels of well-being after receiving the intervention. Overall, the brief intervention showed short-term effectiveness, boosting study-related well-being in particular. These results expand previous findings demonstrating the effectiveness of brief interventions during study periods with chronic stress characteristics.

Keywords: brief intervention, academic stress, well-being, university students, exam preparation

1 Introduction

Pursuing a degree in higher education has been shown to be a stressful undertaking for many students, taking a toll on their well-being (Bewick et al., 2010; Evans et al., 2018; Ribeiro et al., 2018; Xiang et al., 2019). Exam periods in particular have been linked to increased stress levels and decreased overall functioning (Ahrberg et al., 2012; Campbell et al., 2018; Lyndon et al., 2014; Zunhammer et al., 2013). Stress results from the subjective discrepancy between external or internal demands and available coping resources in a given situation that is typically perceived as unpredictable and uncontrollable (Lazarus & Folkman, 1984). Well-being results from the subjective cognitive and affective evaluations of a person's life that includes life satisfaction as well as positive and negative affect (Diener, 1984). In the context of exam periods, academic stress can have both acute and chronic characteristics and heavily depend on the time students invest in preparation (i.e., studying for several weeks or months) as well as the relative importance of the final examination (Giglberger et al., 2022; Maydych et al., 2017). There is ample evidence that exam-related stressors associated with state examination formats, such as those in medical school, are experienced as particularly stressful (Duan et al., 2013; Multrus et al., 2017; Peters et al., 2017). State exams require extensive preparation, leading to a prolonged period of academic stress.

In Germany, obtaining a law degree requires an average of ten semesters. The first state exam is comprised of five to eight written exams taken within a two-week period, each exam lasting 5 hours in duration. In addition, students submit to a 90-minute oral exam a few months later. Students must choose from two possible exam dates offered during the academic year. Passing each written exam is considered very demanding since students need to solve a complex legal case within one topical area of law. Notably, exam performance is 70% of each student's final law school grade, and failure rates are at 25-30%, constituting an additional psychological burden. Even though students are permitted a second attempt, there is a high risk of dropout following a failed first attempt (Ernst, 2018; Heublein et al., 2017). If students successfully pass their first attempt, they can use the second attempt to improve their

grade. Either way, the final grade achieved within the first state exam has a substantial impact on career prospects (Towfigh et al., 2018).

Unlike other state examination formats, the German system of legal education entails an unusually long preparation time for the first state examination (Glöckner et al., 2013; Lobinger, 2016). Students typically start their exam preparation after their sixth semester and then take 18 months on average to prepare for their final exams (Busch, 1990; Sanders & Dauner-Lieb, 2013). Exam preparation requires students to review extensive study material and apply legal reasoning through mock exams. To meet their learning objectives, most students cut back on stress-reducing activities that enhance well-being. Exam preparation therefore constitutes a long-lasting and significant stress period, increasing the law student's risk of chronic stress and resulting in negative trajectories for both physiological and psychological health (Giglberger et al., 2022, 2023; Rabkow et al., 2020; Reschke et al., 2023). While acute stress has been found to have positive effects, chronic stress constitutes a risk factor for psychological and physiological well-being and stress-related psychiatric diseases such as depression and anxiety disorders (Chrousos, 2009; Juster et al., 2010; McEwen, 2004).

Psychological interventions have been found to reduce stress and improve well-being among university students. Specific approaches, such as mindfulness, cognitive-behavioral therapy (CBT), and technology-delivered interventions have been shown to be effective in reducing stress and enhancing well-being when compared to passive controls (Amanvermez et al., 2021; Halladay et al., 2019; Harrer et al., 2018; Howell & Passmore, 2019; Winzer et al., 2018). Interventions that focused on CBT, coping skills, psychoeducation, and social support were shown to be effective in reducing stress, (Yusufov et al., 2019) yielding medium effect sizes. Meta-analyses typically distinguish between brief (1–4 weeks), moderate (5–8 weeks), and long-term interventions (8+ weeks) (Amanvermez et al., 2023; Yusufov et al., 2019). However, many studies did not specifically adapt intervention content to the context of the university to meet students' needs (Seidl et al., 2016; Sheehy & Horan, 2004; Yusufov et al., 2019). For example, brief interventions would be especially beneficial for advanced law

students during exam preparation as students typically have limited time outside of their studies (Multrus et al., 2017; Rabkow et al., 2020). However, most interventions require students to participate over several weeks. Overall, there is very little evidence on brief interventions that were designed to address particular study periods such as prolonged exam preparation. Brief stress reduction interventions have been discussed to be more effective when tailored to a particular student group (Amanvermez et al., 2021; Van Daele et al., 2012; Yusufov et al., 2019).

The present study is based on the Transactional Model of Stress and Coping (TSC; Folkman, 2008; Lazarus, 2006; Lazarus & Folkman, 1984). In the context of TSC, stress arises from a complex interaction between the demands of a given situation and the perceived resources for coping, all an internal process of cognitive evaluations. According to Lazarus and colleagues (Lazarus, 1966; Lazarus & Folkman, 1984), a person perceives certain stimuli from the environment (potential stressors) and then makes a cognitive assessment as to whether these should be classified as positive, irrelevant, or stress-related (primary appraisal). If a situation is evaluated as stress-related, that person makes another assessment as to whether the individual resources to deal with the stressful situation are sufficient (secondary appraisal). The stress response is elicited when the person assesses his or her available resources as insufficient for coping with the demanding situation (Lazarus & Folkman, 1984). To resolve this state, the TSC further assumes that two central pathways are available to deal with stress: problem-oriented and emotion-oriented coping. Whereas the problem-focused coping option holds mainly cognitive strategies to deal with the stressful event and aims at managing the source of the problem, the emotion-focused coping option involves emotional strategies to decrease negative feelings and feel better (Folkman, 2008; Lazarus & Folkman, 1984).

This study aimed to examine the positive effects of a brief psychological intervention on students' subjective stress and well-being during prolonged exam preparation. We implemented a three-hour workshop that aimed to reduce stress and enhance well-being based on TSC principles (Lazarus & Folkman, 1984). We expected participating students to

report (a) lower levels of study-related stress and (b) higher levels of study-related well-being after the intervention. We used a randomized controlled trial (RCT) and applied a pre-post design, including an additional follow-up measurement at one-week intervals each. Students were randomized into an intervention group (IG) and an active waitlist control group (CG) to test for intervention effectiveness on a between-subject level. The IG received the intervention between pre and post-measurement, while the CG received it between post and follow-up measurement. In addition, we included immediate measurements right before and after the intervention to test for intervention effectiveness on a within-subject level. Following our expectations, we derived the following research hypotheses:

A) Immediate intervention effectiveness (differences on a within-student level).

   Hypothesis 1: All students who participate in the intervention report lower levels of study-related stress right after the intervention than before it.

   Hypothesis 2: All students who participate in the intervention report higher levels of study-related well-being right after the intervention than before it.

B) Short-term intervention effectiveness (differences on a between-student level):

   Hypothesis 3: IG students report lower levels of study-related stress at post-measurement compared to controls which shows up in a time × group interaction.

   Hypothesis 4: IG students report higher levels of study-related well-being at post-measurement compared to controls which shows up in a time × group interaction.

C) Short-term intervention effectiveness stability (differences on a within-student level):

   Hypothesis 5: IG students report their study-related stress to be stable at follow-up measurement while controls also benefit from the intervention which shows up in a time × group interaction.

   Hypothesis 6: IG students report their study-related well-being to be stable at follow-up measurement while controls also benefit from the intervention which shows up in a time × group interaction.

2 Method

2.1 Sample and procedure

A total *N* = 61 students took part in our intervention study (baseline and post) with *n* = 41 students taking part in all three measurement occasions including follow-up (34% dropout). We excluded five students that reported a major critical life event to have influenced their well-being within the last weeks. Our final sample thus comprised *N* = 56 students (84% female) who were all actively enrolled at one large German university. The mean age was *M* = 23.98 years (*SD* = 2.24). All participants were advanced law students amidst their exam preparation to complete their studies and earn their law degree. Most students were in their 7th semester (*M* = 9.29, *SD* = 2.67, range 6–19) and in their second month of exam preparation (*M* = 8.35, *SD* = 6.13, range 1–24). The average student planned at least 18 months for preparation (*M* = 18.24, *SD* = 4.60, range 10–36) and had approximately ten months until their exam date.

We advertised for intervention participation via the faculty's website, internal mailing lists, and social media. Students could then mail a staff member to express their wish to participate. We defined three inclusion criteria: Students needed to be within their exam preparation period, scheduled for their final exams within the next 18 months, and be willing to take part in the study. Students were randomly assigned to one of the two groups (IG vs. CG) by receiving a random number from the researchers conducting the study. Data was collected over three weeks in late 2017 using short self-report measures. Students were e-mailed links to the corresponding online questionnaires (baseline, post, and follow-up), and informed consent was obtained. A brief questionnaire was handed out right before and after the intervention for immediate assessment.

The intervention was offered in two consecutive weeks. The IG received the intervention between pre and post-measurements (t0 and t1), whereas the CG received it between post and follow-up measurements (t1 and t2). Since the IG received the workshop a week earlier, we wanted to ensure the CG was not left completely untreated. The video shown to the CG was intended to provide students with a certain degree of attention. This was to ensure that the reduction in the experience of stress was due to the actual experimental

manipulation and not to the mere offering of a novel format. Therefore, differences at post-measurement should be attributable to the effect of the actual intervention (experimental manipulation). Control students were sent a twenty-minute video on creative ideas for studying. Two-thirds of the students within the CG reported having watched the short video. A final number of *n* = 26 students representing the IG whereas *n* = 30 were controls. The intervention was standardized in terms of time and place, as well as by the use of an intervention manual. It covered six modules and included a short break. The intervention was facilitated by a male psychologist roughly the same age as participants and with five years of teaching experience. Participants received no financial compensation, and the study design was approved by the local ethics committee.

2.2 Intervention

The intervention was delivered in a three-hour workshop specifically tailored to students undergoing prolonged exam preparation and addressed psychological stress and coping skills. The content of the intervention was built on the results of a previous interview study, and therefore, was adapted to students' psychological needs. Within the three-hour workshop, students were taught six modules to reduce their stress and enhance their well-being during exam preparation. The intervention was divided into two parts with three modules each (time management, effective learning, and functional thinking routines vs. emotion management, relaxation training, and social support). The first part was based on stress prevention with a problem-focused coping orientation. Students learned about helpful ways to act on stressors and appraise situations differently. The second part was based on stress reduction with an emotion-focused coping orientation.

The intervention started with an introduction during which students described their motivation to take part in the workshop. Directly addressing students' current situation, results of a pilot study about stress during prolonged exam preparation were briefly presented (Reschke et al., 2023). Students were then acquainted with stress theory and learned about four different ways of recognizing stress (cognition, emotions, behavior, and body). Lastly,

students were familiarized with the transactional stress theory to better understand how psychological stress occurs.

Part 1: Stress prevention (problem-focused coping)

The time management module (1) covered the importance of circadian rhythms which regulate learning performance such as the ability to concentrate. This module described "brain-friendly" study breaks and ways of dealing with distractions posed by modern media, promoting effective learning. The effective learning module (2) taught strategies to support active problem-solving. Students learned about preconditions for sustainable knowledge acquisition and how to best set goals and priorities. This included ideas about planning buffer times for learning and the importance of exam practice (i.e., taking mock exams to practice legal analysis). The functional thinking routines module (3) was based on cognitive reappraisal and restructuring of stress-reinforcing cognitions. This module discussed certain personified thoughts that many students are confronted with during exam preparation (e.g., the inner critic, the bad conscience, the fear of failure). Students learned to better identify negative thinking and were provided a list of positive reappraisals and self-instructions to use during exam preparation.

Part 2: Stress prevention (emotion-focused coping)

The emotion management module (4) focused on reducing negative feelings and enhancing positive feelings. This module was comprised of different methods from positive psychology and emphasized regular positive activities after studying to create a sense of purpose, self-affirmation, and achievement in leisure (e.g., drawing or cooking). Students practiced enjoyable habits such as slowly eating a piece of chocolate or writing in a happiness journal that was handed out to them. The relaxation training module (5) informed students about the relaxation response as the physiological counterpart to the stress response. This module included a brief motivational video underscoring the important role of regular relaxation exercises in promoting recovery and maintaining balance. Students then practiced a

mindfulness-based breathing relaxation exercise followed by a brief reflection. The very same guided relaxation was later sent to students as an audio track for further use. The final social support module (6) discussed the stress and anxiety-relieving effects of social support. Students learned about recognizing and making use of individual networks (e.g., roommates, friends, parents) and structural networks at university (e.g., fellow students, study groups, professors). This included highlighting the benefits of study groups that foster learning and make exam preparation a team project. Lastly, students watched a set of short motivational videos in which some of their professors talked about their own exam preparation challenges and how they overcame them.

The workshop ended with a wrap-up of the main ideas and a brief reflection on individual experiences. Students got to take different materials home to encourage integration of skills into their daily study routine (summary sheet, list of positive self-instructions, happiness journal, extra chocolate, guided audio relaxation).

2.3 Measures

2.3.1 Study-related stress

We assessed students' perceived stress right before and after the intervention to account for immediate intervention effectiveness. Students were asked to mark their current stress level on a visual analog scale ranging from 0 (*not stressed at all*) to 10 (*completely stressed out*) using one item. This approach is often used to obtain momentary stress assessments in the course of interventions (Heinrichs et al., 2015). To measure short-term intervention effectiveness, we used the Heidelberg Stress Index (*HEI-STRESS*; Schmidt et al., 2018). The HEI-STRESS is a brief measure of subjective stress that relies on one scale with three items that were specifically developed for university students (Schmidt & Obergfell, 2011). The first item asks students to rate their subjective stress ranging from 0 (*not stressed at all*) to 100 (*completely stressed out*). The second item requires students to rate the frequency of general physical tension on a rating scale ranging from 0 (*never*) to 4 (*daily*). The third item asks

students to evaluate the current stress in their lives on a rating scale ranging from 0 (*not stressful at all*) to 4 (*very stressful*). All items were answered with a seven-day time reference. The final score of the scale ranges between 0 and 100 and is computed with the formula (item 1 + (item 2 × 25) + (item 3 × 25)) /3. The HEI-STRESS internal consistencies were satisfactory for all measurement occasions with α = .79 for baseline, α = .85 for post, and α = .79 for follow-up.

2.3.2 Study-related well-being

We also assessed study-related subjective well-being, including the cognitive and affective components that constitute psychological well-being. For lack of a suitable instrument to measure study-related well-being in the higher education context, we comprised study-related well-being from the following instruments.

Life and Study Satisfaction

We measured students' perceived study satisfaction right before and after the intervention. They answered one item on a visual analog scale ranging from 0 (*not satisfied at all*) to 10 (*completely satisfied*). To account for short-term intervention effectiveness, we applied the Satisfaction With Life and Studies Scale (*LSS*; Holm-Hadulla & Hofmann, 2007). This questionnaire originates from the Satisfaction With Life Scale (Diener et al., 1985) and measures the cognitive component of study-related well-being. Developed for higher education settings such as exam preparation, the LSS includes study satisfaction as a subdomain of life satisfaction. Both life and study satisfaction load on a single factor with α = .79 since academic and private life are assumed to be two life domains that are strongly interrelated for students (Holm-Hadulla et al., 2009). The entire scale consists of seven items. The life satisfaction subscale includes four items that focus on students' personal life situation in terms of their perceived performance and functioning as well as their overall life satisfaction (e.g., "How healthy and productive do you currently feel?", "How satisfied are you with your current life?"). The study satisfaction subscale has three items that focus on performance and

situational aspects of studying (e.g., “How satisfied are you with your current academic achievements?”, “How satisfied are you with your current study situation?”). Students based their answers on the last seven days and were presented a rating scale ranging from 1 (*not at all*) to 5 (*very much*) for all items. The internal consistencies were good at all measurement occasions and ranged from α = .82 for baseline and post to α = .84 for the follow-up-measurement.

Positive and Negative Affect

We applied the International Positive and Negative Affect Schedule Short Form (*I-PANAS-SF*; Thompson, 2007) to measure the affective component of study-related well-being. This questionnaire builds on the Positive and Negative Affect Schedule (PANAS; Watson et al., 1988) and was further condensed and refined to fit time-constrained settings such as brief interventions. The shortened PANAS used comprises ten items for both subscales: five items for positive affect (“alert”, “inspired”, “determined”, “attentive”, “active”) and five items for negative affect (“upset”, “hostile”, “ashamed”, “nervous”, “afraid”). Students answered their experiential intensity on all items on a rating scale ranging from 1 (*never*) to 5 (*always*). They did so on a momentary basis right before and after the intervention as well as on a short-term basis with a seven-day time reference. The internal consistencies for each subscale were mostly acceptable at all measurement occasions both ranging from α = .66 to α = .80.

Study-related well-being was calculated as a composite score based on those single instruments (study-related satisfaction plus positive and negative affect). For immediate intervention effectiveness, we added the value of the study satisfaction VAS-item with the respective mean values for the positive and (inverted) negative affect subscales of the PANAS and got an average well-being score. The following formula was used to receive a final score ranging from 1 to 10 [(((VAS-item value) +1) + PA mean value + NA mean value) /2]. This procedure allowed comparability with study-related stress before and after the intervention. For short-term intervention effectiveness, we added the mean value of the Satisfaction With

Life and Studies Scale with the respective PANAS means and calculated the overall mean for study-related well-being. Joint internal consistencies were good at all measurement occasions ranging from α = .82 to α = .88.

2.3.3 Control variables

We assessed three additional variables to control for potential bias. We asked students to provide more information about their current study situation to check for equal groups at baseline measurement. First, we included a brief instrument to test for personality because neuroticism has been shown to affect subjective stress evaluations in students (Austin et al., 2010; Schmidt et al., 2015). We used the Big Five Inventory-10 to assess basic personality traits (*BFI-10*; Rammstedt & John, 2007) and focused on the two-item neuroticism subscale to account for negative affectivity ("I see myself as someone who is relaxed, handles stress well (reverse coded)", "I see myself as someone who gets nervous easily"). Students rated both items on a scale ranging from 1 (*disagree strongly*) to 5 (*agree strongly*). Second, we asked students to report time until examination because we expected them to rate their study-related stress and well-being differently depending on how many months they have left until taking the exam. Studies have shown students report more pronounced stress during examination periods than the proceeding time period (e.g., Zunhammer et al., 2013). In our study, students prepared for one out of three possible exam dates that fell into three categories (*March 2018*, *September 2018*, or *March 2019*). Third, we identified whether students were preparing for the first time (initial attempt) or preparing to improve their grade (second attempt), creating two additional categories.

2.4 Statistical analyses

All data was analyzed using SPSS (version 25). With regard to the RCT, we first tested for group equivalency at baseline using independent *t*-tests for both groups and applied one-tailed tests to examine our hypotheses. We applied two one-way repeated measures analyses of variance (RM-ANOVA) to examine immediate intervention effectiveness for both outcomes

(hypotheses 1 and 2). To examine short-term intervention effectiveness, we applied two-way RM-ANOVAs including both groups (IG vs. CG) and pre vs. post measurement. This approach allowed us to test the effectiveness of the intervention in reducing stress and enhancing well-being by finding a time × group interaction (hypotheses 3 and 4). Moreover, to test for intervention effectiveness stability, we ran two equivalent RM-ANOVAs to check for another time × group interaction. This was done to examine whether students in the IG remained stable on their study-related stress and well-being at follow-up measurement and whether controls also benefited from the intervention (hypotheses 5 and 6).

We performed theory-driven outlier analyses and checked for relevant statistical assumptions such as testing for normality using Shapiro-Wilk tests for both groups and all time points. Missing data was neither replaced nor substituted by imputation methods because missing values were scattered and followed a random pattern. Moreover, group sizes were small and would have introduced bias. We included three control variables as covariates in all analyses to check for potential bias. For interpreting the magnitude of all mean differences, we calculated effect sizes (Cohen's *d*).

3 Results

We first tested for group equivalency at baseline. Independent t-tests for both groups revealed no significant differences neither for study-related stress and well-being nor for the control variables which made randomization successful (see Table 1).

Immediate intervention effectiveness

A total number of n = 53 students gave ratings on their study-related stress and well-being right before and after the intervention. All students (IG and CG) reported higher stress levels before (M = 4.7, SD = 1.92) than after the intervention (M = 2.67, SD = 1.85) with higher levels of well-being afterward (M = 4.11, SD = 1.11) than before (M = 3.79, SD = 1.06). With regard to our first hypothesis, results showed that students' stress levels were significantly lower after the intervention than before the intervention, $F(1, 49) = 4.27$, $p = .044$, $d = 0.50$. All

three control variables had no significant impact on the changes in students' stress levels. This finding supported our first hypothesis and revealed a medium effect size that suggests that the intervention was immediately effective in reducing students' stress levels. Concerning our second hypothesis, results showed a non-significant effect on students' levels of well-being, $F(1, 49) = 3.29$, $p = .076$, $d = 0.41$. All three control variables had no significant impact on the changes in students' levels of well-being. Our second hypothesis was not supported.

Short-term intervention effectiveness

Looking at study-related stress, both IG students ($n = 26$) and CG students ($n = 29$) gave ratings on their study-related stress at baseline and post-measurement. When testing our third hypothesis, results revealed a non-significant interaction effect of time × group, $F(1, 50) = 0.02$, $p = .89$, $d = 0.04$. This finding did not support our third hypothesis because the changes in students' stress levels were not significantly different between groups. Figure 1a depicts that both groups declined in their stress levels from baseline to post-measurement (Baseline: IG $M = 71.55$, $SD = 15.68$, CG $M = 76.91$, $SD = 10.7$; Post: IG $M = 66.56$, $SD = 17.25$, CG $M = 71.33$, $SD = 15.02$). There were no effects of the covariates.

Turning to study-related well-being, $n = 26$ students within the IG and $n = 30$ controls rated their study-related well-being at baseline and post-measurement. Regarding our fourth hypothesis, the time × group interaction was significant, $F(1, 51) = 5.62$, $p = .02$, $d = 0.66$, indicating that the change in well-being levels in the IG was significantly different from the change in the control group. This finding supported our fourth hypothesis indicating the intervention to have increased students' well-being levels with a medium to large effect size. See Figure 1a for a graphical representation. Students of the IG significantly increased their well-being compared to the CG (Baseline: IG $M = 2.92$, $SD = 0.55$, CG $M = 3.04$, $SD = 0.58$; Post: IG $M = 3.13$, $SD = 0.5$, CG $M = 3.01$, $SD = 0.6$). There were no effects of the covariates.

Short-term intervention effectiveness stability

With regard to study-related stress, there were n = 19 students in the IG and n = 22 in the CG that provided ratings at post and follow-up measurement. Results on our fifth hypothesis revealed a non-significant interaction effect of time × group, $F(1, 36) = 1.27$, $p = .27$, $d = 0.36$. All three control variables had no significant impact on the changes in students' stress levels. IG students reported equally high stress levels at post (M = 70.22, SD = 16.23) and follow-up (M = 70.53, SD = 17.02). In contrast, controls reported declining stress levels from post (M = 69.57, SD = 16.40) to follow-up (M = 66.6, SD = 18.76). Even though students participating in the intervention showed stable stress levels compared to controls, the missing time × group interaction did not support our fifth hypothesis. The results are also depicted in Figure 1b. However, follow-up analyses showed a non-significant main effect of time reflecting stress level stability for the IG, $F(1, 15) = 0.68$, $p = .42$, $d = 0.27$.

Turning to study-related well-being, n = 19 students in the IG and n = 22 controls gave ratings at post and follow-up measurement. Regarding our sixth hypothesis, the time × group interaction was significant, $F(1, 36) = 4.67$, $p = .037$, $d = 0.72$, which suggests that the change in well-being levels of IG students was significantly different from the change of controls. IG students reported their well-being to be stable from post (M = 3.12, SD = 0.53) to follow-up (M = 3.17, SD = 0.64). To the contrary, controls reported their well-being levels to have increased from post (M = 2.97, SD = 0.55) to follow-up (M = 3.26, SD = 0.45). This finding supported our sixth hypothesis in that IG students showed stable well-being levels compared to controls. Figure 1b shows a graphical illustration. Once again, there were no effects of the covariates.

4 Discussion

This was the first experimental study to examine the immediate and short-term causal effects of a brief psychological intervention for students undergoing a study period of prolonged academic stress. Given the chronic stress characteristics of exam preparation, we implemented a single session three-hour intervention that taught advanced law students psychological strategies tailored to their study situation. The intervention showed both

immediate and short-term effectiveness revealing a distinct pattern for study-related stress and well-being. In the following, we discuss our results along with the hypotheses, mention limitations, and provide practical recommendations.

4.1 Immediate intervention effectiveness

In line with hypothesis 1, all students (IG and CG) reported being less stressed right after the intervention than at the beginning. This indicates that the intervention was effective in reducing study-related stress levels on an intraindividual level (d = 50). However, contrary to hypothesis 2, students did not report feeling better immediately after the intervention. Despite its positive trend (d = 0.41), the intervention was not effective in improving students' well-being on an immediate time horizon. This is in line with previous work that showed brief psychological interventions to reduce stress levels quite quickly when university students were targeted (e.g., Call et al., 2014; Renshaw & Rock, 2018). Moreover, there is evidence that such interventions have more pronounced positive effects on stress than on subjective well-being (Renshaw & Rock, 2018). It is likely that the positive impact on well-being would unfold over time, and therefore, did not show up within one day in our study. This is also why we looked at short-term effects over the period of one week.

4.2 Short-term intervention effectiveness

Contrary to hypothesis 3, there was no significant time × group interaction for study-related stress after one week. Changes in students' stress levels were not significantly different from each other because both groups (IG and controls) reported being less stressed from baseline to post-measurement. It is unclear to what this nearly parallel decrease in the stress levels of both groups can be attributed. It is rather unlikely that watching the video had a positive effect on reducing the stress levels of CG students. The video was brief at only 20 minutes and covered creative thinking which is of little importance in exam preparation. However, the video may have made students think less about exam-relevant requirements. The study took place during a typical semester when students were in the midst of routine

exam preparation. Two possibilities could potentially explain this effect. On one hand, the offer of a workshop could have been so well-received by students that the very prospect of such an opportunity could have led to a reduction in stress in controls. On the other hand, the intervention may not have had enough strength to reduce stress in IG students and thus produce the desired interaction effect. This would validate earlier findings that have argued law students suffer from persistently high levels of stress during exam preparation (Reschke et al., 2023; Sanders & Dauner-Lieb, 2013). Two recent studies provide evidence that students suffer from chronic stress during exam preparation and results of longitudinal analyses showed blunted alterations in their cortisol release upon awakening (Giglberger et al., 2022, 2023). Therefore, students' stress experiences could have been too pervasive, thus undermining a stronger stress-reducing effect of the intervention. Furthermore, the stress-reducing effect for both groups of students could have occurred because students exchanged ideas after the first workshop, allowing students of the control group to apply some of the strategies taught.

In line with hypothesis 4, however, there was a significant time × group interaction for study-related well-being after seven days. Changes in study-related well-being were significantly different from each other due to intervention participation from baseline to post-measurement, indicating the positive effects of the intervention unfolded over one week. The intervention increased student well-being in the short term with a medium to large effect size (d = 0.66). This is in line with previous studies showing that students' levels of well-being were higher after taking part in psychological interventions that focus on positive emotions, behaviors, and thoughts (Howell & Passmore, 2019, Renshaw & Rock, 2018). Students received advice on how to uphold a good level of subjective well-being during exam preparation. Offering them different ideas on how to reduce negative feelings and enhance positive feelings may have been what students needed.

Taken together, the results on immediate and short-term intervention effectiveness show a reverse pattern. The intervention had an effect on study-related stress but not well-being on an immediate time horizon. In the short term, the intervention had an impact on study-related well-being but not stress. This constitutes an interesting finding as it is possible that

the brief and tailored nature of the intervention made students more satisfied but not less stressed after one week given academic demands remained the same. Despite evidence suggesting the effectiveness of shorter interventions in reducing study-related stress (Breedvelt et al., 2019; Halladay et al., 2019), stress reduction during prolonged exam preparation may require a lengthier (or more comprehensive) psychological intervention.

4.3 Short-term intervention effectiveness stability

In line with hypothesis 5, stress levels of IG students remained stable two weeks after taking part in the intervention. Students reported equal stress levels from post to follow-up measurement. This indicates that the strategies taught in the workshop were helpful and that the intervention had lasting positive effects on students' stress levels. Interestingly, control students also benefitted from the intervention as the stress-reduction effect appeared as well following the workshop. This mirror image pattern of decreasing stress levels provides further evidence that the workshop was successful in addressing relevant issues to reduce study-related stress in the short term. It is possible that the tailored nature of the intervention played a role in this pattern showing up. Previous research has indicated target group-specific adaptation of training content has several advantages (Seidl et al., 2016; Yusufov et al., 2019).

In line with hypothesis 6, well-being levels of IG students also remained stable after two weeks. Students reported equal levels of well-being from post to follow-up measurement. This finding provides support that the intervention may have helped maintain and uphold a certain level of well-being showing that the intervention had lasting positive effects. Again, control students also benefited from the intervention as the enhancing effect for well-being showed once more. This mirror image pattern of increasing well-being levels in controls provides additional support that the workshop was successful in addressing key concerns in improving study-related well-being in the short term, replicating previous studies showing psychological interventions have positive effects on well-being (Conley et al., 2013; Howell & Passmore, 2019; Winzer et al., 2018).

Of note, the stress levels of IG students decreased from t0 to t1 and stayed stable at t2 meaning that stress did not increase after the intervention. Moreover, the results of the follow-up show that both stress and well-being levels of the IG students remained stable over the course of two weeks. Additionally, the intervention effects were visible twice as the control group also benefited from the intervention. This can be interpreted in terms of the goodness of the intervention. Participating students received lots of material to take home, and this could have been a key factor encouraging integration into daily study situations (e.g., happiness journal, guided audio relaxation). It is possible that by participating in the intervention, students felt they were now better equipped to continue with their exam preparation, even in the face of continued academic stress.

4.4 Limitations and further research

Due to the short-term nature of our study, it is not clear whether the intervention effects were sustainable over a longer period of time. Even though our approach intentionally entailed very little participant burden, future research should examine long-term effects (e.g., one month, six months) specifically for students undergoing prolonged exam preparation. In addition, the sample was relatively small, so future studies should validate the effectiveness of the intervention using larger samples. Furthermore, we drew our causal conclusion based on self-reports solely. Future intervention studies should take physiological measures such as salivary cortisol into account. Moreover, we examined advanced law students only which makes it difficult to generalize our findings to other student groups undergoing prolonged academic stress. Therefore, it would be worthwhile to further examine the effectiveness of tailored psychological interventions to reduce stress and enhance well-being.

4.5 Practical implications

Our study has important practical implications for intervention efforts during stressful study periods in higher education contexts. The results suggest that creating brief psychological interventions beyond traditional approaches, which typically take several weeks

for students to complete, can be useful. Due to their short duration, brief interventions require little participant burden and fit into academic structures more easily, better facilitating the transfer of competencies into everyday study life. Moreover, brief interventions like our three-hour workshop are a feasible format that can effectively reduce stress and enhance the well-being of university students. This becomes particularly important when studying is prolonged, such as in months-long exam preparation (e.g., advanced law students preparing for their final exams within the German system of legal education). For these students with chronically high stress levels, brief interventions can play a crucial role in addressing stress-related complaints and help prevent mental illness (Giglberger et al., 2022; Halladay et al., 2019; Rabkow et al., 2020; Van Daele et al., 2012).

The findings of our study also indicate there is value in tailoring stress reduction interventions to the specific context of the student, such as prolonged periods of exam preparation. Study periods such as these place an unusually high academic burden on students that can exceed coping resources and increase stress levels. Providing students with psychological strategies that are more easily integrated into daily study routines increases the likelihood of continued practice and sustained stress reduction. In this context, studies suggest that tailoring interventions toward particular groups and outcomes is promising (Seidl et al., 2016; Yusufov et al., 2019). When establishing psychological support services, universities should consider the unique needs of students undergoing prolonged exam preparation. Tailored interventions would positively impact students' current study situation by reducing study-related stress. In doing so, they also have the potential to enhance study-related well-being.

5 Conclusion

Challenging study periods such as exam preparation lead to prolonged academic stress that negatively affects students' well-being. Prolonged exam preparation holds chronic stress characteristics that call for tailored stress reduction interventions. Our brief psychological intervention helped law students preparing for final exams increase their study-related well-

being and reduce their stress in the short term. There is great potential in providing students with brief and tailored interventions that are both accessible from a time management perspective and easily integrated into their daily lives. By implementing targeted and effective interventions, universities can play a key role in improving the lives of students undergoing stressful study periods.

Data availability

The dataset of this study can be obtained from the corresponding author upon request.

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Declaration of interest statement

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Disclosure statement

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Table 1

Summary of baseline characteristics using independent-samples t-tests with respective means and standard deviations for both groups

Variable	IG	CG		
	M (*SD*)	*M* (*SD*)	*t (df)*	*p*
Sociodemographic				
Age	23.4 (1.29)	24.55 (2.73)	2.12 (41)	.04*
Semester	8.69 (1.41)	9.80 (3.35)	1.65 (40)	.11
Outcome				
Stress	71.55 (15.68)	75.23 (13.95)	0.93 (54)	.36
Well-being	2.92 (0.55)	3.04 (0.58)	0.79 (54)	.43
Control				
Neuroticism	3.62 (0.86)	3.43 (0.97)	0.74 (54)	.47
Time to examination	2.00 (0.63)	2.03 (0.72)	0.19 (54)	.86
Attempt[1]	1.23 (0.43)	1.07 (0.25)	1.71 (39)	.10

Notes. IG = intervention group, CG = control group, *M* = mean, *SD* = standard deviation. [1]Divided by initial vs. improved attempt.

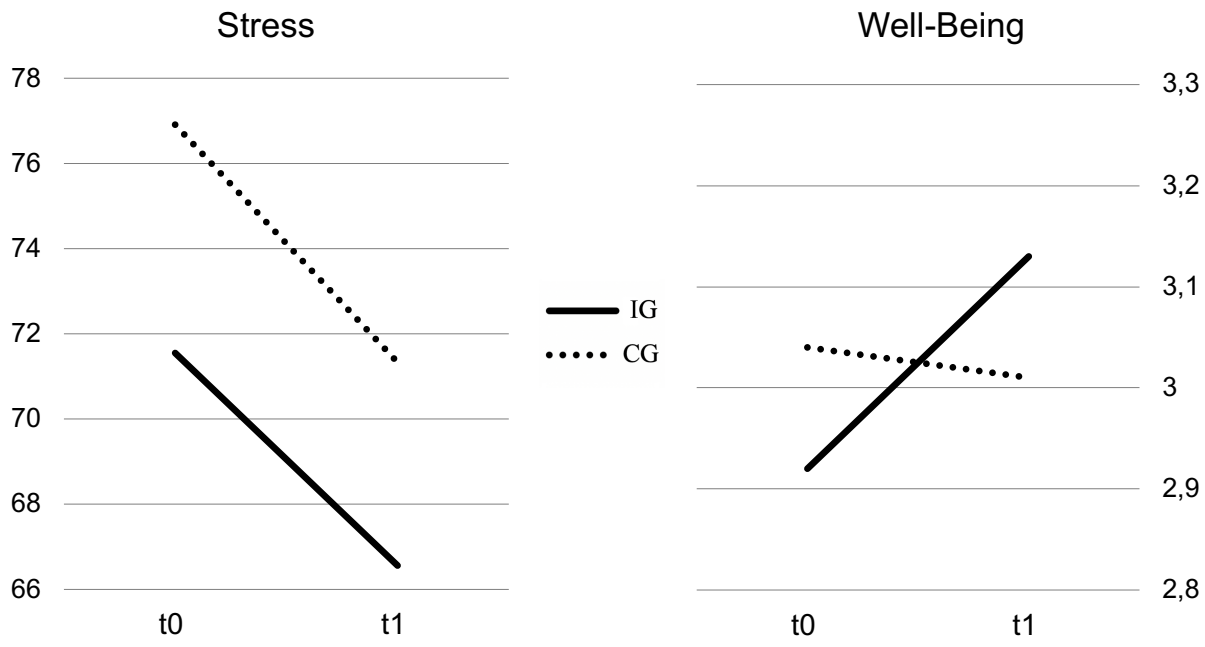

Figure 1a. Short-term effectiveness of the brief psychological intervention for study-related stress and well-being. Lines show students' stress and well-being levels for baseline and post-measurement with respect to the intervention group (IG; *n* = 26; thick line) and control group (CG; *n* = 29; dotted line). The time interval between t0 and t1 is one week.

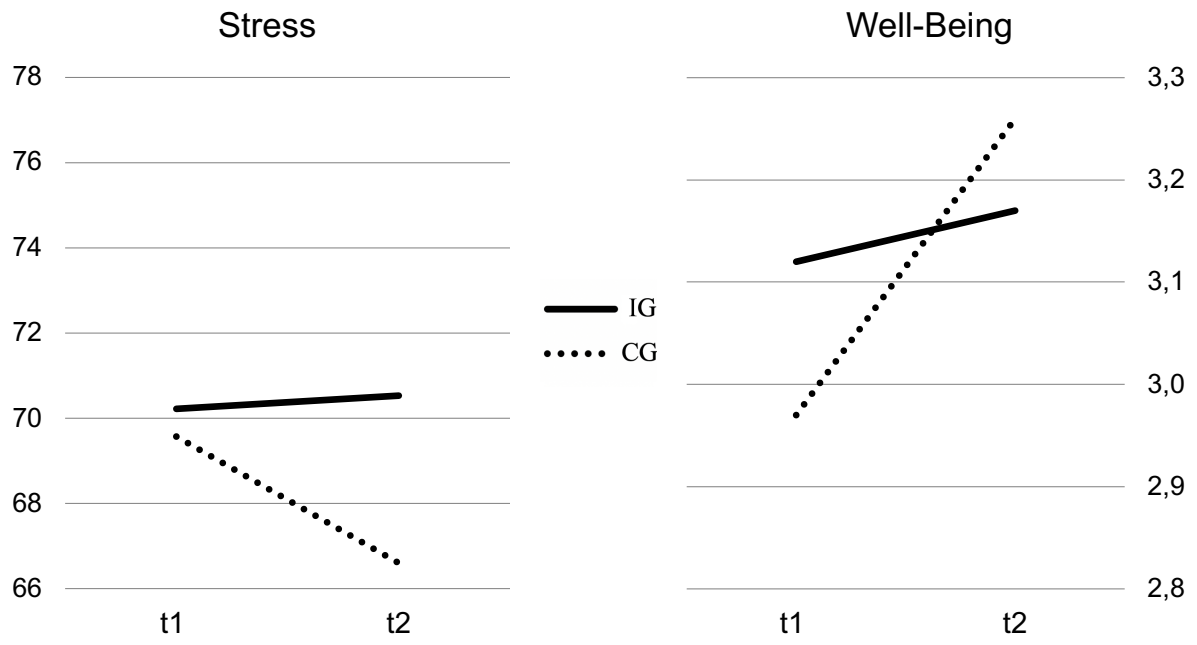

Figure 1b. Short-term effectiveness stability of the brief psychological intervention for study-related stress and well-being. Lines show students' stress and well-being levels for post and follow-up measurement with respect to the intervention group (IG; *n* = 22; thick line) and control group (CG; *n* = 19; dotted line). The time interval between t1 and t2 is one week. CG students received the intervention between t1 and t2.

7.3 Study 3: Examining recovery experiences as a mediator between physical activity and study-related stress and well-being during prolonged exam preparation at university

Note: The following manuscript is the final version that was published in PLOS ONE. However, it is neither supposed to be a copy of the original article nor is it a suitable citation.

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Abstract

Prolonged study periods such as preparing for comprehensive exams pose a significant source of chronic stress for university students. According to the Conservation of Resources Theory, the replenishment of resources during leisure time is essential to a successful stress recovery process. This study examined the role of recovery experiences as a mediator of the relationship between physical activity as one specific recovery activity and both study-related stress and well-being. We applied a longitudinal design and approached students on three measurement occasions over seven months. The sample consisted of *N* = 56 advanced law students enrolled at one large German university who were all in their exam preparation to take their final exams. Students gave self-reports on their respective levels of physical activity (predictor), and recovery experiences (mediator), as well as on their study-related stress and well-being (outcomes). Results showed a negative trend in recovery-related variables and the outcomes as exam preparation progressed. There were mostly small correlations between physical activity and both stress and well-being at each measurement occasion. Recovery experiences partially mediated the relationship between physical activity and the outcomes on some measurement occasions. Our results suggest that the positive effects of recovery experiences related to physical activity become more sustained as exam preparation progresses and have a particularly positive impact on well-being. Future research can build on these findings by further examining recovery as an important means to help students better cope with long-lasting and stressful study periods.

Keywords: academic stress, recovery, well-being, university students, exam preparation

1 Introduction

Navigating through university life requires students to overcome various challenges and taking academic examinations has been shown to be one of the most important stressors (Koudela-Hamila et al., 2022; Lyndon et al., 2014). During exam periods, students not only report elevated levels of stress (Giglberger et al., 2022; Peter et al., 2022) and reduced levels of well-being (e.g., Koudela-Hamila et al., 2022), but also engage in less health-related behaviors such as reduced physical activity (Oaten & Cheng, 2005; Stults-Kolehmainen & Sinha, 2014). Study-related stress during exam periods can have both acute and chronic characteristics and relies on invested time for preparation (e.g., several weeks vs. months) and the relative importance of the exam and its grading. Many studies have argued that students are confronted with more pronounced academic stressors in state examination formats such as in medical school (Multrus et al., 2017; Peters et al., 2017). This is because state exams typically require students to prepare extensive study material over several weeks and even months.

The German system of legal education at university-level is a particular example of a state examination format that requires students to undergo a long preparation time to finish their formal studies and pass their first state examination (Glöckner et al., 2013; Lobinger, 2016). Exam preparation takes about 18 months for most students and it is necessary to study an extensive amount of material and to take mock exams to practice solving legal cases. Most students reduce their participation in stress-relieving activities that have the potential to improve well-being (i.e., physical activity) to accomplish their academic objectives. Therefore, exam preparation constitutes an intense study period that increases the likelihood of chronic stress which has been linked to adverse psychological and physical health outcomes (Giglberger et al., 2022; Reschke et al., 2023). Although acute stress has positive effects such as providing individuals with energy to master academic challenges, chronic stress affects academic performance (Bruffaerts et al., 2018) and is directly linked to mental health problems in students (Auerbach et al., 2018; Beiter et al., 2015; Karyotaki et al., 2020). For example,

chronic stress has repeatedly been shown to be a risk factor for developing depression and anxiety disorders (Agorastos & Chrousos, 2021; D'Alessio et al., 2020).

In a recent work, Giglberger et al. (2022) conducted a multi-method longitudinal study and followed 452 advanced law students over a 13-month period of their exam preparation. This exam group was studied along with a control group of students that did not start with their exam preparation. Over time, there was a significant difference in perceived stress levels between both groups with exam students showing a continuous increase until the exam whereas controls were stable in their stress levels. For exam students, this pattern could also be observed for symptoms of anxiety and depression as well as several facets of perceived chronic stress. Those results were also underpinned by psychobiological markers. The study concluded exam preparation poses a significant source of stress for students both on a psychological and physiological level but remained unrevealing about practical implications (Giglberger et al., 2022). However, chronically elevated stress levels and the deterioration of overall functioning call for stress recovery to avoid serious health problems.

1.1 Theoretical overview of recovery research

Stress is defined as the subjective discrepancy between external or internal demands and available coping resources in a given situation that an individual usually perceives as unpredictable and uncontrollable (Lazarus & Folkman, 1984). Well-being includes two components: subjective cognitive evaluations of a person's life and important domains (satisfaction) as well as affective states (positive and negative affect) (Diener, 1984). Continuous and prolonged exposure to stressors makes recovery an important counterpart to feeling stressed and not well. Lack of recovery after stressful periods has been identified as a key factor in explaining stress-related health problems in occupational contexts (e.g., Steed et al., 2021; Sonnentag et al., 2017). Recovery describes the unwinding and restoration processes that lead a person's stress level to return to pre-stressor levels if it has previously increased in response to a particular demand (Sonnentag et al., 2017). Importantly, recovery

is an everyday phenomenon that can be initiated and experienced during various occasions such as work breaks and during leisure time (e.g., free evenings or weekends).

The Conservation of Resources Theory (COR; Hobfoll, 1989, 2002) is one of the predominant theoretical approaches for understanding the recovery process. Within this framework, work is assumed to be effortful, resources are depleted to meet demands, and the process of recovery is required to replenish these resources. Therefore, time spent with recovery activities and experiencing recovery as such should help individuals restore resources. COR theory regards resources to play a key role in stress and recovery processes since resources are valuable means helping us to achieve goals which makes it important to protect and conserve them while threats to these resources or even loss can lead to stress-related outcomes (Halbesleben et al., 2014; Hobfoll, 1989, 2002). According to COR theory, resources may be restored by investing additional resources such as engaging in certain activities to initiate and sustain the recovery process. To explore what promotes recovery, researchers have identified two distinct factors that are closely related to each other: recovery activities and recovery experiences. Both are considered the two driving mechanisms of recovery.

1.2 The role of recovery activities

Recovery activities (or behaviors) refer to what individuals do during work breaks or leisure time. In line with COR theory, certain activities such as exercising or meeting friends are not only assumed to provide resources and promote recovery rebuilding resources, but to help diminish the physiological stress response (i.e., resource-providing activities) (Ragsdale et al., 2011). For example, resource-providing recovery activities such as physical exercise and social activities have been shown to be positively associated with well-being and feelings of recovery (see recent review by Sonnentag et al., 2022). To achieve recovery from work, sport and exercise belong to the most effective recovery activities (Sonnentag et al., 2022). Many studies have established a significant link between physical activity and both physical health (e.g., cardiovascular diseases, diabetes, sleep) and psychological health (e.g., well-

being, stress, psychopathological symptoms) in work-related contexts (Calderwood et al., 2021; Marquez et al., 2020).

For the situation of university students, empirical evidence is less elaborated but paints a similarly positive picture in favor of physical activity. Studies have underlined the moderately positive association between physical exercise and mental health outcomes (Molina-García et al., 2011; Skead & Rogers, 2016; Tyson et al., 2010). Final examinations have also received attention from a few researchers to determine the relationship between study-related stress and students' levels of physical activity. Two studies examined students both at the beginning of a semester and during an exam period and also included a control group that was assessed at the end of the semester without taking final exams (Oaten & Cheng, 2005; Steptoe et al., 1996). While both studies found reductions in the duration of physical activity compared to controls, Oaten and Cheng (2005) also discovered reductions in exercise frequency. Griffin et al. (1993) demonstrated that those students who experienced higher study-related demands during stressful exam periods were also less likely to engage in physical activity. There is a lack of empirical findings on prolonged study periods such as exam preparation that lasts over several months and puts students at risk for developing stress-related health problems.

1.3 The role of recovery experiences

Recovery experiences refer to what individuals perceive during and after recovery activities and have been divided into four core psychological states: psychological detachment from work, relaxation, mastery, and control (Sonnentag & Fritz, 2007). Psychological detachment can be understood as an individual's experience of being mentally disconnected from work during free time. Relaxation refers to the experience of low sympathetic activation that can occur when engaging in calming activities during leisure time. Mastery goes along with an individual's experience of being challenged outside the work context which can occur when participating in activities that promote learning and personal growth. Control refers to an individual's need for self-determination during free time such as choosing certain activities on one's own terms. All four psychological states form a combined concept of recovery

experiences and have been found to show low to moderate positive intercorrelations (Ragsdale & Beehr, 2016; Sonnentag & Fritz, 2007). Studies have provided ample evidence that all four recovery experiences are negatively related to stress-related health complaints, exhaustion, and depression and positively related to psychological and psychosomatic well-being as well as performance (e.g., Sonnentag & Fritz, 2007; Steed et al., 2021).

Recovery is considered a key mechanism by which individuals can enhance their overall well-being with recovery being equally related to psychosomatic outcomes and psychological outcomes (Steed et al., 2021). For example, recovering from work has been shown to have significant positive effects on mind and body, as shown by the links with sleep and state positive and negative affect (short-term) as well as with life satisfaction (long-term effects) (Steed et al., 2021). Importantly, however, psychological recovery has mostly been studied in samples from the workplace. There is good reason to presume that the same recovery mechanisms apply to other populations such as students in an academic context as well. University students face similar stressors to those experienced at work and academic stress can be compared to occupational stress in many respects.

1.4 Recovery experiences as mediators

It is reasonable to assume that recovery activities have positive effects on health-related outcomes by acting as necessary precursors to recovery experiences. Recovery experiences can be seen as the actual mechanism that contribute to the restoration of resources. In line with COR theory, recovery experiences transmit the effects of leisure activities into resource replenishment (Hobfoll, 1989). Recovery activities such as physical exercise should lead to positive experiences that facilitate improvement in resources because they provide protection by preventing resource loss or creating possibilities for resource replenishment (Halbesleben et al., 2014; Hobfoll, 1989). For the situation of students, participating in recovery activities to help experience recovery more frequently should lead to reduced stress as well as enhanced well-being. This association could be explained by the mediating effect of recovery experiences being involved in and resulting from these activities.

However, this mediating effect has rarely been investigated by previous studies that based their analyses on student samples.

There is one particular study that examined the link between recovery activities and recovery experiences as well as associated outcomes in university students. Ragsdale et al. (2011) tested the importance of recovery experiences in the relationship between recovery activities and stress recovery during an exam period using a sample of 221 undergraduate students at an American university. The authors examined whether recovery experiences pose the mediating mechanism between recovery activities and certain stress outcomes over a weekend (i.e., need for recovery and psychological strain). Recovery experiences were found to fully mediate the relationship between recovery activities and recovery quality. Ragsdale et al. (2011) argued that engaging in resource-providing recovery activities poses a promising way to not only experience recovery, but also to reduce academic stress. In this study, however, recovery in students was only examined over a very short period of time. It would have been valuable to examine the role of recovery activities and recovery experiences over the course of several weeks or even months.

Overall, empirical findings are insufficient with regards to stress recovery in university students over longer periods of time. Exam preparation poses a particularly stressful study period for advanced law students that usually lasts more than one year (Giglberger et al., 2022; Reschke et al., 2023). In this context, it would be desirable to better understand what might help students to reduce stress and enhance well-being over the course of exam preparation.

1.5 Rationale of the present study

The purpose of this study was to examine whether physical activity as a specific recovery activity would constitute a meaningful resource-providing activity for students during prolonged exam preparation. Being confronted with high academic demands during exam preparation that threaten students' energetic and emotional resources, students are in need to restore those resources. In line with COR theory (Hobfoll, 1989), we expected physical activity to have a stress-buffering potential that protects against loss of personal resources while facilitating

resource gain. We therefore assumed that it would be beneficial when students invest additional resources (i.e., time for resource-providing activities) to help replenish the resources needed for recovery. We chose students' level of physical activity (i.e., reported hours spent with exercising per week) to be this resource-providing activity. Physical activity should help students (re)gain resources to facilitate stress recovery and have positive effects on their experienced stress and well-being at several measurement occasions.

The main goal of our study was to determine the extent to which recovery experiences mediate the relationship between physical activity (predictor) and stress as well as well-being (outcomes) over the course of prolonged exam preparation. We are not aware of any existing empirical studies that have examined the potential of physical activity and the role of recovery during prolonged periods of academic stress such as exam preparation. We deemed physical activity as one specific recovery activity to be a promising approach to help students better cope with academic strains during this stressful study period. Also, we thought physical activity to become more important for stress recovery over the course of exam preparation. On the basis of the literature and our expectations mentioned above, we derived two sets of directionally formulated hypotheses:

(1) First set of hypotheses for study-related stress as outcome:
    a. Students' recovery experiences mediate the negative association between physical activity and study-related stress at t1.
    b. Students' recovery experiences mediate the negative association between physical activity and study-related stress at t2.
    c. Students' recovery experiences mediate the negative association between physical activity and study-related stress at t3.

(2) Second set of hypotheses for study-related well-being as outcome:
    a. Students' recovery experiences mediate the positive association between physical activity and study-related well-being at t1.
    b. Students' recovery experiences mediate the positive association between physical activity and study-related well-being at t2.

c. Students' recovery experiences mediate the positive association between physical activity and study-related well-being at t3.

2 Method

2.1 Sample and procedure

Our study comprised *N* = 56 participants (64% female) who were physically and mentally healthy. All subjects were advanced law students enrolled for at least six semesters and amidst their exam preparation to finish their law studies at one large German university. Most students were 22 years old (*M* = 22.88, *SD* = 1.54), in their 7th semester (*M* = 7.57, *SD* = 0.95, range 6–11), and in their third month of exam preparation (*M* = 8.35, *SD* = 6.13, range 1–24). The average student planned at least 18 months for exam preparation (*M* = 15.27, *SD* = 3.08, range 10–18) and had about 13 months distance to taking their exams when the study began. About 90% of students were therefore at the beginning of their exam preparation. The typical period for exam preparation ranges anywhere between 12 and 24 months.

All students went through the longitudinal design of the study which entailed three measurement occasions over seven months (June 2018, November 2018, January 2019). Students needed to actively prepare for their final exams, take them within the next 18 months, and be motivated to participate across all measurement occasions to fit the inclusion criteria. We invited students to participate by advertising via the faculty's website, internal mailing lists, and social media. Data was collected in standardized terms by using the same paper-and-pencil questionnaire including the same measures each time. The time to complete one survey took about 20 min and informed consent was obtained. Students received a small financial compensation after the third measurement occasion. The entire study design was supervised and approved by the local ethics committee.

2.2 Measures

2.2.1 Study-related stress

We measured students' levels of perceived stress as one of our primary outcomes by applying the Heidelberg Stress Index (*HEI-STRESS*; Schmidt et al., 2018). The HEI-STRESS is a brief scale that contains only three items to measure study-related stress and was specifically developed for the university context. For the first item, students rate their subjective stress on a scale of 0 (*not at all stressed*) to 100 (*completely stressed out*). Students then evaluated the frequency of general physical tension on a rating scale ranging from 0 (*never*) to 4 (*daily*). For the last item, students rate their level of stress in their life right now on a scale from 0 (*not at all stressful*) to 4 (*very stressful*). Students needed to answer with a two-week time reference. The final score of the brief stress scale ranges from 0 to 100 and is computed using the following formula (item 1 + (item 2 × 25) + (item 3 × 25)) /3. The internal consistencies were good at all measurement occasions (α = .82–.87).

2.2.2 Study-related well-being

We assessed students' levels of subjective well-being as the other primary outcome besides stress. Again, we strived to apply an instrument that would fit the university context by measuring study-related well-being. For lack of an existing instrument and based on good experience from a previous study (Reschke et al., 2023), we composed study-related well-being out of the following instruments considering both its cognitive and affective components.

Life and Study Satisfaction

We measured students' perceived study satisfaction using the Satisfaction With Life and Studies Scale (*LSS*; Holm-Hadulla & Hofmann, 2007). This questionnaire assessed the cognitive component of study-related well-being and is based on the Satisfaction With Life Scale (Diener et al., 1985). The LSS was specifically developed for higher education settings and therefore includes study satisfaction as a subdomain of life satisfaction. Since students' academic and personal lives are two life domains that are thought to be closely related, both

life and study satisfaction load on a single factor with α =.79. (Holm-Hadulla et al., 2009). Seven items make up the full scale with four items for life and three items for study satisfaction. For the life satisfaction subscale, students evaluated their individual living circumstances in terms of their reported functioning and performance as well as their general level of life satisfaction (e.g., “How healthy and productive do you currently feel?”, “How satisfied are you with your current life?”). For the study satisfaction subscale, students were asked to rate their performance and situational aspects of studying (e.g., “How satisfied are you with your current academic achievements?”, “How satisfied are you with your current study situation?”). Students gave ratings for the last seven days on a rating scale ranging from 1 (*not at all*) to 5 (*very much*). The internal consistencies were satisfactory to good at all measurement occasions (α = .77–.84).

Positive and Negative Affect

We measured students’ affect using the International Positive and Negative Affect Schedule Short Form (*I-PANAS-SF*; Thompson, 2007). This questionnaire assessed the affective component of study-related well-being built on the Positive and Negative Affect Schedule (PANAS; Watson et al., 1988). The shortened PANAS comprised ten items for both subscales: five items for positive affect (“alert”, “inspired”, “determined”, “attentive”, “active”) and five items for negative affect (“upset”, “hostile”, “ashamed”, “nervous”, “afraid”). Students were asked to give ratings on their experienced affective intensity for the last seven days on a rating scale ranging from 1 (*never*) to 5 (*always*). The internal consistencies for the combined scale of positive and negative affect (inverted) were mostly acceptable at all measurement occasions (α = .65–.80).

To get a composite score for study-related well-being, we integrated both instruments that assessed study-related satisfaction as well as positive and negative affect. We calculated an overall mean by combining the means of the LSS and the I-PANAS-SF (all items for negative affect were inverted) into one measure for study-related well-being. Joint internal consistencies were good at all measurement occasions (α = .81–.89).

2.2.3 Recovery experiences

We assessed students' recovery experiences with the Recovery Experiences Questionnaire (*REQ*; Sonnentag & Fritz, 2007). The REQ measures the ability to recover from work-related demands during leisure (i.e., students' ability to unwind and recuperate from exam preparation). It contains four scales: psychological detachment (e.g., "I forget about work"), relaxation (e.g., "I use the time to relax"), mastery (e.g., "I seek out intellectual challenges"), and control (e.g., "I decide my own schedule"). We calculated the sum score of all 16 items to get a picture of students' subjective recovery status at each measurement occasion. Students evaluated their recovery experiences on a rating scale ranging from 1 (*strongly disagree*) to 5 (*strongly agree*). The internal consistencies were acceptable at all measurement occasions (α = .77–.78).

2.2.4 Recovery activities

We focused on students' level of physical activity and exercise as a central recovery activity from academic coursework during exam preparation. Physical activity has repeatedly been reported to be a particularly important activity for psychological recovery in work-related contexts (Sonnentag et al., 2022) and has been shown to be very effective in improving well-being (Calderwood et al., 2021). Due to their high academic workload, we assumed that these effects would be transferable to students in exam preparation. We measured students' current level of physical activity by simply asking them to think of the last month and report the average hours spent with exercising per week at each measurement occasion.

2.4 Statistical analyses

Data were analyzed using SPSS (version 28). We used the PROCESS macro by Hayes (2013) to test the mediation hypotheses, namely whether the relationship between physical activity and study-related stress as well as study-related well-being is mediated by recovery experiences. For each measurement occasion (t1–t3), we first computed basic models in which a direct effect of physical activity on the criterion (study-related stress or well-being) was

calculated. Subsequently, two mediation models were calculated for each measurement occasion in which an indirect effect of physical activity over recovery experiences on both outcomes with respect to the respective criterion. One mediation model postulates an effect of physical activity (exogenous variable) on recovery experiences (mediator) as well as effects of the exogenous variable and the mediator on stress (criterion). The other mediation model includes an effect of physical activity (exogenous variable) on recovery experiences (mediator) as well as effects of the exogenous variable and the mediator on well-being (criterion). We computed confidence intervals (95%) to examine the significance of an indirect effect within the mediation models. Each mediator was tested using the bootstrap method in the PROCESS tool with 1000 drawn samples. Mediation occurred when indirect effects significantly differed from zero in that the confidence intervals did not contain zero. Based on directionally formulated hypotheses, we applied one-sided testing.

3 Results

3.1 Descriptive statistics and intercorrelations

Means (*M*), standard deviations (*SD*) of all variables across the three measurement occasions are presented in Table 1. Students reported to do sports and exercise about *M* = 3.54 hours a week at t1 (*SD* = 2.31, range 0–14). This level of physical activity showed a further reduction from t2 (*M* = 3.43, *SD* = 2.06, range 0–9) to t3 (*M* = 3.02, *SD* = 2, range 0–10). Students spent less and less time engaging in recovery activities such as physical activity. This downward trend over the course of exam preparation is also reflected in the other variables. For recovery experiences, students reported an initial mean of *M* = 3.44 (*SD* = 0.45) at t1 which further declined from t2 (*M* = 3.23, *SD* = 0.47) to t3 (*M* = 3.18, *SD* = 0.45). Students reported their experienced recovery to decrease over time. There was a similar longitudinal development for both outcomes with some stabilization to be observed from t2 to t3. Moreover, students reported study-related well-being to decrease over time (SWB t1: *M* = 3.30, *SD* = 0.5) (SWB t2: *M* = 3.12, *SD* = 0.6) (SWB t3: *M* = 3.13, *SD* = 0.61). Vice versa, students reported study-related stress to increase across measurement occasions (SST t1: *M* = 67.15, *SD* =

15.7) (SST t2: *M* = 75.85, *SD* = 15.7) (SST t3: *M* = 75.11, *SD* = 14.89). See Table 1 for an overview on the descriptive results.

When looking at the intercorrelations between variables within each measurement occasion, there were some significant relationships among physical activity as one specific recovery activity, recovery experiences, and study-related stress and well-being as outcomes (see Table 2). Starting at t1, physical activity was correlated with well-being (r = .31, p < .05) but neither with recovery experiences nor stress. Also, recovery experiences were associated with well-being (r = .33, p < .01) but not with stress. At t2, physical activity was related with stress (r = –.37, p < .01) but did not correlate with well-being or recovery experiences. Moreover, recovery experiences were correlated with stress (r = –.31, p < .05) and well-being (r = .50, p < .001). At t3, physical activity was associated with stress (r = –.36, p < .01) and well-being (r = .35, p < .05) but not with recovery experiences. Furthermore, recovery experiences were associated with stress (r = –.46, p < .001) and well-being (r = .57, p < .001).

3.2 Mediation models

Our first set of hypotheses examined study-related stress as an outcome across all measurement occasions (t1–t3) (see Table 3 for results). Hypotheses 1a-c postulated that recovery experiences would partially mediate the relationship between physical activity and study-related stress at t1–t3, respectively. In the first step, we computed a basic model in which physical activity predicted stress for all three measurement occasions. In the second step, we included recovery experiences as a mediator of the association between physical activity and stress. The results did not support our hypotheses 1a and 1b because there was no significant correlation between both recovery experiences and physical activity at t1 and physical activity and recovery experiences at t2. For this reason, no indirect effects from physical activity on stress were evident. These findings should be interpreted carefully due to the small sample size that renders even more pronounced changes in coefficients insignificant. However, the results did support our third hypothesis 1c in that recovery experiences partially mediated the relationship between physical activity and stress at t3. In this third model there was a significant

indirect effect from physical activity on stress. Recovery experiences explained 33% of this relationship between physical activity and study-related stress as students progressed in time over their exam preparation. Figure 1a provides a graphical illustration of the statistical models with recovery experiences included as a mediator of this relationship at t3.

The second set of hypotheses looked at study-related well-being as an outcome across all measurement occasions (t1–t3) (see Table 4 for results). Hypotheses 2a-c postulated that recovery experiences would partially mediate the relationship between physical activity and study-related well-being at t1–t3, respectively. Again, we first computed a basic model in which physical activity predicted well-being. In the second step, we included recovery experiences as a mediator of the association between physical activity and well-being. The results of mediation analysis did support hypothesis 2a in that recovery experiences partially mediated the relationship between physical activity and well-being at t1. This was confirmed by a significant indirect effect from physical activity on well-being. We found no support for hypothesis 2b when students had already advanced in their exam preparation at t2. There was no significant indirect effect from physical activity on well-being. Again, this finding should be interpreted with caution as to the small sample size. Nevertheless, results did provide support for hypothesis 2c because recovery experiences did partially mediate the relationship between physical activity and well-being at t3. This was also confirmed by a significant indirect effect from physical activity on well-being. The amount of variance explained by recovery experiences was 37% as students got further along with their exam preparation. Figure 1b shows a visual representation of the statistical models with recovery experiences included as a mediator of the aforementioned relationship at t3.

4 Discussion

The main purpose of this study was to determine the extent to which recovery experiences mediate the relationship between physical activity and study-related stress as well as well-being. Given the chronic stress characteristics of prolonged exam preparation (Giglberger et al., 2022), we examined whether physical activity as a specific recovery activity

would constitute a meaningful resource-providing activity for advanced law students. We hypothesized that spending time on recovery activities with physical activity in particular results in reduced study-related stress levels and increased levels of well-being. We found partial support that this recovery process occurs through the mediating effect of recovery experiences and resource replenishment. This was in line with COR theory (Hobfoll, 1989, 2002) because students could invest additional resources (i.e., time to be physically active) to help replenish the resources needed for recovery in order to reduce stress and enhance well-being. Over the course of all three measurement occasions and in line with previous research (Giglberger et al., 2022), we saw a negative trend in all measures especially in recovery activity and recovery experiences. Students declined in their time spent with physical exercise and their experiences to feel recovered. There was a similar longitudinal pattern for study-related stress and well-being as outcomes. With regard to our mediation models, we found inconsistent results with recovery experiences being a mediator of the association between physical activity and stress as well as well-being at the respective measurement occasion.

4.1 Recovery experiences as a mediator of the relationship between physical activity and study-related stress

Our analyses revealed mixed results for recovery experiences mediating the negative association between physical activity and study-related stress across all three measurement occasions. Contrary to our first hypothesis (t1), mediation did not occur. We did not find a significant negative relationship between physical activity and stress, nor between recovery experiences and stress. The same was seen with regard to our second hypothesis (t2). Both physical activity and stress as well as recovery experiences and stress were negatively associated, but physical activity was unrelated to recovery experiences as students progressed with their exam preparation resulting in no mediation. However, in line with our third hypothesis (t3), we found a partial mediation effect for recovery experiences explaining the association between physical activity and stress with recovery experiences showing a much more pronounced effect on stress than physical activity. These findings suggest that

recovery experiences play an important role in students' stress experience at later stages of their exam preparation. Recovery experiences showed stronger associations with stress across measurement occasions as reflected by the increasing magnitude of correlations. Moreover, the amount of variance explained by the statistical models that considered recovery experiences as a mediator kept increasing at each measurement occasion and was most pronounced at t3. However, it should also be noted at this point that we were only able to find comparatively low standard deviations for recovery experiences across all three measurement occasions. This could be a reason for weak correlations between the variables. Likewise, this could explain why we could only find a significant mediation effect of recovery experiences at t3, but not at t1 and t2.

It is somewhat surprising that physical activity was not correlated with stress at t1 because several studies have underlined the moderately positive association between exercising and mental health outcomes for work-related contexts (Calderwood et al., 2021) as well as academic settings (Skead & Rogers, 2016; Tyson et al., 2010). Findings are more inconsistent concerning the correlation between physical activity and perceived stress in college students (Griffin et al., 1993; Hubbs et al., 2012) while few researchers looked at academic examination periods. Our study examined students during exam preparation and this could explain why physical activity was less likely to have a positive impact on stress. Previous work showed that during exam periods, students reduced their time and frequency spent with exercising compared to non-exam conditions (Oaten & Cheng, 2005, Steptoe et al., 1996). At our first measurement occasion (t1), most students had to find their way in exam preparation which likely explains the lack of correlation between recovery-related variables and stress. Recovery does not seem to have played an overriding role with regard to students' subjective experience of stress at t1 and this relates to the non-occurring mediation effect of recovery experiences. Our second measurement occasion (t2) produced another pattern of correlations with only physical activity showing no significant relationship with recovery experiences which also resulted in a lack of mediation. The proposed mediation effect only

occurred at our last measurement occasion (t3) and adding recovery experiences to the model showed a significant reduction in the original relationship between physical activity and stress.

Our findings can be put in context with one particular study that demonstrated recovery experiences to fully mediate between resource-providing recovery activities and recovery quality in a sample of college students during a short exam period (Ragsdale et al., 2011). Contrary to our study, Ragsdale et al. (2011) looked at recovery quality as a somewhat less rigorous outcome than perceived stress. Recovery quality is much more related to recovery experiences than perceived stress which could explain why mediation only occurred at t3 in our data. However, study-related stress gave us a sense of how drained students felt and how they evaluated academic demands along with their ability to cope at each time point of our study (t1–t3). Another reason why mediation did not also occur at t1 and t2 could be the small sample size of our study. Unlike Ragsdale et al. (2011), the small number of subjects within our statistical models may have caused the lack of mediation effects. Furthermore, and unlike previous studies, the longitudinal approach of our study examined recovery over a longer period of time than just a weekend. The actual development of academic strain within exam preparation could have played a role in students' recovery activities and experiences at both t1 and t2. Because study-related stress is not perceived as so high earlier in students' exam preparation, recovery activities such as physical activity are not likely to have as great an effect on stress, nor are recovery experiences on stress (see correlations at t1). We think this to change the longer exam preparation lasts. Physical activity seems to become an important contrast to sitting down and studying (i.e., being physically inactive) every day. We assume that this contrast effect is psychological in nature, as recovery experiences not only showed a moderate negative correlation with stress, but were shown to partially mediate between physical activity and stress at later stages in exam preparation (t3).

Taken together, our results indicate recovery experiences gain importance in the relationship between physical activity and stress as students progress with their exam preparation. The prolonged academic strains of exam preparation lead to chronic stress (Giglberger et al., 2022) and therefore take a toll on students' cognitive and affective resources

which translates into students having a greater need for recovery the further they get. Because recovery is a process that restores those resources that are in the process of deteriorating, recovery experiences seem to transmit the effects of physical activity into resource replenishment because they facilitate improvement in resources as described by COR theory (Halbesleben et al., 2014; Hobfoll, 1989). Physical activity as one specific recovery activity seems to offer a promising approach to help students better cope with academic strains during stressful exam preparation and this stress-buffering potential might unfold via feeling recovered after exercising.

4.2 Recovery experiences as a mediator of the relationship between physical activity and study-related well-being

Our results were somewhat more consistent for recovery experiences mediating the negative association between physical activity and study-related well-being across measurement occasions. In line with our first hypothesis (t1), there was a significant relationship among all variables which resulted in partial mediation. The same mediation effect occurred with regard to our third hypothesis (t3), but was absent for our second hypothesis (t2). On the second measurement occasion, we did not find a significant positive relationship between physical activity and well-being, nor between physical activity and recovery experiences. Students were not quite halfway through their exam preparation at this point. Taken together, these results indicate that recovery experiences make up an important part of students' subjective well-being during exam preparation. Similar to what was already seen with stress as an outcome, how students live through and experience their off-learning time appears to become more valuable the further they progress on the road of their exam preparation. Recovery experiences showed stronger associations with well-being across measurement occasions as reflected by the increasing magnitude of correlations. Furthermore, the amount of variance explained by the statistical models that considered recovery experiences as a mediator kept increasing at each measurement occasion. Again, it should be noted that we

found rather low standard deviations for recovery experiences across all measurement occasions which could explain the lack of a mediation effect at t2.

Our findings were mostly consistent with previous studies showing that physical activity in general increases individual psychological well-being (Calderwood et al., 2021; Marquez et al., 2020). Positive relationships between exercising and mental health outcomes are reported for both work-related contexts (Calderwood et al., 2021) and higher education settings (Molina-García et al., 2011; Skead & Rogers, 2016; Tyson et al., 2010). Going beyond those positive associations with well-being, we also found positive correlations between physical activity and feelings of recovery (i.e., recovery experiences) which is in line with one recent review (Sonnentag et al., 2022). The few studies that examined students during academic exam periods found reductions in both the duration and frequency of physical activity for those students who were facing exams compared to controls, but failed to look at their well-being (Oaten & Cheng, 2005, Steptoe et al., 1996). Our study extends previous findings by including study-related well-being as an outcome, which was also not addressed by Ragsdale et al. (2011) who found recovery experiences to be an important mediator of the association between resource-providing activities and recovery quality.

It is important to note, however, that the reported consistencies hold only for the first and third measurement occasions of our study (t1 and t3), but not for our second measurement occasion (t2). The proposed mediation effect did not occur at t2 because there were no positive correlations between physical activity and well-being, nor between physical activity and recovery experiences. This lack of a positive relationship between physical activity and recovery experiences resembles the correlational pattern we found for stress at t2 which leads us to assume that students were possibly confronted with a particular stressor. This idea is supported by looking at descriptive results because students reported their highest level of stress and their lowest level of well-being at t2 compared to the other measurement occasions. Going further than the small sample size of our study, we think that the reason to explain this irregularity may also lie in mock exams that are taken by students to train in solving legal cases. Mock exams represent an additional stressor during exam preparation and this stress may

have had such a strong impact on students at t2 that negative effects on well-being and recovery experiences were evident. This explanation relates to a study that found cyclic motivational drops as students progressed with their exam preparation (Glöckner et al., 2013). Therefore, lower levels of motivation might also have affected the relationship between both physical activity and well-being as well as recovery experiences.

Furthermore, our results suggest recovery experiences become more important to the relationship between physical activity and well-being as students progress with their exam preparation. Both students' cognitive and affective resources are depleted as a result of the prolonged nature of exam preparation and this makes recovery a key process to enhance study-related well-being. In line with COR theory, recovery experiences transmit the effects of leisure activities into resource replenishment (Hobfoll, 1989). Our findings support the fact that physical activity can be considered a promising way to help students maintain certain levels of well-being during stressful exam preparation. Importantly, it is not about physical activity alone, but students need to experience this recovery activity as actual psychological recovery from their everyday academic strains.

4.3 Limitations and further research

Despite its merits, our study has some shortcomings that need to be mentioned. First, we applied self-report measures using questionnaires only, which raised the concerns about social desirability of students' answers. Objective measures such as physiological assessments of stress recovery (e.g., cortisol levels or heart rate variability) would have ruled out such response biases by providing more precise data. However, we deemed self-reports to be a reasonable method to assess students' psychological experiences of recovery as well as study-related stress and well-being including reported time of physical activity per week. Second, even though we followed a longitudinal approach with three measurement occasions, our design does not allow for strong causal inferences. We did not control for variables that could have affected students' levels of physical activity at each measurement occasion (e.g., physical injuries, lack of motivation). Third, in spite of carrying out our research at only one law

school, the sample size was restricted to only a few students who engaged in our longitudinal study. Due to this small sample size, we cannot be very confident that a genuine mediation effect exists. Fourth, our study looked at a very specific group of students (i.e., advanced law students during exam preparation to pass their first state examination) which raises concerns about the generalizability of our results although this was the exact sample that we wanted to examine.

Beyond consideration of the above, future research should also examine other student outcomes such as exam grades as an indicator of academic achievement. It would be interesting to relate academic performance to stress recovery and examine whether those students who report higher levels of pre-exam recovery also achieve better grades. Moreover, further research is needed to better understand students' specific needs for stress recovery during prolonged study periods of academic pressure. For example, it is unclear whether students perceive exercising to be enjoyable and beneficial at all stages of exam preparation. There might be a shift towards engaging in more low-effort activities (e.g., watching TV) as exam preparation progresses. Furthermore, an experimental approach applying a recovery activity intervention would shed light on the actual effectiveness of physical activity for stress recovery. Future research should employ a randomized controlled trial to make causal statements about whether exercising can indeed be considered responsible for positive effects on student outcomes. Another aspect to be considered by further research is methodological improvements by using latent profile analyses that require bigger samples, for instance. This would allow for the examination of systematic patterns in students' recovery activities and experiences as well as to test whether these profiles differ in stress and well-being.

4.4 Practical implications

From a practical perspective, some interesting starting points can be derived from our study to help students better cope with prolonged and stressful study periods. This study sheds initial light on recovery activities and related experiences to reduce stress and enhance well-being during exam preparation. Our results suggest that physical activity as one specific

recovery activity offers a feasible way to initiate the recovery process for advanced law students and that recovery experiences play a critical role for the positive effects to unfold. For example, physical activity allows for recovery experiences such as psychological detachment which promotes restoration and regeneration that reduces negative states (stress) and enhances positive states (well-being). To achieve recovery, sport and exercise belong to the most effective recovery activities (Sonnentag et al., 2022) and this why students are recommended to find some time and become active during off-learning time. As outlined by previous studies, engaging in sports as one particular resource-providing activity poses a simple means of helping oneself and improving both physiological and psychological health (Calderwood et al., 2021; Ragsdale et al., 2011). For example, low-threshold, easily accessible, and free university exercise classes could encourage law students to become more physically active during their studies, as suggested in a recent study (Rabkow et al., 2020). In any case, higher education institutions are advised to support students in taking action by raising awareness about the supposed costs of prolonged academic strains. Because exam preparation is assumed to be effortful and resources are depleted to meet demands, recovery is needed to replenish those resources as described by COR theory (Hobfoll, 1989). Professors and academic staff at universities should make students more aware that long periods of learning also require specific actions to counteract the stress and regain resources. In doing so, they should refer to the scientific evidence and highlight physical activity as an effective way to improve physical and mental health.

More importantly, our findings point to recovery experiences as a mediating mechanism between activities and positive outcomes. To achieve recovery and regeneration through physical activity, students need to take advantage of recovery experiences. For example, students could learn to become more aware of their respective mental state during off-learning time. This involves to consciously experiencing leisure as a pathway to recovery that fosters resource replenishment which could be achieved by giving students access to positive psychological interventions such as practicing mindfulness. In this context, students could also be invited to dwell on their experiences of feeling recovered and having recharged their

batteries through journaling. Being a self-reflective form of writing about individual occurrences and experiences, journaling poses another promising method of positive psychology to reduce stress and enhance well-being. Universities would do well to establish suitable support formats that involve psychological advice to better cope with long-lasting study periods such as exam preparation. Specifically, universities could assist students in making better use of their recreation experiences by creating curricula that intentionally set aside time for recovery activities and experiences. Reminding students to do something about their stress recovery would reduce the inhibition threshold and thus make the desired behavior more likely to translate into everyday practice. The fact that the process of recovery and the process of learning are directly linked and mutually dependent should not only be better understood by the universities, but also implemented accordingly.

4.5 Conclusion

Demanding study periods such as exam preparation put students through a period of long-lasting academic stress that also takes a toll on their well-being. Given the chronic stress characteristics and supposed decline in resources during prolonged exam preparation, recovery is an important mechanism to achieve resource replenishment. Physical activity is one specific recovery activity that helps students better cope with academic strains during such study periods. Our findings support the idea that recovery experiences are a key factor in the association between physical activity and study-related stress and well-being. We found evidence for recovery experiences to be a partial mediator of the relationship between physical activity and the outcomes. The findings indicate that the positive effects of recovery experiences become more sustained longitudinally meaning that how students live through and experience their off-learning time gets more valuable the further they progress with exam preparation. Recovery activities and experiences are both important and students can benefit from engaging in more physical activity and taking intentional advantage of recovery experiences.

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Table 1

Means (M), standard deviations (SD), and Cronbach's alpha reliability coefficients (α) of all variables across measurement occasions

	t1			t2			t3		
	M	*SD*	*α*	*M*	*SD*	*α*	*M*	*SD*	*α*
RAC	3.54	2.31	—	3.43	2.06	—	3.02	2.00	—
REX	3.44	.45	.77	3.23	.47	.78	3.18	.45	.78
SST	67.15	15.70	.87	75.85	15.70	.88	75.11	14.89	.82
SWB	3.30	.50	.81	3.12	.60	.87	3.13	.61	.89

Notes. N = 56. RAC = physical activity as specific recovery activity in hours per week, REX = recovery experiences, SST = study-related stress, SWB = study-related well-being.

Table 2

Intercorrelations among all variables across measurement occasions

	RAC t2	RAC t3	REX t1	REX t2	REX t3	SST t1	SST t2	SST t3	SWB t1	SWB t2	SWB t3
t1 RAC	.60***	.60***	.23	.16	.24	–.19	–.22	–.24	.31*	.26*	.25
t2 RAC		.74***	.09	.16	.35**	–.27*	–.37**	–.29*	.01	.18	.21
t3 RAC			.21	.21	.26	–.29*	–.26	–.36**	.18	.26	.35*
t1 REX				.48***	.21	–.23	–.12	–.06	.33**	.16	.23
t2 REX					.63***	–.31*	–.31*	–.32*	.32*	.50***	.51***
t3 REX						–.40**	–.38***	–.46***	.21	.42***	.57***
t1 SST							.71***	.56***	–.25	–.44***	–.38**
t2 SST								.73***	–.24	–.42***	–.38***
t3 SST									–.30*	–.50***	–.58***
t1 SWB										.61***	.53***
t2 SWB											.80***
t3 SWB											—

Notes. $N = 56$. RAC = physical activity as specific recovery activity, REX = recovery experiences, SST = study-related stress, SWB = study-related well-being.
*$p < .05$, **$p < .01$, ***$p < .001$.

Table 3

Results of mediation analyses for study-related stress across measurement occasions

		Standardized coefficients			Indirect effects[a]
Model	R^2	RAC → SST	RAC → REX	REX → SST	RAC → SST
t1 Basic	.04	–.19			
t1 Mediation	.07	–.14	.24*	–.20	[–.12; .01]
t2 Basic	.14	–.37**			
t2 Mediation	.20	–.32**	.17	–.26*	[–.12; .03]
t3 Basic	.13	–.36**			
t3 Mediation	.33	–.24*	.27*	–.46***	[–.23; –.01]

Notes. RAC = physical activity as specific recovery activity, REX = recovery experiences, SST = study-related stress. Basic model includes recovery activity as predictor only. Mediation model includes recovery activity as predictor and recovery experiences as mediator. → path weight, [a] = one-tailed bootstrapped confidence intervals, *p < .05, **p < .01, ***p < .001.

Table 4

Results of mediation analyses for study-related well-being across measurement occasions

		Standardized coefficients			Indirect effects[a]
Model	R^2	RAC → SWB	RAC → REX	REX → SWB	RAC → SWB
t1 Basic	.10	.31**			
t1 Mediation	.16	.25*	.23*	.27*	[.01; .15]
t2 Basic	.03	.18			
t2 Mediation	.26	.11	.16	.48***	[–.04; .20]
t3 Basic	.12	.35**			
t3 Mediation	.37	.21*	.26*	.52***	[.01; .26]

Notes. RAC = Physical activity as specific recovery activity, REX = Recovery experiences, SWB = study-related well-being. Basic model includes recovery activity as predictor only. Mediation model includes recovery activity as predictor and recovery experiences as mediator. → path weight, [a] = one-tailed bootstrapped confidence intervals, *p < .05, **p < .01, ***p < .001.

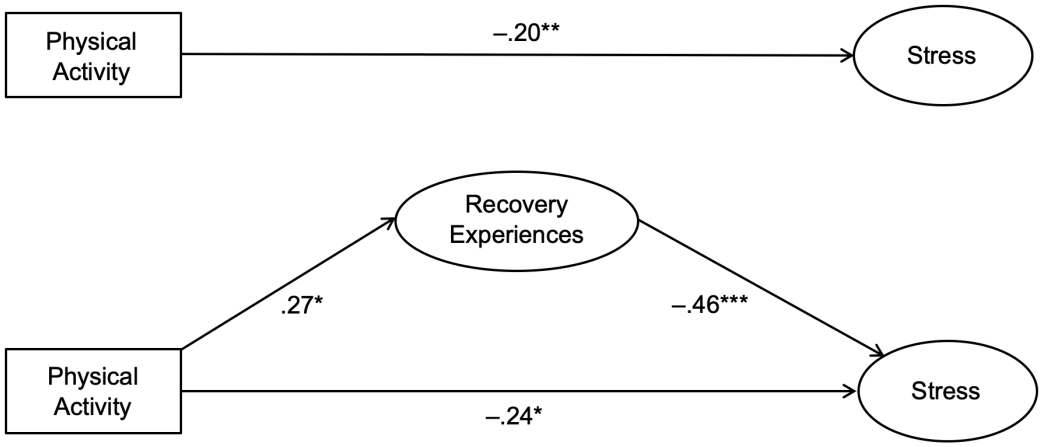

Figure 1a. Basic and mediational model for stress. Depicted is the relationship between physical activity as specific recovery activity and study-related stress and its direct effects for the third measurement occasion (t3). Recovery experiences were included as mediator. *p < .05; **p < .01; ***p < .001.

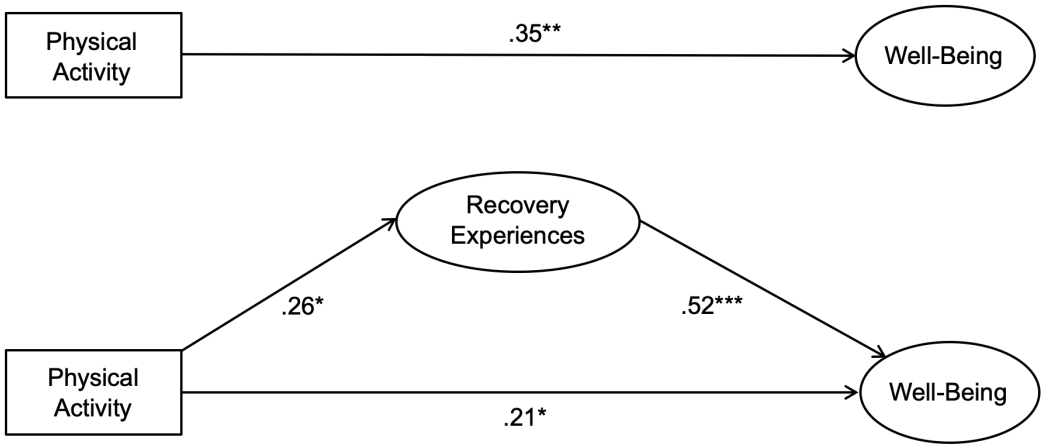

Figure 1b. Basic and mediational model for well-being. Depicted is the relationship between physical activity as specific recovery activity and study-related well-being and its direct effects for the third measurement occasion (t3). Recovery experiences were included as mediator. *p < .05; **p < .01; ***p < .001.

8 General Discussion

The overarching objective of this dissertation was to examine the potential of different approaches to reduce stress and enhance well-being in students undergoing prolonged exam preparation. The three single studies of this dissertation focused on different intervention approaches to act on study-related stress and well-being that each followed a distinct theoretical approach. The following sections summarize the findings of the dissertation and link them with the relevant research literature. Subsequently, strengths and limitations of the presented studies are discussed. Finally, implications for theory, future research, and practice are outlined.

8.1 Summary of Empirical Findings and General Aspects

To provide a good overview, the most important results of this dissertation will be divided into two areas below. Starting with the findings of each single study, both important aspects to reduce study-related stress and enhance study-related well-being are discussed. Then, general aspects are outlined to improve study conditions.

8.1.1 Possibilities to Reduce Stress

Study 1 has taken a setting-based intervention approach and looked at the potential of an exam villa to reduce stress among students and followed a cross-sectional design. Using the exam villa was associated with experiencing lower levels of subjective stress when compared to students that did not use the villa during exam preparation. It is one key finding of Study 1 that decision latitude mediated the relationship between villa use and stress. According to these results, villa students who felt they had more freedom to make decisions may also be less stressed. This is in line with previous work where students that reported higher levels of decision latitude (along with lower demands) were also less stressed during an examination period (Schmidt, Sieverding, Scheiter, & Obergfell, 2015). Another important finding is that villa use predicted stress and did so over and beyond the demand-control dimensions. This goes beyond previous studies that have applied the DCM (Karasek, 1979)

to the higher education context and examined students' stress experiences (Chambel & Curral, 2005; Sieverding, Schmidt, Obergfell, & Scheiter, 2013; Schmidt et al., 2015). The results of Study 1 demonstrate the villa's potential as a structural resource for reducing stress because of its power to predict stress in the face of prolonged and challenging study periods. Even though the additional amount of variance in stress explained by villa use was small, the villa had incremental validity. Studying within the villa environment seems to have positively affected how students experience the stressors associated with exam preparation.

Study 2 has chosen an individual-based intervention approach and examined the effectiveness of a brief and tailored psychological intervention that followed a workshop format within an RCT including follow-up. Results showed a significant stress reduction right after the workshop because students reported to feel less stressed compared to when they came in. This is consistent with previous research that showed brief psychological interventions have quick and pronounced positive effects on stress when university students were targeted (Amanvermez et al., 2023; Call, Miron, & Orcutt, 2014; Renshaw & Rock, 2018; Yusufov, Nicoloro-SantaBarbara, Grey, Moyer, & Lobel, 2019). Despite the fact that the intervention effects on stress remained stable at follow-up, there was no significant time x group interaction for study-related stress after one week. Changes in students' stress levels were not significantly different from each other because both groups of students (experimental and control group) reported to be less stressed from baseline to post measurement. For short-term intervention effectiveness, this suggests that the intervention did not have enough impact for reducing stress, which is consistent with past research showing that law students suffer from high levels of stress during exam preparation (Giglberger et al., 2022; Sanders & Dauner-Lieb, 2013). On the one hand, it is likely that students' stress was too pervasive which undermined the ability of the intervention to significantly reduce stress. On the other hand, the offering of a psychological intervention as a new supportive format could have acted like a signaling effect showing a stress-reducing effect for both groups of students.

Study 3 followed an alternative intervention approach and examined the role of recovery experiences as a mediator of the relationship between physical activity as one specific recovery activity and study-related stress. This study followed a longitudinal design with three measurement occasions (t1–t3) over seven months. Results showed that students declined in their time spent with physical exercise and their experiences to feel recovered during exam preparation. This is in line with previous work that showed students undergoing exam phases to reduce their time and frequency spent with exercising compared to non-exam conditions (Oaten & Cheng, 2005, Steptoe, Wardle, Pollard, Canaan, & Davies, 1996). Results showed that recovery experiences partially mediated the relationship between physical activity and stress at the third measurement occasion, but neither at the first nor second measurement occasion. It is possible, that the actual development of academic strain within exam preparation plays a role for this pattern to show. Students' stress experiences might be lower at the beginning of their exam preparation and therefore stress-recovery activities like physical exercise and recovery experiences are less likely to have a significant impact on stress levels. This is in line with one longitudinal study showing that perceived stress levels of students were significantly lower at earlier stages of their exam preparation when compared to later stages (Giglberger et al., 2022). These findings suggest that the positive effects of recovery experiences related to physical activity and their effects on stress reduction become more sustained as exam preparation progresses. According to COR theory (Hobfoll, 1989), it can be argued that students' cognitive and affective resources are depleted as a result of the prolonged nature of exam preparation and this makes recovery a key process to reduce stress while this stress-buffering potential seems to unfold via feeling recovered after exercising.

8.1.2 Possibilities to Enhance Well-Being

The setting-based intervention approach of Study 1 also aimed at examining the potential to enhance satisfaction among students. Study-related satisfaction was chosen as one important facet of students' subjective well-being during exam preparation. Results of Study 1 showed that villa use was linked with experiencing higher levels of satisfaction when

compared to non-villa use. However, using the villa made no substantial contribution to explaining satisfaction over demands and decision latitude. This is well in line with previous research demonstrating decision latitude to be the strongest predictor of study-related satisfaction (Chambel & Curral, 2005; Sieverding et al., 2013). Results also showed decision latitude to be a mediator of the relationship between villa use and satisfaction with an indirect effect of villa use on satisfaction over decision latitude but not over demands. This suggests decision latitude to play a key role in enhancing well-being among students. The positive effects on satisfaction are likely to unfold because students that use the villa are provided with more control over their study situation. Students are offered different learning opportunities and become empowered to take an active role in selecting and organizing learning tasks. This is also in line with research from the work-context where individuals' basic psychological needs such as the need for autonomy are linked with higher motivation and well-being among employees (e.g., Deci, Olafsen, & Ryan, 2017; Ryan & Deci, 2019).

The individual-based intervention approach of Study 2 also examined the effectiveness of an RCT to specifically target students' well-being. Results showed that students' experienced study-related well-being could be increased over a short period of time. Although there were no immediate effects on well-being right after the intervention, which marks a typical finding for brief psychological interventions (e.g., Renshaw & Rock, 2018), the intervention unfolded its power on well-being over time. One of the central findings of Study 2 was that the intervention was effective in enhancing students' well-being after one week when compared to students in the control group. The intervention was specifically designed to meet the specific needs of students during exam preparation and it is likely that this tailored aspect played an important role in the effect on well-being, as previous studies have shown (Seidl, Limberger, & Ebner-Priemer, 2016; Yusufov et al., 2019). The intervention provided insights into how to maintain good levels of subjective well-being during exam preparation, which seemed to accurately meet the needs of students during long and demanding study periods. Previous studies have also demonstrated increased student well-being following participation in psychological interventions when positive emotions, behaviors, and thoughts were specifically

addressed (Howell & Passmore, 2019; Renshaw & Rock, 2018). Moreover, the results of Study 2 also indicate that tailored interventions appear to contribute to longer lasting positive effects on well-being, even though only two weeks were considered. For students of the experimental group, intervention effects remained stable indicating lasting positive effects while students of the control group also showed improvements in their well-being. Therefore, interventions that also address student well-being have the potential to achieve even more than just reducing stress.

The alternative intervention approach of Study 3 examined the role of recovery experiences as a mediator of the relationship between physical activity and study-related well-being across three measurement occasions (t1–t3). Results showed these mediation effects to occur for all measurement occasions except for t2 when most students were about halfway through with their exam preparation. Across measurement occasions, both recovery experiences showed stronger associations with well-being and the amount of variance explained by the statistical models that considered recovery experiences as a mediator kept increasing. This suggests that the further students progress with their exam preparation, the more valuable the way they experience their study-free time seems to become. This is in line with previous work that considers recovery to be a key mechanism by which individuals can regain resources and improve their well-being (Calderwood et al., 2021; Sonnentag, Niessen, & Neff, 2012; Sonnentag et al., 2022; Steed, Swider, Keem, & Liu, 2022) as key process to regain resources. However, only few studies examined students' physical activity and recovery during academic exam periods and findings related to well-being are still lacking (Oaten & Cheng, 2005; Ragsdale, Beehr, Grebner, & Han, 2011; Steptoe et al., 1996). The findings of Study 3 support the fact that physical activity can be considered as a promising way to help students uphold certain levels of well-being during exam preparation. As a consequence, specific initiatives should therefore be taken to ensure that students are made aware of the benefits of physical activity and the role of recovery from their every-day academic strains.

8.1.3 Possibilities to Improve Study Conditions

To improve study conditions during exam preparation, students should be provided with more structural resources such as the opportunity to use an exam villa for their studies. The results of Study 1 underscore the potential that lies in such structural initiatives, which have their positive impact because they are directly anchored in the study environment. By using the exam villa, students can experience more space and freedom in a literal sense, as well as a form of appreciation from their university (Lobinger, 2016). Experienced decision latitude seems to be of particular importance in this context. By making use of structural resources, students are given the opportunity to make their own decisions and thus experience more control over their exam preparation. At the same time, learning itself is likely to become more structured as a result of attending the villa, and the effect of social support from other fellow students is also likely to be a supportive component. Although the role of social support was not examined by Study 1, it appears to be a seminal empirical work that set out to examine an entire learning environment. This is consistent with the evidence on setting-based interventions that call for more research that looks beyond curriculum-embedded interventions (Upsher et al., 2022; Worsley et al., 2022). Therefore, in order to improve study conditions, students should be provided with more structural resources during exam preparation. The exam villa is one example of an entire learning environment that support students better cope with academic demands as they occur in every-day study situations.

To improve study conditions during exam preparation, students should also be offered individual-based interventions that act on their overall psychological functioning. The findings of Study 2 underline the potential of a brief psychological intervention to reduce stress and enhance well-being among students. It is important to note that the intervention was specifically designed to meet advanced law students' needs, such as the scarce time resources, because participation in the intervention only involved three hours. Beyond that, however, the intervention was primarily tailored to meet the students' psychological needs. Due to the chronic stress characteristics of exam preparation (Giglberger et al., 2022), students were taught different strategies to better cope with academic stress and improve well-being

that were based on CBT and mindfulness principles. This is consistent with a recent meta-analysis that showed that psychological interventions have a positive impact on students' mental health and well-being when they are based on principles of CBT or mindfulness (Worsley et al., 2022). Universities are the institutions that should not only offer structural resources to students during exam preparation, but should also advocate for making individual resources available. Following the individual-based approach, universities should offer a small range of psychological support services, such as courses and workshops that focus on individual and behavioral possibilities to strengthen students as they move through exam preparation. For example, course formats that teach psychological strategies to better cope with academic stress could become a fixed part of the curriculum during exam preparation. Following this logic and the findings of Study 3, universities should also appeal to the role of self-initiated behaviors such as exercising and engaging in physical activity. As suggested by a recent study, low-threshold, easily accessible, and free university exercise sessions could motivate law students to be more physically active while they are studying (Rabkow et al., 2020). While communicating the importance of performance and good grades, the value of active recovery as an essential counterbalance to stress is at least as important. Exam preparation is a prolonged period of academic stress, where students need to be made much more aware of the role of recovery experiences. This could take the form of psychoeducational informational materials provided to students during exam preparation.

Taken together, the study conditions during exam preparation could also be improved by combining the main practical implications of all three studies. Students could be provided with additional offerings that are explicitly part of the exam villa. For example, course formats to support students' mental health (e.g., stress management, mindfulness) could be held. Likewise, sports courses could be offered in designated group rooms (e.g., spinning, aerobics). Also, establishing a small gym within the exam villa would provide students with an opportunity to better integrate physical activity into their daily learning. These offerings would not only promote stress recovery and well-being, but are also low-threshold strategies to improve study conditions that meet students' psychological needs.

8.2 Strengths and Limitations of This Dissertation

A major strength of this dissertation is that it has been devoted to a research topic that has not received appropriate consideration to date: This dissertation examined different stress reduction approaches among advanced law students undergoing prolonged exam preparation. To address this research topic, different theoretical frameworks were considered from each of which different starting points for interventions were derived. Thus, this dissertation explored several possibilities for stress reduction as well as for enhancing well-being during exam preparation. Legal exam preparation is a long-lasting study period that extends over many months and is associated with chronic stress experiences in the majority of students. Each single study of this dissertation offers applied research findings that gives directions on how to support students during exam preparation and thereby improve study conditions. From a methodological point of view, another strength of this dissertation is that different research designs were implemented. Beyond a cross-sectional study (Study 1), an elaborate longitudinal study (Study 3) was conducted that followed students over several months. In addition, one study designed and evaluated an RCT (Study 2), which can be considered the centerpiece of this dissertation. For this purpose, a novel intervention format was created that was individually tailored to the psychological needs of law students during exam preparation. Thus, all studies have set their own methodological focus and also allow for ways to reduce stress that can be distinguished from one another by the type of intervention chosen.

In addition to the strengths of this dissertation, there are also important limitations to be mentioned. First, each single study used self-reports to collect data. Even though this was in line with the hypotheses that aimed to assess students' subjective perceptions of stress and well-being, objective stress assessments could have added validity to the measurements. For example, cortisol levels in saliva have been shown to provide simple physiological stress assessments in higher education settings. However, psychological stress is defined as a subjective experience and is also typically assessed using questionnaires. Another limitation is that the results of the single studies can be considered promising but not very robust. For example, not all hypotheses could be confirmed, which can be attributed to various reasons

(including small sample sizes). Both Study 1 and Study 3 examined relationships between variables and all detected effects should be understood as describing predictions and correlation. Therefore, no causal conclusions can be drawn from both studies. Study 2, however, implemented an RCT that could provide strong evidence that the brief psychological intervention was effective in enhancing students' well-being, for instance. Future research should put more emphasis on examining long-term effects (e.g., 6 to 12 months) to gain a better understanding of what interventions are most valuable for students. This is important because exam preparation is a prolonged study phase with academic stress that usually lasts for at least one year. Finally, all studies focused solely on advanced law students and therefore conclusions cannot easily be generalized to other study programs.

8.3 Implications

The following sections provide an overview of general implications for theory, future research, and important practical implications that expand the scope of the specific implications mentioned in each of the studies in this dissertation.

8.3.1 Theory

The present dissertation makes a number of contributions to both theory and the associated literature to advance our understanding of stress and coping. First of all, specific reference can be made to the individual theoretical models used for each of the studies in this dissertation. Many theoretical assumptions of the stress models could be confirmed by the results of the individual studies. Based on the DCM (Karasek, 1979), Study 1 demonstrated the significance of structural resources, namely perceived decision latitude, when students are in a prolonged period of study-related stress. Since this finding provides immediate starting points for reducing stress in work-related contexts, the model could be supplemented with specific intervention steps on how to do just that. Following the TSC (Lazarus & Folkman, 1984) and COR theory (Hobfoll, 1989), Study 2 and Study 3 showed that students' coping efforts were each related to the present time when the measurements took place, which was

primarily associated with an increase in well-being. However, in the case of law students who are in their exam preparation and still have the actual state exam ahead of them, future-oriented coping offers a promising avenue. For instance, recent studies have focused their attention beyond the classic problem- and emotion-oriented coping efforts within the TSC (Lazarus & Folkman, 1984) that have been criticized as being reactive (i.e., taking action with regard to stressful events that have happened or are happening in the present) rather than proactive (Serrano, Andreu, Greenglass, & Murgui, 2021). Future-oriented coping provides a more active and purposeful coping approach that emphasizes taking action before stressful events occur. This is why future-oriented coping has become increasingly important in applied stress research and could therefore be incorporated into the theoretical conceptualization of the TSC (Biggs, Brough, & Drummond, 2017).

All three theoretical models that were chosen to drive the single studies of this dissertation share one important commonality: they provide a framework that can explain how stress occurs and also offer starting points how to reduce stress. As a consequence of the possibilities to reduce stress, ways to improve well-being and thus promote mental health can also be derived. In all three models, available resources play an important role in preventing or reducing stress. These resources can either be anchored in the individual (e.g., a pragmatic and functional thinking style) or be found in the environment (e.g., permission to make autonomous decisions at work). Despite these overarching similarities, however, there are also significant differences in these theoretical approaches to stress. Whereas the TSC (Lazarus & Folkman, 1984) that was used in Study 2 emphasizes cognitive and thus subjective appraisal of stress, COR theory (Hobfoll, 1989) applied in Study 3 emphasizes the objective nature of stress over the individual appraisal process. The DCM (Karasek, 1979) that laid the foundation for Study 1 focuses on objective structural aspects that can explain stress in work-related contexts. It is important to note that examining academic stress in the higher education context also requires to look at structural conditions that play a role for students while underdoing exam preparation.

In order for these differences in theoretical approaches to complement each other, future efforts should be invested in designing a combined stress model. A refined stress model could then consider both approaches, the consideration of subjective aspects that contribute to the development of stress and the integration of objective aspects of the environment. At this point, it would also be conceivable to consider how subjective well-being could be included in a combined and complementary model of stress. While well-being is more than the mere absence of stress and thus not a reciprocal construct, integrating well-being could lead to new ways of thinking about stress management and coping. Likewise, considering well-being may prevent one-sided deficit- or problem-oriented thinking and open up long-term opportunities so that the physical and mental health of individuals is promoted.

8.3.2 Future Research

Future research related to the scope of this dissertation should further elucidate the unique challenges that advanced law students are facing while going through exam preparation. While there are initial findings from basic research that confirm the high level of stress experienced during exam preparation (Giglberger et al., 2022), there is a lack of applied research that offers starting points for reducing stress and enhancing well-being that can be used to improve study conditions. Importantly, future research should focus on providing more robust findings on those already promising yet preliminary results of this dissertation. This is particularly the case for Study 1, which examined an exam villa as an innovative setting-based intervention to reduce stress and enhance satisfaction among students. However, in order to really speak of an actual intervention and to be able to draw causal inferences, future work needs to conduct a genuine experiment. Even though Study 1 marks a first attempt to examine the effect of the exam villa as a structural resource, only an experiment can provide findings that are highly internally valid. The same rationale applies to Study 3 that was also dealing with correlational data. Despite the fact that recovery experiences were a key factor of the association between physical activity and study-related stress and well-being, the study design lacked an intervention group to be contrasted with a control group. In order to improve

upcoming study designs, it should be examined whether students who systematically exercise and are made aware of the associated recovery experiences show lower levels of stress and higher levels of well-being compared to largely inactive students. In this very context, it would also be interesting to look at other outcomes. For example, it would be promising to examine whether certain interventions also show positive effects on academic performance. Although Study 3 followed a longitudinal design over seven months, this would require more effort for conducting the study (i.e., waiting for exam results and using a follow-up measurement to see if good performance was due to the experimental manipulation). Moreover, although Study 2 conducted a genuine experiment in the form of an RCT, only short-term effects could be examined. Future research should look at intermediate and long-term effects of such psychological interventions even if they were meant to be brief in nature. This is because only longer follow-ups that take place after several months allow researchers to determine whether intervention effects are sustainable. Ultimately, it would also be promising to conduct a study that combines the different intervention approaches and to better understand which kind of students benefit the most. This is because considering the setting-based approach along with the individual-based approach would result in additive effects that should have a significantly greater impact on stress reduction in students. It would also be promising to identify certain protective factors that contribute to a particularly positive development over the course of exam preparation.

8.3.3 Practice

The findings of this dissertation clearly demonstrate that there are several possible approaches to reduce study-related stress during exam preparation. At the same time, the examined intervention approaches also provide opportunities to enhance well-being during this study phase. This is particularly important because it has been shown that exam preparation poses a significant and prolonged source of stress for students both on a psychological and physiological level (Giglberger et al., 2022). Therefore, there is no way around practical considerations to reduce stress and enhance well-being. In order words, it is important to take

steps to maintain students' mental health over the course of exam preparation. Probably the most important lesson to be learned from this dissertation is that while individual-based interventions revealed positive effects during exam preparation, a combination with the setting-based interventions may be significantly more effective. This is in line with meta-analytic evidence showing the effectiveness of each single approach (e.g., Amanvermez et al., 2023; Fernandez et al., 2016; Huang et al., 2018; Worsley et al., 2022). However, it would make sense to combine the individual and stetting-based approach to achieve greater impact on stress reduction as well as the promotion of mental health among students. Thus, it is important to provide students with both structural and individual resources to help them cope with prolonged academic stress during exam preparation.

Following the findings from Study 1, universities and their respective law faculties are advised to provide special learning environments such as the exam villa. This would support students by helping them to experience more decision latitude which is conducive to reducing their levels of study-related stress. Such endeavors would also have a positive effect on study-related satisfaction that has been identified to be a protective factor for law students (e.g., Rabkow et al., 2020). To improve study conditions during exam preparation, the findings of Study 2 should also be applied to practice. In addition to the setting-based approach that provides structural resources, students should also be offered individual-based intervention formats that address their particular psychological needs during exam preparation. According to the few research findings that exist on this subject, tailored interventions seem to offer particular added value (Seidl et al., 2016; Yusufov et al., 2019). It would be important that students can invest a manageable amount of time in an intervention that both meets their needs and facilitates transfer into every-day study life. For example, the completion of such a psychological training format could become part of the academic curriculum for exam preparation and students could be credited with ECTS points for participation. In this way, universities would clearly position themselves in relation to their educational mission, namely that successful exam preparation can succeed above all if the study conditions also recognize the significance of mental health (Fernandez et al., 2016; Rabkow et al., 2020).

Eventually, based on the findings of Study 3, universities and their law faculties should also emphasize to students the importance of recovery in reducing stress and improving well-being. It is important to make extra efforts to ensure that law students understand the need for recovery which should go hand in hand with intense study. This is because recovery is assumed to be the key mechanism by which individuals can regain resources and physical activity holds particular value to reduce stress and enhance their well-being (Calderwood et al., 2021; Sonnentag et al., 2012, 2022; Steed et al., 2022). Before they start their exam preparation, students should be made aware that their invested resources need to be actively restored and that recovery experiences play a crucial role in this. To summarize at this point, it is recommended to take at least some of these practical considerations and suggestions into account to provide students with more psychological support during exam preparation.

8.4 General Conclusion

The purpose of this dissertation was to examine the potential of different intervention approaches to address high stress levels experienced by advanced law students during their exam preparation. To achieve this goal, three individual studies were conducted, each taking a distinct theoretical approach to reducing stress and enhancing well-being among students. Apart from their individual characteristics, all studies had important commonalities, in particular the focus on investigating starting points for improving study conditions during legal exam preparation. The first two studies followed the two major intervention approaches to reduce stress, namely setting-based interventions (Study 1) and individual-based interventions (Study 2). The last study (Study 3) followed an alternative intervention approach. The main finding is that all intervention approaches showed positive effects on the respective outcomes, thus highlighting the power of psychological support measures to reduce stress and enhance well-being in higher education. A special achievement of this dissertation is that the strongly application-oriented studies help to derive starting points to improve the study conditions during legal exam preparation in particular.

Returning to the introductory questions, there are now answers regarding the potential of the different intervention approaches. One question asked whether the high stress levels of advanced law students during exam preparation can be addressed with a setting-based initiative. Following the results of Study 1, this dissertation has shown that using an exam villa is a structural resource for students and that decision latitude plays an important role for these positive effects to unfold. Another question asked whether stress levels can be reduced by a special psychological intervention. According to Study 2, this dissertation demonstrated that participation in a brief psychological workshop in an RCT significantly reduced stress and improved well-being in the short term. The final question aimed to determine whether alternative intervention approaches related to physical activity and recovery show positive effects over the course of exam preparation. Following Study 3, this dissertation demonstrated that recovery experiences mark a partial mediating mechanism of the association between physical activity and study-related stress and well-being and that these effects appear to become more sustained as exam preparation progresses.

Taken together, setting-based and individual-based interventions are two different pathways to reduce stress and enhance well-being during prolonged and demanding study periods such as exam preparation. Alternative intervention approaches provide additional opportunities to positively impact students' mental condition during exam preparation. While examining the effectiveness of different interventions remains a task for future research, it is in the hands of universities and their law faculties to gradually introduce such intervention formats to improve study conditions during exam preparation. In the end, universities should do more to promote the mental health of law students as they prepare for their final exams. The state exam in law certainly is an important obstacle that students must overcome in order to be successful lawyers or judges. At the same time, it would be desirable for law students not to emerge from exam preparation overly stressed and exhausted. Young people should instead be motivated to take their next steps in life with vigor and to look forward to new challenges with optimism.

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Appendix

List of Tables

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List of Abbreviations

Abbreviation	Long Version
CAR	Cortisol Awakening Response
CBT	Cognitive Behavioral Therapy
COR	Conservation of Resources Theory
COVID-19	Corona Virus Disease 2019
DCM	Demand-Control Model
RCT	Randomized Controlled Trial
SEM	Structural Equation Modeling
SWB	Subjective Well-Being
TSC	Transactional Model of Stress and Coping

Description of Personal Contribution for This Dissertation

Study 1

The potential of an exam villa as a structural resource during prolonged exam preparation at university.

Study 2

Short-term effectiveness of a brief psychological intervention on university students' stress and well-being during prolonged exam preparation: results of a randomized controlled trial.

Study 3

Examining recovery experiences as a mediator between physical activity and study-related stress and well-being during prolonged exam preparation at university.

The following contributions apply to each individual study in this dissertation: Tom Reschke developed the research hypotheses, designed the study, conducted data collection, performed data analyses, and wrote the manuscript. Prof. Dr. Thomas Lobinger enabled and approved data collection and supervised the manuscript. Dr. Katharina Reschke performed additional data analyses and revised parts of the manuscript for publication.

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